Since the financial and food price crises of 2007, market instability has been a topic of major concern to agricultural economists and policy professionals. This volume provides an overview of the key issues surrounding food prices volatility, focusing primarily on drivers, long-term implications of volatility and its impacts on food chains and consumers.

The book explores which factors and drivers are volatility-increasing and which others are price level-increasing, and whether these two distinctive effects can be identified and measured. It considers the extent to which increasing instability affects agents in the value chain, as well as the actual impacts on the most vulnerable households in the EU and in selected developing countries. It also analyses which policies are more effective to avert and mitigate the effects of instability.

Developed from the work of the European-based ULYSSES project, the book synthesises the most recent literature on the topic and presents the views of practitioners, businesses, NGOs and farmers’ organisations. It draws policy responses and recommendations for policy makers at both European and international levels.

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Agricultural Markets Instability
Revisiting the recent food crises
Chapter 8
Are derivatives introducing distortions in agricultural markets?

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1 Introduction

Volatility in agricultural commodities markets has been in the spotlight for a while. Considered as a threat to global food security, it has been analyzed by experts, debated by policymakers, and often misinterpreted by the press. Indeed, price level changes are often misunderstood and classified as volatility phenomena.

Agricultural prices decreased (in real terms) for a long period, and only recently was there a reversing signal, suggesting a possible increase in the future. It must be acknowledged that fertilizers and energy mainly contributed to the wide price spikes during the two crises in 2008 and 2012.

Contrary to the common perspective, with an annual large grid and long observations interval, volatility decreased. Figure 8.1 sums up this double behavior: prices rose while volatility lowered significantly. It should be noted that the choice of pivotal years (2009 in particular) is crucial and that 2014 data are partial. The landscape is completely different when considering the short-term horizon and data based on higher frequency: this fact makes questionable even the definition of “highly volatile markets”.

While the effects and implications are clearer, a lot of papers have been published without reaching a consensus on the causes of agricultural commodities volatility. The ULYSSES project’s works are an important contribution to the process.

Overall, the stream of literature has been inconclusive up to now. Inputs cost has been indicated as a trigger of price explosion, as has co-movement among commodities following oil prices. Financialization is among the most-quoted candidate causes, even if there is not an agreement on what financialization means!

2 Financialization

On one hand, financialization is represented by the massive flow of capital into agricultural futures markets and other activities, such as index contracts or agricultural exchange trade products (ETP). The sudden move of capital from
one suffering financial sector (credit default swap, securitization, government bonds, etc.) to another clearly caused serious issues to financial stability. When hedge funds started to pump up capital into agricultural contracts, several bells began ringing.

Some years later, we can draw some lessons: as expected, more capital made the markets more liquid and hence more resilient and efficient. The main fear was the consequent upward pressure to prices, caused by a significant increase of long positions. Some increases were registered, but at the same time, hedging

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**Figure 8.1** Coefficient of variation (top) and compounded annual growth rate (bottom) of soybeans, maize, and wheat (US HRW).

*Source: Elaboration of World Bank data.*
has become easier, which is a massive gain. Concurrently, long positions contributed to stabilizing the markets and to decreasing risk premiums, so there’s growing consensus on a mildly positive impact of index funds’ activity.

On the other hand, I am more interested in describing the increase of financial engineering in agricultural markets and discussing how and why investment banks “invaded the field”.

### Box 8.1 Options and derivatives

In finance, a derivative is a type of contract that takes its value from the performance of an underlying entity: the underlying entity can be an asset, index, interest rate, etc., and it is often simply called the “underlying”. Derivatives are used for many purposes, such as insuring against price movements (hedging), increasing exposure to price movements for speculation, or getting access to otherwise hard-to-trade assets or markets. It should be remarked that futures are derivatives, the simplest case of forward contract.

Among all derivatives, I shall focus on options since they are the most relevant, interesting, and standardized class.

An **option** is a type of financial contract which gives the buyer (“owner”) the **right**, but not the obligation, to buy or sell an underlying instrument: the purchase, if the option is exercised, happens at a specified strike price (K) on (or before) a specified maturity date (T). Important asymmetry: the seller of the option has the corresponding **obligation** to fulfil the transaction (to sell or buy) if the buyer exercises the option. On the negotiation day (t), the buyer pays upfront a premium, the price of the option, to the seller in order to have this right. An option that conveys to the owner the right to buy at a specific price is referred to as a call (C), while an option that conveys the right of the owner to sell at a specific price is called a put (P).

The main link among options and an underlying asset is the so called **put–call parity formula**:

$$C(t) - P(t) = S(t) - K \cdot B(t,T)$$

where:

- $C(t)$ is the value of the call at time $t$ (negotiation time),
- $P(t)$ is the value of the put of the same expiration date $T$,
- $S(t)$ is the spot price of the underlying asset,
- $K$ is the strike price, and
- $B(t,T)$ is the present ($t$) value of a zero-coupon bond that matures to 1€ at maturity time $T$.

In other words, $K \cdot B(t,T)$ is the current, at time $t$, value of $K$€ at time $T$. 

**Note:** The notation $B(t,T)$ typically represents the bond price at time $t$ that will mature to $1$€ at time $T$. The formula above relates the prices of a call and a put option to the underlying asset and the bond. This parity relationship is a fundamental concept in financial economics.
At the beginning of the 2000s, derivatives were less than marginal in the agricultural sector, while they already gained dominance in other sectors. Options on stock exchange indexes such as the S&P500 already had trading volumes that were ten times higher than the underlying basket of shares. The landscape was completely different in the agricultural finance sector; in fact, options represented a small corner of the trading platform. In 2009, options written on the MATIF wheat contract (probably the most important European agricultural future contract) were still less than 1% of the market; three years later, they represented 20% of the cake. The values were much higher in the US, since options were introduced before.

2.1 Why such an increase?

First of all, a significant change of players took place; traditional actors were probably reluctant to introduce new, more complicated instruments whose price was, and still is, difficult to link to the underlying commodity value. Sophisticated mathematics is required together with market knowledge, so small cooperatives and small traders had to rely on financial expertise provided by other actors, who at a certain point decided to step into agricultural commodities markets on their own.

This triggered a new factor, the increase in financial engineering involved in commodities trading. Just as an example, I recently found a “double barrier knock-out Bermudan” option in the basket offered to customers by a bank specializing in agricultural hedging: how can a farmer correctly evaluate the offer?

Last but not least, derivatives are particularly appealing to the so called “speculators” class for two reasons: delivery is not necessarily physical, often just netting of position, and they also allow a massive use of financial leverage. Indeed, margins are also required to trade futures, but the ratio among upfront payment and final cash flow is particularly low, making derivatives a perfect tool to “enter the market” with a small amount of cash, even while taking relevant positions. That is why all of a sudden aggressive investment banks started to deal with maize and wheat.

3 Policy issue

The financial crisis triggered, with a significant delay, a massive amount of legislation on both sides of the Atlantic: namely, Dodd-Frank in the US and the EU package MIFID-MAR-EMIR. Agricultural commodities markets have been influenced by the new regulations in many ways – position limits, obligation to register contracts, and so on. A wide amount of scientific literature and policy papers have been published on many related subjects, disclosing widely positive and rarely negative effects of the new regulations. From my point of view, there still is at least one open question.
Futures markets were already rather well regulated, and the surveillance/monitoring has been overall very efficient through years; indeed, futures markets are still alive after more than two centuries and several crises. On the contrary, options had been left into the over-the-counter market (OTC) for many years: by definition, it is a market of purely bilateral transaction among customers who found an agreement on their own. It seems nothing too serious, except that the amount of OTC contracts (all sectors included) is actually 700 trillion dollars, yes, trillion, prudently estimated by the International Swap and Derivatives Association (ISDA). It is true that there is some double counting and that some compression and netting could significantly reduce this huge amount, but still it’s ten times the world GDP! More interesting, it’s 15 to 20 times the amount of regulated finance.

Dodd-Frank and the EU financial directives push at least standardized options (“plain vanilla” European and American type) into the stock exchange framework and hence under the supervision umbrella; this is very good. At the same time, for many other contracts there is only the obligation to report or register activity in specified trade repositories, while for few other contracts and few other players there are no constraints.

My question is: can volatility coming from the synthetic derivatives world affect futures markets and consequently spot markets? The answer is not trivial, of course.

Spot markets and futures markets are strictly connected: convergence at delivery date is a standard check, and every time it fails to happen, severe investigations start both from supervisory authorities and by market makers on their own.

Slightly more complicated is to judge the relation among futures and options. Analytical tools are really different: futures market volatility analysis is generally based on historical/realized volatility, while for options the main variables are implicit volatility and risk neutral probability, both forward-looking measures.

As already described in the Box 8.1, the put–call parity formula is the main chain among the derivatives market and the underlying assets market.

In reality, the parity is systematically violated, because friction costs, margins, and brokerage fees unbalance the delicate abstract equilibrium given by the formula. To be clearer: the put–call parity formula is already not obeyed in highly liquid and efficient markets, so there is no hope that it works with agricultural commodities.

Do agricultural markets need a different treatment? More specifically, are position limits and circuit breakers enough to make the markets properly functioning? At a larger scale, these points lead to concerns which bring to the forefront the debate about food security, a hot policy item within the G20 initiative.

4 Ongoing work

In a recent paper (Sanfelici and Uboldi, 2014), a rather similar situation was analyzed, aiming at understanding whether high-frequency data machinery
for the underlying asset was compatible with a risk-free measure approach to perform option pricing. Indeed, many volatility estimators are now available: they are all historical/realized measures, while option pricing techniques are based on the forward-looking risk-free measure. The old style Black-Scholes approach (volatility is the only input, price is the output) is now not only abandoned, but even reversed: implied volatility is obtained backwards from options prices. The analysis was performed on the S&P500, probably the most liquid contract worldwide, and the output should be read as follows:

Provided that the “right” high frequency volatility estimator and the “right” jump filtering technique are applied with an ad-hoc stochastic volatility model, it is possible to have high-quality option pricing. In other, hopefully simpler, words: the two markets (underlying asset and derivatives) are blended and there is a bridge properly functioning that allows viable hedging strategies.

Ongoing research is developed to understand whether the same results apply to agricultural commodities and corresponding derivatives.

In fact, several variables are really different in synthetic and agricultural markets: the ratios among open interest and volumes are not comparable, option quotas in the markets are completely different, even trading frequencies are different, and so on. Clearly, the possibility to implement robust and reliable hedging strategies is at stake.

5 Conclusion

Price volatility is a serious threat to market stability, to a properly functioning food chain, and to overall food security. In the last years, many financial products were introduced into the agricultural commodities markets, making hedging strategies more technical, even if easily available through financial intermediaries. This contributed to facilitating the migration of capital together with financial players into agricultural markets. The so-called speculators are crucial to market viability: if a player would like to get rid of a type of risk, there should be somewhere another one willing to bear it, when adequately compensated.

At the same time, derivatives introduce new and relevant policy issues, and the supervisors should investigate whether distortions from the synthetic derivatives market can negatively affect the spot market.

This does not happen with solid, robust, and highly liquid markets, but the question is still on the table for young, least-developed, and sometimes illiquid agricultural commodities markets.

More precisely: relatively recent agricultural derivatives markets are developing, following the way paved by stock/equity markets. Positive features are welcome; higher liquidity, lower friction costs, efficient hedging, and transparent risk transfer would be beneficial. On the contrary, the increased technicality and enhanced financial engineering introduce threats to market stability and
could generate serious problems, such as the so called “Flash Crash” in 2010. Are circuit breakers sufficient to curb high-frequency speculation and algorithmic trading? Further research is needed.

Note

Reference