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Features of the use of digital Risk management tools in the capital market and the organized commodity market

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Abstract. The article discusses the features of the introduction of digital risk management tools in the capital market and the organized commodity market. In the course of research, it has been proved that a detailed classification of exchange risks is necessary for their identification at the stage of developing an exchange agreement, planning the income of all participants in an organized commodity market: enterprises (clients of the trading platform), brokers and others. It is proved that the price of grain, determined not so much by the costs of the commodity producer, as by supply and demand and the political situation in the relevant market, is a key element determining the profitability of their economic activities. The current situation shows that the development of an organized commodity market for grain futures will reduce the number of futures transactions concluded by investors on foreign exchanges, thereby increasing the capitalization of domestic trading platforms operating in the capital market and organized commodity market and generally increase the competitiveness of the financial market. Since in a market economy there are frequent fluctuations in prices for goods and services, ex-change rates, interest rates, these facts are catalysts not only for pre-dicting future market conditions, but also for insuring their activities, which will allow hedging on another person, more often on a financial intermediary (speculator). The tools for risk management at the enterprise are highlighted, which can be used by commodity producers independently, while the tools for transfer and risk sharing assume the existence of an appropriate institutional environment and market infrastructure. It is noted that the use of risk management in working with grain futures can allow agricultural producers, processors, elevators to increase the profitability of their enterprises by insuring risks from adverse price changes (especially during a period of high market volatility) in an organized commodity market; to participate in the formation of a fair market price for grain; to plan and control the monetary results of activities more accurately; to ensure the reliability of calculations; to get the

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best credit opportunities in banks; to expand opportunities for buying and selling grain.

1 Introduction

Risk is inherent in any sphere of human activity associated with a variety of conditions and factors leading to a positive or negative result of decisions made by individuals. Historical experience shows that the risk of not receiving the intended results especially began to manifest itself in the conditions of universality of commodity-money relations, competition of participants in economic turnover, therefore, with the emergence and development of capitalist relations, different risk theories appear, and the classics of economic theory pay special attention to the study of risk problems in entrepreneurial activity. If the risk is unavoidable, then the problem of its analysis, evaluation, choice of measurement methods and possibilities for further management becomes particularly relevant. As a result of the risk analysis, a picture of possible risk events, the probability of their occurrence and consequences comes out; risk assessment using special methods. After comparing the obtained risk values with the maximum permissible ones, a risk management strategy is developed, and on this basis, measures to prevent and reduce risk are proposed.

The effectiveness of the risk management system largely depends on the probability and accuracy of forecasts of price dynamics of financial instruments and methods of assessing their impact on the value of open positions of economic entities. Therefore, forecasting the dynamics of the financial market, determining the impact of risks on the financial stability of market participants and the use of modern methods of risk reduction, in particular hedging, form the fundamental basis of the risk management system for any participant in market relations. At the present stage of information technology development, the growth of transaction volumes and the emergence of new tools in the financial market of forecasting and hedging as important components of the risk management process are impossible without the use of innovative tools. It is the use of modern strategies, methods and management systems that ensures the successful solution of these problems.

The purpose of the scientific work is to develop measures to minimize risks in exchange activities. Further study of exchange risks, their types, nature of occurrence, clarification and additions to existing systems of classification of exchange risks, factors affecting the degree of risk.

To achieve these goals, it is necessary to solve the following tasks, including to study the economic essence of risk; to investigate the classification of risks in ex-change activities in the organized commodity market; to work out the types of risks in the exchange market; to investigate the trends of the global exchange market; to assess the management of price risks based on "long hedging" strategies; to assess the management of price risks based on strategies short hedging; explore the advantages and disadvantages of hedging with exchange-traded instruments; to develop prospects for the development of trading in urgent instruments in Ukraine; to investigate the economic efficiency of using spread trading strategies.

2 Materials and methods

Exchange activity is impossible without risk. Each participant in exchange trading tries to make a profit, doing everything possible to avoid a situation directly related to risks. A significant number of scientific works of foreign and domestic researchers are devoted to the problems of risk research and the mechanism of their hedging in organized commodity markets: J. Junttila, J. Pesonen & J. Raatikainen (2018), A. Sarris, P. Conforti & A. Prakash

(2011), B. Gaudenzi, G.A. Zsidisin, J.L. Hartley & L. Kaufmann (2018), F. Wen, J. Cao, Z. Liu & X. Wang (2021), G. Abuselidze (2021), P. Arunanondchai, K. Sukcharoen & D.J. Leatham (2020), T. Matsumoto & Y. Yamada(2021) [1-7]. In recent years, more and more attention has been paid to risk research, considering the role and their significance in the market sphere and the im-pact on pricing. In particular, we can highlight the works of such authors as T. McGough & J. Berry (2022), A.K. Tiwari, S.K. Jena, A. Mitra & S.M. Yoon (2018), S. Mahapatra & S.N. Bhaduri (2019) [8-11].

Hedging is often compared with a similar, but not identical type of activity – insurance. Taking into account the absence of hedging in practice at the present stage of the formation of an organized commodity market, there is a need for further research on risk management during the development of exchange activities.

3 Results

The categories "risk" and "profitability" form the core of modern risk management concepts. The inevitability of risk in the pursuit of ultra-high incomes is taken into account when planning, creating and developing an enterprise in business plans. For example, when conducting marketing research, they take into account the possibility of incurring losses when demand drops and prices for products and resources change (entrepreneurial risk). In the planning and organization of production activities, the risk of a decrease in profitability is taken into account, setting a certain level of resource efficiency, the level of current costs and profits. When making a decision on investments and financing, they take into account the risk of loss of financial stability and liquidity.

In the process of monitoring the business plan, a conscious and accepted level of risk is monitored when organizing and coordinating the activities of departments and performers. The remuneration of managers, accordingly, should depend on their ability to foresee the development of events and make effective decisions in conditions of increased risk.

Risk is understood as all internal and external prerequisites that can negatively affect the achievement of strategic goals during a precisely defined period of observation time, for example, the operational planning period. Strategic indicators include revenue and cost coverage, including interest on capital, turnover, quality, and image.

Risk manipulation is the development and implementation of measures that will compensate for future risks (for example, hedging), reduce them (for example, by deciding on a less risky alternative activity, diversification) or transfer (for example, through insurance), avoid risky actions or consciously take risks (accept).

Through risk, damage is realized, acquiring concretely changing and real outlines. Otherwise, it is a quantitative assessment (criterion) of a successful or unsuccessful result. Risk measurement is possible mathematically through the use of probability theory and large numbers based on statistical data.

Today, risks have become an integral tool of the market economy. They cannot be avoided because of their objective-subjective nature. The objectivity of risk is based on the fact that it exists due to objective, that is, inherent in the economy categories of uncertainty, and the lack of comprehensive information at the time of assessment and management decision-making. The subjectivity of risk is caused by the fact that there are real people in the economy (investors, managers, management teams, businessmen) with their experience, psychology, interests, tastes, inclination or aversion to risk, with their behavior, etc. [12]. Currently, there are several risk concepts in research (Fig. 1).



Fig. 1. Types of risk concepts. Note* built by the authors on the basis of [13].

The need to systematize and classify risks is due not only to theoretical, but also to practical needs, since risk classification in practice facilitates the process of identifying risks and contributes to the adoption of effective management decisions aimed at minimizing the negative impact of risk. The main responsibility of a manager in conditions of uncertainty is not to avoid risk, but to foresee it and reduce possible negative consequences to a minimum level or eliminate it altogether. Targeted actions to limit risk in the business system are called risk management.

The risk management system includes the following main elements:

- Identification of differences in risk alternatives;
- Development of plans that allow optimal action in risk-related situations;
- Development of specific recommendations aimed at eliminating or minimizing possible negative consequences;
- Preparation for the adoption of by-laws and regulations related to risky activities;
- Accounting and analysis of psychological perception of risk decisions and programs.

For almost any operation related to economic activity, the initial and final states have a monetary value. The purpose of its implementation is to maximize profit – the difference between the final and initial estimates (or some similar indicator). As a rule, such operations, especially financial ones, are carried out under conditions of uncertainty, so their consequences cannot be foreseen in advance. These operations are risky: when they are carried out, both profit and loss are possible.

The species diversity of risks and ways of their expression is quite significant. However, whatever the form of expression of the risk caused by the uncertainty of the economic situation, its content is the deviation of the actually established data from the typical, stable, average levels or the alternative value of the assessed attribute.

3.1 Optimality criteria

The uncertainty associated with the lack of information about the probabilities of environmental conditions (nature) is called hopeless. In such cases, criteria are used to determine the best solutions:

• the criterion of a guaranteed result (Wald's maximistic criterion) is an inherently pessimistic criterion, since only the worst of all possible results of each alternative is

taken into account. This approach sets a guaranteed minimum, although the actual result may not be so bad;

- the criterion of optimism (Maximax criterion) corresponds to an optimistic offensive strategy. No possible result is taken into account here, except the best;
- the criterion of pessimism is characterized by choosing the worst alternative from the worst of all the worst payback values;
- Savage's minimax risk criterion can be considered as a criterion of least harm, which determines the worst consequences for each alternative and selects an alternative with the best of the bad values;
- Hurwitz's generalized maximum (pessimism- optimism) criterion allows us to take into account the state between extreme pessimism and unrestrained optimism.

The application of various performance criteria for various tasks of choosing optimal solutions under conditions of uncertainty shows that an approach based on the complex application of these criteria can become decisive.

3.2 The criterion of a guaranteed result

It is also called the Wald maximum criterion. The essence of this criterion is as follows. The optimal solution has many strategies (options, alternatives) for solving the problem:

$$P = \{P_i\}, i = \overline{1, m}.$$

These strategies are considered controlled (controlled) factors. Along with the controlled factors, there are factors that cannot be controlled. Denote them by

$$\Pi = \{\Pi_i\}, \ j = \overline{1, n}.$$

Pi can be: technical parameters of the designed systems, economic indicators of the state of the enterprise, different options for solving the tasks.

The factors of Π j are: the level of demand for goods offered by the company, market prices, operating conditions of technical and production systems, actions of competitors, etc.

To evaluate the effectiveness of the decisions taken, we introduce the efficiency indicator E and consider that the function E (P, II) is known. Since the factors P and II are discrete, the efficiency E is also a set of discrete numbers. Thus, each point of controlled and uncontrolled factors (P_{i} , Π_{j}) is assigned an efficiency value of E. So, we can build a matrix $E = ||e_{ij}||$, which is presented in the form of Table 1.

Table 1. Efficiency Matrix.

Р	Π_{I}	Π_2	 Π_n	min e _{ij} j
P_I	<i>e</i> 11	<i>e</i> ₁₂	 e_{ln}	$\min e(P_l, \Pi)$
P_2	<i>e</i> ₂₁	e 22	 e _{2n}	$\min e(P_2, \Pi)$
			 	•••
P_m	<i>e</i> _{m1}	e _{m2}	 emn	$\min e(P_m, \Pi)$

Note* compiled by the authors according to [14].

For each controlled factor Pi (row), a minimum factor is found, as a result of which a set of values of the efficiency indicator min $e(P_1, \Pi)$, min $e(P_2, \Pi)$,..., min $e(P_m, \Pi)$ is determined.

Comparing the obtained values, a controlled factor P_r , is selected, at which the maximum value $E(P, \Pi)$ is provided.

Thus, the criterion of a guaranteed result (the maximum Wald criterion) is written as:

$$E_r = \max_i \min_i E(P, \Pi).$$

This criterion ensures the maximization of the minimum gain or, what is the same thing, the minimization of the maximum losses that may occur during the implementation of one of the strategies. The criterion is simple and clear, but conservative in the sense that it orients the decision to an overly cautious line of behavior. The value corresponding to the maximum criterion is called the lower price of the game, which should be understood as the maximum gain guaranteed in a game with a given opponent by choosing one of their strategies with minimal results. This is a reinsurance position of extreme pessimism, designed for the worst case. Such a strategy is acceptable, for example, when a player is not so interested in great luck, but seeks to insure himself against unexpected losses. The choice of such a strategy is determined by the player's attitude to risk.

3.3 The criterion of optimism

When using this criterion, which is also, called the Maximax criterion, the operating conditions of the systems under consideration will be the most favorable. As a result, the optimal solution is a strategy that leads to obtaining the highest value of the optimality criterion in the payment matrix. It is advisable to apply this criterion in cases where there is a fundamental opportunity to influence the functions of the opposite party.

If the matrix of the $E(P, \Pi)$ effect of one kind or another is analyzed, then the choice of controlled factors is carried out in such a way as to ensure maximum effect. In this case, the criterion of optimism is written as

$$E_o = \max_i \max_i E(P, \Pi)$$

3.4 The criterion of pessimism

In contrast to the criterion of optimism, when they focus on the most favorable external environment, which is uncontrolled, and on the optimal use of controlled factors, when using the principle of pessimism, it is assumed that controlled factors can be used unfavorably:

$$E_r = \min_i \min_i E(P, \Pi),$$

where $E(P, \Pi)$ is a function of the effectiveness of decisions made.

The application of this principle may cause some doubt, given that the factors P are controllable and should be used optimally in one sense or another. However, in real situations, in a number of tasks, it may be impossible to control the uncontrolled factors belonging to a set of P. This is especially true for tasks related to the need to take into account the time factor.

These tasks include the following tasks: socio-economic forecasting; long-term planning; design of complex objects. For example, production costs are controlled factors in short time intervals. However, when analyzing long-term processes that make up several years, some elements of these costs become uncontrollable. Such elements include the cost of electricity, the cost of materials and purchased products.

Another example is the determination of the production volumes of an enterprise. This indicator can also be considered a manageable factor. But it depends on various factors that can be significantly applied in the production process. At the same time, these factors relate to the internal environment of the enterprise: the level of design and technological preparation of production, the type of equipment used the qualifications of employees, etc.

3.5 Sevidge criterion for minimax risk

When using the above criteria, there may be situations when uncontrolled factors will act in a more favorable way compared to the worst condition that they were guided by. For example, weather conditions turn out to be more favorable than predicted. The number of competitors in certain markets turns out to be significantly less compared to the expectations that manufacturers were guided by.

In such situations, the useful result may differ significantly from what is provided when implementing the criterion of a guaranteed result or the criterion of pessimism.

Therefore, there is a need to determine possible deviations of the results obtained from their optimal values. The Savage criterion is applied here. Choosing a strategy is similar to choosing a strategy based on the Wald principle, with the difference that the player is guided by a risk matrix $R = ||r_{ii}||$ or a missed opportunity matrix based on the E win matrix.

The amount of risk is the amount of payment for the lack of information about the state of the environment. The risk r_{ij} of a player using the strategy Pi and the state of the environment Π_j will be called the difference between the winnings that the player would have received if he knew that the state of the environment would be Π_j , and the winnings that the player will receive without having this information.

Knowing the strategy Π_j , the player chooses the strategy in which his winnings are maximum, i.e.

$$r_{ij} = \beta_j - e_{ij},$$

where $\beta_j = \max_{1 \le i \le m} e_{ij}$ for a given value of j.

The Savage criterion is formulated as follows:

$$E_{rc} = \min_{i} \max_{j} R(P, \Pi)$$

Thus, the Savage criterion minimizes possible losses. The main initial assumption of this criterion is the assumption that the choice of options for the situation is influenced by the actions of reasonable opponents (nature), whose interests are directly opposite to the interests. Therefore, if the opponents (competitors) have the opportunity to extract any advantages, then they will definitely do it. This circumstance makes it necessary to minimize losses as a result of these actions.

3.6 The criterion of generalized Maximin (pessimism-optimism) Hurwicz

The criterion Hurwicz allows taking into account combinations of the worst states. When choosing a solution, this criterion recommends to be guided by some average result characterizing the state between extreme pessimism and unrestrained optimism.

In accordance with this compromise criterion, a linear combination of minimum and maximum winnings is determined for each solution, and preference is given to the solution variant for which the maximum indicator will turn out to be. E_i that is:

$$E_{i} = \{k \min_{1 \le j \le n} e_{ij} + (1 - k) \max_{1 \le j \le n} e_{ij} \}$$
$$E_{ir} = \max_{1 \le i \le m} \{k \min_{1 \le j \le n} e_{ij} + (1 - k) \max_{1 \le j \le n} e_{ij} \},$$

Where k is the coefficient considered as an indicator of optimism $(0 \le k \le 1)$.

At k = 0, the criterion Hurwicz coincides with the maximum criterion, that is, the orientation to the marginal risk, because a greater gain is usually associated with a greater risk. When k = 1 – orientation to cautious behavior. The k value between 0 and 1 is intermediate between risk and caution and is chosen depending on the specific situation and the propensity for the optimal decision. Let's summarize all the optimality criteria in Table 2.

Indicator	Formula	Title	
The greatest caution	$E_r = m_i x m_j i n e_{ij}$	Guaranteed result criterion (Walda)	
Least caution	$E_o = m_i a x m_i a x e_{ij}$	Criterion of optimism	
Extreme caution	$E_n = m_i n m_j n e_{ij}$	The criterion of pessimism	
Minimal risk	$E_{rc} = \min_{i} \max_{j} r_{ij}$	Savage Criterion	
Compromise in the solution	$E_{ir} = \max_{\substack{1 \le i \le m}} \{k \min_{\substack{1 \le j \le n}} e_{ij} + \\ + (1 - k) \max_{\substack{1 \le j \le n}} e_{ij} \}$ $E_{ir} = \min_{\substack{1 \le i \le m}} \{k \min_{\substack{1 \le j \le n}} r_{ij} + \\ + (1 - k) \max_{\substack{1 \le j \le n}} r_{ij} \} \\ (0 \le k \le 1)$	Hurwicz Criterion Hurwicz criterion on the risk matrix	

Table 2. Table of optimality coefficients.

Note* compiled by the authors on [14, 15].

3.7 Pareto optimality

The analysis of solutions with many criteria largely boils down to the organization in one form or another of interaction with the optimal decision, which can solve the problem of comparing different criteria. However, there is a rather limited environment in which the use of purely formal analysis without reference to the optimal decision is quite useful. We are talking about the allocation of the so-called set of Pareto-efficient or optimal alternatives.

It is easy to understand that an alternative that is not effective, under no circumstances can be considered as a solution to the problem. After all, for an ineffective alternative, there is another one that surpasses it by all criteria. Hence, the most important criterion for the rationality of the solution development process follows: the chosen option must be effective. An effective alternative is considered to be one for which there is no other, which is not inferior to it by all criteria and surpasses it by at least one criterion. How to find effective solutions?

The main thing here is that after the criteria are formulated, the task of finding a set of effective solutions on a given set of alternatives is, although complex, but quite a formal task that does not require an appeal to the decision made for its solution. In many cases, many effective alternatives can be found by solving problems with an integral optimality criterion, which is the sum of the individual parts of the criteria with variable weights. At the same time, it does not matter which scales to take to start the process. All the same, all possible combinations on the segment from 0 to 1 are sorted with some given step. After a lot of effective alternatives have been identified, the optimal decision can choose one of them, but it is impossible to build combinations of them even in cases where such a combined alternative makes sense. It may be ineffective and cannot be considered as a solution to the problem.

This technique is used so often that sometimes it begins to be perceived as the only possible one. Its advantages, in addition to simplicity, include the fact that the alternative obtained with this approach will be consciously effective. However, the application of this scheme is based on additional assumptions that are not always justified. From a mathematical point of view, such a sum of equity criteria with importance coefficients is nothing more than an additive value function. In order for such a logical construction to correctly reproduce the system of advantages of optimally made decisions, it is necessary (corresponding theorems have been proved in this regard) that the criteria used to evaluate alternatives have the property of mutual independence of advantage.

Foreign experience in the functioning of the exchange market shows that one of the most effective tools for managing price risk in an organized commodity market is hedging. Hedging in an organized commodity market, interpreted as insurance, reducing the risk of losses caused by unfavorable changes in market prices for goods for sellers or buyers compared to those that were taken into account when concluding the contract. Hedgers in the organized commodity market are:

- Farmers, suppliers of cattle – those who need protection from the increase in prices for purchased goods, for example, feed;

- trading firms, owners of granaries - in need of protection from price reduction from the moment of purchase or conclusion of a contract for the purchase of grain from farmers until the moment of sale;

- food producers, feed producers - in need of protection from rising raw material costs or from a decrease in the market value of stocks;

- Exporters - those who need protection from the increase in grain prices, for which a contract has already been concluded with a deferred delivery date, but the delivery has not yet been carried out;

- Importers are those who want to benefit from the reduction in grain prices, for which a contract has already been concluded with a deferred delivery date, but the delivery has not yet been carried out.

The hedging mechanism consists in balancing two opposite positions in the spot (real commodity market) and the exchange futures market (Fig. 2).





Fig. 2. Hedging mechanism. Note* compiled by the authors on [16].

According to the technique of implementation, hedging by sale (from the English short hedging) and hedging by purchase (from the English long hedging) are distinguished. Hedging by sale (short hedging) is when a participant in the real market owns a commodity, that is, he has a long position in this market, and in the futures market, to protect against a possible fall in price, he sells a contract for the commodity he owns and takes a short position. A possible drop in the available price by the time of sale of products is compensated by profit on the futures market [17].

Purchase hedging (long hedging) is when a participant in the market of a real commodity (consumer) does not own the commodity, it needs to be bought in the future, then in the futures market he takes a long position – that is and he buys a futures contract. Such an action protects him from an increase in the price in the market, where over time he will buy the necessary goods. The increase in the existing price will be compensated by the profit received on the futures market [19].

To further illuminate the essence of the hedging process, we use an example of the behavior of an agricultural producer in the American futures market specializing in wheat cultivation. Let's say it's April 1st and the wheat is just turning green. The producer expects that by the end of July it can harvest about 10 thousand bushels of wheat (about 272.0 tons). For certain reasons, the manufacturer has not signed a forward contract with anyone for its implementation. But he wants to know what the price of wheat will be at the time of harvest. To determine this price, you should contact the futures market and see what the price is on it for the month when it harvests and is ready to sell it. In our example, this is July [18].

According to futures quotes, the price of the July wheat futures contract in April is \$3/bushel. This price suits the manufacturer, because it compensates for all costs and brings a certain profit. To protect itself from a possible price drop, the producer turns to the stock market, selling a futures contract for 10,000 bushels of July wheat at \$3/bushel. Thus, he becomes a hedger with a short position. But in order to participate in hedging, it was only necessary to sell a futures contract. The producer must deposit funds to a clearing company that is a member of the exchange and through which he implements his contract [18].

As a rule, the amount of collateral (margin) is 2-10% of the transaction amount. In our example, this is \$3000 (10 thousand bushels x \$3 = \$30,000 x 10%). The need to deposit such an amount is due to the fact that prices on the futures market change over time and the exchange constantly redistributes winning or losing funds between participants in the futures market, depending on price changes. In our example, the exchange requires the farmer to deposit \$ 3000 to his account, and also calls another figure \$ 2000. This is the amount below which the farmer's account cannot fall so that he can maintain participation in the futures market [18].

The first digit is called the initial deposit (initial margin), and the second, respectively, the supporting or variation margin. Consequently, the farmer entered the futures market, selling 10,000 bushels of wheat at \$3 per bushel, and deposited an initial margin of \$3,000 into his account. If now the price of wheat begins to decline, then for each percentage reduction in the price of one bushel, \$100 (0,01x10000) will be credited to the farmer's

account. These funds are transferred from the accounts of other participants who are buyers of futures contracts. Similarly, if the price increases and the farmer act as a seller of the same 10 thousand bushels of wheat, the exchange will withdraw \$100 from the farmer's account each time the price increases by one cent per bushel. These funds, in turn, are transferred to the account of participants who are buyers [18].

But back to our example. Several months pass. At the end of July, the whole crop is harvested. Unfortunately, since the beginning of April, the price has dropped from \$3 to \$2.5/bushel. One way or another, and the participant decides to sell the grain. To do this, he delivers it to a local elevator and receives the current price of \$2.5/bushel for it [18].

If all commerce had ended with this, the manufacturer would most likely have suffered losses this year or at least would not have made a profit. But the operation in the real market is only part of the case. He has to get out of the game – liquidate his position in the futures market. To do this, the producer buys futures on the futures market for 10,000 bushels of July wheat at the current price of \$ 2.5/bushel. According to the rules of the game, during this time the exchange transferred 50 cents to his account for each of the 10,000 bushels of his previous futures. Adding 50 cents earned by him on trading futures contracts to the money he received for his harvest on the real market, the manufacturer will sum up: 2,5 + 0,5 = 3,0 (table 3) [18].

Cash	Futures		
April 1 – The producer expects a harvest of 10 thousand bushels, but does not have a contract for sale.	The producer sells July wheat futures: 10 thousand bush., at \$3.0/bush.		
Meanwhile, the price is declining	The price is reduced		
July 15th – The producer harvests and sells it to a local elevator for \$2.5/bush.	The producer buys July futures: 10000 bush. at \$2.5/bush. And liquidates its position.		
\$2.5/bush. The price of real products	+\$0.5/bush profit from futures agreement		
\$2.5 bush. +0.5 bush - \$3.0 bush Guaranteed target price of the manufacturer			

Table 3. Example of hedging at a reduced price.

Note* compiled by the authors on [18].

Consequently, the manufacturer finally received \$3.0 per bushel. And this is just the price that is favorable for him, which he dreamed of on the first of April. He managed to get this price, despite the fact that the price of wheat in the real market fell. And, if the participant had not taken part in the mentioned game, he would have suffered great losses.

The manufacturer achieved success due to the fact that he simultaneously participated in two independent processes that took place in completely different spheres: the real world and the world of the game reflecting the real world.

In the example given, the prices on the real commodity market and the futures market declined simultaneously. Consider the case when the price of wheat in the futures market was rising. In order to protect against unpredictable price changes, the producer sells July wheat futures contracts for 10 thousand bushels at a price of \$3.0/bushel and, accordingly, deposits a deposit of \$3,000 to the clearing firm [18].

At the end of July, when the harvest was harvested, it turned out (unlike the previous example) that the price of wheat rose to \$3.26 per bushel. The producer sells his grain on the real market: delivers it to a local elevator and receives the current price of \$3.26/bushel for it.

If he had completed transactions on the real market on this, he would have received a much larger profit than he had planned. But this is only part of the business. The manufacturer has yet to exit the game, that is, liquidate its position in the futures market.

In order to exit the futures market, the producer buys futures for 10 thousand bushels of July wheat. But he is forced to do it at the current price of 3.26/bushel. And since entering the game, the participant sold them for 3.0 / bushel, and now has to buy them for 3.26 per bushel, he lost 26 cents on each bushel, which in the end is 2600 [18].

Technically, this is how it is done: while the price of July futures was rising, the clearing firm where the farmer made a deposit withdrew money from his account, and by the time the price reached \$3.1, the participant had already lost \$ 1,000, that is, \$ 2,000 remained in his account. This is the amount of the supporting deposit, below which the account has no right to decline. An official of the clearing company immediately notified the manufacturer by phone. In order to be eligible to continue participating in the trade, the manufacturer had to deposit additional funds in the amount of \$1,000 to his account [18].

When the futures price increased to \$3.20, the producer again made an additional \$1000. Therefore, when the participant decided to liquidate his position at a price of \$3.26/bushel, \$2,400 remained in his account, and the clearing firm returned them to him, deducting, of course, a certain small amount for servicing [18].

Consequently, in the futures market, the producer lost 26 cents on each bushel. Now, to determine the result of his commerce on the real and futures market, you need to subtract 26 cents from the \$3.26 he received for each bushel sold on the real market. As a result, the manufacturer (Table 4) received for one bushel: \$3.26-\$0.26 = \$3.

Cash	Futures			
April 1st –	The producer sells July wheat futures: 10			
The producer expects a harvest	thousand bush. at \$3/,0/bush.			
10 thousand bush., but there is no				
contract for sale.				
Meanwhile, the price increases	The price is going up			
July 15th –				
The producer harvests and sells it to a	The manufacturer buys July futures: 10			
local elevator for \$3.26/bush.	thousand bush. at \$3.26/bush. and liquidates its			
	position.			
	\$0.26/bush. loss			
\$3.26/bush. The price of real products				
\$0.26/bush. Damage from the futures agreement				
\$3.26 bush \$0.26 bush = \$3.0/bush.				

Table 4. An example of hedging when the price rises.

Note* compiled by the authors on [18].

As you can see, the manufacturer received \$ 3.0, which he planned to receive back in April. He was completely satisfied with this price, although it turned out to be lower than what could have been obtained if he had not engaged in hedging.

In the examples given, the selling price is set at \$3/bushel. But the possible advantage of the price increase was missed in order to protect against a decrease [19].

Other market participants (processors, exporters) they seek to protect themselves from price increases and can achieve this through purchase hedging (long hedging).

In a broad sense, futures hedging are not only a form of insurance. For example, six months before harvesting corn, the producer enters into forward contracts for its sale with a local

elevator, which is also insurance, since in this way the elevator manager assumes the risk [19].

The elevator manager carries out hedging on the futures market, because as the owner of grain, he is an uninsured market participant and risks the same as a speculator who owns only commodity futures contracts, that is, as unprotected persons, they analyze commodity prices.

Now the fact of the close relationship of pricing in global and local markets is obvious. This is especially well tracked on the products of the agro-industrial complex. Studies have confirmed the relationship and a high degree of dependence of pricing in the domestic market of cereals and oilseeds on world exchange centers (Chicago, Paris, London, Budapest). This dependence is especially convincingly observed in relation to the corn market [18].

The prices of the Ukrainian spot corn market demonstrate a high level of correlation with the quotes of futures prices for this crop on the Euronext exchange, the Chicago Mercantile Exchange and the Budapest Stock Exchange. It should be noted that the greatest degree of correlation is observed between the Ukrainian and French markets, which is most likely due to geographical proximity and the same quality (not genetically modified corn), as well as the fact that both countries compete with each other in the joint export markets of North Africa.

A similar relationship is also observed in the comparative analysis of the correlation dependence of the domestic spot market with the American and European futures markets for food and feed wheat, brewing and feed barley, soybeans, sunflower seeds and oil (Table 5).

	Euronext Exchange	Chicago Mercantile Exchange	Budapest Stock Exchange	Average spot price in Ukraine
Average spot price in Ukraine	90%	79%	89%	100%
Euronext	100%	89%	96%	90%
Chicago Mercantile Exchange	89%	100%	87%	79%
Budapest Stock Exchange	96%	87%	100%	89%
Number of observations	1260	1260	1260	1260

Table 5. Results of correlation analysis of the corn market.

Note* compiled by the authors on [20-23].

Therefore, it can be argued that there is a certain level of correlation between prices on the spot market of the country and foreign exchange markets of commodity derivatives. But this statement is not enough, because it is an extremely important element that allows us to insist on the need to build a domestic agricultural exchange market that fixes the degree of influence of some prices on others.

The presence of correlation allows risk management based on the use of commodity derivatives of the world's leading stock exchanges, in particular European commodity exchanges. After all, hedging is based on the fact that price changes in the spot market and in the futures market are interrelated. Price movements are not necessarily identical, but, as a rule, they are so similar that it is possible to reduce the risks of losses in the spot market by taking the opposite position in the futures market. Thus, we have identified the main types of risks of grain market participants: extreme weather conditions, price risk, and regulatory risk. Various weather risk insurance programs for agricultural producers make it possible to compensate for damage caused by extreme weather conditions.

4 Conclusions

Therefore, a detailed classification of exchange risks is necessary for their identification at the stage of developing an exchange agreement, planning the income of all participants in the organized commodity market: enterprises (clients of the trading platform), brokers and others. The allocation of risks by the subjects of the exchange agreement will help to focus the efforts of each participant on the development of measures to minimize them, improve the efficiency of trading on exchanges.

Consequently, the price of grain, determined not so much by the costs of the commodity producer, as by supply and demand and the political situation in the relevant market, is a key element determining the profitability of their economic activities. In this connection, price risk occupies a special place in the work of a risk manager in the market. It is possible to obtain grain products in order to comply with all agro-technical standards, you can even insure yourself against adverse weather conditions, but if in the end the prices of manufactured products do not even allow you to cover the costs of its production, this leads to a decrease in the financial stability of the agricultural enterprise and may lead to bankruptcy.

It is proved that the development of an organized commodity market for grain futures will reduce the number of futures transactions concluded by investors on foreign exchanges, thereby increasing the capitalization of domestic trading platforms operating in the capital market and organized commodity market and generally increase the competitiveness of the domestic financial market.

Since in a market economy there are frequent fluctuations in prices for goods and services, exchange rates, interest rates, these facts are catalysts not only for predicting future market conditions, but also for insuring their activities, which will allow hedging on another person, more often on a financial intermediary (speculator).

The tools for risk management at the enterprise are highlighted, which can be used by commodity producers independently, while the tools for transfer and risk sharing assume the existence of an appropriate institutional environment and market infra-structure.

It is proved that the use of risk management in working with grain futures canal-low agricultural producers, processors, elevators to increase the profitability of their enterprises by insuring risks from adverse price changes (especially during a period of high market volatility) in an organized commodity market; participate in the formation of a fair market price for grain; plan and monitor the monetary results of operations; ensure the reliability of settlements; get the best lending opportunities in banks; expand opportunities for buying and selling grain.

Consequently, all of the above reasons are an objective reality and a prerequisite for the development of grain futures as a guarantee for the development of an organized commodity market and capital market in Ukraine.

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