Examination of Risk Management Strategies for the Use of Future and Spots Prices of Agricultural Commodities

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Abstract:

This study examines risk management strategies for agricultural commodities using futures and spot markets. The research analyzes price trends, investigates the relationship between futures and spot prices, assesses the impact of futures contracts on risk management, and analyzes the risk-return tradeoff of using futures in selected agricultural commodities. Using 3-5 years of historical price data for cardamom, mentha oil, CPO bales, cotton, and natural rubber, the study employs quantitative analysis including descriptive statistics, regression, correlation, and Sharpe ratio calculations. Results show significant price volatility, strong positive correlations between futures and spot prices, and a significant positive effect of futures contracts on risk management metrics. Natural rubber and mentha oil offer the most attractive risk-adjusted returns. The findings highlight the importance of futures markets in managing agricultural price risks and provide insights for developing effective risk management strategies in the sector.

Keywords: Agricultural commodities, futures markets, risk management, price volatility, hedging strategies

Introduction

In the current global economy, agricultural commodity markets are very important but are also subject to price fluctuations driven by factors such as climate change, supply and demand, and local instability. These changes pose significant risks to farmers, traders and other stakeholders in the agri-food industry. Risk management strategies are therefore very important for the stability and profitability of the agricultural sector.

This paper focuses on future markets for risk management in agricultural products. In particular, it analyzes price volatility in agricultural futures and spot markets, analyzes the relationship between futures and fixed markets, analyzes the impact of futures contracts on risk management and analyzes risk and the price of futures contracts on selected agricultural commodities.In this regard, this study seeks to help stakeholders make better agricultural commodity price risk decisions by shedding light on future market returns on commodity price risk so in agricultural marketing management.

Literature Review:

Agricultural Commodities:

Agricultural Commodities involves a large number of goods and services, ranging from grains and oilseeds to livestock and dairy products constitute an essential factor in the global economy. Papers that captured price risks in agricultural commodity markets include Liu, Kang, Lee, and Ma (2020) whose analysis took into consideration the way in which the global economic and political environment affected agricultural prices risks across nations. Their work yielded such measures as ‘long-term equilibrium’, and ‘Granger causality’ which helped to explain

issues on futures and spot prices like seasonal patterns and nonlinear risk. On this basis, Lou (2024) further examined how futures markets contribute to the agriculture necessary issues such as volatility, weather risks and disruption of chain. Through the passages of this research, it highlighted the function of futures markets in risk management, investment, and efficiency in the agricultural structure elucidating its role in sustainable agriculture.

Iuga et al., (2024) worked on effects of crises periods especially the covid-19 pandemic on agricultural futures' returns. In the case of MARKS they have used Pre COVID, COVID and Post COVID phases and have worked with important commodities such as cotton, sugar, rice, wheat and corns. The result showed that the stability and fluctuation was very much disrupted throughout the pandemic, it was not normal volatility. These finding emphasize the necessity to evaluate the influence of unanticipated outside events for the agricultural commodity markets and the imperative of sound risk management when it comes to crises.

Kovačević (2024) studied the transformation of the physical markets in commodities to electronic trading markets and focusing on the futures and options markets. The study located the case in the Western Balkan region where, to the best of the authors' knowledge, commodity markets are not yet well-developed and on this basis it proposed the creation of a regional commodity exchange to enhance trading security and risk management for farmers in the context of recent fluctuations in prices. This research also points to the continued dynamic in the establishment of the markets for agricultural commodities as well as the possibility of further improvement of the structure of the markets with a view of strengthening the existing hedge facilitation in the agricultural markets.

Future and Spot Prices:

Previous studies have particularly concentrated on the interaction of futures and spot prices in agricultural commodities owing to the impact of analysis in risk management and price determination. Atik et al. (2023) used the tail-restricted integrated regression function (IRF) to analyze market dependence and tail risk between the US and Turkish agricultural commodity markets. It resulted in a specific risk transmission process of US agricultural market to the Turkish agricultural market and proposing an agricultural commodity futures market in Turkey for enhancing the completeness of the linkage. This work shows market linkages in global agriculture and efficient ways, which futures markets can be developed in emerging economies.

Dai et al. (2023) applied the Copula-CoVaR model depending on the ARMA-GARCH-skewed Student-t model to examine the tail dependences and risky spillovers among the international agricultural futures and the spot markets of soybean, maize, wheat, and rice. Then, they pointed out that the tail dependence structures and the asymmetries differed among the commodity pairs, and that extreme risk connectivity from futures to spot markets was substantial. This research draws the attention to the interdependencies between futures and their spot counterparts and their impact the worldwide food security and investment in agricultural commodities.

Čermák and Ligocká (2022) analysed the contemporaneous causal interdependence between spot and futures prices of principal agricultural commodities by means of the Granger causality tests. Boyka et al developed evidence of casual relationship between spot and futures prices for wheat and cocoa while the flow of influence was reciprocally linked to wheat. These the authors attributed as market position, policy, speculation as well as with interconnections with energy markets for inventories and storage hence influencing the wheat markets. This paper confirms some of the underlying dynamics of commodity futures and spot prices and various factors that might define their connection.

Risk Management Strategies:

Managerial risk function is particularly important for agriculture industry since its revenues fluctuates dependently on the price of the produce and external conditions such as weather and geo-political risks. Another study by Fan and Zhang (2024) explained the application of risk management in commodity factor premia working on the idea of commodity stop-loss strategies contributing to long-short commodity premia returns. They were able to

establish that stop-loss measures, when properly employed, serve the useful purpose of decreasing both the magnitude and the incidence of drawdowns and thus giving better mean return. This work points to the need for dynamic risk management to enable enhancement of commodity risk premia beyond the risk factor volatility targeting and risk parity.

Continuing on the topic of how COVID-19 affected grain prices as the subject of Li et al. (2024), the authors were concerned with how grain price risks can best be hedged by grain enterprises using dynamic behavioral strategies. To investigate the dynamic hedging ratio, they employed the DCC-GARCH model to examine the variations of corn spot and futures prices; moreover, they adopted the loss aversion (LA) utility function. From the study, their results presented that the behavioral hedging strategy was superior to the traditional approach in risk management due to the flexibility in risk management archetypes it offered under volatile markets.

Peng (2023) provided a method of identifying and examining the large-scale farmers of china's ways of dealing with price risks under conditions of incomplete market structure especially with regards to their risk preference, time preference, and constraints to liquidity. The study, which was carried out among 409 large-scale grain farmers and analysed by a bivariate probit model, established that risk-averse farmers employ risk transfer and risk diversification techniques. Yet, they have realized that liquidity constraints and their strong time preferences prevented them from effectively engaging in risk diversification, and these constraints were even more significant for large farms. This paper offers important information about the large-scale farmers' behavior and secures recommendations concerning the efficient strategies for managing the price risks under the conditions of the incompleteness of agricultural insurance and futures markets.

Methods and Materials

Research Methodology:

This study uses a quantitative research approach, utilizing historical price data to analyze the relationship between futures and spot prices and assess the effectiveness of futures contracts in risk management for agricultural commodities.

Data Collection:

Historical price data for futures and spot prices of selected agricultural commodities (cardamom, mentha oil, CPO bales, cotton, and natural rubber) were collected from financial market databases covering a period of 3-5 years.

Sampling:

The study uses purposive sampling to select five agricultural commodities based on their significance in the market and data availability.

Objectives:

To analyze price trends of futures and spot prices for selected agricultural commodities

To investigate the relationship between futures and spot prices of selected agricultural commodities

To assess the impact of futures contracts on risk management in selected agricultural commodities

To analyze the risk-return tradeoff of using futures contracts of selected agricultural commodities.

Hypothesis:

H0: There is no significant correlation between futures prices and spot prices for the selected agricultural commodities.

H1: There is a significant positive correlation between futures prices and spot prices for the selected agricultural commodities.

H0: Futures contracts have no significant impact on risk management metrics for the selected agricultural commodities.

H1: Futures contracts have a significant positive impact on risk management metrics for the selected agricultural commodities.

H0: There are no significant differences in risk-adjusted returns (Sharpe ratios) across the selected agricultural commodities.

H1: There are significant differences in risk-adjusted returns (Sharpe ratios) across the selected agricultural commodities.

Data Analysis:

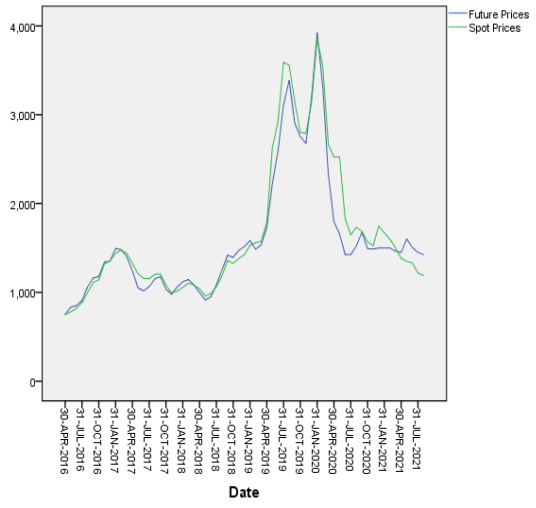
The study employs descriptive statistics, regression analysis, correlation analysis, and calculation of Sharpe ratios to analyze the data and test the hypotheses.

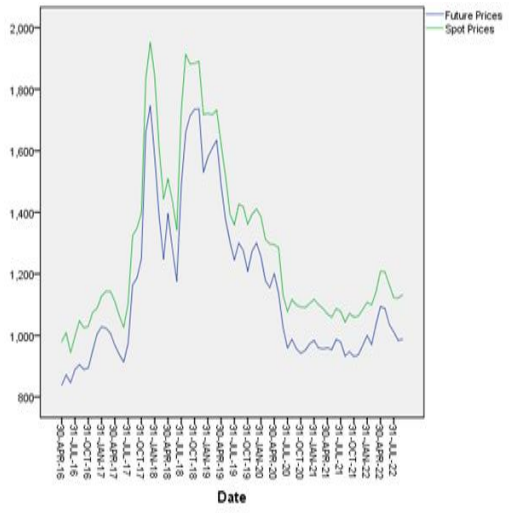
Data Analysis and Results

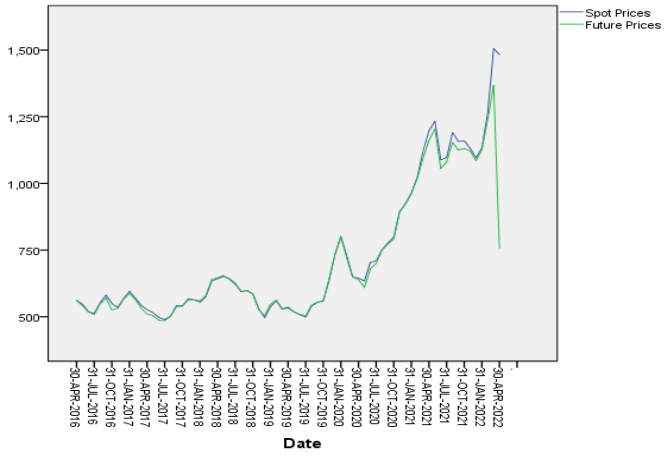
Price Trend Analysis:

Descriptive statistics and regression analysis were conducted to examine price trends for both futures and spot prices of the selected commodities. Results showed significant price volatility over time for all commodities. For example, cardamom prices ranged from 748.5 to 3853.57 for spot prices and 752.74 to 3923.21 for futures prices, indicating substantial fluctuations.

Regression analysis revealed weak positive or negative trends over time for most commodities. For instance, cardamom showed a positive trend with coefficients of 6.261E-6 for futures and 7.066E-6 for spot prices, while mentha oil displayed a weak negative trend with coefficients of -7.362E-7 and -8.830E-7 for futures and spot prices respectively.






Spot Prices
Future Prices
1,500
1,250
1,000
750
500
30-APR-2016
31-JUL-2016
31-OCT-2016
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30-APR-2017
31-JUL-2017
31-OCT-2017
31-JAN-2018
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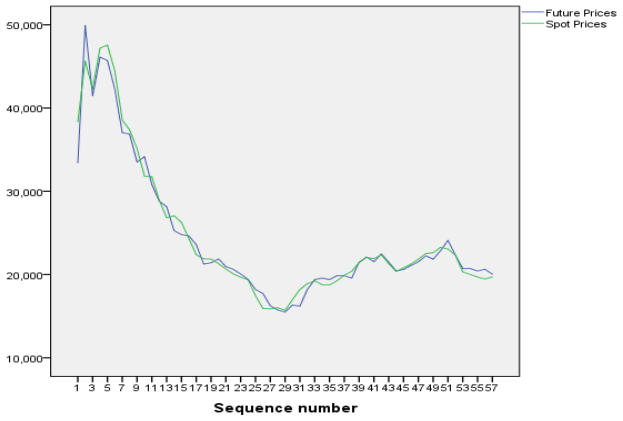
Date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Spot Prices
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40,000
30,000
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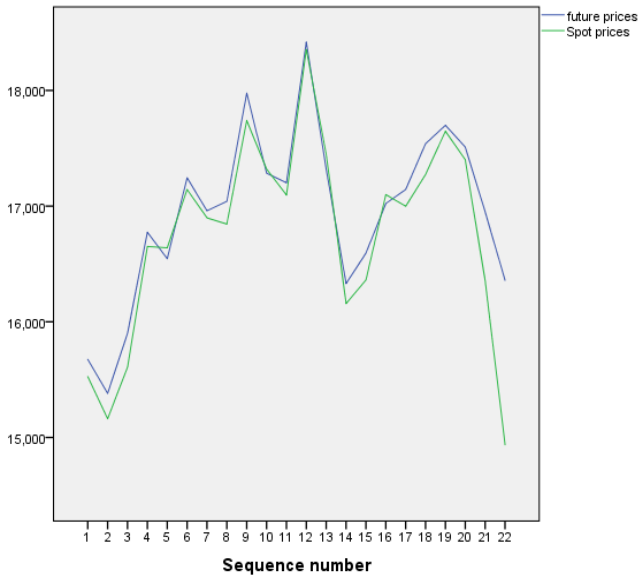
10,000
Sequence number


future prices
Spot prices
18,000
17,000
16,000
15,000
Sequence number

Relationship between Futures and Spot Prices:

Correlations

		Future Prices	Spot Prices
Future Prices	Pearson Correlation	1	.989**
	Sig. (2-tailed)		.000
	N	57	57
Spot Prices	Pearson Correlation	.989**	1
	Sig. (2-tailed)	.000	
	N	57	57

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		future prices	Spot prices
future prices	Pearson Correlation	1	.936**
	Sig. (2-tailed)		.000
	N	22	22
Spot prices	Pearson Correlation	.936**	1
	Sig. (2-tailed)	.000	
	N	22	22

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		Future Prices	Spot Prices
Future Prices	Pearson Correlation	1	.947**
	Sig. (2-tailed)		.000
	N	73	73
Spot Prices	Pearson Correlation	.947**	1
	Sig. (2-tailed)	.000	
	N	73	73

Correlations

		Future Prices	Spot Prices
Future Prices	Pearson Correlation	1	.970**
	Sig. (2-tailed)		.000
	N	65	65
Spot Prices	Pearson Correlation	.970**	1
	Sig. (2-tailed)	.000	
	N	65	65

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		Spot Prices	Future Prices
Spot Prices	Pearson Correlation	1	.994**
	Sig. (2-tailed)		.000
	N	78	78
Future Prices	Pearson Correlation	.994**	1
	Sig. (2-tailed)	.000	
	N	78	78

Correlation analysis was performed to investigate the relationship between futures and spot prices. Strong positive correlations were found for all commodities:

Cardamom: 0.970

Mentha Oil: 0.994

CPO Bales: 0.947

Cotton: 0.989

Natural Rubber: 0.936

These high correlations indicate that movements in futures prices closely mirror changes in spot prices, supporting Hypothesis 1,that there is a significant positive correlation between futures prices and spot prices for the selected agricultural commodities.

Impact of Futures Contracts on Risk Management:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.970[a]	.941	.940	189.577835583290000

a. Predictors: (Constant), Future Prices

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.994[a]	.988	.988	29.9501266091

a. Predictors: (Constant), Future Prices

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.989[a]	.978	.977	1266.166

a. Predictors: (Constant), Future Prices

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.936[a]	.875	.869	312.4083239215060

a. Predictors: (Constant), future prices

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.947[a]	.896	.895	85.619349201996800

a. Predictors: (Constant), Future Prices

Regression analysis was conducted to assess the impact of futures contracts on risk management metrics. Results showed a significant positive effect for all commodities:

CPO Bales: R-squared = 0.896

Cardamom: R-squared = 0.941

Mentha Oil: R-squared = 0.988

Cotton: R-squared = 0.978

Natural Rubber: R-squared = 0.875

These high R-squared values indicate that futures contracts explain a large proportion of the variability in risk management metrics, supporting Hypothesis 2.

Risk-Return Tradeoff Analysis:

Sharpe ratios were calculated to analyze the risk-return tradeoff of using futures contracts:

Natural Rubber: 4.51, Mentha Oil: 4.03, CPO Bales: 2.82, Cotton: 2.77,Cardamom: 2.21,

The varying Sharpe ratios across commodities support Hypothesis 3, indicating significant differences in risk-adjusted returns.

Commodity	Average Return	Standard Deviation	Risk-Free Rate	Sharpe Ratio
Natural Rubber	16,235.18	3,602.99	0.01	4.51
Cardamom	1,565.67	708.5	0.01	2.21
Cotton	23,846.89	8,600.41	0.01	2.77
Mentha Oil	1,140.87	283.41	0.01	4.03
CPO Bales	700.36	248.21	0.01	2.82

Discussion:

The results of this study provide several key insights into the use of futures markets for risk management in agricultural commodities. The strong positive correlations between futures and spot prices across all examined commodities align with findings from previous studies such as Dai et al. (2023), confirming the close relationship between these markets. This relationship underscores the potential of futures markets as effective price discovery mechanisms and risk management tools.

The significant positive impact of futures contracts on risk management metrics, as evidenced by high R-squared values in our regression analysis, supports the findings of studies like Lou (2024) and Kovačević (2024) regarding the importance of futures markets in agricultural risk management. However, the varying effectiveness across different commodities, as shown by the range of R-squared values (0.87 to 0.98), suggests that the utility of futures contracts may depend on the specific characteristics of each commodity market.

The analysis of risk-adjusted returns using Sharpe ratios reveals substantial differences among the commodities, with Natural Rubber and Mentha Oil offering the most attractive risk-return profiles. This variability in risk-adjusted returns aligns with the findings of Fan and Zhang (2024), who noted that the effectiveness of risk management strategies can vary across different commodities.

Our findings on price volatility and trends are consistent with studies like Iuga et al. (2024), which highlighted the volatile nature of agricultural commodity markets. The weak trends observed in our study suggest that while there may be short-term price movements, long-term price trends are not strongly evident in the examined period.

Overall, our results contribute to the existing literature by providing a comprehensive analysis of multiple aspects of futures markets across several agricultural commodities. The findings support the general consensus on the utility of futures markets for risk management but also highlight the need for commodity-specific strategies.

Conclusion

This study shows that futures markets are effective in managing price risks for agricultural commodities. The strong relationship between futures and spot prices, along with the significant impact of futures contracts on risk management measures, highlights the importance of these financial tools in agriculture. The different risk-adjusted returns across various commodities emphasize the need for careful assessment when implementing hedging strategies. Natural Rubber and Mentha Oil stand out as particularly appealing choices for risk management based on their Sharpe ratios. The research confirms that agricultural commodity prices are volatile and that futures markets have the potential to reduce this volatility. However, the weak price trends observed suggest that making long-term price predictions solely based on past data may be difficult. Overall, this study helps us understand how futures markets can be used for effective risk management in agriculture, providing valuable insights for stakeholders in these markets.

Implications and Future Scope of Study

Managerial Implications:

Agricultural producers and traders should consider incorporating futures contracts into their risk management strategies, particularly for commodities like Natural Rubber and Mentha Oil that show favorable risk-adjusted returns. The strong correlation between futures and spot prices suggests that futures markets can be reliable indicators of price trends, aiding in decision-making processes. Given the varying effectiveness across

commodities, managers should tailor their risk management approaches to the specific characteristics of each commodity they deal with.

Academic Implications:

This study contributes to the body of knowledge on agricultural risk management by providing a comprehensive analysis across multiple commodities. The methodological approach used in this study, combining various analytical techniques, can serve as a framework for future research in this field. The findings highlight the need for more nuanced understanding of commodity-specific factors that influence the effectiveness of futures markets in risk management.

Future Scope of Study

Future research could extend this analysis to a broader range of agricultural commodities and over longer time periods to enhance the generalizability of findings. Investigating the impact of external factors such as weather patterns, geopolitical events, and global economic conditions on the effectiveness of futures markets could provide additional insights. Comparative studies across different geographical markets could help identify regional variations in the utility of futures markets for agricultural risk management. Exploring the potential of more advanced financial instruments, such as options and weather derivatives, in conjunction with futures contracts could lead to more comprehensive risk management strategies for the agricultural sector

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