Cross-Product Hedging

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Cross-product Hedging for Farm Service Companies

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# ABSTRACT

The purpose of this paper was to research the feasibility of using the agricultural commodities futures market to hedge against risks faced by companies of the farm service sector. Through the research of the strategy I hope that agriculture producers can gain a better understanding of how to implement this type of cross hedging strategy and what considerations to take. Revenue volatility is one of the largest risks of participating in agriculture production and this will help these participants manage risks from serving a volatile agriculture industry.

**INTRODUCTION**

The Agriculture Industry:

The agriculture industry is a risky market. The supply chain is dependent on environmental elements. Additionally, inelastic demand creates high levels of price volatility. This makes producing food and fiber products risky and also leaves the producers not knowing from year to year what their income or harvest might look like. With farm exits reaching over 25% for a 4 year period in recent year's actions must be taken by producers to protect themselves and income (Stam, 2004).

To combat this riskiness and volatility, farm programs, crop insurance and other policies have been developed in order to help farmers keep producing. Farmers are also able to use the futures market in order to take out some volatility from the market and the constantly changing prices.

Future and Forward Contracts:

A forward contract is a contract made between a buyer and a seller where a buyer promises to purchase a certain good from the seller at a predetermined price at a set date in the future. This type of contract is useful for farmers who are price takers and have no power over market prices at harvest time. Essentially, a farmer is able to lock in a price at today's market price for delivery at some time in the future (Wasendorf, 2001). For example:

The price today is $5 per 100/cwt. of apples. The farmer who has grown the apples knows that at this price he is able to cover all his costs of producing the apples, cover his cost of living and make a decent profit, but is

susceptible to the volatility of the market in the future because his apples are

not yet ready for harvest. Another guy who makes applesauce needs apples in

order to make his sauce. He knows that at $5 per 100/cwt. of apples he is able

to make his applesauce and sell it for a decent enough price that he is able to

make some profit, cover all his costs and take care of his family. But he does

not know what the price of apples will be in the future and therefore is

susceptible to the volatility of the apple market.

Both the farmer and the applesauce producer decide to enter into a contract

stating that the farmer and will sell X amount of apples to the applesauce

maker for $5 per 100/cwt. The amount of apples contracted can be any amount

predetermined by the two parties. With the contract in place, it does not matter

what happens to the price of apples. Such as if the market price falls to $1 per

100wt. or if it sky rockets to $20 per 100/cwt.


    Using the scenario above, it is easy to see that the farmer and applesauce maker were

removing themselves from the volatility of the apple market by entering into this contract. When

forward contracts became popular, the Chicago Board of Trade (CBOT) decided to standardize

the contracts on a market similar to the New York Stock Exchange. Standardizing the contracts

meant that they would all trade the same amount of a commodity for the same market price and

that they were all guaranteed. CBOT, now part of the Chicago Mercantile Exchange Group

(CME Group), has guaranteed all the contracts on the exchange meaning that they are taking on

all the risk that one of the parties might fault on their end of the contract. CME Group does claim

a small fee for acting as the clearing house for the contract but with the contracts guaranteed,

producers and speculators alike may buy and sell contracts as they please. These standardized

and traded contracts are known as futures contracts (Kolb & Overdahl, 2006).

The Farm Service Sector:

There is considerable risk in the agriculture industry, but with the help of crop insurance

and government programs, some of this risk has been mitigated. However, considerable risk

remains for the farm service sector. The farm service sector is a term used in the agriculture

industry for companies that provide a service to the actual producers of agricultural commodities.

This includes companies like John Deere, or Kubota that produce tractors, or a guy welding

water troughs for cattle in his backyard. Nonetheless, all of these businesses' revenues or sales

depend heavily on what is happening to the producers in their industries. Thus, participating in

the farm service sector is also carries many of the same risks as being a producer with none of

the insurance.

**MATERIALS AND METHODS**

Cross-product Hedging:

The question this research investigated is if a farm service company could use a

commodity that is traded on the Chicago Mercantile Exchange to hedge against fluctuations in

sales revenue. If a service industry member could, with some measure of certainty, correlate the

fluctuation in their revenue resulting from fluctuations in the prices of a commodity then they

could potentially hedge some of the risk of being in the service sector by using a hedging

strategy in the futures market. Unless the service company owner has some degree of certainty of

the correlation between that commodity and their sales revenue, then this strategy could actually increase their risk and be a speculator in a separate market (Sinclair, 2008).

The sample company for this project was Raine Tank & Fabrication. Raine Tank is a steel fabrication company that specializes in the production of steel, bulk overhead feed bins. These storage bins are purchased by livestock producers, but demand for the tanks is at least partially dependent on the profitability of cattle producers. This market risk manages to travel back up the product chain to Raine Tank in the form of lost sales revenue. Having no commodity to hedge against and no crop insurance, the company is left to bear the risk of the market.

Augmented Dickey-Fuller:

Sales data received from Raine Tank was collected and then plotted against several commodities believed to have some correlation with their sales performance. These commodities were corn, cattle and hot rolled steel. Corn was chosen because it is one of the main input component for feed mixes that producers use to fill up the feed tanks that Raine Tank produces. Fluctuations here were anticipated to be seen visually in Raine Tank sales. Cattle was also chosen because cattle raisers make up the majority of Raine Tanks customers. Market activity within this commodity was anticipated to move down the supply chain to Raine Tank. This inference is made off of the assumption that what effects the customer base, affects the company. The last commodity was hot rolled steel. This commodity was different than the rest in that the company actually has an underlying stake in the commodity as steel is one of the main components used to manufacture the feed tanks.

In Fig. 1 are the actual data retrieved from each of the commodities and Raine Tank. All of the data has been multiplied by the same random number in order to create confidentiality for Raine Tank and consistency among the rest of the data.

Table 1.

| Quarter | Year | RTS | HRS | Corn | Cattle |
|---|---|---|---|---|---|
| 1 | 2013 | 90300 | 615 | 7.043333 | 142.87 |
| 2 | 2013 | 107800 | 632 | 6.97 | 136.4767 |
| 3 | 2013 | 176400 | 630 | 6.133333 | 154.3767 |
| 4 | 2013 | 211250 | 675 | 4.47 | 166.14 |
| 1 | 2014 | 125200 | 639 | 4.43 | 170.51 |
| 2 | 2014 | 107500 | 652 | 4.64 | 191.84 |
| 3 | 2014 | 167201 | 639 | 3.726667 | 225.32 |
| 4 | 2014 | 248000 | 605 | 3.653333 | 238.7667 |
| 1 | 2015 | 112500 | 475 | 3.806667 | 214.81 |
| 2 | 2015 | 106060 | 465 | 3.66 | 223.9367 |
| 3 | 2015 | 111500 | 418 | 3.72 | 214.17 |
| 4 | 2015 | 163340 | 391 | 3.636667 | 177.3633 |
| 1 | 2016 | 162220 | 480 | 3.6 | 158.5333 |
| 2 | 2016 | 174850 | 618 | 3.686667 | 148.39 |
| 3 | 2016 | 164250 | 496 | 3.343333 | 142.1667 |
| 4 | 2016 | 270720 | 633 | 3.283333 | 128.8933 |
| 1 | 2017 | 147000 | 630 | 3.443333 | 132.5667 |
| 2 | 2017 | 104738 | 640 | 3.436667 | 148.65 |
| 3 | 2017 | 203400 | 599 | 3.343333 | 151.2733 |
| 4 | 2017 | 216280 | 662 | 3.213333 | 155.92 |

Table 1: Quarterly income for Raine Tank is displayed along futures prices by quarter for the years 2013-17. Note that Raine Tank is labeled as RTF and hot rolled steel as HRS.

The data was plotted and illustrated using several different methods in order to find the most suitable for Raine Tank to successfully hedge its income. Beginning by using an augmented Dickey-Fuller test, the data was checked for a unit root present in a time series. This will ultimately tell if there is stationarity which is used as an indicator for spurious regression.

Table 2.

| Augmented Dickey-Fuller Test | | | |
|---|---|---|---|
| Data Set | Test Statistic | 5% Critical Value | Reject or Fail to Reject |
| RTS | -6.087944 | -3.081002 | Reject |
| Cattle | -5.265313 | -3.065585 | Reject |
| Corn | -11.75631 | -3.065585 | Reject |
| HRS | -8.26506 | -3.052169 | Reject |

Table 2: Augmented Dickey-Fuller Test Results. Note that Raine Tank is labeled as RTS and hot rolled steel as HRS.

For the test in table 2, an alpha level of 5% was used. This is essentially a level of confidence in the data and 5% percent is typically standard for this type of test. Consistently in each of the tests the test statistic was lower than the critical value. This means the null hypothesis that the data has a unit root is rejected, essentially establishing that the data set was stationary. This result also eliminated spurious regression which is beneficial to the study as spurious regression is deceptive when measuring the correlation between two variables as it actually increases and exaggerates this correlation. This is particularly true when two variables, such as the commodities in this study, have similar trends.

Regression:

In the next step, following the procedures laid out in CME Group's study of cross hedge effectiveness, the commodity prices were each regressed against the sales of Raine Tank. This in order to show hedge effectiveness

Table 3.

| Cross-Hedge Effectiveness | |
|---|---|
| Regressed against Raine Tank Sales | |
| Commodity | R^2 |
| Hot Rolled Steel | 0.07 |
| Corn | 0.16 |
| Cattle | 0.01 |

Table 3: Cross hedge effectiveness for Raine Tank Sales.

After running the regression all $R^2$ values were relatively low meaning low to no hedge effectiveness. A similar study on cross hedge effectiveness completed in 2015 by the CME Group regressed the futures prices for corn and sorghum. The two commodities were highly correlated, with CME reporting $R^2$ values all above 90% meaning high levels of hedge effectiveness (CME Group, 2015).

Traditional Hedge:

With the given data set being so small the only hedge that makes sense for Raine Tank is a traditional hedge. The data was then put into quarters in an attempt minimize the variations in the data from month to month it. This still proved problematic though as the data only dated back to 2013. Breaking this down into quarters left only around 20 data entries per variable which is minimal when compared to larger studies with high levels of accuracies. Comparing Raine Tanks quarters 3 and 4 sales to the futures prices for hot rolled steel for the same periods of time, as in figures 8-11, it is clear that the hot rolled steel market faces historic lows for 2015 in the data set.
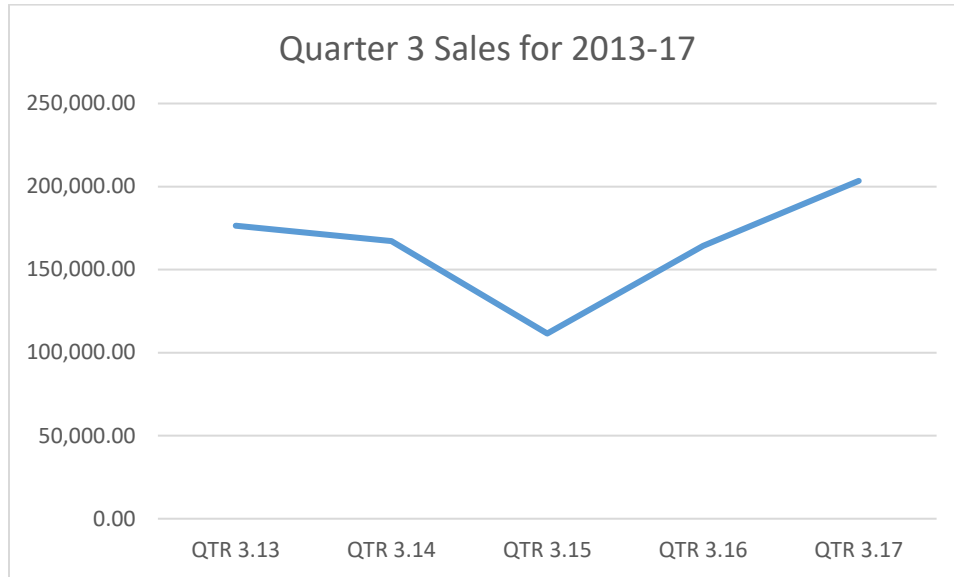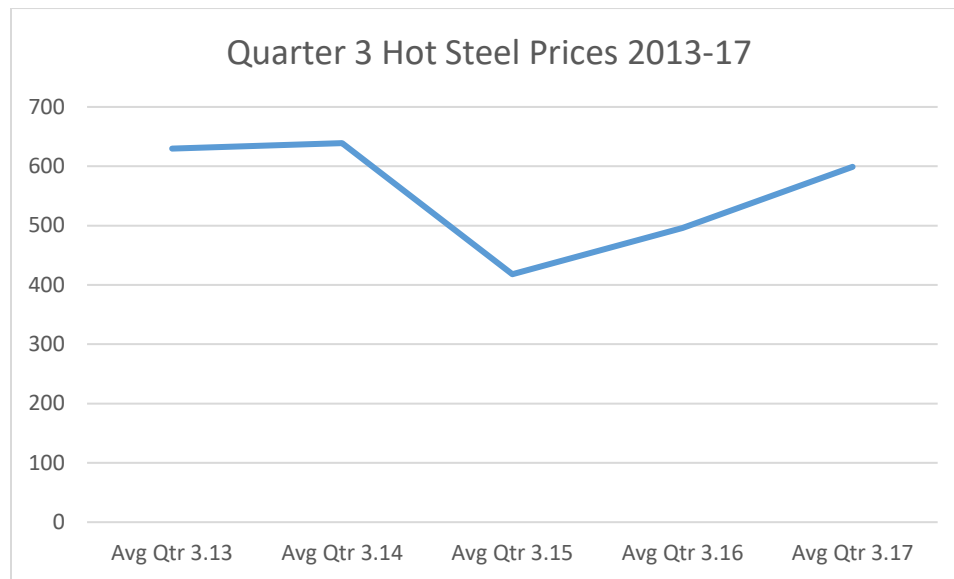
Figure 1.



Figure 2.



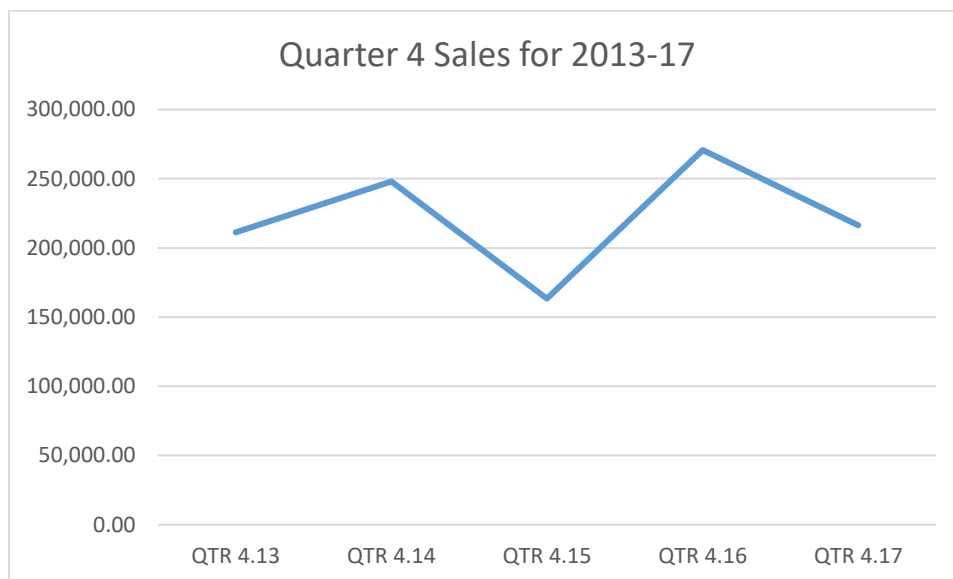Similar data trends are exhibited in quarter 4.

Figure 3.



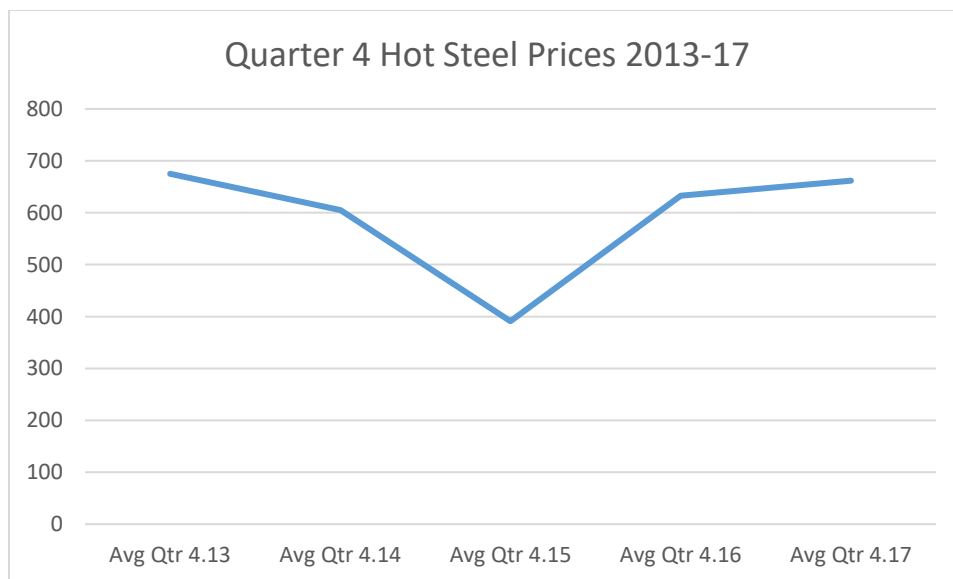Quarter 4 Sales for 2013-17

Figure 4.



Quarter 4 Hot Steel Prices 2013-17

Using a traditional hedge the sales data of Raine Tank would not need to be included because the company is only hedging against the underlying commodity. It was included though

because it is interesting to look at some of the similar trends in the data although trend is not always an indicator of correlation. With the traditional strategy Raine Tank could purchase steel futures in 2015 at $390 per short ton. Then the following year the company could buy steel on the spot market for $636 per short ton but using the money gained in the futures market, would offset their position and have a total net effect equal to the $390 he locked in 2015 assuming they were yearlong contracts for convenience sake. The company using about 750,000 lbs. of steel every year equates about 375 short tons. This traditional hedge position for the company could potentially have saved the company around $90,000.

Though the graphs illustrate trends that are favorable to using a cross hedge strategy, it is important to note that any cross hedge here would be merely speculation and would not mitigate risk at all. In fact, it would increase it.

**DISCUSSION AND CONCLUSION**

Thoughts and Market Trends:

The limitations of this study most likely arose because of the accounting practices of Raine Tank. After speaking with the owner and secretary it occurred that the input methods for invoices between the two weren't always consistent with each other. This means that not every tank was entered on the books at the same time. Whether that time be when the tank was sold, delivered, manufactured, or payment received, they were all different. In some cases invoices were being held from one year to the next. For example, some ranchers would request that their purchase not be made on the December books but instead held it until January so that it would go on the next year's books. These practices can be misconceiving when attempting to correlate the data as they aren't an actual representation of what actually took place for those months.

The cross hedge strategy is one that has still proved to be useful in the hedging of commodities in other commodities. Corn and sorghum for example have proven to be closely correlated to one another for a long time. Making cross hedging opportunities appealing for corn and sorghum producers alike. It is still possible for a cross hedge strategy to be applicable and successful for farm service companies with more accurate, consistent accounting practices and longer histories of data.

Some factors that might have affected the sales futures prices for corn was the U.S. Corn policy due to ethanol. For steel, recently 25% tariffs were imposed on imported foreign steel. Such legislations should drive the market price up higher. Hedging against such risk could prove beneficial to farm service companies. Although the cross-product hedges investigated don't appear promising, if a traditional hedge on input commodities used by this firm had been in place, the company would have had hedging revenue to offset the increase in steel prices. Despite the lack of success in finding a commodity to use as a cross-product hedge, the increased understanding of the ability to use commodity markets has benefitted me for my future role at RTS.

**REFERENCES**

ADF - Augmented Dickey Fuller Test. (n.d.). Retrieved April 06, 2018, from
http://www.statisticshowto.com/adf-augmented-dickey-fuller-test/

Columbia University. Center for the Study of Futures Markets. (1981). The journal of futures
markets. *The Journal of Futures Markets,*

Cross Hedge Effectiveness of Ags Commodities – CME Group. (n.d.). Retrieved April 09, 2018,
from http://www.cmegroup.com/education/cross-hedge-effectiveness-of-ags-   commodities.html

Kim, A. (2015). Does Futures Speculation Destabilize Commodity Markets?. *Journal Of Futures
Markets*, *35*(8), 696-714. doi:10.1002/fut.21716

Kolb, R. W., & Overdahl, J. A. (2006). *Understanding futures markets* (6th ed.). Malden, MA ;
Oxford: Blackwell Pub.

Madeley, J. (2010). Speculation. *Appropriate Technology, 37*(3), 46-47. Retrieved from
https://login.proxy.tamuc.edu/login?url=https://search.proquest.com/docview/759653919
?accountid=7083

Miner, R. C. (2009). *High Probability Trading Strategies : Entry to Exit Tactics for the Forex,
Futures, and Stock Markets. Hoboken, N.J.: Wiley.*

Sharma, T. (2016). The impact of future trading on volatility in agriculture commodity: A case of
pepper. *IUP Journal of Financial Risk Management, 13*(4), 47-55. Retrieved from
https://login.proxy.tamuc.edu/login?url=https://search.proquest.com/docview/186538463
3?accountid=7083

Sinclair, E. (2008). *Volatility Trading*. Hoboken, N.J.: Wiley.

Stam, J. M., & Dixon, B. L. (2004). Farmer bankruptcies and farm exits in the United States,
1899-2002. Washington, DC: US Department of Agriculture, Economic Research
Service.
Wasendorf, R. R. (2001). *All About Futures : The Easy Way to Get Started*. New York:
McGraw-Hill Professional.