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## **ECONOMIC IMPERATIVES OF FINANCIALIZATION OF AGRICULTURAL COMMODITY MARKETS**

**Purpose.** *The purpose of the article is to substantiate the theoretical and methodological foundations and economic feasibility of intensifying the processes of financialization of the business model of Ukrainian grain producers, in particular through the formation of the grain futures market and the creation of commodity exchange in Ukraine.*

**Methodology / approach.** *In the article, it is clarified the concept of financialization as one of the global trends of economic development that provides deep integration of financial and real economy on macro- and micro levels. Hedge effectiveness of price risks for Ukrainian grain (wheat and corn) using futures contracts traded on CME Group and Euronext is evaluated using regression analysis. Ukrainian wheat and corn FOB price volatility for 2016–2021 marketing years is estimated. The dynamics and volatility of the basis for Ukrainian wheat and corn and respective futures contracts traded on CME Group and Euronext are analyzed.*

**Results.** *The analysis of securitization index of global agricultural markets has shown an increase of its financialization rate. The main reasons for this process were the deepening of financial and commodity markets integration, deregulation of financial markets and introduction of new financial instruments. The structure of the grain market in Ukraine is analyzed, particularly the role of agricultural holdings and international companies. The tendencies and determinants of wheat and corn market prices in Ukraine during marketing year are revealed. Regression analysis of hedge effectiveness has shown that all considered futures contracts are suitable for wheat and corn CPT and FOB price hedging in Ukraine. The highest hedge effectiveness was revealed for Black Sea Corn Financially Settled (Platts) Futures (CME Group) and Milling Wheat / Ble de Meunerie (Euronext Matif). Short hedge efficiency of CME Group futures contracts was supported by analysis of basis dynamics for Ukrainian wheat and corn and respective futures contracts.*

**Originality / scientific novelty.** *Based on the analysis of the theoretical foundations of financialization, the positive and negative consequences of the strengthening of financialization of global commodity markets and the peculiarities of the functioning of the modern grain market in Ukraine, the economic imperatives of the development of the Ukrainian market of grain derivatives, as an objectively determined trend of agricultural commodity market, are substantiated. The evaluation of the effectiveness of hedging price risks on the Ukrainian grain markets using derivatives traded on global exchanges has gained further development.*

**Practical value / implications.** *It is proposed to intensify market tools usage for risk hedging in Ukraine in order to cover interests of all market participants. Risk management instruments available for Ukrainian agricultural producers are discussed.*

**Key words:** *financialization, agricultural commodities, corn futures, wheat futures, volatility, basis, emerging economy, derivative market, hedge effectiveness, Ukraine.*

**Introduction and review of literature.** Today's global commodity markets are the focus of financial and non-financial corporations, households, national governments, and international organizations. The researchers of global commodities markets increasingly warn about beginning of new commodity supercycle accompanied by significant increase of global commodity prices, including food (grain, vegetables). In the FAO experts' opinion, Covid-19 pandemic, unfavorable weather conditions, geopolitical tensions, in particular, large-scale Russian military aggression in Ukraine have caused significant disruptions in supply chains and become the cause of shocks in supply and demand in world markets for agricultural products, and hence food inflation. In particular, under conditions of military aggression, the magnitude of the risks to which Ukrainian agricultural producers are exposed increases significantly due to the impossibility of shipping and supplying products to the world market, restrictions on the possibility of carrying out production activities. At the same time, the reduction of market supply on the world market increased its sensitivity to adverse weather conditions in other productive regions of the world, and thus contributed to its volatility.

The excessive volatility of prices is of particular concern, which creates additional risks that affect the income and expenses of all market participants (stakeholders). Among the factors that have a significant impact on the dynamics of commodity prices today is the process of financialization. The term financialization has appeared in the professional literature not long ago. Scholars define financialization as the progressive process of increasing the scale and importance of the financial sector in the economy, the growing role of finance in the lives of economic agents, the emergence and application of a wide range of financial instruments and operations. Such processes are often accompanied by the use of modern information technologies, which permeate all spheres of economy and society [1; 2].

World experience shows that the financialization of certain sectors of the economy, such as the agricultural sector, the development of a professional transparent liquid market for commodity derivatives for agricultural products, based on the integration of real and financial sectors of the economy, can contribute to the development of production in the industry through the transfer of market risks, the increased lending to farmers at lower interest rates and the improvement of the management of financial resources of enterprises.

Even though modern researchers tend to consider the financialization of the economy as one of the global trends in the financial system, theoretical and methodological aspects of this phenomenon were formulated in the late nineteenth and early twentieth centuries. Proponents of predominantly left-wing and centrist politics in economics (K. Marx, R. Hilferding, J. M. Keynes, H. Minsky, etc.) in their works emphasized the importance of the influence of financial capital on the distribution of economic resources and the effectiveness of the world economic system and considered aspects of the interaction of the physical (real) and monetary economies [3; 4; 5].

Proponents of monetary post-Keynesianism affirm that financialization is a conscious consequence of neoliberal policies in the developed world. The development of credit relations has significantly affected the behavior of households and has become one of the factors stimulating aggregate demand. Such a policy provoked a massive transfer of capital to the financial sector of the economy and had a negative impact on the real sector, in particular on the volume of investment in production [6].

Modern researchers consider a number of events and processes that took place in the late 1990s and early 2000s, which significantly strengthened the role of finance in commodity markets and increased the level of financialization of the economy as a whole. It is worth mentioning the processes of further deregulation of the financial sector of the US economy and the adoption of the Commodity Futures Modernization Act of 2000, which, in particular, significantly affected the model of commodity markets. This law provided for the introduction of so-called OTC commodity derivatives, which are not subject to regulation and control by the SEC, which reduces the transparency of this market model.

With the rapid introduction of information technology, the adoption of this law led to the emergence of another financial bubble – the dot-com boom in the US market in 1995–2000. State economic policy measures during this period were aimed at further deregulation of the financial market and lowering interest rates to stimulate investment in the real sector of the economy [7].

Deregulation of the financial sector in large economies and the crisis in the manufacturing sector have prompted non-financial companies to expand their financial activities (for example, providing consumer credit to their customers without the involvement of banks (the emergence of shadow banking).

When non-financial companies begin to use financial instruments not only to hedge risks but also to make speculative profits, financialization begins to become destabilizing. Expansion and multiple overruns in the financial sector of the economy and the transformation of the financial sector into a self-sufficient sector of the national economy led to the emergence of fictitious capital, resulting from large-scale speculative transactions in the financial market, causing bubbles and financial crises. G. Krippner and C. Lapavistas, studying the manifestations and consequences of financialization, concluded that excessive financialization was the result of the process of deregulation of the financial sector, which took place in the last decades of the twentieth century and became one of the causes of the global financial crisis of 2007–2009 [8; 9].

Despite the negative consequences, the financialization of commodity markets can have a positive impact on the business model of economic agents. Exchange-traded financial instruments in commodity markets create favorable conditions for financial resources management, transfer of risks to third parties, reduce price volatility, increasing market transparency, and generally have a positive impact on the effectiveness of market stakeholders.

J. Keynes [10], J. Hicks [11] and N. Kaldor [12] developed in their studies the

basic tenets of the theory of hedging in commodity derivatives markets. Hedgers typically have a short position in such markets and should offer risk rewards to attract speculators to the market. Financial investors will take a long position, which helps mitigate and effectively share risks [13].

At the same time, it is difficult to disagree with the statement that the financialization of commodity markets helps to increase their transparency – the futures segment of commodity markets, where trade is usually exchange-traded (organized), complements the spot segment, where trade takes place mainly on the over-the-counter (unorganized) market [14].

On the other hand, as studies of modern commodity derivatives markets have shown, the demand of financial investors for risks is changing over time, in particular, due to shocks in the financial markets [15]. As a result, the behavior of financial speculators becomes a kind of transmission mechanism through which external shocks determine the situation in commodity markets.

The dominance of institutional investors in commodity futures markets over the last decade has actualized the study of the impact of external shocks, including global stock market shocks on commodity markets. The research by Z. Adams and T. Gluck confirmed the hypothesis that the economic effects of the financialization of commodity markets are enhanced when a financial investor opens a long position on a commodity with high volatility [16].

To explain the process of transferring risks arising from global financial markets to commodity markets, it is used a liquidity spiral that formalizes the effects of financial investors entering commodity markets. The massive opening of long positions by financial investors in commodity futures markets causes a significant increase in commodity prices and thus provokes a shock in the real sector of the economy [17].

As is known, the prices of commodities such as copper, crude oil, soybeans have become a kind of indicator of the health of the world economy. For example, rising prices in these markets indicate a revival of business activity. Under such conditions, the actions of financial investors in commodity markets may lead to economically unjustified changes of a speculative nature in supply and demand in world commodity markets, prices for final goods and services, and thus the global macroeconomic environment [18; 19].

The rapid development of instruments and mechanisms of the global financial system in the last third of the twentieth century significantly intensified the process of financialization of the agricultural markets. It was the emergence of new financial instruments (commodity indices, index swaps, commodity ETFs) that exacerbated the effects of financial deregulation and had destabilizing consequences [20]. Such instruments have become available to retail investors, and their behavior in the market can significantly affect the prices of real assets, as well as cause price volatility and increase uncertainty in market conditions. Producers of agricultural products suffer the most from such conditions [21].

Increased participation of financial investors in agricultural markets, who

consider agricultural products as assets similar to financial assets, is mainly due to the desire to optimize the structure of the asset portfolio to reduce risk and increase its profitability. The actions of hedgers are accompanied by the actions of speculators, who are not interested in buying or selling a particular product, but rather interested in profits due to changes in their prices. Speculative transactions have been among the main causes of recent crises in agricultural markets. The growth of financialization of the agricultural market has led to a number of important transformational changes directly in the industry itself. The fact is that financial business activity is often considered by modern agricultural companies as a kind of core activity that generates a reliable (constant) flow of economic profit (income). The generation of economic profit takes place outside the core activity of the agricultural enterprise. This can lead to a reorientation (diversion) of the company's financial resources, including retained earnings from investments in the development of the company's production potential to a financial activity [22].

It should be noted that during the financial crisis of 2007–2009 there was a significant increase in prices for agricultural raw materials and processed products. Researchers believe, that one of the reasons for this growth is the excessive financialization of the agricultural sector, in particular the growth of commodity indices, which led to rising prices in futures and therefore spot markets [23].

At the same time, according to research results, in the conditions of emerging economies, the development of commodity derivatives markets helps to reduce price volatility, has a positive effect on the functioning of spot markets, and allows hedging risks. Scholars have found no clear evidence that national markets for financial and commodity derivatives are catalysts for financial crises in these countries [24].

In the last decade, Ukraine has taken the position of a large economy in certain markets for agricultural products, due to a significant share of market supply. Domestic agricultural products have conquered the national markets of many countries and the international market due to the attractive ratio of quality and price of products, convenient geographical location of ports of departure. Under such conditions, Ukraine can influence the situation in these markets. In 2021, Ukraine became a member of the UN Committee on World Food Security and became one of the guarantors of food security in the world.

Today, grain exports significantly affect the dynamics of macroeconomic indicators of Ukraine's economy. Domestic exports of agricultural products provide about 10 % of real GDP, 18 % of employment, and 6 % of tax revenues, and therefore significantly affect the macroeconomic environment of Ukraine's economy. According to the State Statistics Service of Ukraine in 2020, agriculture is one of the most profitable sectors of the Ukrainian economy (18.4 %), while the average profitability of operating activities was 6.5 % [25]. Given the strategic importance of the industry, the issues of increasing the efficiency of domestic agricultural enterprises deserve special attention.

However, Ukrainian farmers face several challenges that negatively impact the effectiveness of their activities, one of which is price and currency risks. Under such

conditions, in our opinion, further financialization of the business model of agricultural enterprises, in particular through the development of a liquid and transparent derivatives market, will significantly increase their efficiency and have a positive impact on the macroeconomic environment of Ukraine.

**The purpose of the article** is to substantiate the theoretical and methodological foundations and economic feasibility of intensifying the processes of financialization of the business model of Ukrainian grain producers, in particular through the formation of the grain futures market and the creation of commodity exchange in Ukraine.

**Results and discussion.** The securitization indicator of economic activity is most often used to illustrate the phenomenon of financialization of the global agricultural sector of the economy. The last ten years have seen a marked reactivation in the global derivatives market. Global derivatives trading increased by 40.4 % from 22.9 billion contracts in 2011 to 46.2 billion trading contracts in 2020, of which almost 7.0 billion were commodity derivatives. The share of agricultural instruments in 2020 increased significantly by 46 % compared to 2019. In 2020, more than a third (2.37 billion contracts) of the global trade in commodity derivatives are instruments whose underlying asset is agricultural products. Rapid growth was also observed in the nominal value of concluded agreements, which in 2020 amounted to 25.8 trillion USD [26].

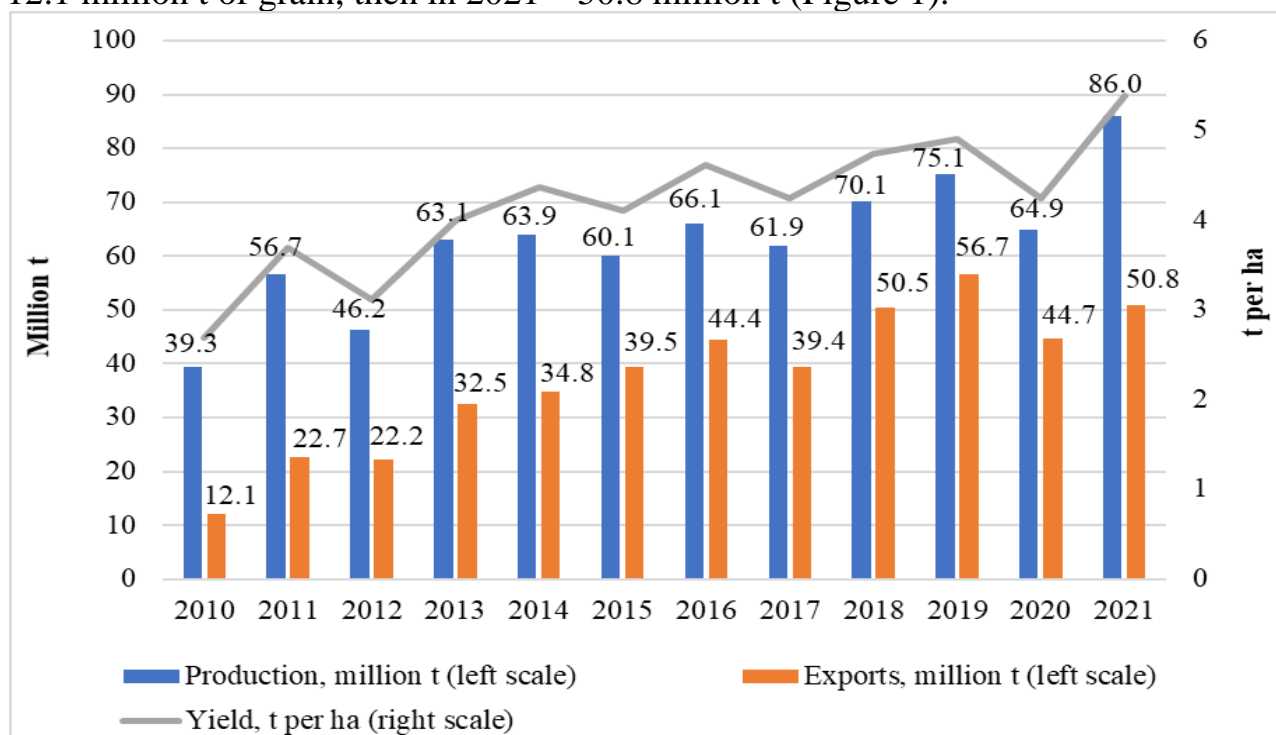
The strengthening of Ukraine's role in the international grain market stimulated the growth of interest of the world leader in exchange trading in derivatives CME Group. In particular, in June 2012, the Chicago Mercantile Exchange launched futures trading on Black Sea wheat, but the contract was not in demand among market participants. In December 2017, CME Group launched new cash-settled futures and options for Black Sea wheat and corn (Black Sea Wheat Financially Settled (Platts) Futures, Black Sea Corn Financially Settled (Platts) Futures). In the first 1.5 years, a total of 320,000 lots were signed, corresponding to 16 million t [27].

In 2021, against the background of favorable forecasts of increasing exports from Black Sea ports, the role of futures for Black Sea corn as a regional price benchmark has increased. Exporters, traders, processors, importers, and end buyers increased their activity in this market, which was reflected in the number of concluded agreements and open positions. According to CME Group, during January–April 2021 the number of concluded agreements increased by 14 % compared to the same period last year. The number of open positions, which is the most important measure of the success of the futures contract as of mid-July, reached 8,487 lots or 424,350 t, showing an increase of 471 % (year on year) [28].

In fact, CME does not often trade in these commodity derivatives, compared to global reference futures for wheat and corn. One of the reasons for the illiquidity of such instruments is that, for international investors, local commodity markets for such derivatives remain opaque. At the same time, such instruments act as a price benchmark for Black Sea grain and corn for international traders.

In addition, interest in the Ukrainian grain market is shown by the Euronext

exchange, which in early 2021 announced a plan to launch settled futures for wheat and barley from the Black Sea region in response to growing grain exports from Ukraine [29]. The attention of global exchange participants to such commodity assets is not accidental. Over the last 20 years, significant progress has been made in the physical volume of agricultural exports. If 20 years ago Ukraine exported 12.1 million t of grain, then in 2021 – 50.8 million t (Figure 1).



**Figure 1. Production, exports and yield of grain in Ukraine in 2010–2021**

Source: [30].

According to 2019–2020, Ukraine ranks second in the world in terms of grain exports. The main grain export items today are corn, wheat, barley, soybeans. In particular, Ukraine ranked second in the world in terms of barley supplies, fourth in terms of corn exports, and fifth in terms of sales of wheat on world markets. In the geographical structure of grain exports, Asia and the EU occupy the top positions. In 2020, the main importers of Ukrainian grain were China, Egypt, Indonesia, Spain, the Netherlands, Turkey, Tunisia, Bangladesh, South Korea, and Libya.

One of the factors ensuring the competitiveness of Ukrainian grain on the world market is a competitive price-quality ratio. In recent decades, there have also been significant transformational changes in the model of functioning of the domestic grain market. Those changes were due to several objective factors. Participants in the domestic grain market are producers who are suppliers of products, processors, trade intermediaries, suppliers of material and technical resources, elevators and warehouses, carriers, financial service providers, exporters.

The business model of grain producers is determined mainly by the size of the enterprise, its organizational and legal form, and specialization. Producers supply products to intermediaries, processors, and exporters. Producers sell their products throughout the marketing year. Producers sell about 55 % of the harvest during the

harvest period. This is because producers (mostly small and medium) do not own storage infrastructure and do not have access to it, and need immediate revenue to finance production costs. In addition, producers are not sure of the favorable dynamics of the price of the harvest in the future [31].

Processors are the largest segment of demand in the market. Processors purchase raw materials both directly from producers and intermediaries. Processors mostly buy products at spot prices that have developed in the market at a certain point in the marketing year.

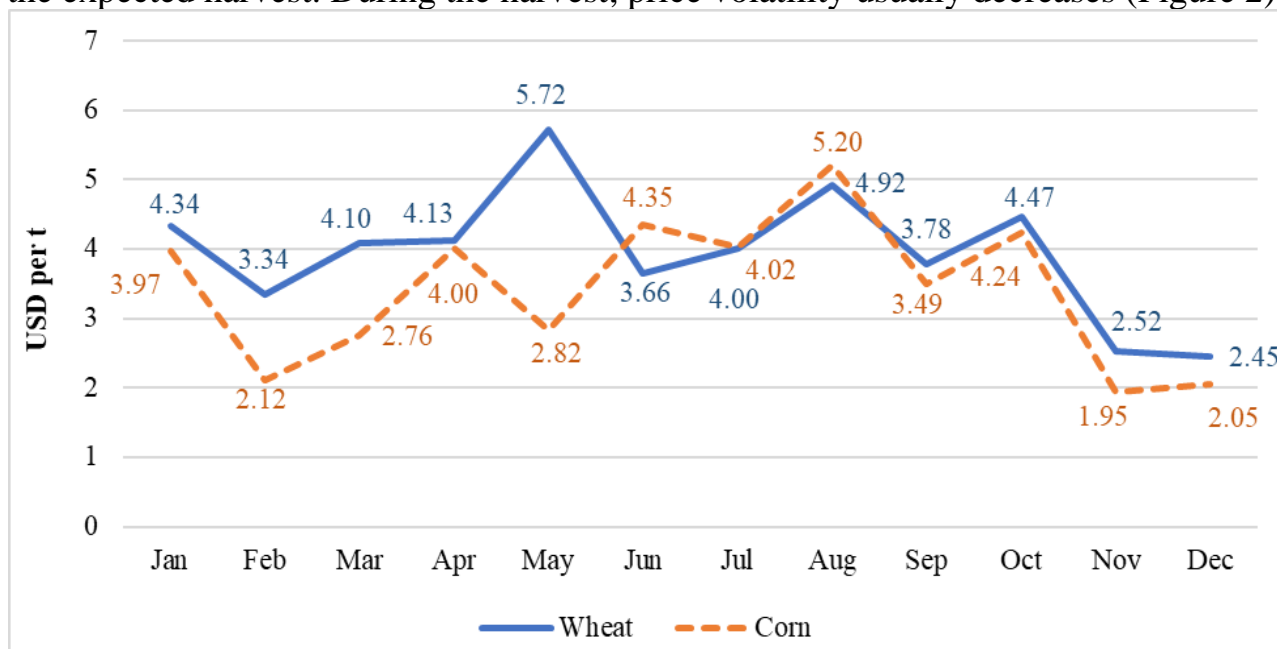
Suppliers of material and technical resources, among which many divisions of international companies operate in the Ukrainian market today, in recent years have begun to play a significant role in the domestic grain market. Today, such intermediaries, along with the main activity – the supply of plant protection products, seeds, fertilizers provide producers with commodity loans, enter into forward contracts with producers for the purchase of products on specific terms, often beneficial to farmers.

Intermediaries, as well as processors purchase products directly from agricultural producers and form and supply goods on terms, agreed with the buyer. Both domestic and international trading companies act as intermediaries in the grain market. The entry of international companies into the market has caused the development of warehousing and port infrastructure in Ukraine, and the intensification of competition in the world market. Elevator and warehouse companies can also perform the functions of intermediaries.

The emergence of large agricultural companies (agricultural holdings) has reduced the influence of intermediaries on the functioning of the grain market in Ukraine. Now foreign and domestic consumers and exporters prefer to work with large agricultural holdings. In fact, Ukraine has undergone a process of “agroholdingization” of the economy, which has led to the involvement of a significant number of foreign companies, most of which are located in jurisdictions with favorable tax legislation in their production structures. Today in Ukraine 117 agricultural holdings cultivate 16 % of the country’s agricultural lands. Almost all companies in the top 10, among other types of agricultural production, are engaged in the production and trade of grain. Today there are more than 10 foreign agricultural holdings in Ukraine. About 4 million hectares of land or 26 % of all harvested areas are under their control [32].

Participants in the domestic grain market face a number of risks – currency, harvest, price, tax, interest risks. Ukrainian farmers are also at liquidity risk related to the problem of insufficient liquid funds to fulfill their own obligations to suppliers or commercial banks. Market risks of farmers may be due to fluctuations in prices for borrowed economic resources (fertilizers, fuel, seeds, plant protection products, etc.), changes in supply and demand in domestic and foreign markets, which may be due to weather conditions, changes in foreign economic policy, excessive exchange rate fluctuations. One of the indicators of the magnitude of price risks is the indicator of their volatility usually measured by standard deviation of the price. We calculated

standard deviations of wheat and corn daily FOB prices in 2016–2021 for each month and its average values for respective months in the period. Analysis of grain price volatility during the marketing year makes it possible to trace the so-called seasonal volatility – prices increase during sowing and ripening periods when farmers enter into fixed-term contracts and there is uncertainty for both producers and buyers about the expected harvest. During the harvest, price volatility usually decreases (Figure 2).



**Figure 2. Average FOB price volatility of wheat and corn in Ukraine in 2016–2021, USD per t**

*Source:* calculations of the authors according to [33].

Uneven distribution of income among producers poses new threats to the functioning of the agricultural market. Under such conditions, scholars and experts often emphasize that domestic agricultural producers need state support in the form of subsidies, soft loans, or infrastructure financing. Today, domestic farmers are trying to manage risks through product diversification, concentration, and production integration. One of the consequences of such a policy is the growth of concentration of production, “agroholdingization” of the economy.

Attempts to mitigate risks through the implementation of state programs to support agricultural producers in Ukraine are not effective yet. According to world experience in developed economies, hedging and risk insurance instruments have supplanted state subsidies for farms. In the United States, for example, the Federal Agriculture Improvement and Reform Act was passed in 1996, providing for a pilot program to subsidize farmers to participate in hedging risks in futures and options markets. At the same time, the farmer’s participation in such a program made it impossible for him/her to receive traditional financial assistance in case of a crop loss [34].

In our opinion, an important condition for the effective functioning of the industry is the intensification of market mechanisms to maintain the balance of interests of all market participants, and thus its further development and support of food security. One of the effective tools for neutralizing risks for Ukrainian farmers

should be a liquid market for derivatives for agricultural products. The current model of the domestic market of agricultural products does not allow the producer to adequately assess the actual demand (the impact of economic and political factors) and respond adequately to them. Forward programs offered to Ukrainian producers today do not always allow taking into account such price fluctuations. Forward agreements can be concluded both by state-owned enterprises (PJSC “Agrarian Fund”) and with Ukrainian and foreign intermediary companies and exporters. For example, PJSC “Agrarian Fund” has implemented forward program for the purchase of wheat, rye, buckwheat, and sunflower. The forward agreement provides forward price, a minimum batch of contract, the amount of prepayment which is determined for each customer and is from 50 % up to 70 % of the delivery cost, interest rate for the use of funds, delivery time and delivery basis. In addition, the insurance of the future harvest is a mandatory condition of the contract [35].

Divisions of large international companies that purchase products, enter into contracts with end users, ship and transport products play a significant role in the grain market. They have large production and logistics facilities for transportation and storage of products. These companies usually offer domestic farmers quite flexible financial solutions for hedging market risks. The terms of the forward contract allow the farmer to fix a guaranteed price level and give the right to review it with the intent of increasing if the current market price at the moment of asset delivery is higher.

For example, a division of the international company Syngenta, which offers plant protection products, in 2021 offered several flexible financial programs for Ukrainian farmers. The Forward Plus program for wheat, rapeseed, and corn stipulates that the farmer fixes the price in the forward agreement, which is slightly lower than the market indicators, but the farmer gets the right to revise the price to market level before asset delivery if the market price is higher than the price fixed in the agreement. This will allow the farmer to get the current price for their harvest in any market situation. However, this contract provides additional conditions for the volume of products, which should be equal to the planned purchase of the company’s products. Ukrainian manufacturer of plant protection products UKRAVIT offers forward programs without reference to price. The company is ready to buy the future harvest from farmers and under a forward agreement to provide plant protection products, seeds, etc., and the price of grain can be fixed at any time, at the request of the farmer without additional fees. Only the volume of purchased products is set in advance [36].

The main difference between futures and forward contracts is that the forward contract can balance profits and losses only on the day of the contract. Futures prices for agricultural products, which are formed on the stock exchange, tend to show significant volatility during the marketing year and are determined by many factors. For example, during the sowing period, futures prices for the harvest are usually higher than at the time of harvest. The reason for this is that the futures price includes weather, market, interest, and currency risks. If, for example, weather conditions were unfavorable, current prices may increase during the harvest period.

A similar situation was observed in Ukraine in 2020 when Ukrainian agricultural

producers refused to fulfill forward contracts when prices for Ukrainian barley, wheat, corn, soybeans, and sunflowers increased significantly during the harvest due to adverse weather conditions and growing demand in the international market from China and the EU. At the time of the contract, spot prices exceeded forward prices. In other words, there were real preconditions when agricultural producers did not want to fulfill forward contracts. According to experts, only about 20 % of suppliers have fulfilled contracts. Such companies entered into forward contracts for only 10–20 % of production [37]. But in 2021, the threat of defaults on forward contracts for agricultural products was much lower, as forward prices exceeded spot prices.

Such events negatively affect the reputation of agricultural producers, causing losses to their counterparties, as buyers-exporters usually conclude contracts for contracted batches of products at the same time on international exchanges and the market as a whole, reducing its liquidity. Given the specifics of agricultural production and the lack of a liquid market for commodity derivatives, such contracts should specify the force majeure circumstances that may determine the terms of the contract execution.

To hedge the risks of changes in the price of these assets in regional spot markets, it is also advisable to use futures contracts for wheat and corn, which are listed on global exchanges. As there is no market for grain derivatives in Ukraine yet, domestic producers can use wheat and corn futures on the CME Group and Euronext exchange to hedge price risks in the Ukrainian spot market. Using regression analysis, we tried to evaluate the effectiveness of hedging using Corn Futures (CME Group), Black Sea Corn Financially Settled (Platts) Futures (CME Group) and Corn / Mais futures (Euronext Paris). In our samples we used daily data on spot and futures prices. For FOB corn price time series include data from July 2012 to August 2021 (CME Corn, Euronext Corn) and from December 2017 to August 2021 (CME Black Sea Corn). For CPT corn price time series include data from October 2016 to August 2021 (CME Corn, Euronext Corn) and from December 2017 to August 2021 (CME Black Sea Corn).

Hedge efficiency is the extent to which changes in the fair value or cash flows of a futures contract offset changes in fair value or cash flows of the underlying asset. Qualitative and quantitative methods of analysis are used to assess the effectiveness of hedging, including regression analysis between changes in futures and the underlying asset prices. The efficiency of hedging is determined by the indicators of the angular coefficient and the coefficient of determination. Hedging is considered highly effective if the slope of the regression line is in the range  $[-0.8; 1.25]$ , and the coefficient of determination exceeds 0.8 [38].

The relationship between Ukraine's domestic FOB corn prices, CPT-based export prices, and futures prices was assessed. The regression equation is following:

$$Y = b_0 + b_1X, \quad (1)$$

where  $Y$  – the FOB or CTP price of corn in Ukraine;

$b_0$  – zero regression coefficient;

$b_1$  – slope of a regression line;

$X$  – respective corn futures price.

The results of the analysis are presented in the Table below.

*Table 1*

**The results of regression analysis of corn price hedge effectiveness using futures contracts**

Futures contract Variable	CME Corn	CME Black Sea Corn	Euronext Corn	CME Corn	CME Black Sea Corn	Euronext Corn
	FOB			CPT		
Zero regression coefficient	63.8*	-0.2	7.8*	28.7*	-7*	-21.7*
Futures price	0.79*	1*	0.89*	0.95*	0.98*	0.98*
Correlation coefficient (r)	0.92	0.99	0.94	0.91	0.99	0.93
Determination coefficient (R <sup>2</sup> )	0.86	0.98	0.89	0.82	0.98	0.86
F significance of the model (F sign)	0.01*	0.01*	0.01*	0.01*	0.01*	0.01*

*Note.* \*Value denotes significance at 5 % level.

*Source:* calculations of the authors according to [33].

According to the results of the analysis, all considered futures contracts can be used for effective hedging of corn FOB and CPT prices in Ukraine. As expected, regional futures for Black Sea corn on the CME Group were the most suitable for hedging. However, it should be noted that although the role of this contract as a regional price benchmark is growing, its liquidity is low compared to the global reference futures for corn on the same exchange. The relatively low efficiency of hedging with global corn futures (CME Corn Futures) can be explained by the fact that its price fluctuations are largely due to supply and demand factors in North America. Futures on the Euronext exchange are also suitable for hedging, but for participants in the grain market in Ukraine, there are additional currency risks due to fluctuations in the exchange rate of EUR/USD, as most export contracts are denominated in US dollars, and futures are quoted in euros.

We also assessed the effectiveness of hedging price risks for Ukrainian wheat using Chicago SRW Wheat Futures, Ukrainian Wheat (Platts) Futures (CME Group) and Milling Wheat / Ble de Meunerie (Euronext Matif) by building a correlation model for assessing the dependence of domestic FOB price for Ukrainian wheat, CPT-based export prices on the futures prices of these contracts. In our samples, we used daily data on spot and futures prices. For FOB wheat, price time series include data from March 2015 to August 2021 (CME Wheat, Euronext Wheat) and from April 2021 to August 2021 (CME Black Sea Wheat). For CPT wheat, price time series include data from October 2016 to August 2021 (CME Wheat, Euronext Wheat) and from April 2021 to August 2021 (CME Black Sea Wheat). The regression equation is following:

$$Y = b_0 + b_1X, \quad (2)$$

where  $Y$  – the FOB or CTP price of wheat in Ukraine;

$b_0$  – zero regression coefficient;

$b_1$  – slope of a regression line;

$X$  – respective wheat futures price.

The results of the analysis are presented in the Table below.

Table 2

**The results of regression analysis of wheat price hedge effectiveness using futures contracts**

Variable \ Futures contract	Chicago SRW Wheat (CME)	Ukrainian Wheat (CME)	Euronext Wheat	Chicago SRW Wheat (CME)	Ukrainian Wheat (CME)	Euronext Wheat
	FOB			CPT		
Zero regression coefficient	28.9*	-	-5.5*	37.0*	-	-7.9*
Futures price	0.94*	1.00*	1.00*	0.85*	0.93*	0.96*
Correlation coefficient (r)	0.85	0.99	0.93	0.86	0.99	0.94
Determination coefficient (R <sup>2</sup> )	0.72	0.99	0.87	0.73	0.99	0.88
F significance of the model (F sign)	0.01*	0.01*	0.01*	0.01*	0.01*	0.01*

*Note.* \*Value denotes significance at 5 % level.

*Source:* calculations of the authors according to [33].

According to the analysis, the most suitable for hedging domestic and export prices for Ukrainian wheat is a futures contract traded on the EURONEXT exchange, which is considered the reference price benchmark for the European market. However, trading in these futures can also lead to additional currency risk because the futures price is denominated in euros. The slightly lower coefficient of determination does not justify classifying Chicago SRW Wheat Futures as an effective hedging tool, what can probably be explained by regional pricing factors that are specific to the North American market. The highest values of the coefficients of determination were obtained for the contract Ukrainian Wheat (Platts) Futures, which can be explained by the peculiarities of the formation of futures prices. At the same time, the critical weakness of this contract, which hinders its effective use in hedging, is its absolute illiquidity (at the date of the article prepared for publication for each available contract, the number of open positions was 0).

Thus, according to the results of the analysis, the most suitable for hedging price risks in the Ukrainian market of corn and wheat are the relevant futures on the Euronext exchange, but their use may lead to additional currency risk. Therefore, given the high level of transaction costs for Ukrainian traders on this exchange, we consider it appropriate to recommend the launch of futures contracts for corn and wheat on the Ukrainian stock market.

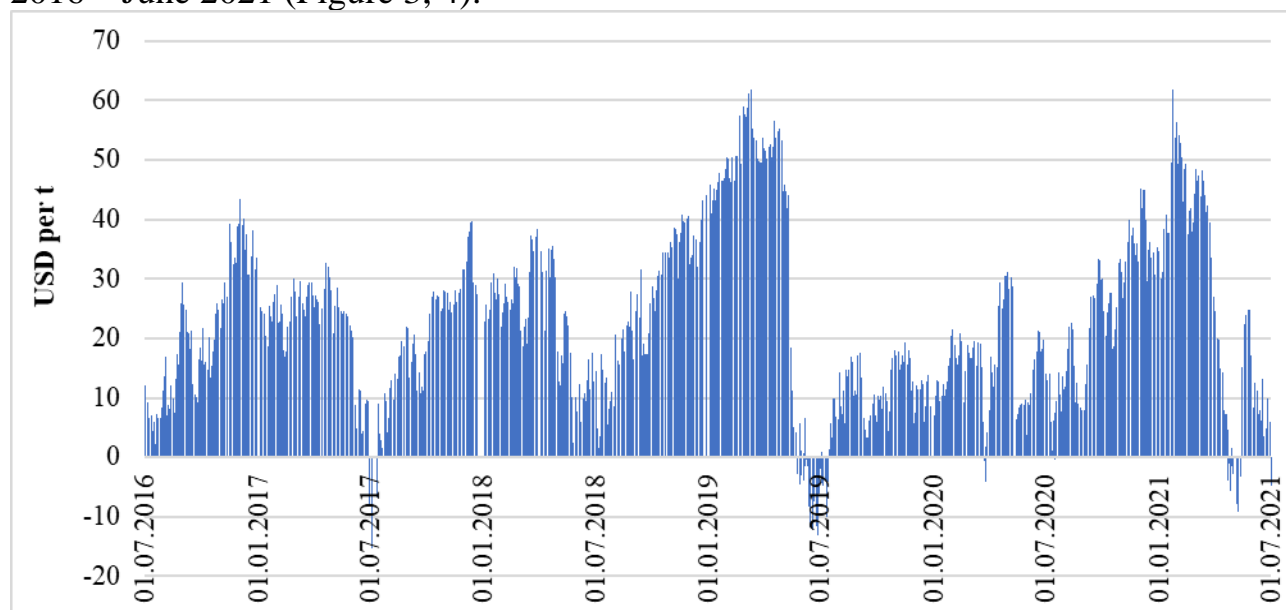
The farmer should learn and be able to make quick decisions about hedging price risks. For this purpose, it is necessary to use liquid commodity derivatives, the quotations of which correlate with the current price on the domestic grain market. Under the current grain market model, Ukrainian farmers can track demand prices for harvested crops and analyze the basis – as the difference in prices on Ukrainian markets with futures quotes on international exchanges, analyze changes in demand from key importers to predict the potential for future price changes and whether the prices offered today meet the expectations of the producer.

Today, grain market participants use quotations of relevant commodity futures on

the Chicago Mercantile Exchange (CME Group) and the Euronext exchange to build and analyze the basis. Producers can also use historical data based on past years to determine when it would be profitable to store grain in storage with its later sale, as well as to set the price of a forward contract that would ensure the profitability of hedging. It is the basis that determines how effective a result of hedging will be. The ability to analyze the basis allows producers to make timely decisions on the sale of products on the spot and futures markets, by taking into account historical data on the bases, as well as to form strategies for hedging risks or speculation in the grain market.

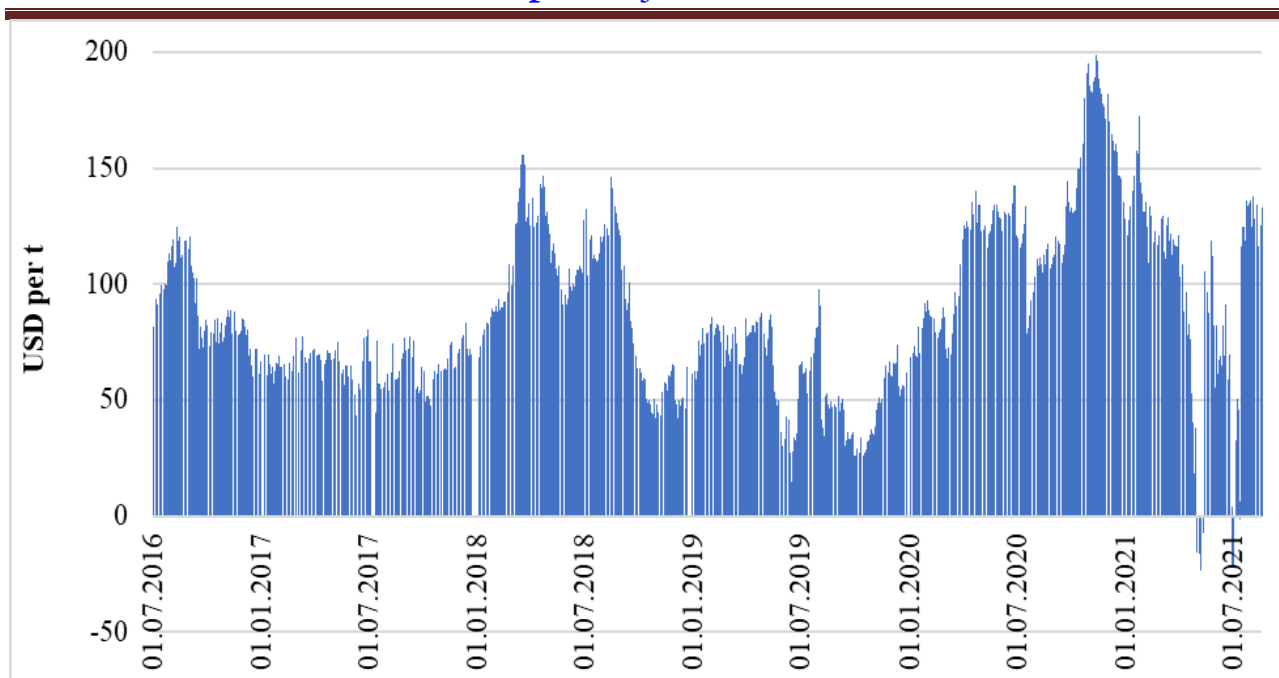
The historically strong basis indicates that prices in Ukraine are growing faster than on the Chicago Mercantile Exchange and this is a signal to sell products on the spot market. The historically weak basis indicates that prices are falling or rising faster on the spot market of Ukraine than on the Chicago Mercantile Exchange, so it is advisable to refrain from immediate sale of products on the market.

When forming the producer's strategies, it is advisable to compare the historical and current basis, as well as to compare the basis at the time of concluding the contract with the historical basis at the time of its implementation. The grain producer who hedges the price risk with the relevant futures, sells the grain at the spot market price on the date of completion of the hedge and receives income on the futures market if the futures price decreases. Therefore, for him/her, the effective selling price is equal to the sum of the initial futures price of grain and the basis on the date of completion of the hedge. Thus, the stable positive historical value of the basis on the date of completion of the hedge increases the effectiveness of the short hedge and weakens the effect of long hedge. We analyzed the dynamics of the basis for wheat and corn based on the FOB price in relation to the relevant global reference contracts on the CME Group (Chicago SRW Wheat Futures and Corn Futures) during July 2016 – June 2021 (Figure 3, 4).



**Figure 3. Ukrainian wheat 11.5 % FOB price to Chicago SRW Wheat Futures basis, USD per t**

*Source:* calculations of the authors according to [33].



**Figure 4. Ukrainian corn FOB price to Corn Futures (CME Group) basis, USD per t**

*Source:* calculations of the authors according to [33].

For Ukrainian wheat and corn, a positive average value of the basis is observed during the analyzed 5 marketing years. In addition, the low volatility of the basis for these crops and the built 90 % confidence interval (Table 3) indicate a relatively low risk for domestic hedgers and the possibility of using these contracts for hedging.

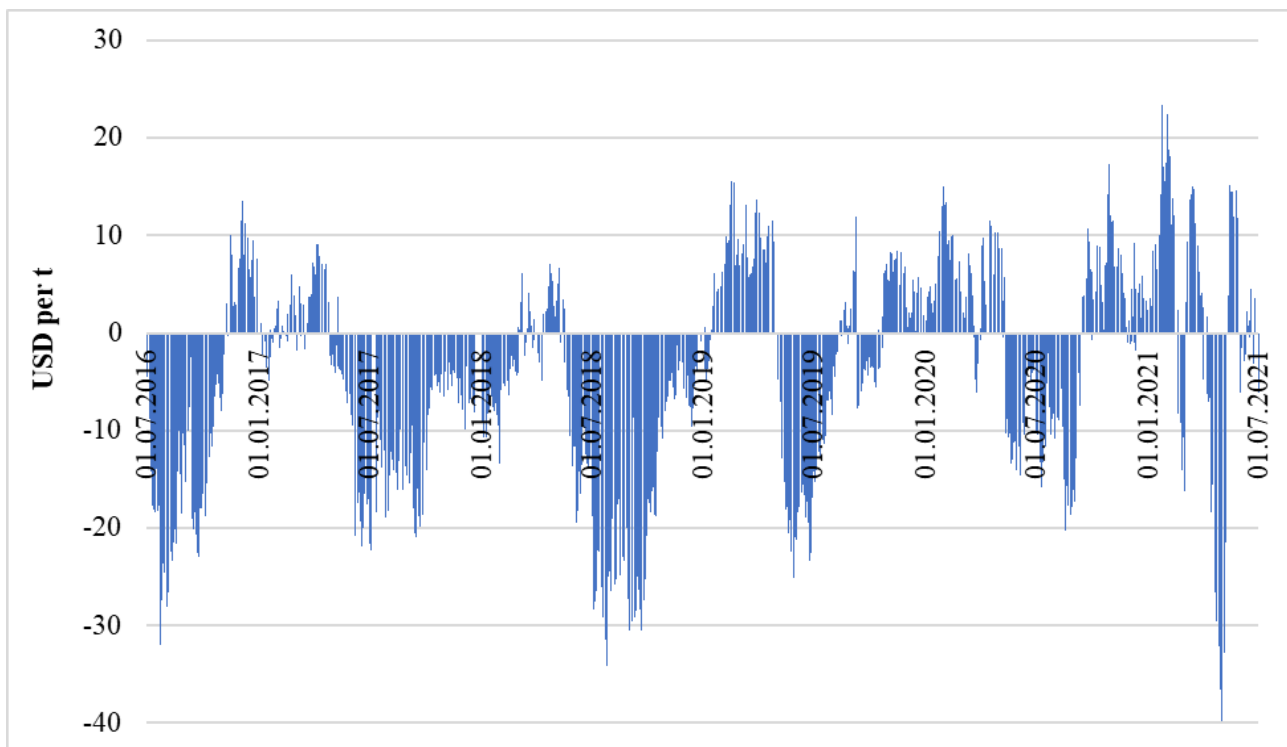
*Table 3*

**Indicators of the basis for Ukrainian FOB wheat and corn price and benchmark futures on the CME Group**

Marketing year	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021
<i>Wheat</i>					
The average value of the basis	20.8	21.1	30.3	12.2	24.5
Standard deviation of the basis	9.6	10.0	19.6	7.2	15.5
90% confidence interval	[5.1; 36.5]	[4.8; 37.4]	[-1.7; 62.4]	[0.3; 24]	[-1; 50]
<i>Corn</i>					
The average value of the basis	77.8	88.0	73.0	76.0	114.2
Standard deviation of the basis	17.8	27.9	27.5	34.6	44.4
90% confidence interval	[48.7; 106.9]	[42.3; 133.7]	[27.9; 118.2]	[19.3; 132.7]	[41.4; 187]

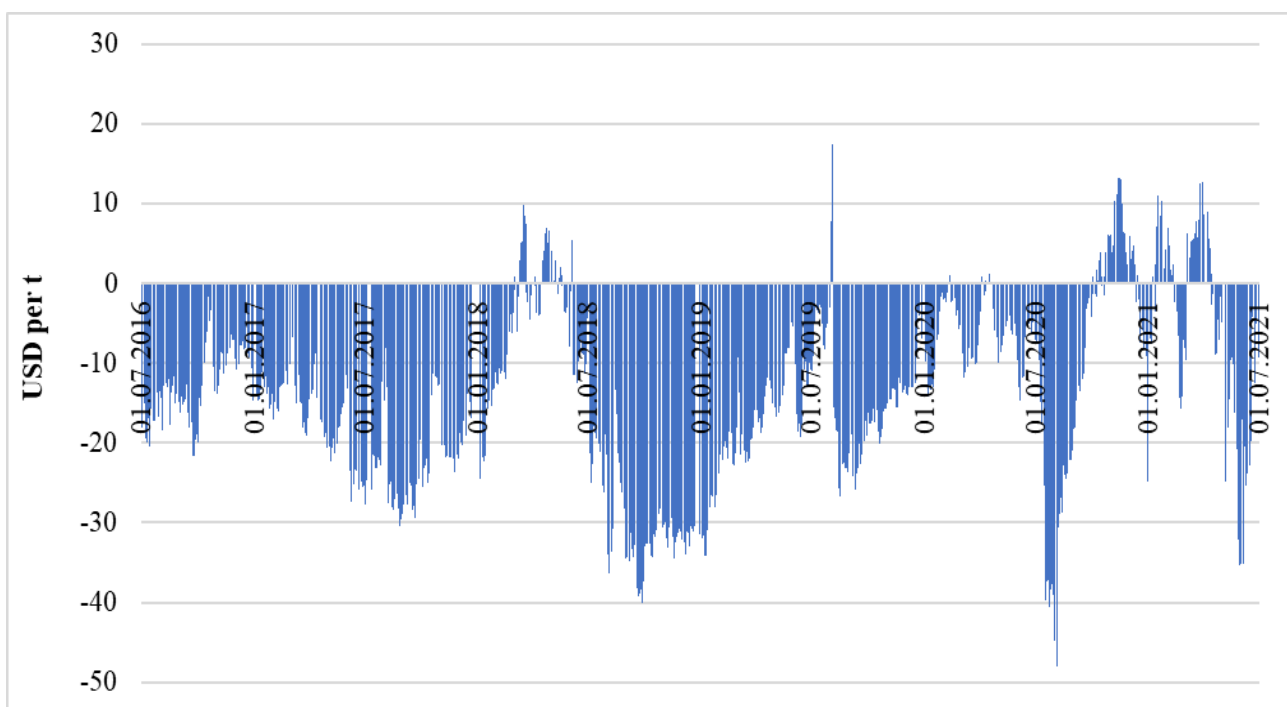
*Source:* calculations of the authors according to [33].

At Euronext, the average basis value for wheat and corn reference futures in the 2016–2021 marketing years was mostly negative (Figure 6, 7). Given the confidence intervals obtained and the relatively high volatility of the basis (Table 4), hedging futures on the Euronext exchange is riskier for both buying and selling contracts. In our opinion, the high volatility of the basis here is further enhanced by the volatility of the exchange rate of EUR/USD. Thus, although benchmark European wheat and corn futures show higher hedging efficiencies than North American benchmarks, high basis volatility poses additional risks for hedgers.



**Figure 5. Ukrainian wheat 11.5 % FOB price to Milling Wheat / Ble de Meunerie Futures (Euronext) basis, USD per t**

*Source:* calculations of the authors according to [33].



**Figure 6. Ukrainian corn FOB price to Corn Futures (Euronext) basis, USD per t**

*Source:* calculations of the authors according to [33].

*Table 4*

**Indicators of the basis for Ukrainian FOB wheat and corn price and benchmark futures on the Euronext exchange**

Marketing year	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021
<i>Wheat</i>					
The average value of the basis	-6.1	-7.0	-8.5	0.5	-0.5
Standard deviation of the basis	10.6	6.5	13.2	7.0	11.6
90 % confidence interval	[-23.5; 11.2]	[-17.7; 3.7]	[-30.1; 13.2]	[-10.9; 11.9]	[-19.5; 18.6]
<i>Corn</i>					
The average value of the basis	-14.0	-12.5	-23.3	-10.1	-7.4
Standard deviation of the basis	4.9	10.4	8.6	7.3	14.0
90 % confidence interval	[-22; -6]	[-29.6; 4.6]	[-37.3; -9.3]	[-22.1; 1.8]	[-30.4; 15.6]

*Source:* calculations of the authors according to [33].

These results of the analysis are another argument for the need to form a national market for agricultural derivatives.

**Conclusions.** Ukrainian grain market is at a stage of development, when further financialization regulated by effective legislation should be considered as an objectively determined trend of its progress. The formation and development of a deep and transparent domestic market of grain derivatives, which will contribute to the improvement of the efficiency of agricultural enterprises, in particular with regard to the management of financial assets and market risks, and therefore the development and realization of the export potential of Ukrainian agricultural sector, is an important mechanism for realizing the economic imperatives of financialization of grain markets in Ukraine. Financialization of grain markets will allow market participants to effectively supplement the so-called natural hedge – fluctuations in prices due to natural conditions, and plan cash flows to finance operating expenses and capital expenditures.

In our opinion, in Ukraine or other countries with an emerging economy, the financial system and financial intermediaries are still at a stage of development that is unable to generate a critical mass of financial resources that exceeds the real commodity sector and can lead to a collapse in commodity prices and provoke an economic crisis.

On the other hand, it is difficult to imagine the pricing of commodity derivatives without the participation of speculators – financial investors who have enough free capital to play in the market and assume the risks associated with uncertainty about future price dynamics, provide market liquidity. Due to speculators, the depth and liquidity of the commodity derivatives market increases, the possibilities of risk hedging expand, and excessive price volatility can be avoided.

It should be noted that the formation of the national market for agricultural derivatives will not create a new marketing channel for products, but rather should become a reliable and transparent source of information about market conditions. Even if we assume that not all (especially small) producers will participate in trading on the national stock exchange, its functioning will have a positive impact on the competitiveness of small and medium-sized producers along with large producers.

The results of the regression analysis of Ukrainian domestic and export prices for wheat and corn and future prices for Black Sea corn and wheat traded on CME Group and Euronext gave grounds for drawing conclusions about the high efficiency of hedging price risks using the market derivatives.

Futures are not a substitute for a forward contract, but rather a supplement to it in building an effective strategy for hedging market price, currency, and political risks. For example, the grain futures market can significantly reduce the uncertainty of an intermediary who plans to enter into a forward contract, which should result in the actual delivery of the asset. He/she does not know what the price will be at the time of harvest. Therefore, the existence of a national derivatives market can significantly affect the model of the grain market in Ukraine. The analysis of the volatility of the domestic price basis in relation to future prices on the CME Group and Euronext exchanges for wheat and corn has proved that Ukrainian agricultural producers can use historical data on the basis for making effective operational decisions regarding the sale of products on the spot market, determining a favorable price for forward contracts and formation of an effective risk hedging strategy using futures contracts. Such research results are important arguments for the necessity and advisability of further financialization of grain markets in Ukraine.

Russia's large-scale military aggression in Ukraine in 2022 has led to an aggravation of non-financial risks that Ukrainian farmers faced, namely political risks. The latter, unlike financial ones, cannot be quantified. Political risks caused by the difficult military and political situation in the country, which led to a series of sudden losses in the field of commercial, investment activity and foreign currency transactions of agricultural producers, created obstacles for conducting operational activities of agricultural producers and fulfilling obligations regarding shipment and safe delivery of products to buyers, and therefore the fulfillment of obligations to counterparties. Under such conditions, the problems of forming reliable tools for minimizing political risks on Ukrainian grain markets, which are of strategic importance both for the national economy and in mitigating the world food problem, remain unsolved. In our opinion, the financialization of grain markets can become one of the effective tools for minimizing the negative consequences of the emergence of political risk, as well as for post-war reconstruction of the strategic sector of Ukrainian economy.

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