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INSTRUMENTS FOR MANAGING PRICE RISK IN GRAIN MARKETS

PENEV, PLAMEN[1]

Abstract
Price risk management in the grain market is a fundamental component of economic stability within the agricultural sector. Given the exposure of grain producers, traders, and processors to fluctuations in global and domestic prices, effective risk management strategies are essential to ensure income predictability and financial resilience. This report analyses the principal instruments used to manage price risk in grain markets, focusing on forwards, futures, options, swaps, and insurance schemes. Each instrument is examined in terms of its structure, operational mechanisms, advantages, and limitations, as well as its suitability under different market and institutional conditions. The study explores how forwards and futures contracts allow market participants to lock in prices and reduce exposure to unfavourable movements, while options provide greater flexibility by offering the right, but not the obligation, to trade at predetermined prices. Swaps are discussed as tools for more complex or long-term hedging arrangements, particularly in contexts where counterparties seek to exchange floating and fixed price exposures. In addition, the role of crop insurance and revenue insurance programs is assessed as complementary instruments that protect against both price and yield variability. The study indicates that the performance of price risk management instruments varies across regions and market structures. Factors such as market depth, transaction costs, access to credit, and the transparency of pricing mechanisms significantly affect their efficiency. In developing or thinly traded markets, limited liquidity and high margins may restrict participation, reducing the effectiveness of derivative-based strategies. Conversely, well-developed markets with active exchanges and robust regulatory oversight tend to offer more reliable hedging opportunities. The report further notes that successful application often depends on the user's financial capacity, managerial skills, and ability to interpret market signals, underscoring the importance of education and institutional support in enhancing the practical use of risk management instruments. The findings underscore that optimal price risk management in grain markets requires not only technical knowledge of available instruments but also an understanding of broader market dynamics and policy environments. Effective implementation depends on the alignment of risk management strategies with business objectives, cost structures, and the timing of market participation. Overall, the study contributes to the discussion on improving resilience in the agricultural value chain by demonstrating how a well-designed mix of price risk management instruments can reduce income volatility, support investment decisions, and enhance the long-term sustainability of grain sector enterprises.

Keywords: futures markets, price risk, derivates, hedging tools
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[1] Doctoral student in Agricultural Business, University of Economics, Varna, Bulgaria, plamen.penev@ue-varna.bg

Introduction

The volatility of agricultural commodity prices remains one of the most pressing challenges for producers, traders, policymakers, and consumers alike. In grain markets in particular, where food security and farm incomes are directly tied to price dynamics, managing uncertainty is not merely a financial exercise but a fundamental necessity. Over the past decades, a variety of instruments have been developed to mitigate exposure to adverse price movements. Among these, derivatives such as forwards, futures, and options, along with swaps and specialized insurance schemes, have emerged as the core mechanisms through which market participants seek stability in an inherently unstable environment.

The purpose of this report is to analyse the main instruments available for price risk management in grain markets, examining their structure, functionality, and practical applications. The author approaches the topic with the conviction that no single instrument can provide a universal solution. Instead, effective risk management depends on understanding the relative advantages and limitations of each tool, and on aligning the chosen strategy with the specific needs and constraints of producers, traders, and institutions.

This study argues that the discussion cannot be reduced simply to technical definitions or the mechanics of contracts. What deserves closer attention is the degree to which these instruments contribute to broader economic stability and sustainable agricultural development. For example, while futures markets offer liquidity and transparency, their accessibility for small-scale farmers remains limited. Similarly, options resemble insurance in their design, but their costs can make them prohibitive unless supported by policy frameworks. Insurance schemes themselves, although comprehensive in principle, face challenges in covering systemic risks that affect entire regions simultaneously.

Against this background, the central question that will guide the following analysis is: Which instruments, or combination of instruments, provide the most effective, accessible, and sustainable framework for managing price risk in grain markets? This question is not only technical but also socio-economic in nature, as it touches on issues of market access, institutional capacity, and the balance between public and private sector roles in stabilizing agricultural incomes.

By engaging with this question, the report aims to contribute to the academic and policy debate on risk management in agriculture and holds a view that the effectiveness of price risk management cannot be evaluated solely on the basis of financial outcomes, but must also be considered in terms of its ability to enhance resilience, reduce vulnerability, and ensure fair participation of different actors in the grain value chain.

Approaches for price risk management

The financial instruments most often applied to mitigate price risk can generally be classified within the group of derivatives. Broadly defined, a derivative is a contract whose value depends on the movement of an underlying asset or benchmark indicator (Garcia and Leuthold, 2004). Although this definition has its limitations, it provides a useful starting point for understanding the role of derivatives as mechanisms that allow market participants to secure future price levels or ranges for particular goods and services. A classic example is the commodity derivative, which enables the purchase or sale of a raw material at a future date, with the price being predetermined at the time of contracting. Common underlying assets for such instruments include equities, currencies, bonds, and a wide spectrum of commodities, among them agricultural products. Depending on the market environment where they are traded, derivatives are generally divided into two main categories. The first comprises standardized contracts traded on organized exchanges, where futures and options are the most widespread. The second category consists of over-the-counter (OTC) instruments, negotiated bilaterally between counterparties. These provide greater flexibility in tailoring contract terms, with forward contracts and swaps playing a central role.

Commodity exchanges, in turn, function as institutionalized markets where different groups of participants trade contracts linked to commodity prices. These platforms perform a dual role: on the one hand, they facilitate physical trade in raw materials, and on the other, they serve as an essential mechanism for transferring and managing risks stemming from price volatility (Shao et al., 2019). In this sense, commodity exchanges are a cornerstone of the broader system for price risk management in the agricultural sector and in the economy as a whole. The following sections of the report examine the five major instruments used in the agribusiness to manage the price risk:

1. Forward contracts

As the academic literature points out, a forward contract is a bilateral agreement between a seller and a buyer that stipulates the delivery of a predetermined quantity of a commodity at a future date, at a price (or a pricing formula) fixed at the moment of contracting (Bernrud et. al., 2005). Since these agreements are negotiated individually, their terms are highly customized and tailored to the specific needs of each transaction.

According to Ghoddusi et al. (2023), the use of forward contracts is built on three essential principles. First, no monetary exchange takes place at the time of signing. The seller undertakes the obligation to deliver the commodity at maturity, while the buyer is not required to make an advance payment, aside from potential transaction costs.

Second, the authors assert that because the only assurance of contract fulfilment lies in the counterparties' reputation and financial standing, forward agreements carry inherent credit or counterparty risk. There is always the possibility that one party may default by failing either to deliver the agreed quantity or to make payment at maturity (UNCTAD, 1998).
Third, forwards are primarily regarded as instruments for physical trade, where both parties expect to complete the actual delivery or receipt of the contracted product. This feature makes early exit from a forward agreement extremely difficult unless the counterparty agrees to cancel the contract (CFTC, 2005).

Price risk management using forward contracts

As emphasized by De Angelis et al. (2016), the use of forwards as a hedging tool relies on the principle of securing a future selling price in advance, thereby limiting exposure to adverse market volatility. The mechanism typically functions as follows: a producer or trader who holds, or intends to acquire, a certain volume of a commodity on the spot market can protect against a potential decline in prices by entering into a forward contract to sell that same quantity at a pre-agreed price. This creates the equivalent of a "short position" in the forward market. Conversely, purchasing a forward (or futures) contract corresponds to taking a "long position," reflecting the expectation that prices will rise.
At maturity, the holder of a short position sells the commodity at the fixed contract price, effectively neutralizing the risk of unfavourable price movements in the interim (UNCTAD, 1998). Yet despite their advantages, forwards are not without limitations. The most significant drawback for producers lies in the binding nature of the contract: the seller is legally obligated to deliver the exact contracted volume within the agreed time frame. Should actual output fall short of expectations, the producer must procure the missing quantity from external sources in order to fulfil contractual commitments.

Types of forward contracts

Because forward contracts are negotiated individually between the parties, they allow for significant flexibility in structuring. The key elements shaping these agreements usually include the method of price determination, the degree of discretion in choosing when to fix the price, the payment terms, and the possibility for participants to benefit from favourable market movements. Prager et al. (2020) identify several of the most commonly applied variants in Figure 1:

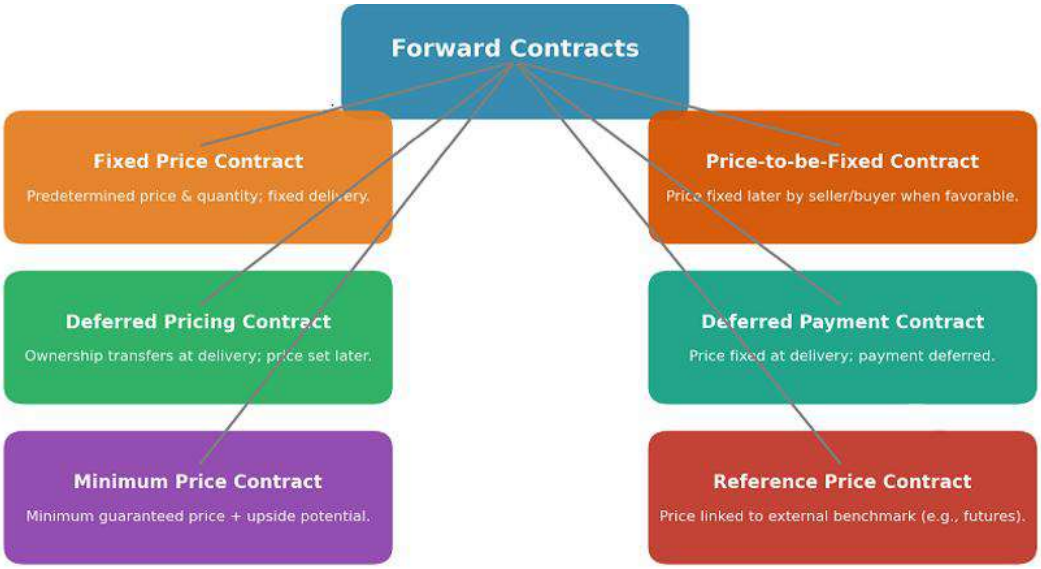

Figure 1. Types of forward contracts (Prager et al., 2020)

2. Futures contracts

Futures contracts emerged as an institutionalized means of standardizing forward agreements. In essence, a futures contract can be regarded as a standardized forward contract traded on an organized exchange. As MacDonald et al. (2004) emphasize, a futures contract is neither a share nor the commodity itself, but functions in a way that resembles stock trading. The buyer or seller of a futures contract agrees to purchase or deliver a specified quantity of a commodity, security, currency, stock index, or another underlying asset at a predetermined date in the future.

Unlike forwards, the actual transfer of the underlying asset is not always required at maturity. In most cases, contracts are settled before expiration through an offsetting transaction, meaning that a buyer of a futures contract sells an equivalent position, or vice versa. Thus, although a futures agreement fixes an approximate price in advance, the eventual costs of purchase or sale may still vary depending on market conditions.

The fundamental distinction between forwards and futures lies in their degree of standardization and in the organization of their trading, as noted by Atkin (1989). Futures contracts are strictly standardized in terms of the quantity and quality of the underlying asset and are traded exclusively on exchanges. For example, each soybean contract on the Chicago Board of Trade (CBOT) represents 5,000 bushels, while each wheat contract on EURONEXT MATIF covers 50 metric tons with specified quality standards.

Although both forwards and futures serve the same basic economic purpose by providing greater certainty over future cash flows, futures offer several additional advantages:

1. High liquidity, stemming from standardization, which enables a large number of participants to trade in homogeneous instruments.
2. Performance guarantees, since all transactions are processed through specialized clearinghouses.
3. Elimination of counterparty risk, because if one party defaults, the clearinghouse ensures contract fulfilment.

These characteristics explain why futures markets have become a more reliable and efficient tool for price risk management compared with individually negotiated forward contracts.

Price risk management using futures contracts

Futures contracts play a central role in mitigating price volatility in the agricultural sector. It is important to stress that hedging with futures does not necessarily aim to improve financial performance; rather, its primary objective is to reduce uncertainty and stabilize expectations.

The underlying principle is that spot prices and futures quotations tend to move in the same direction. By taking an opposite position in the futures market, producers and traders can offset adverse developments in the spot market. For instance, a farmer expecting to sell output in three months can hedge today by selling a futures contract and later closing the position at maturity by buying back an equivalent contract. Losses (or gains) realized in the spot market are then counterbalanced by gains (or losses) in the futures market. In this sense, futures exchanges are not used primarily for the physical purchase and sale of commodities but rather as an effective platform for hedging against price risk.

Basis risk in futures

Hedging through futures contracts does not guarantee that gains or losses on the exchange will fully offset the corresponding outcomes in the physical market. This discrepancy is referred to as **basis risk**. The basis is defined as the difference between the spot price and the futures price. Consequently, the effective purchase or sale price achieved through hedging with futures can be expressed as the sum of the futures contract price and the basis at the moment the position is closed.

The sources of basis risk are diverse, as noted by Anderson and Danthine (1983). The price dynamics of the physical commodity being hedged do not always mirror the movements of the standardized futures contract. In addition, the markets in which a company trades may differ from the exchanges where futures are listed, creating situations in which physical (client) markets evolve differently from

exchange quotations. Further mismatches can arise because the volume being hedged does not always align with the standardized contract size. Finally, the relationship between futures and spot prices may occasionally be distorted by attempts at market manipulation or by technical imbalances caused by supply shortages (UNCTAD, 1998).

The importance of the basis stems from the fact that it is the decisive factor determining the effectiveness of a hedging strategy. Essentially, a hedger is not speculating on price changes per se, but on movements in the basis itself. While overall price levels may fluctuate considerably across years, the basis usually remains relatively stable and can be forecast with reasonable accuracy through historical data analysis. The impact of basis risk can be either positive or negative. In a **short hedge**, a strengthening basis (where spot prices rise above futures) improves the hedger's position, whereas a weakening basis worsens it. In a **long hedge**, the opposite applies: a stronger basis undermines results, while a weaker basis improves them.

Table 1 observes some of the indirect benefits of futures that might serve as another advantage for those managing the price risk within a farming/trading company:

Table 1. Indirect benefits of futures

Benefit	Description
Price Discovery	Futures markets provide transparent and reliable price signals about expected spot price levels, allowing market participants to make informed production, storage, and marketing decisions (Dismukes et al., 2004).
Reference Prices	Futures quotations reflect current market expectations about future spot price levels. Transparent and competitive trading ensures these quotations act as credible benchmarks for pricing spot and forward contracts.
Agricultural Infrastructure	Futures exchanges foster institutional and technical infrastructure: licensed storage facilities, scientific preservation methods, strict delivery standards, quality control systems, and efficient telecommunications, all of which modernize and sustain agricultural markets.
Risk Management Culture	Beyond hedging itself, the use of futures markets promotes a broader culture of risk awareness and management. This encourages farmers, traders, and agribusinesses to adopt more professional planning practices and reduces vulnerability to unexpected shocks.

Sources: Dismukes et al., (2004); own elaboration

3. Options

Options provide the seller with a guaranteed minimum sale price, while the buyer secures the assurance of not paying more than a predetermined level, as defined by Cohen (2005). In this sense, options resemble insurance: they offer protection against adverse price changes while preserving the opportunity to benefit from

favourable market movements. Purchasing an option grants its holder the right, but not the obligation, to buy or sell a defined quantity of an underlying asset (such as cereals or oilseeds) at a fixed price, either at a future date or within a specified time frame (Garcia & Leuthold, 2004). In grain markets, options are most frequently written on futures contracts, which then serve as the underlying asset.

Price risk management using options

In practice, agricultural producers often hedge against falling prices by purchasing a put option, which guarantees a minimum selling price. However, the choice of strategy depends on the seller's contractual situation. For instance, if a farmer already has a spot-market sales agreement (such as through contract farming) that ensures a fixed minimum price, the use of put options becomes unnecessary, as the physical contract itself provides price protection. In such cases, options are instead employed to increase flexibility and to capture additional profit opportunities when prices rise. For this purpose, a call option can be purchased, generating a positive return in the event of upward market movements. At an institutional level, options are also used by governments and supply chain actors as a policy instrument to support farmers, reduce exposure to price volatility, and stabilize incomes (Hull, 2012). In this way, options are established as a flexible mechanism for managing uncertainty in the agricultural sector.

Hedging strategies with options

The combination of options and futures creates a broad array of potential trading strategies. It is important, however, to distinguish between speculative approaches and those designed specifically for risk management. Among the latter, Rata and Cinade (2009) highlight the so-called fence strategy, which limits the cost of acquiring options while setting a defined range of returns. This approach eliminates the possibility of unlimited gains but simultaneously reduces exposure to extreme losses, offering a balanced hedging solution. Table 2 provides a comparison view of Options versus Futures and their key aspects to consider in risk management:

Table 2. Comparison view of Options versus Futures

Aspect	Futures Contracts	Options Contracts
Initial Cost	Small initial margin deposit required	Premium paid upfront (fixed cost)
Financial Liability	Potentially large and unpredictable losses	Limited to the premium (no further liability)
Liquidity Pressure	High (margin calls possible)	None (premium paid once, no margin calls)

Aspect	Futures Contracts	Options Contracts
Cost Predictability	Low – settlement values fluctuate	High – premium is known and fixed
Cash-Flow Volatility	Greater exposure	Lower exposure
Suitability for Beginners	Less suitable (complex, risk of losses)	More suitable (predictable, controlled risk)
Best Use in small to medium size companies	Risky due to volatility and limited resources	Favorable – provides stability and planning capacity
Flexibility *(extra dimension)*	Limited – obligatory positions once entered	High – can combine strategies to optimize costs

Sources: own elaboration

Options on futures

Options on futures differ from standard option contracts in that, upon exercise, they require the delivery not of the physical commodity but of the underlying futures contract (Stulz, 2002). In agricultural markets, the term "option" often refers precisely to this form – an option written on a futures contract. For example, the underlying asset of a wheat option traded on the Chicago Board of Trade (CBOT) is the wheat futures contract.

Exercising a call option on a futures contract grants the buyer a long position in the futures market plus a cash amount equal to the difference between the futures settlement price and the option strike price. Conversely, exercising a put option provides the holder with a short futures position along with the difference between the strike price and the latest settlement price. Options on futures are often more attractive than those on physical commodities, as delivery of a futures contract is less costly and easier to arrange. Their role becomes particularly important in fragmented spot markets, where physical trade is burdened by high transaction costs and logistical constraints (Hull, 2012).

4. Swaps

Swaps originated in the over-the-counter (OTC) markets as long-term instruments for managing price risk. According to Zmeskal (2004), a **commodity swap** is a contractual agreement under which two parties exchange a fixed price for a floating price (or vice versa) for a predetermined quantity of a commodity over a specified period, with payments made at agreed intervals.

In essence, as further described by Zmeskal (2004), a swap is a bilateral arrangement between a hedger who is typically a producer or consumer of a commodity and a provider of hedging services. Under this structure, the hedger agrees to pay a fixed price while receiving a floating price for the agreed volume of

the commodity. The most common setup involves a producer and a consumer, with a financial institution, usually a bank, acting as intermediary to guarantee and administer payments. When swaps are negotiated directly between producers and consumers without an intermediary, the advantage lies in avoiding additional counterparty exposure to a financial institution, though this increases the direct bilateral risk borne by the contracting parties.
Commodity swaps are settled on a **net basis** for predefined periods, with no physical delivery of goods. Depending on whether the prevailing market price is above or below the fixed price, one party compensates the other through a cash payment. Entering into a swap usually does not require an upfront fee. Unlike futures contracts, swaps do not involve margin calls, nor is there an initial premium payment as with options (Geman, 2005). Nevertheless, due to the high counterparty risk inherent in these transactions, financial institutions often demand collateral to secure the exposure.

Price risk management through swaps

The most common form of swap agreement in both commodity and financial markets is the fixed-for-floating swap. As depicted by Geman (2005), under this arrangement the two parties periodically exchange floating for fixed payments (or vice versa) on a specified quantity of a commodity over an agreed term. The fixed price is usually set by the financial institution facilitating the transaction, while the floating price is linked to a pre-selected futures contract, market index, or other price benchmark.
This structure enables participants to transform uncertainty stemming from volatile market quotations into more predictable cash flows, while retaining the flexibility to adapt to market dynamics. In the agricultural sector, where price volatility is particularly pronounced, fixed-for-floating swaps are especially valuable. They allow both producers and consumers to stabilize financial planning while maintaining a degree of responsiveness to market conditions.

5. Insurance

Like other risk management instruments, the essence of insurance lies in the principle of risk sharing. In agriculture, however, insurance has traditionally been applied primarily to non-marketing risks such as crop losses caused by weather events, pest infestations, or other natural hazards. Its use for price risk management is more common within revenue insurance schemes and contract farming arrangements. Price insurance is most effective for products with objective and transparent price data. To avoid problems of moral hazard and adverse selection, loss assessments should be based on reference prices such as futures quotations or spot market prices that cannot be influenced by the farmer's individual actions (Walters & Preston, 2018).

Revenue Insurance

Revenue insurance has been designed as a comprehensive protection tool covering not only price risks but also production risks. It compensates producers for significant declines in expected revenues due to reduced yields, falling prices, or a combination of both. Compensation is triggered when the value of the harvest, calculated at prevailing market prices during collection, falls below the guaranteed revenue threshold.

This type of insurance emerged partly in response to the reduced role of governments in providing direct financial guarantees to farmers. In the United States for instance, a variety of revenue insurance schemes are available through the USDA, including:

- Group Risk Income Protection (GRIP)
- Adjusted Gross Revenue (AGR)
- Crop Revenue Coverage (CRC)
- Income Protection (IP)
- Revenue Assurance (RA)

Price insurance through contract farming

Contract farming, where producers commit to meeting the requirements of buyers, can incorporate price insurance mechanisms through special pricing clauses. For instance, (although not on focus of this report) in the cotton sector in Chennai, India, spinning mills purchase cotton from farmers at whichever is higher – the fixed price or the prevailing market price. If mills fail to absorb the agreed volumes, the federal procurement agency buys the remainder at market value, but not below the minimum support price set by the government. In practice, this model functions as a form of price insurance, closely resembling the mechanism of an option: both guarantee a minimum price while retaining the possibility of benefiting from favourable price movements. In another variant, companies may contract directly with farmers to guarantee either a fixed purchase price or even a minimum revenue per production unit (e.g., per acre or hectare).

Limitations of price insurance

The main limitation of price insurance arises from the high correlation of agricultural prices, which reflects systemic market risk. Such risk can generally be managed more effectively with derivative instruments such as options, futures, or swaps. Power et al. (2012) argue that any price insurance policy can effectively be replicated through a long-put option strategy, where the strike price acts as the insurance trigger and the option premium represents the cost of coverage. The effectiveness of price insurance therefore depends heavily on the existence of well-developed derivative markets, which enable insurers to transfer excess risk

associated with highly correlated price movements. Alternatively, it relies on the availability of sufficient reinsurance capacity to absorb such systemic exposures (Alizadeh & Nomikos, 2005).

Conclusion

The analysis of forward contracts, futures, options, swaps, and insurance schemes demonstrates that each instrument plays a distinct role in managing price risk in grain markets. No single mechanism can be regarded as universally optimal. Forwards offer flexibility but expose producers to counterparty risk; futures provide liquidity and transparency but demand technical expertise and financial discipline; options combine protection with upside potential, though at the cost of premiums; swaps transform volatility into predictable cash flows, yet remain complex and largely limited to institutional players; and insurance schemes extend comprehensive coverage, but struggle with systemic risk and high correlation of prices.

Therefore, as this study would suggest, the most effective framework for price risk management in grain markets lies not in relying exclusively on one instrument, but in strategic combinations adapted to the needs of specific market participants. For small and medium-scale farmers, integration of contract farming and insurance with selective use of options may offer the best balance of protection and opportunity. For larger producers and traders, futures and swaps provide efficient tools to stabilize revenues and manage exposure at scale.

Ultimately, the sustainability of price risk management depends on well-functioning derivative markets, supportive institutional infrastructure, and policies that enhance accessibility for a broader spectrum of agricultural actors. The guiding question raised at the outset – *which instruments provide the most effective, accessible, and sustainable framework for managing price risk in grain markets* – finds its answer in a **complementary system of instruments** rather than a single solution. By blending financial innovation with institutional support, grain markets can achieve both stability and resilience in the face of ongoing volatility.

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