ON COMMODITIES, RISK MANAGEMENT, AND DERIVATIVES

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ABSTRACT

We often assume that risk is beyond the control of farmers. Farmers are exposed to weather, unpredictable changes in seed prices, tax rates, technology, fuel prices, chemical prices, and constantly changing commodity prices, Brorsen and Irwin (1996). However to some extent, farmers can control some of their risks by the use of financial instruments for hedging, Bessembinder (1992). Farmers can consciously affect the risk of their equipment by building in flexibility.

In the next section, hedging will be explained. In the following sections, options, futures contracts, (forward contracts, a specialized financial instruments that have been devised to help manage risk), and derivatives will be described. Each of these instruments provide a payoff that depends on the price of some underlying commodity (corn in the following examples). Because their payoffs derive from the prices of other assets, these instruments are often known collectively as derivative instruments (or derivatives for short). Derivatives often conjure up an image of wicked speculators, and they attract their share of speculators (some of whom may be wicked). But derivatives are also used by sober and prudent farmers who simply want to reduce risk.

WHY HEDGE?

Some risk can be hedged or offset. The idea behind hedging is straightforward. First, two closely related assets are found. Then, one asset is purchased and the other sold in proportions that minimize the risk of the net position. If the assets are perfectly correlated, the net position can be risk free. However, hedging is seldom free, Smith and Stultz (1985). Most farmers hedge to reduce risk, that is to reduce uncertainty, Martines-Filho (1996). Why then bother to hedge? For one thing, reducing the risk makes financial planning easier and reduces the odds of an costly shortfall. A shortfall might mean only an unexpected trip to the bank, but in extreme cases it could trigger bankruptcy. Why not reduce the odds of these awkward outcomes with a hedge?

Financial distress can result in indirect as well as direct costs to a farmer. (Direct costs include legal fees and administrative costs. Indirect costs reflect the difficulty of managing a farm under watchful eyes of a "friendly" banker). Costs of financial distress arise from disruption to normal farming operations as well as from the effect financial distress has on the farmer's investment decisions. The better the risk management policies, the less risk and expected costs of financial distress. As a side benefit, better risk management increases the farmer's debt capacity.

In some cases hedging also make it easier to decide whether the farmer deserves a stern lecture or a pat on the back. Hedging extraneous events can help focus the farmer's attention. While the farmer should not have to worry about events outside of his control, most people (and farmers are people) worry anyway. It is naive to expect the farmer not to worry about changing corn prices

if his "bottom line" depends on them. Still, the time spent worrying could be better spent if the farmer hedged against such movements.

REDUCING RISK WITH OPTIONS

Farmers regularly buy options on commodities to limit their downside risk. Many of these options are traded on option exchanges, but often they are simply private deals among farmers, millers and bankers.

Suppose your neighbor, and employee of Illinois Milling, Incorporated (IMI), is concerned about potential increase in the price of corn, which is one of its major inputs, Gerht and Good (1993). To protect IMI against such increases, your neighbor on behalf of IMI buys 6-moth options to purchase 1,000 bushels of corn at an exercise price of $2 per bushel. These options might cost $0.10 per bushel.

If the price of corn is above the $2 exercise price when the option expires, IMI will exercise the option and receive the difference between the corn price and the exercise price. If the corn price falls below the exercise price, the options will expire worthless. The net cost of corn will therefore be:

	Corn Price, Dollars per Bushel		
	$1.50	$2.00	$2.50
Cost of 1,000 Bushels	$1,500	$2,000	$2,500
less Payoff on Call Option	-0-	-0-	$ 500
Net Cost	$1,500	$2,000	$2,000

By buying options, IMI protects itself against increase in the corn price while continuing to benefit form corn price decreases. If corn prices falls, it can discard its call option and buy its corn at the market price. If the corn prices rise, however, it can exercise its call option to purchase corn for $2 a bushel. Therefore, options create an attractive asymmetry. Of course, this asymmetry comes at a price: the $100 cost of the options (1,000 options as $0.10 each).

Hedging with Options

Consider now the problem of your uncle, a Georgia corn farmer, who supplies IMI with corn. His problem is the mirror image of IMI's: he losses when corn prices fall and gains when corn prices rise.

Your uncle wants to lock in a minimum price of his corn but still benefit from rising corn prices. He can do so by purchasing put options that give him the right to sell corn at an exercise price of $2 per bushel. If corn prices fall, he will exercise the put. If corn prices rise, he will disregard the put and sell corn at the market price:

	Corn Price, Dollars per Bushel		
	$1.50	$2.00	$2.50
Revenue from 1,000 Bushels	$1,500	$2,000	$2,500
less Payoff on Put Option	$ 500	-0-	-0-
Net Revenue	$2,000	$2,000	$2,500

If corn prices rise, your uncle reaps the benefit. But if corn prices fall below $2 a bushel the payoff of the put option exactly offsets the revenue shortfall. As a result, your uncle realizes net revenues of at least $2 a bushel, which is the exercise price of the put option.

Once again, it is important to remember that one "does not get something for nothing". The price your uncle pays for "insurance" against a fall in the price of corn is the cost of the put option. Similarly, the price that IMI paid for "insurance" against a rise in the price of corn was the cost of the call option. Options provide protection against adverse price changes for a fee, the option premium!

Notice both your uncle, the corn farmer, and your neighbor, the milling company employee, use options to insure against an adverse move in corn prices. Bu the options do not remove all uncertainty. For example, your uncle may be able to sell corn for much more than the exercise price of the option.

FUTURES CONTRACTS

Suppose your uncle, the corn farmer in Georgia, is optimistic about next year's corn crop, he still has trouble sleeping at night. He is worried that when the time comes to sell the corn, prices may have fallen through the floor. The cure for your uncle's insomnia (or just the start of bigger worries) is to sell corn futures. (see Irwin et al. (1996) for a Monte Carlo Analysis). In this case, he would agree to deliver so many bushels of corn in (say) September at a price that is set today. This future contract is not to be confused with an option. With an option, the holder has the right but not obligation to make delivery. The futures contract is a firm promise to deliver what at a fixed selling price, Garcia et al (1988). While options are great in theory, human emotions can be an obstical.

Your neighbor in Minneapolis, the employee of IMI, is in the position opposite to your uncle: she needs to buy corn after the harvest. If she would like to fix the price of this corn ahead of time, she can do so by buying corn futures, Kastens and Schroeder (1996). In other words, she agrees to take delivery of corn in the future at a purchase price that is fixed today. The miller dose not have an option either; she is obligated to take delivery if she still holds the contract when it matures.

Now suppose your uncle the farmer and your neighbor the miller strike a deal. They enter a futures contract, see Tomek (1997) for a review of futures prices as forecasts. What happens? First, essentially no money exchanges hands when the contract is initiated. (Actually, each party will be required to set up a margin account to guarantee performance on the contract. Despite this, the futures contract still may be considered as essentially requiring no money down. First, the

amount of margin is small. Second, it may be posted in interest-bearing securities, so that the parties to the trade need not suffer opportunity cost from placing assets in the margin account.) Your neighbor, the miller, agrees to buy wheat at the futures price on a stated future date (the contract maturity date). Your uncle, the farmer, agrees to sell at the same price and date. Second, the futures contract is a binding obligation, not an option. (Recall, options give the right to buy or sell if buying or selling turns out to be profitable). The futures contract requires that your uncle, the farmer to sell and your neighbor, the miller, to buy regardless of who profits and who losses. While no money changes hands when a futures contract is entered into, the contract is a binding obligation to buy or sell at a fixed price at contract maturity.

The profit on the futures contract is the difference between the initial futures price and the ultimate price of the corn when the contract matures. For example, if the futures price is originally $2.00 and the market price of the corn turns out to be $2.25, your uncle, the farmer, delivers and your neighbor, the miller, receives the corn for a price $0.25 below market value. Your uncle, the farmer, loses $0.25 per bushel and your neighbor, the miller, gains $0.25 per bushel as a result of the futures transaction. In general, the seller of the contract benefits if the price initially locked in turns out to exceed the price that could have been obtained at contract maturity. Conversely, the buyer of the contract benefits if the ultimate market price of the asset turns out to exceed the initial futures price. therefore, the profits on the futures contract to each party are:

Profit to Seller	=	initial futures price - ultimate market price
Profit to Buyer	=	ultimate market price - initial futures price

Now it is easy to see how the farmer and the miller can both use the contract to hedge. Consider your uncle the farmer's overall cash flows:

	Cash Flow
Sale of Corn	Ultimate Price of Corn
Futures Profits	Futures Price less Ultimate Price of Corn
Total	Futures Price

The profits on the futures contract offset the risk surrounding the sales price of corn and lock in total revenue equal to the futures price. Your neighbor, the miller, also has a fixed price for the corn, the futures price. Any increase in the cost of corn will be offset by a commensurate increase in the profit realized on the futures contract.

Both your uncle, the corn farmer, and your neighbor, the miller, have less risk than before. You uncle has hedged (that is offset) risk by selling corn future; your neighbor has hedged by buying corn futures. However, neither has eliminated all risk. For example, your uncle the farmer, still has quantity risk. He does not know for sure how many bushels of corn he will produce.

Hedging with Futures

Suppose that your uncle originally sold 5,000 bushels of December corn futures at a price of $2.00 per bushel. In December, when the futures contract matures, the price of corn is only $1.50 per bushel. Your uncle, the farmer, buys back the corn futures at $1.50 just before maturity, giving him a profit of $0.50 a bushel on the sale and subsequent repurchase. At the same time he sells his corn at the spot price of $1.50 a bushel. His total receipts are therefore $2.00 a bushel. Basically involving:

Profit on Sale and Repurchase of Futures	$0.50
Sale on Corn at the September Spot Price	$1.50
Total Receipts	$2.00

The futures contract has allowed your uncle, the farmer, to lock in total proceeds of $2.00 a bushel.

The Mechanics of Futures Trading

In practice, your uncle, the farmer, and your neighbor, the miller, would not sign the futures contract face to face. In stead, each would go to an organized futures exchange. Your neighbor would not be prepared to buy future contracts if your uncle were free to deliver half-rotten corn to a leaky barn at the end of a cart track. Futures trading is possible only because the contracts are highly standardized. For example, in the case of corn farmers, each contract calls for delivery of specified quantity of corn at a specified quality at a specified warehouse.

When a futures contract is bought or sold, the price is fixed today, but payment is not make until later. However, each party will be asked to put some cash or securities as margin to demonstrate that they are able to honor their side of the bargain.

In addition, futures contracts are "marked to market". This means that each day any profits or losses on the contract are calculated; the exchange is paid any losses and receive any profits. For example, assume your uncle, the farmer, agreed to deliver 5,000 bushels of corn at $2.00 a bushel. Suppose the next day the price of corn futures increases to $2.05 a bushel. Your uncle now has a loss on his sale of 5,000 * $0.05 = $250 and must pay this sum to the exchange. In a way, your uncle is "buying back" his futures position each day and then opening up a new position. Thus after the first day your uncle has realized a loss on his trade of $0.05 a bushel and now has an obligation to deliver corn for $2.05 a bushel.

Of course your neighbor, the miller, is in the opposite position. The rise in futures price leaves her with a profit of 5 cents a bushel. The exchange will therefore pay her this profit. In effect your neighbor sells her futures position at a profit and opens a new contract to take delivery at $2.05 a bushel.

The price of corn for immediate delivery is known as the spot price. When your uncle sells corn futures, the price he agrees to take for his corn may be very different from the spot price. But the future eventually becomes the present. As the date for delivery approaches, the futures contract becomes more and more like a spot contract and the price of the futures contract approaches the spot price.

Your uncle, the farmer, may decide to wait until the futures contract matures and then deliver corn to the buyer. But in practice such delivery is rare, for it is more convenient for the farmer to buy back the corn futures just before maturity.

Additional Price Increase

Suppose that 2 days after taking out the futures contract the price of September corn increase to $2.20 a bushel. What additional payments will be made by or to your uncle, the farmer, and your neighbor, the miller? What will be their remaining obligations at the of this second day?

Your uncle, the farmer, has a further loss of 15 cents a bushel ($2.20 - $2.05) and will be required to pay this amount to the exchange. Your neighbor, the miller, has a further profit of 15 cents per bushel and will receive this from the exchange. Your uncle is now committed to delivering corn in September for $2.20 per bushel and your neighbor is committed to paying $2.20 per bushel.

Your uncle, the farmer, and your neighbor, the miller can both use corn futures to hedge their risk; however, actual implementation has behavioral issues dealing with basic human emotions, which can lead to the wrong application. Because corn prices can fluctuate widely, a large corn buyer like your neighbor's employer IMI could be knocked badly financial "off course". IMI therefore reduces its exposure to movements in corn prices by hedging with corn futures.

Forward Contracts

Each day billions of dollars of futures contracts are bought and sold. This liquidity is possible only because futures contracts are standardized. Futures contracts mature on a limited number of dates each year, and the contract is standardized. For example, a contract may call for the delivery of 1,000 bushels of corn. If the terms of a futures contract do not suit either the buyers or sellers needs, they may be able to buy or sell a forward contract.

Forward contracts are custom-tailored futures contracts. One difference between forward and futures contracts is that forward contracts are not "marked to market". Thus with a forward contract, one settles up any profits or losses when the contract matures. A forward contract can be written with any maturity date for delivery of any quantity of goods.

DERIVATIVES

The earlier examples of your uncle, the farmer, and your neighbor, the miller. showed how derivatives (futures and options in these cases) can be used to reduce risk. However, if your brother-in-law, a private investor, was to copy your uncle without an offsetting of corn, your brother-in-law would not be reducing risk; rather, he would be speculating.

A successful derivatives market needs speculators who are prepared to take on risk and provide your uncle and your neighbor with the protection they need. For example, if an excess of farmers wished to sell corn futures, the price of futures would be forced down until enough speculators were tempted to buy in the hope of a profit. If there is a surplus of millers wishing to buy corn futures, the reverse will happen. The price will be forced up until speculators are drawn to sell. Speculators are necessary to a thriving derivatives market, but it can get your brother-in-law, an investor, into serious trouble. Does this mean that your brother-in-law should not use derivatives? No! However, speculation is foolish for your brother-in-law unless he has reason to believe that the odds are "stacked" in his favor; informational anomalies represent another dimension beyond the scope of this paper. If your brother-in-law is not much better informed than the highly paid professionals in banks and other institutions, he should leave the use of derivatives to your uncle and neighbor and avoid speculation involved in the market.

SUMMARY AND CONCLUSIONS

Fluctuations in commodity prices can make planning difficult and throw farmers and millers alike badly off "financial" course. So, both farmers and millers look for opportunities to manage these risks, and a number of specialized instruments have been invented to help them. These instruments are collectively known as derivative instruments, or commonly derivatives.

Options are often used by both farmers and millers to limit their downside risk. For example, owning a commodity and having the option to sell it at the current price is effectively "insurance" against loss.

Futures contracts are agreements made today to buy or sell commodities in the future. The price is fixed today, but the final payment does not occur until the delivery date. Futures contracts are highly standardized and are traded on organized exchanges. Commodity futures allow farmers and millers to "fix:" the future price of commodities. Forward contracts are equivalent to tailor-made contracts.

Speculation is foolish unless you have reason to believe that the odds are "stacked" in your favor, but it is difficult to "beat" the professional traders. If you are not much better informed than the highly paid professionals in banks and other institutions, you should use derivatives for hedging and not for speculation. There are no "money machines" Derivatives are not the answer to all of the farmers and millers problems. The farming turmoil of the 1980s could happen again, and the use of derivatives will not warn or protect the farmer and miller from all disasters.

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