



Understanding Fertilizer Price Risk

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The fertilizer market of 2008 provided a classic example of supply and demand conditions resulting in price volatility. Low fertilizer inventories combined with increased domestic and global demand led to an unprecedented spike in fertilizer prices. Prices of some fertilizer products more than doubled. The surge in prices reduced farm returns and led to stress and uncertainty in the farming sector. Within a year, fertilizer prices fell as global fertilizer demand softened in response to the record-high fertilizer prices and declining crop prices.

The events of 2008 underscore the need to understand the importance of fertilizer price risk in the overall risks of a farming operation. Producers also need to understand the structural changes in the fertilizer market and supply chain which led to increased volatility and identify potential strategies to reduce or manage fertilizer price risks. This Fact Sheet focuses on the first issue, examining the relative importance of fertilizer price risk.

Input Price Risk: Perception versus Reality

Several studies have asked producers about the most important categories of risk they encounter in their farming operation. For example, an Illinois study (Patrick and Musser) asked producers to rank the importance of 16 risk factors. Crop price variability was rated as the most important risk factor followed by crop yield variability. Input price variability was ranked near the middle of the list (7th out of 16) behind the risk of changing commodity programs and environmental regulations.

Studies of farm profitability paint a different picture. A recent study (Anderson and Brorsen) re-examined research involving the financial records of 1,000 Kansas grain farms during a 10-year period. The authors concluded that producers have the highest probability to increase profit by lowering costs, followed by increasing planting intensity, increasing yield, and adopting technology. Managing input price risk was the least likely management factor to increase profit.

This raises the question of the relative importance of fertilizer prices in the overall profit picture. Oklahoma State University wheat production budgets indicate that fertilizer costs represent over 30 percent of total operating costs. Each \$100/ton increase in fertilizer price decreases a wheat producer's profits by around 11 percent. Fertilizer accounts for 19 percent of operating costs for grain sorghum and 27 percent for annual forages. These percentages are fairly typical for crops in the Southern Plains. In the corn belt, fertilizer accounts for a larger (38 percent to 40 percent) share of the operating costs. Crops requiring heavy application of fertil-

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izers are not necessarily those for which fertilizer makes up the greatest share of total costs. Fertilizer use is relatively high for sugar beet, rice, and peanut production, for example, but fertilizer expenses amount to less than 20 percent of the operating cost for those cropping systems.

Another way to put fertilizer price risk into perspective is to consider the overall risks faced by a typical wheat producer. A simple simulation of a wheat producers' revenue risk can be created from county yields, and county wheat and fertilizer price data. This obviously understates the true risk since an individual producer's yield may vary from the county average and not every producer sells their wheat or purchases their fertilizer at the county average price. Based on county yields and prices, Oklahoma wheat producers had a contribution margin (revenue minus fertilizer expenditures) of \$52/acre during the 2000-2008 periods. The standard deviation of their contribution margin was \$47. If producers had been able to eliminate yield risk and produce exactly their average yield (26 bushels) each year, the standard deviation of their contribution margin would have decreased to \$29. Eliminating yield risk would have decreased their risk by 36 percent.

If the Oklahoma wheat producers in the previous example had been able to sell at the average price (\$4.06) every year, the standard deviation of their contribution margin would have actually increased to \$49. Eliminating the year-to-year variability in wheat price would not have improved their risk situation because the variation in yields still drove variation in revenue. In this respect, our model understates the impact of managing commodity price risk, since wheat prices also vary within a marketing year. If the producers had been able to buy fertilizer at a constant price representing the average price per ton (\$205/ton) every year the standard deviation of their contribution margin would have decreased to \$38. Eliminating fertilizer price risk would decrease their overall risk by 17 percent. In this simple example, based on county data, eliminating fertilizer price variability is roughly two-thirds as effective as eliminating yield variability in terms of overall risk reduction.

Fertilizer Prices Less Correlated with Commodity Prices

During the 2008 peak in fertilizer prices, higher commodity prices softened the negative effect of higher fertilizer prices, at least for farmers producing corn, soybean other summer crops.

The impacts were more severe on winter wheat producers who purchased fertilizer in the fall when fertilizer prices had increased and then sold their crop after wheat prices had fallen. Because the U.S. fertilizer market is driven by global demand and supply factors, U.S. fertilizer prices are increasingly uncorrelated with commodity prices. Future fertilizer prices similar to those experienced in 2007-2008 could be driven by global demand and tight supply factors and could occur even if U.S. crop prices were relatively soft. This scenario of low crop prices coupled with high fertilizer prices would stress farm profits. Farms with higher than average fertilizer usage or a limited ability to rotate to less fertilizer-intensive crops would be particularly vulnerable.

Summary

Producers have not historically ranked fertilizer price as one of their major risk factors. However, as the recent volatility in fertilizer markets demonstrate, changes in fertilizer prices can be a substantial risk factor. Fertilizer accounts for roughly

a third of all operating costs for many crops in the Southern Plains. To put fertilizer risk in perspective, eliminating fertilizer price risk would be roughly two thirds as effective as eliminating yield variability in terms of reducing overall risk. The U.S. fertilizer industry is increasingly driven by global supply and demand factors. This could increase the implications of fertilizer price risk since fertilizer prices may not move in tandem with commodity prices.

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