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**Research Report**

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# Options trading in agricultural futures markets: A reasonable instrument of risk hedging, or a driver of agricultural price volatility?

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Options trading is increasingly important in more volatile agricultural markets. Options allow for unilateral hedging of price risks, e.g. against falling prices only, and are an indispensable risk management instrument for farmers and grain dealers. Concerns that soaring options trading could spark incremental volatility of international agricultural commodity prices have not been empirically verified to date. Econometric assessments for the MATIF grain maize market suggest that option trading does not have a volatility increasing effect.

Since the middle of the last decade grain prices – wheat, grain and soy beans – have not only risen in terms of level, but also of volatility. Primarily, such price developments are prompted by changes in real economy factors, while a potential influence of the financial sector has been alluded to for quite some time. It is surmised that agricultural futures transactions could significantly boost both the level and volatility of grain prices (Master, 2009). The empirical literature cites differing and controversial interpretations of such findings; however, conclusive evidence is lacking (Glauben et al., 2012).

What is undisputed, though, is that agricultural futures transactions enable farmers and grain dealers to hedge their prices, conduct arbitrage through storage, and thus counteract price volatility (Glauben et al., 2013). In principle, high price volatilities are not a desirable feature of agricultural markets. Nevertheless, both farmers and grain dealers may very well profit from greater volatility of grain prices if they participate in agricultural futures markets. The former can hedge more profitable sales prices in high-price phases through forward contracts, and the latter can benefit from stronger basis fluctuations in forward purchases and sales.[1]

Trading agricultural futures contracts and its consequences for pricing processes in agricultural markets was already intensively discussed in academic literature (e.g. Irwin and Sanders, 2011, Prehn et al., 2014). In contrast, there are no empirical studies available on the relationship between option trading, i.e. trading options on agricultural futures contracts, and price formation for agricultural commodities. Options have also increasingly traded on agricultural futures markets since the 1980s. Such options are a specific and more differentiated form of conventional agricultural futures trading. Agricultural futures contracts permit only the collateralization of complete price risks, while options provide for (unilateral) hedging of price risk portions.

## Functional principle of options

Options, like agricultural futures contracts, are traded at stock exchanges. A distinction is made between call and put options. A call option (put) gives the buyer the right, but not the obligation, to buy (sell) an agricultural futures contract at a predetermined price. For this purchase right, the purchaser pays a so-called option premium to the issuer, irrespective of whether the purchaser exercises this right or not. The issuer of a call (put) is obliged, when the relevant futures contract is called, to realize it at the current futures price. The issuer of a call (put) receives an option premium from the buyer, whether or not the buyer calls the relevant call or put. In contrast to an agricultural futures contract, a call or put may be resold by the buyer but not by the seller.

[1] Contrary to the widely-held belief, grain dealers do not speculate for prices but are engaged in basis trading, i.e. the spread between spot and futures prices. Grain dealers try to buy the basis at low prices and then sell it at high prices; this is tantamount to forward purchases. On the other hand, they are attempting to sell the basis at high prices and then repurchase it at low prices; such transactions are tantamount to forward sales.

## Risk management through options trading

In the option seller's view, the economic value of a call or put depends on whether and by which amount the agricultural futures price is above or below the previously agreed price, adjusted by the option premium. If the price of a futures contract is above the previously agreed price, plus an option premium upon realization of the call by the buyer, then the buyer of the call generates a gain from the option trade. If the price of a futures contract is below the previously agreed price, plus an option premium upon realization of the put, then the buyer of the put generates a return. Hence, calls can be used to speculate on increasing prices. Puts are reasonable when dropping prices are anticipated. The maximum loss of such a transaction corresponds to the option premium (Gardner, 1977).

A closer look at options trading between grain dealers, who typically handle futures trades for farmers, and the farmers themselves, the significance of options is notably realized by the conclusion of minimum price contracts. Under a minimum price contract, a grain dealer not only sells a futures contract, as with a forward contract, in order to hedge a sales price (i.e. minimum price) for the farmer, but the grain dealer additionally buys a call, namely an option on an agricultural futures contract.

This approach yields various benefits for dealing with price volatilities and also for the business relations between farmers and grain dealers. Firstly, farmers can hedge 'doubly'; he is secured against falling prices by sale of the futures contract, while the purchase of a call simultaneously permits the farmer to participate in potential price increases. If futures prices rise up to a level that is acceptable for the farmer, then the grain dealer can realize this price for the farmer by clearing the call. In other words, the sales price is composed of the minimum price and the gain from an option transaction. Falling futures prices mean that the farmer will still realize the minimum price, but has to disburse the call's option premium to the grain dealer.[2]

Secondly, a further advantage of minimum price contracts is that they provide hedging against non-delivery. Failure of a farmer to honor his delivery commitments entitles the grain dealer to realize the call. The futures contract thereby acquired can be used by the grain dealer to clear the original agricultural futures contract that was sold to hedge the minimum price. The trader does not incur any costs in the process, and the farmer loses only the option premium. Hence, minimum price contracts are a suitable instrument in order to resolve non-delivery by mutual consent.

Thirdly, in times of highly volatile prices, options are also an important risk management tool for grain dealers. Grain dealers typically hold a larger number of short contracts than long contracts. This may cause problems for a grain dealer, especially with sharply rising futures prices, because the trader will have to put up with higher margin calls. The latter may jeopardize his liquidity. What has been proven in practice for grain dealers is that they cover about one-quarter of their net sales positions through calls. The performance of short contracts and calls is diametrical, so that grain dealers are exposed to liquidity problems only at a later date. This hedge type is commonly called rally insurance.

## Market impacts and options trading

Economic theory suggests that in the absence of information asymmetries, options promote risk allocation and market efficiency, and thus also mitigate price volatility. The more realistic view of a world with informational asymmetry, however, might lead to opposite conclusions. Consequently, there is no clear theoretical assessment of the effects that options have on price formation processes on agricultural futures markets. The positive effects certainly include the opportunity of a more differentiated risk allocation and, secondly, their informative function. Options markets extend scopes of action and allow for more targeted and differentiated risk allocation through hedging partial risks.[3] In addition, the distribution of calls permits us to draw conclusions regarding the expected distribution of future market prices. When applying options price theory approaches on calls for a specific futures contract, it can be forecast ex-ante which price distribution is currently expected on the agricultural futures market for the respective futures price in the future.[4] This is a beneficial feature for decision-making of the market participants. The improved information situation should contribute to faster identification and adjustment of future market imbalances, and hence counteract excessive volatility.

These mechanisms require that all market participants have easy access to information. Where this is not the case, options markets may send the wrong signals due to the presence of poorly-informed market participants, and thus disturb the market equilibrium. This could result in increased volatility in the agricultural futures market. Ultimately, it is an empirical question whether options are conducive to the functionality of agricultural futures markets or not.

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[2] In the case of dropping prices, a forward contract would be the more favorable variant as there is no option premium payable.

[3] Under a rally insurance, a grain dealer will not buy a call at the current futures price, but rather buy a call whose price will give the grain dealer liquidity problems. Under a minimum price contract, the farmer merely hedges his downside but not his upside risk. Hence, options extend the scope of action for all participating market players.

[4] Options, in other words, not only provide information about the expectation value of futures prices, but also about the anticipated future standard deviation, skewness and kurtosis (Sherrick et al., 1990).

## Empirical findings

When considering the increasing importance of options for agricultural trade it is surprising that to date there have not been any empirical analyses of the market impact of options on agricultural futures markets.[5] This prompted IAMO, in cooperation with Göttingen and Kiel Universities, to study this issue using the example of the MATIF grain maize contract.[6]

The MATIF grain maize contract was launched on 30.9.1999 and the associated subscription warrant on 2.9.2005. Trade volumes of both securities have strongly increased, notably after 2009, which enhanced market liquidity. Presently, approximately 2,000 grain maize futures contracts and 150 option contracts are traded at MATIF, which is interesting because grain maize is an important raw feed material that is increasingly used in biofuel production. Grain maize production has also risen in recent years in the EU.

To further investigate the question of whether there is a correlation between options trading and price volatility at the MATIF grain maize market, econometric assessments based on an ARMA-EGARCH-X model[7] were made. The ARMA model served to explain price levels, while the EGARCH model explained volatility. In addition, the EGARCH model was extended by exogenous variable trade intensity. The latter measures the influence of the number of traded options on the volatility at the MATIF grain maize market. The data basis was the respective closing prices of the November contract, which corresponds to the crop contract that is relevant for farmers.[8]

The results of econometric assessments indicate the following. Firstly, both price level and volatility can be appropriately explained with the ARMA-EGARCH-X model. This speaks for the suitability of the model's approach to exploring this question. Secondly, there was no volatility-increasing effect by options trading verified for both periods under review. Hence, it can be stated that, at least for grain maize at the MATIF, volatility-increasing effects from options trading were not observed.

[5] There are only two similar studies, for the gold market (Tschoegl, 1982) and the crude oil market (Fleming & Ostdiek, 1999).

[6] More detailed information cf. Dannemann et al., 2014.

[7] Autoregressive Moving Average – Exponential General Autoregressive Conditional Heteroscedasticity – Exogenous Model

[8] On account of structural discontinuity, two submodels were assessed; the first period under review was from 1.12.2000 to 29.11.2007 and the second from 1.12.2007 to 30.11.2013.

## Concluding comments

Options trading is increasingly important in higher-volatility agricultural markets. Options allow for a specific structuring of futures trading by hedging price risk portions. Thus, options trading is a reasonable and increasingly important risk management instrument for both farmers and grain dealers.

Concerns that option trading increases the volatility of agricultural commodity prices are unfounded, as demonstrated by the findings of the first-ever empirical investigation. This is at least true for the European MATIF grain maize market. Future studies could also conduct assessments of other MATIF futures markets, such as wheat or rapeseed.

The findings at hand demonstrate once again that agricultural futures transactions are not responsible for increasing price fluctuations on agricultural markets. Requirements for more stringent regulation of agricultural futures markets beyond increasing transparency cannot be justified. Limiting the use of options could even lead to an undesirable outcome: similar to other price hedging instruments, options trading can help strengthen market functions, diminish market imbalances and counteract excessive price volatility.

## Further Information

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