Implied Volatility-Based Hedging Decisions with Futures and Options Markets

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IMPLIED VOLATILITY-BASED HEDGING DECISIONS WITH FUTURES AND OPTIONS MARKETS

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INTRODUCTION

- In financial markets, hedging has become a popular way to control risks and offset losses. A hedge can be constructed across many different types of financial instruments, such as futures and options. Economists found out that when futures prices and options premiums are unbiased, optimal hedging requires only futures (Feder, Just and Schmitz (1980)).
- As long as the exogenous risk is linear in price, the futures market provides a perfect hedge. However, if futures prices or options premiums are biased, options are typically used along with futures (Lapan, Moschini, and Hanson (1991)).
- We use a regime-switching model to examine the relationship between cash and futures prices and the state variable is the function of the implied volatilities. Therefore, we can see how the implied volatilities impact the hedging decisions.

DATA & METHODS

Data

- For the empirical analysis, we consider corn, wheat and cotton markets. These three markets are selected because of their important roles in U.S. agricultural commodity markets.
- The daily spot and futures prices data, and the implied volatility data were obtained from the Commodity Research Bureau (CRB Infotech CD).

Methods

- The model consists of three parts: profit of the firm, utility maximization and the specification of the relationship between cash prices and futures prices and we focus on the third part.
- We use a threshold model to examine the relationship between cash and futures prices and the forcing variable is the implied volatilities. Therefore, we can see how the implied volatilities impact the hedging decisions.

CONCLUSION

From the results, we confirm the importance of allowing for the presence of different regimes in the model.

	α_{low}	α_{high}	β_{low}	β_{high}
2017 corn	-1.234	1.0215	1.209	0.8263
2020 wheat	-2.906	0.9198	1.473	0.8601

To be more specific, from Table 1, we can conclude that there exists a significant difference between high volatile state and low volatile state when we are looking at the 2017 corn and 2020 wheat data.

Compared to the corn market and the wheat market, the cotton market does not reflect a significant regime-switching feature.

To conclude, we use the implied volatility as the forcing variable in our regime-switching model and verify that it is reasonable to allow for different regimes in the model. Therefore, different regimes will have different impacts on the hedging decisions.

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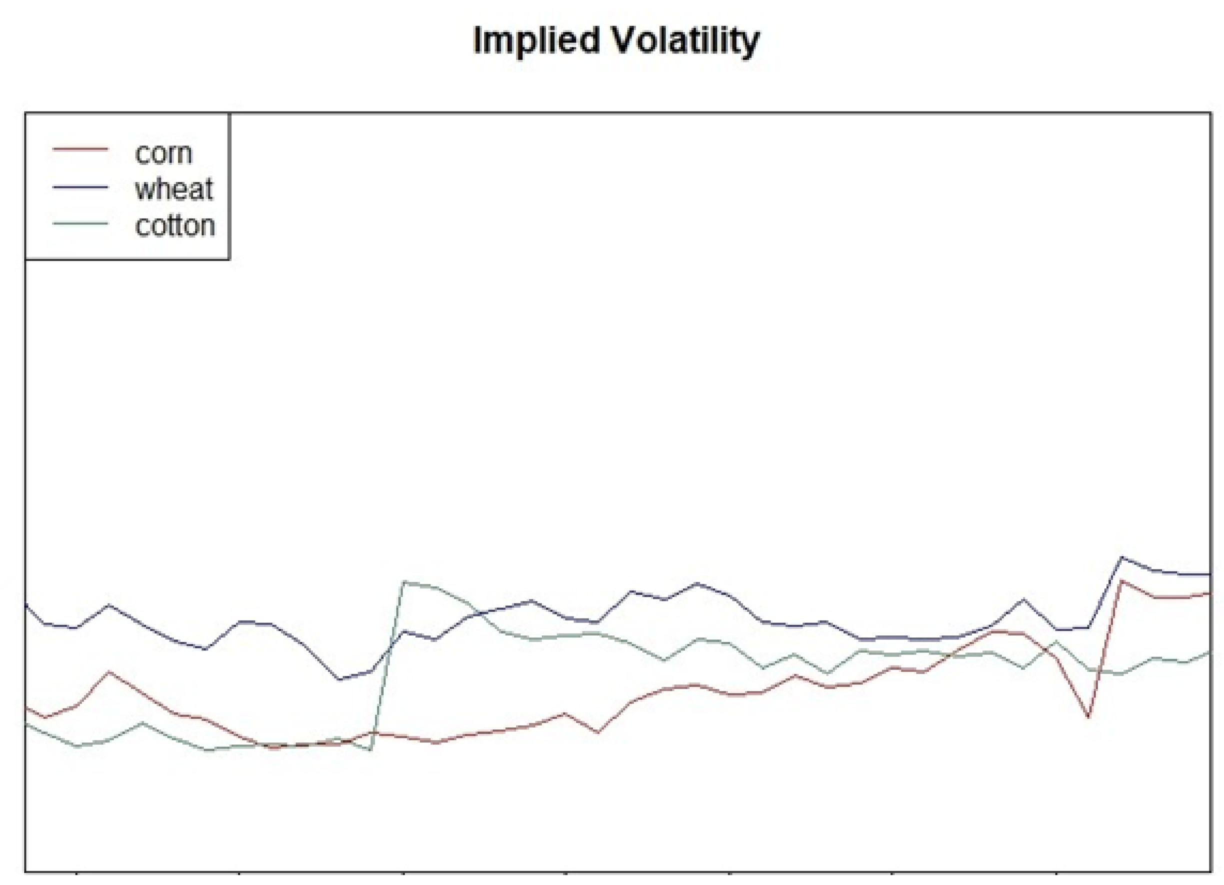
RESULTS 1

	α_{low}	α_{high}	β_{low}	β_{high}
2017 corn	-1.234	1.0215	1.209	0.8263
2018 corn	0.1245	-0.09686	0.9749	1.01274
2019 corn	-6.874	-1.987	2.158	1.337
2020 corn	-0.083	-1.150	1.019	1.198
2017 wheat	-0.8722	-0.6533	1.1387	1.1030
2018 wheat	1.6286	0.0511	0.7337	0.9935
2019 wheat	1.024	2.5963	0.839	0.5844
2020 wheat	-2.906	0.9198	1.473	0.8601
2017 cotton	0.5344	0.2721	0.8703	0.9337
2018 cotton	-0.03674	0.03293	1.00487	0.98967
2019 cotton	0.1782	0.3538	0.9453	0.9059
2020 cotton	-0.1875	-0.2874	1.0335	1.0563

Table 1: Estimates

MODEL



The problem is to choose (y, x, z) to maximize expected utility; that is,

$$\max_{y,x,z} L = E[u(\pi)] \quad (1)$$

The relationship between cash and futures prices is given by:

$$p_c = \alpha(s) + \beta(s)p_f^1 + \tau \quad (2)$$

- u is producer's utility, E is the expectation operator, and π is the profit at the end of the period.
- y is the output quantity produced, x is the futures quantity sold, z is the put option quantity sold.
- p_f^1 is the futures price at the end of the period and p_c is the cash price at the end of the period.
- p_f^1 and τ are independently distributed and $E(\tau) = 0$. $\alpha(s)$ and $\beta(s)$ are parameters which depend on state variable s, where s is a function of implied volatility iv.
- We assume s contains two states: a high volatile state and a low volatile state.