Stress Testing Farmer Cooperatives: An Application to Fertilizer Inventories

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Fertilizer prices are soaring and many industry leaders in U.S. agriculture are concerned. Higher fertilizer prices push up costs for farmers, cooperatives, as well as other agricultural retailers. While these sharp price increases are jarring, U.S. farmer cooperatives do have experience managing through significant fertilizer price volatility. In 2007-2008, just before and during the Great Financial Recession, fertilizer prices skyrocketed and then collapsed. That period was certainly turbulent for farmer cooperatives. So, what lessons learned from the 2007-2008 fertilizer price volatility are applicable today? And could we develop a cooperative stress test model to see what cooperatives are most exposed to a collapse in fertilizer prices?

The purpose of this fact sheet is to discuss the recent development of elevated fertilizer prices and its implication for U.S. farmer cooperatives. We develop a cooperative financial stress test model and use the model to run fertilizer inventory stress scenarios on various types of farmer cooperatives. A unique data set of farmer cooperative financial statements, provided by CoBank, is used to develop a financial stress test model.

After running various 2007-2008 fertilizer price scenarios on current farmer cooperatives' financial position, findings show that many farmer cooperatives are well positioned to absorb significant declines in the value of fertilizer inventories. However, two types of farmer cooperatives from the stress test could experience a significant decline in retained earnings – mid-sized cooperatives with sales between $50 million and $150 million that are a mix of grain and farm supply sales and small, supply cooperative with less than $50 million in sales. Key takeaways from this research, which is applicable to all farmer cooperatives, are to ensure fertilizer inventory is managed appropriately and to make certain all contracts for fertilizer purchases are collected in a timely manner.

Turbulence in Fertilizer Markets

Issues in fertilizer markets have led to skyrocketing prices. According to data obtained from the Illinois Production Cost Report, fertilizer prices have increased 113.82% over the past year. A confluence of factors has contributed to the soaring prices. European producers are halting production due to rising natural gas prices. Hurricane Ida swept through the Gulf Coast in August, disrupting fertilizer production and logistical networks. China, a major supplier of phosphate, urea, and sulphate, has been plagued by soaring energy prices and production issues. In September, China imposed restrictions on fertilizer exports in an attempt to steady domestic prices and ensure adequate supply; Russia, another large exporter, followed suit the following month with the measures expected to take effect in December. And finally, Turkey has banned fertilizer exports entirely.

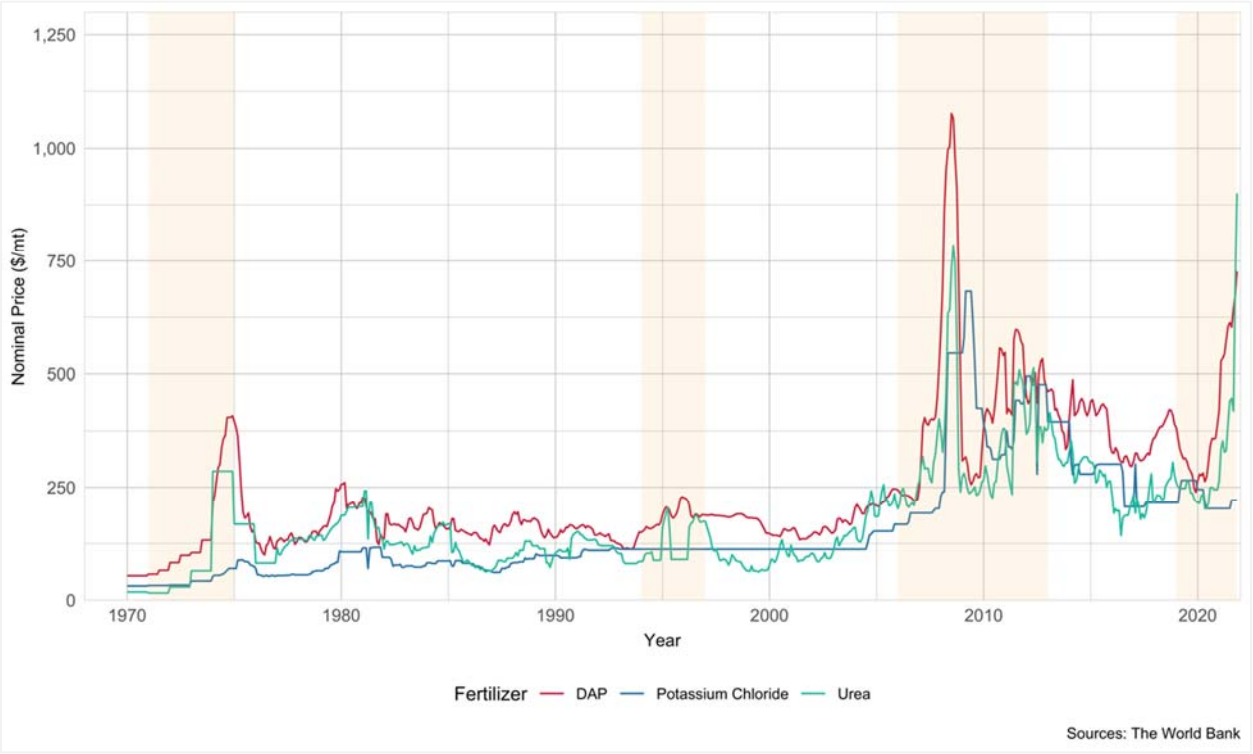

Figure 1. Historic Fertilizer Prices

Similar price increases were observed over a decade ago, however, the higher prices were primarily driven by strong demand. As shown in Figure 1, fertilizer prices started rising sharply in October 2007 and dramatically collapsed in late 2008. The sudden fall in prices in the U.S. was a result of tighter credit due to the Great Financial Recession, increasing fertilizer imports, and farmers cutting back on fertilizer use. The collapse in prices negatively affected many farmer cooperatives and independent retailers because many had to write-down their fertilizer inventory and, in some cases, incur heavy losses.

With continued supply chain disruptions, it is likely that higher fertilizer prices will persist. However, since history often repeats itself, what lessons can be learned from collapsing fertilizer prices for farmer cooperatives?

Examining and Stress Testing Farmer Cooperative Balance Sheets

The impact of the 2008 collapse of fertilizer and grain prices can be seen on cooperative balance sheets. If a cooperative were to write down a loss in fertilizer inventory, then it will likely occur by first decreasing retained earnings. Comparing the reduction of retained earnings across cooperatives does require having retained earnings be on a common scale or normalizing the value for all cooperatives. This is done by dividing retained earnings by total sales to arrive at a normalized retained earnings value.

When fertilizer prices collapsed in 2008, mid-sized cooperatives experienced the biggest decline in retained earnings. Figure 2 shows the normalized retained earnings of cooperatives with sales of less than $50 million (small), sales between $50 and $150 million (mid-sized), and those cooperatives with sales of $150 million or greater (large). In 2008, the largest decline in normalized retained earnings of 29.47% was experienced by mid-sized cooperatives. Small cooperative experienced a slight decline of 5.96%, while large cooperatives normalized retained earnings remained flat.

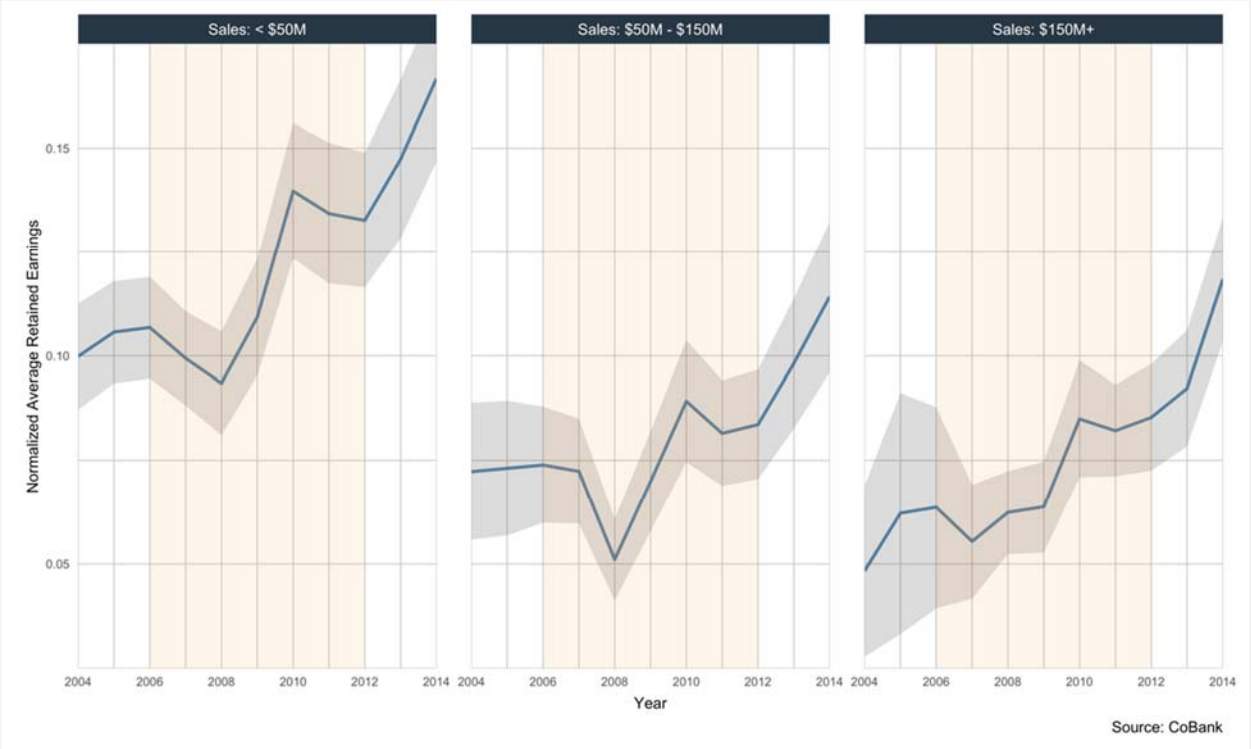

Figure 2. Normalized Farmer Cooperative Retained Earnings

Stress Test Methodology

To examine the impact of a potential decline in today's elevated fertilizer prices, a cooperative stress test model is developed. The stress test model measures the impact of a collapse in fertilizer prices on a portfolio of cooperatives. In addition to segmenting cooperatives by size of total sales, cooperatives are divided into three types based on the types of sales generated – farm supply cooperatives (over 2/3 of sales from farm supply), grain cooperatives (over 2/3 of sales from grain), and the remaining are labeled as mixed cooperatives (essentially an equal mix of farm supply and grain). Grain cooperatives are not included in the analysis because they are unlikely to hold fertilizer inventory that would be material on the financial statements.

The stress test model uses a representative farmer cooperative data by adjusting fertilizer inventory values and exposure to fertilizer price fluctuations. The first step in our stress test model is to consider how exposed a cooperative is to fertilizer price fluctuations. Many cooperatives try to minimize fertilizer price risk by purchasing or holding inventory that is already sold on a contract or is paid in full. If 100% of the inventory is already sold to a farmer, then the cooperative would be fully protected from a price decline and would not experience any inventory write-down. However, most cooperatives are exposed to fertilizer price declines. To identify how exposure to fertilizer price declines can reduce inventory values and then retained earnings, we consider 3 scenarios – (1) a cooperative is 25% price exposed (75% of inventory is sold); (2) a cooperative is 50% price exposed (50% of inventory is sold); (3) a cooperative is 75% price exposed (25% of inventory is sold).

From here, fertilizer inventory values will be decreased by lowering fertilizer prices in 5% increments. This inventory write-down effectively creates an expense that will reduce net income. If net income becomes negative after applying fertilizer price decrease, then fertilizer inventory write-down expense is assumed to create a net income loss for the cooperative. To absorb this loss, the cooperative's retained earnings will be decreased by an amount equal to the net income loss.

Although the inventory write-down expense is assumed to create a net income loss, which would entitle the cooperative to tax credits, we allow the write-down expense to flow through the income statement untaxed. This is because the tax accounting required is complicated and not the focus of this article. Therefore, the resulting net income is equal to the initial net income less the simulated inventory write-down expense.

Stress Test Model Results

The stress test model results are influenced by outliers. This creates an issue because the distributions are not symmetrical, which can confound interpretations of the results. To alleviate this issue, the stress test results are presented in quartile form. These quartiles are based on the distribution of the stress test results. Therefore, the results are shown for the first (bottom 25%), second (median), and third (top 25%) quartiles of the percentage changes of retained earnings. Figure 3 shows the impact of falling fertilizer prices on retained earnings at different inventory exposures and different sales sizes of mixed cooperatives.

Mixed cooperatives with sales between $50 and $150 million were the most negatively impacted by inventory write-downs. At a fertilizer inventory exposure of 25% and a price drop of 50%, the retained earnings of the bottom 25% of cooperatives decreased by 24.1%, 48.1% at 50% exposure, and 72.2% at 75% exposure. The decline in retained earnings for half of the cooperatives in the same sales category is not as large but is still significant. When prices declined by 50% at a 25% exposure, retained earnings for these cooperatives were reduced by 13.1%, 26.2% at 50% exposure, and 39.2% at 75% exposure.

Large cooperatives with sales of $150 million or more were the least impacted by the inventory write-downs. At the highest price drop of 50% and exposure of 75%, the bottom 25% of large cooperatives reduced their retained earnings by 44.3% compared to 72.2% for cooperatives with sales between $50 and $150 million, and 52.0% for those with sales less than $50 million.

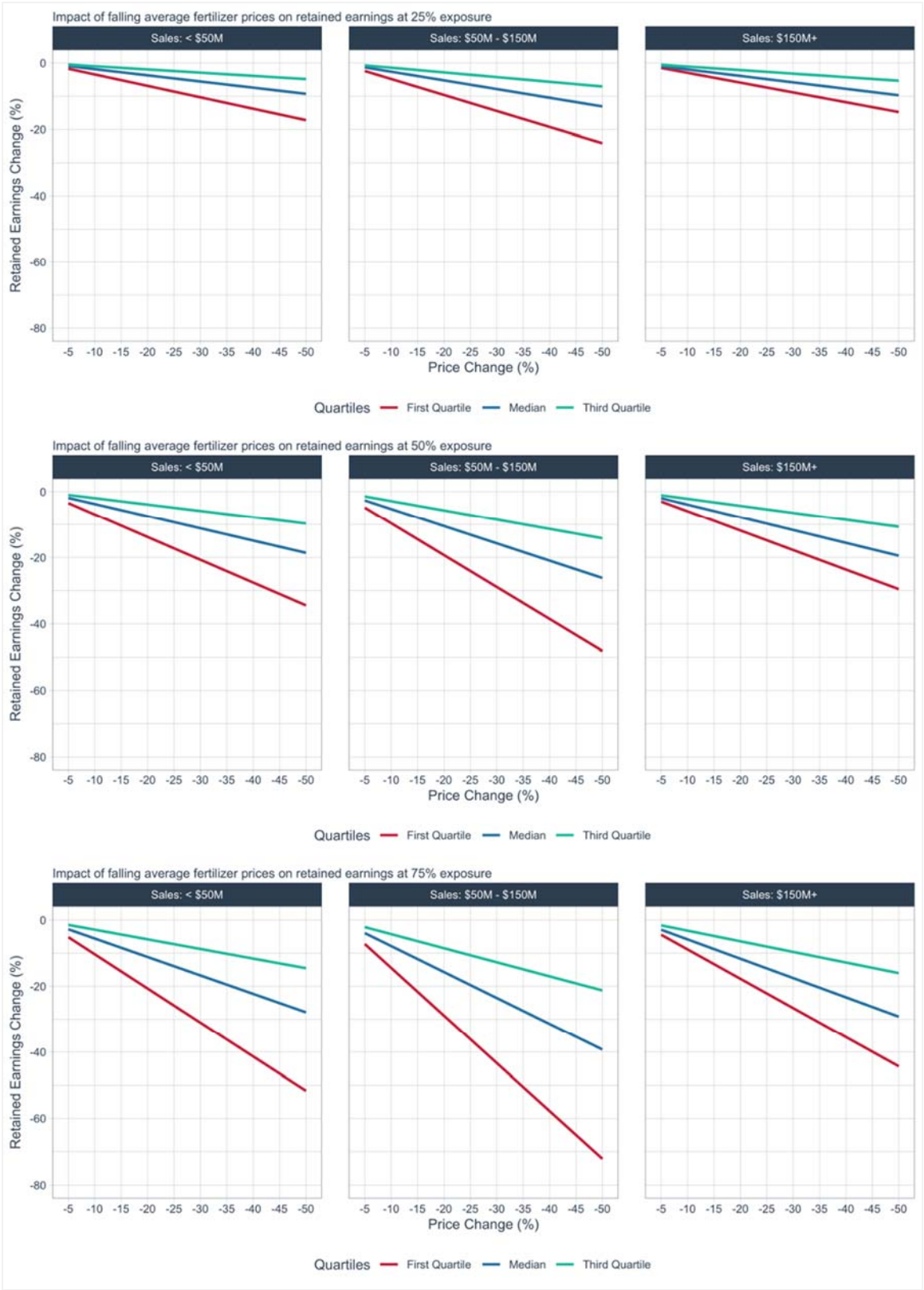

Figure 3. Mixed Cooperatives Stress Test Results

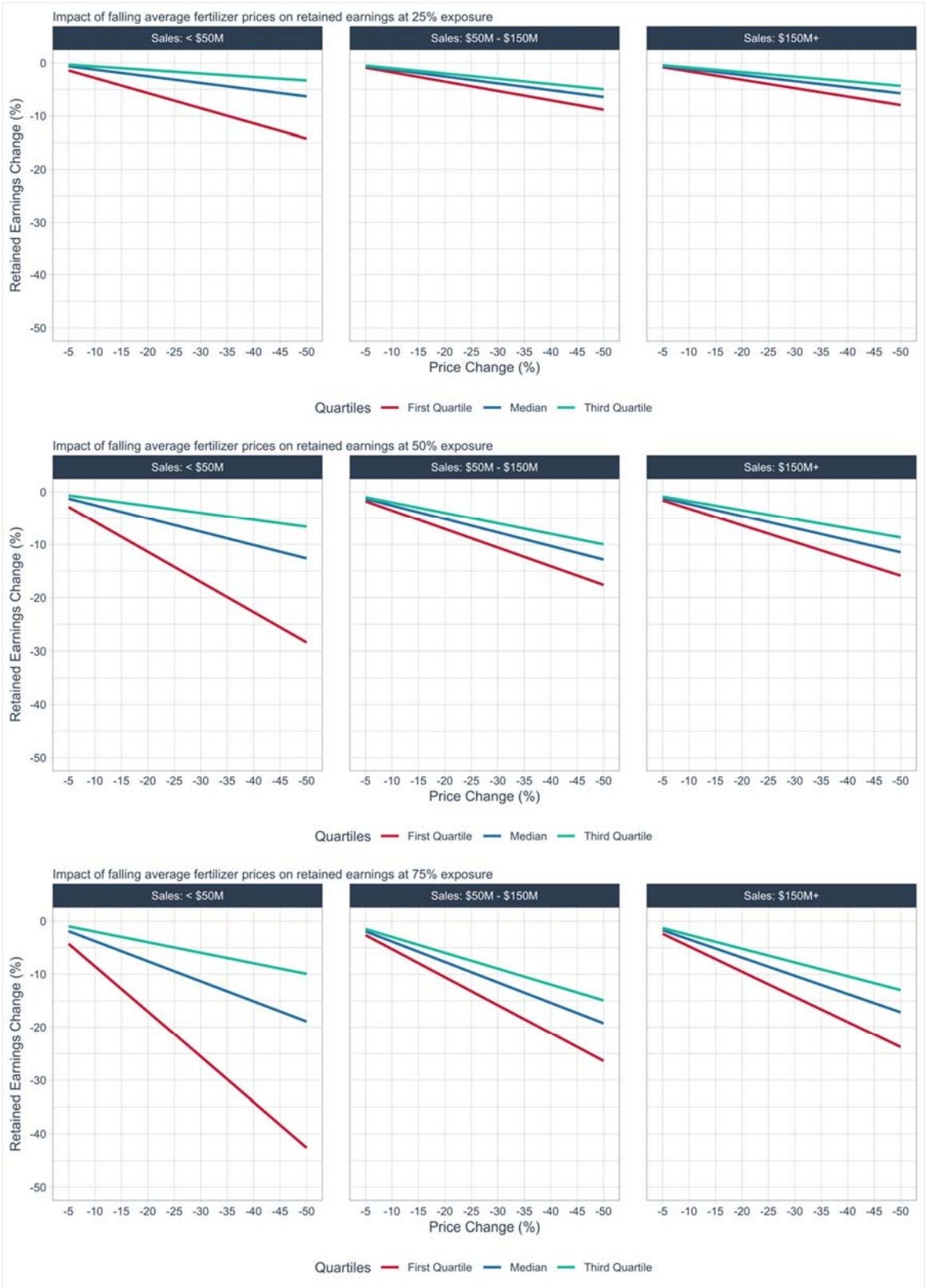

Figure 4. Supply Cooperatives Stress Test Results

Compared to mixed cooperatives, supply cooperatives experienced a much lower reduction in retained earnings. Figure 4 shows the impact of falling fertilizer prices on retained earnings at different inventory exposures and different sales sizes of supply cooperatives. This is because supply cooperatives exhibited higher profitability and were therefore less impacted by the inventory write-downs. Cooperatives with sales of less than $50 million were the most negatively impacted. At the highest price drop of 50% and exposure of 75%, the bottom 25% of small supply cooperatives reduced their retained earnings by 42.6% compared to 52.0% for mixed cooperatives. Supply cooperatives with sales between $50 and $150 million reduced their retained earnings by 26.4% when prices declined by 50% at a 75% exposure compared to 72.2% for mixed cooperatives of the same size.

Key takeaways

Today, fertilizer markets are very volatile, which has implications for farmer cooperatives. A stress test model is presented to show how a fertilizer price decline coupled with being exposed to price movements can negatively impact various types and sizes of farmer cooperatives. Our research shows that mid-sized, mixed supply and grain cooperatives as well as small supply cooperatives could experience the most stress if fertilizer prices declined and they are exposed to falling prices. All other farmer cooperatives, including large cooperatives, could still experience fertilizer inventory write-downs, just the subsequent decline in retained earnings would not be as large as the mid-sized mix and small supply cooperatives.

These results emphasize the importance for all cooperatives to manage their fertilizer inventory efficiently. It is important to track and monitor fertilizer inventory and know how quickly this inventory turns over. Also, cooperatives should know and protect fertilizer margins because that has implications for the cooperative's bottom-line profits. Managing fertilizer inventory also entails minimizing price risk exposure by not being open to fertilizer market movements. One way to minimize this price risk is to closely align when the cooperative purchases fertilizer to when the fertilizer is sold.

Finally, it is imperative that cooperatives ensure that all fertilizer purchased under contract is paid in-full. Not following through with collecting on contracts leads to significant accounts receivable risk and can lead to a steep rise in bad debt expense. In fact, not collecting on a fertilizer contract is no different than being exposed to price fluctuations in the market. And as shown in this fact sheet, being exposed to fertilizer price fluctuations can cause a significant decrease in a cooperative's retained earnings.