

Risk Transfer Techniques for the American Wheat Farmer

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ABSTRACT

The purpose of this paper is to explore the various alternative risk transfer techniques available to farmers. The two primary transfer techniques available to the agricultural sector include crop insurance policies and the derivatives markets. This paper identifies the advantages and disadvantages of crop insurance relative to derivative products. It also discusses the externalities of the primary sources of risk transfer to protect, conserve, and reduce the volatility in wheat prices. This paper is of interest to the agricultural sector of the property casualty industry and the exposures have grown more significant over time, in conjunction with fewer government subsidies.

“Farmers, who are not gamblers by nature, are often forced by nature to gamble” (Subik 2008). As a farmer, you are at the mercy of the weather, and the demand of your product. With increasing costs, such as equipment, fertilizers, and pesticides, farmers need to have a risk management plan to protect themselves. The most common technique is transferring these risks to a third party. The two most widely used methods of transferring these risks are by purchasing crop insurance, and by using derivative products, such as options, future contracts, and options on future contracts. The purpose of this paper is to compare the costs and benefits of using both insurance and derivative products.

Hard red winter wheat will be used for an example commodity. This wheat accounts for about 40% of the wheat in the United States. It is grown mostly from the Mississippi River to the Rocky Mountains and from Texas to Montana. The hard red winter wheat in our examples is an irrigated crop. This wheat is mostly used in all-purpose flour and breads. Soft red winter wheat, like most winter wheat, is seeded in the fall (Dr. Beuerlein 1).

Crop insurance protects farmers from many different unavoidable losses in production. The major causes of loss in production come from adverse weather conditions, such as excess rain, wind, hail, and frost. Crop insurance contracts also cover insect or plant disease, wildlife damage, and low market price. There are many perils crop insurance doesn't cover such as; wheat being destroyed and not reseeded in a timely matter, acres inter planted with another crop, and acres planted after a designated late planting period.

Crop insurance uses actual production history when the farmer suffers a loss. The insurance companies call this the production guarantee. Production Guarantees are found by taking the average yields based on the last four to ten years of production. Farmers can elect to throw out a year if they experienced a year where their yields were 60% of the transitional yield of the county. The transitional yield is an actuarial table which gives the insurance company the average yield in the farmer's location. Transitional yields are also used for new farmer's, who don't have four years of actual records. Production guarantee is used for both yield and revenue protection.

Yield protection guarantees a specific amount of bushels of wheat grown by using historical data. This protection is on a unit basis and not per acre. This is used so that if a farmer has some acreage damaged, but the other acres performed better than the unit guaranteed, there will be no money awarded to the farmer. The unit guarantee is found by multiplying the per acre guarantee, that the farmer selected, and the number of acres in the unit.

Revenue protection protects farmers against adverse price movements in the markets, and against lower yields. Revenue protection is found by taking the yield guarantee for the unit and multiplying by the higher of the projected price and the harvest price. The projected price and the harvest price come from the commodity exchange price provision. When calculating the

farmer's premium the projected price is always used. A farmer may choose revenue protection with harvest price exclusion. This exclusion protects the farmer if the harvest price goes down, but doesn't cover when the harvest price is higher than the projected price.

Here is an example of how yield protection works. Farmer John has a yield protection policy on his crop of hard red winter wheat. He has decided to cover 75% of his crop, and the projected price of hard red winter wheat is \$5.20. John has a unit guarantee of 11,700 bushels, but due to poor weather he was only able to harvest 5,260 of those bushels, which leaves a production loss of 6,440 bushels. The insurance company would owe farmer John 75% of the 6,440 bushels, at a price of \$5.20, which calculates to \$25,116.

Figure 1

Guaranteed Bushels	Coverage level	Bushel Guarantee
40	70%	28
Projected Price	Revenue Guarantee	
\$7.42	\$208	All numbers are per acre

Bushel Guarantee=40*.70

Revenue guarantee= 40*7.42*.70

Example 1 Harvest price drops to \$7.10

Farmer harvest 29 bushels. 29*\$7.10=\$206

Indemnity=\$2.08-\$2.06. Farmer receives \$2.00

Example 2 Harvest price rises to \$8.00

New Revenue Guarantee 28*\$8.00=\$224 New Revenue Guarantee

Farmer only harvest 24 bushels 24*\$8.00=\$192

Indemnity=\$224-\$192 Farmer receives \$32

With the harvest price exclusion

Revenue guarantee is locked in at \$208

Farmer only harvest 24 bushels 24*\$8.00=\$192

Indemnity=\$208-\$192 Farmer receives \$16

Farmer's pay a premium for their crop insurance, and there are many factors that go into this premium. The first part is the coverage level. There are six different coverage levels that a farmer may choose from, and they must be in increments of five and between 50% and 75%. An example would be if a farmer chooses a coverage level of 75%, and a storm comes through and wipes out the entire crop, the insurance company would cover 75% of the loss and the farmer would cover the remaining 25%. These coverage levels work for both yield and revenue protection.

Once the farmer has selected their coverage level the insurance company multiplies the coverage levels and the unit guarantee plus the projected price. This number is the total liability for the insurance company. They will then multiply this number by a base rate to calculate the premium needed to insure the crop. The base rate is a percentage of the total liability that covers the liability of the crop. The final component is the subsidy factor. The government helps farmers by paying a portion of the premium. The higher the amount of coverage the more premium they will cover. Premium will also depend on what county the farm is in.

Below is the revenue protection and yield protection quotes for a hard red winter wheat farm in Fresno, California. There are quotes from each types of coverage in 2010 and 2011. The 2011 quote is missing the harvest price because the 2011 harvest hasn't occurred yet. The 2010 quote was included so that a comparison could be made later between both risk transfer methods last year. The assumption is that the farm has 10,000 acres of wheat planted, and the average annual yield is 94 bushels an acre. In these examples the farmer will pay the sub premium and the government will pay the difference between the base and sub premiums.

Figure 2

Premium Quote for 2011

Revenue Protection

Level	Projected Price	Acres	Avg. Yield	Guar/Acre	Total Guar.	Base Prem.	Sub Prem.	Cost/acre
50%	\$7.42/BU	10,000	94 BU	47	\$3,487,400	\$341,500	\$112,695	\$11.27
55%	\$7.42/BU	10,000	94 BU	51.7	\$3,836,140	\$429,800	\$154,728	\$15.47
60%	\$7.42/BU	10,000	94 BU	56.4	\$4,184,880	\$525,100	\$189,036	\$18.90
65%	\$7.42/BU	10,000	94 BU	61.1	\$4,533,620	\$625,400	\$256,414	\$25.64
70%	\$7.42/BU	10,000	94 BU	65.8	\$4,882,360	\$781,300	\$320,333	\$32.03
75%	\$7.42/BU	10,000	94 BU	70.5	\$5,231,100	\$969,100	\$436,095	\$43.61

Premium Quote for 2011

Yield Protection

Level	Projected Price	Acres	Avg. Yield	Guar/Acre	Total Guar.	Base Prem.	Sub Prem.	Cost/acre
50%	\$7.42/BU	10,000	94 BU	47	\$3,487,400	\$246,667	\$81,400	\$8.14
55%	\$7.42/BU	10,000	94 BU	51.7	\$3,836,140	\$310,000	\$111,600	\$11.16
60%	\$7.42/BU	10,000	94 BU	56.4	\$4,184,880	\$377,500	\$135,900	\$13.59
65%	\$7.42/BU	10,000	94 BU	61.1	\$4,533,620	\$446,341	\$183,000	\$18.30
70%	\$7.42/BU	10,000	94 BU	65.8	\$4,882,360	\$567,805	\$232,800	\$23.28
75%	\$7.42/BU	10,000	94 BU	70.5	\$5,231,100	\$716,667	\$322,500	\$32.25

Premium Quote for 2010

Revenue Protection

Level	Projected Price	Acres	Avg. Yield	Guar/Acre	Total Guar.	Base Prem	Sub Prem	Cost/acre
50%	\$5.42/BU	10,000	94 BU	47	\$2,547,400	\$255,151.52	\$84,200	\$8.42
55%	\$5.42/BU	10,000	94 BU	51.7	\$2,802,140	\$314,166.67	\$113,100	\$11.31
60%	\$5.42/BU	10,000	94 BU	56.4	\$3,056,880	\$380,277.78	\$136,900	\$13.69
65%	\$5.42/BU	10,000	94 BU	61.1	\$3,311,620	\$449,512.20	\$184,300	\$18.43
70%	\$5.42/BU	10,000	94 BU	65.8	\$3,566,360	\$563,170.73	\$230,900	\$23.09
75%	\$5.42/BU	10,000	94 BU	70.5	\$3,821,100	\$694,000.00	\$312,300	\$31.23

Harvest Price was

\$4.79/BU

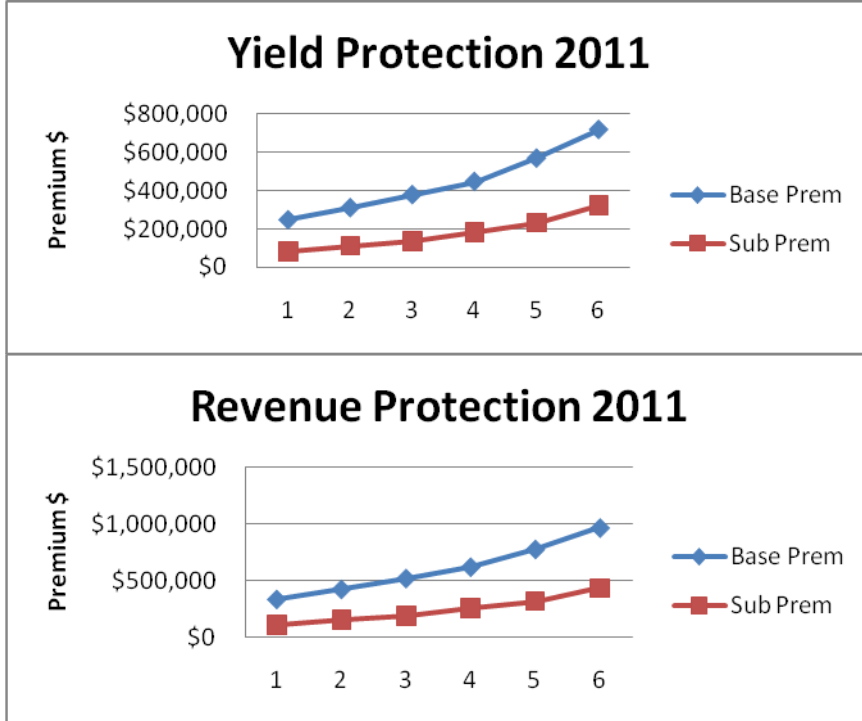
Premium Quote for 2010

Yield Protection

Level	Projected Price	Acres	Avg. Yield	Guar/Acre	Total Guar.	Base Prem	Sub Prem	Cost/acre
50%	\$5.42/BU	10,000	94 BU	47	\$2,547,400	\$189,393.94	\$62,500	\$6.25
55%	\$5.42/BU	10,000	94 BU	51.7	\$2,802,140	\$230,277.78	\$82,900	\$8.29
60%	\$5.42/BU	10,000	94 BU	56.4	\$3,056,880	\$275,000.00	\$99,000	\$9.90
65%	\$5.42/BU	10,000	94 BU	61.1	\$3,311,620	\$320,243.90	\$131,300	\$13.13

70%	\$5.42/BU	10,000	94 BU	65.8	\$3,566,360	\$395,609.76	\$162,200	\$16.22
75%	\$5.42/BU	10,000	94 BU	70.5	\$3,821,100	\$480,222.22	\$216,100	\$21.61

Graph 1



With these premium charts different scenario tests can be used to find the total cost to both the farmer and the insurance company. .

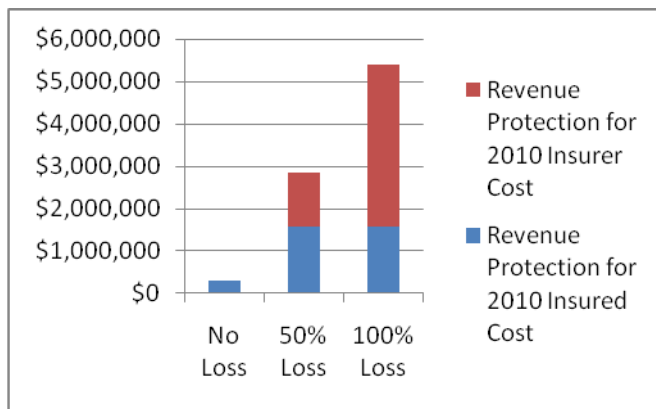
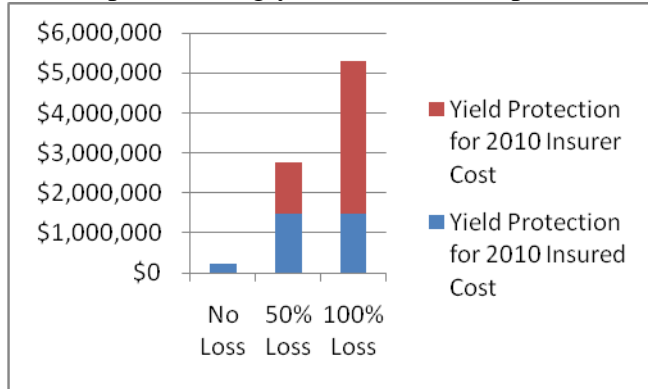
Figure 3

Revenue Protection for 2011			Yield Protection for 2011		
75% coverage	Insured Cost	Insurer Cost	75% coverage	Insured Cost	Insurer Cost
No Loss	\$436,095	\$0	No Loss	\$322,500	\$0
50% Loss	\$2,179,795	\$1,743,700	50% Loss	\$2,066,200	\$1,743,700
100% Loss	\$2,179,795	\$5,231,100	100% Loss	\$2,066,200	\$5,231,100

Revenue Protection for 2010			Yield Protection for 2010		
75% coverage	Insured Cost	Insurer Cost	75% coverage	Insured Cost	Insurer Cost
No Loss	\$312,300	\$0	No Loss	\$216,100	\$0
50% Loss	\$1,586,000	\$1,273,700	50% Loss	\$1,489,800	\$1,273,700
100% Loss	\$1,586,000	\$3,821,100	100% Loss	\$1,489,800	\$3,821,100

Graph 2

Bar Graphs showing yield and revenue protection payouts



These scenarios were conducted by using a 75% coverage level. Without a loss the farmer pays the premiums (but they only pay the sub premium), and receives no compensation. At a 50% loss the farmer would have to pay the premium plus 25% of the deductible, and the insurance company pays the other 25% to the farmer. Then at a total loss the farmer's expenses stay the same, and the insurance company pays out the total guarantee amount.

The second way a farmer can transfer their risk is by using the derivatives market. Options, future contracts, and options on futures are the three major contracts that a farmer would use.

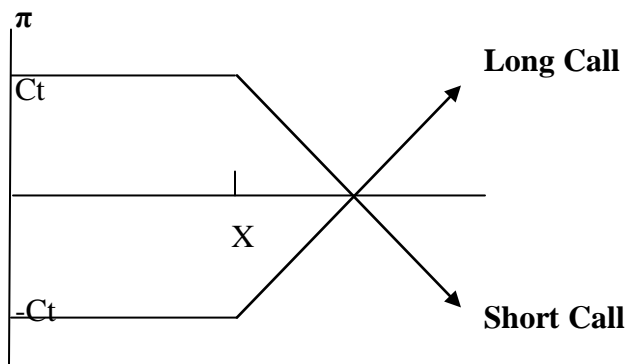
“An option is a contract between two parties—a buyer and a seller—that gives the buyer the right, but not the obligation, to purchase or sell something at a later date at a price agreed upon today”

(Chance and Brooks 2). In the options market, the right to purchase an underlying asset at an agreed upon fixed price on or before the predetermined date, is known as a long call, and the

option to sell is called a long put. The seller or writer of an option must buy or sell if the buyer exercises his or her right to buy or sell, and for this right the buyer must pay the seller a premium. Most options are bought and sold on organized options exchanges (Chance and Brooks 2). The options, futures, and options on futures for the commodity hard red winter wheat are traded on the Kansas Board of Trade.

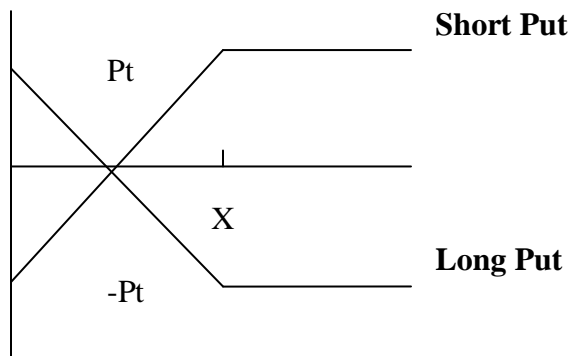
The price that the buyer and seller agree on is known as the exercise price or strike price and the date that the decision to exercise on is known as the expiration date (Chance and Brooks 24). When a call on an underlying asset has a spot equal to the price it is known as being at-the-money, and when the spot price is above the exercise price the long call option is in-the-money. When the prevailing spot price is below the exercise price the call option is considered to be out-of-the money (Chance and Brooks 26). Put options are at-the-money when the spot price equals the exercise or strike price, in-the-money when the spot price is below the exercise, and out-of-the money when the spot price exceeds the exercise price. Options that are in the money will have intrinsic value as well as a time value component embedded in the premium price. Higher volatility will also increase the premium, the average volatility for wheat options has been increasing and the average volatility between February and May of 2011 is 40.76%. Options are usually listed with all the calls together and all the puts together.

Chart 1 Call Diagram



For the long call option the payoff or π (profit) is maximized when the spot price increases, there is theoretically unlimited upside potential, while the downside is limited to the call premium, C_t . When $S_t < X$ or E $\pi = -C_t$. When $S_t > X$ or E , $\pi = (S_t - X \text{ or } E) - C_t$. The profit to the call writer is $+C_t$ when the call buyer does not exercise, this occurs when $S_T < X$. When the call buyer exercises the payoff to the short position will be: $(E - S_T) + C_t$. This provides limited upside potential with unlimited potential downside risk for naked calls. Our farmer would have a covered call position due to the long underlying exposure to wheat and would have limited downside losses.

Chart 2 Put Diagram

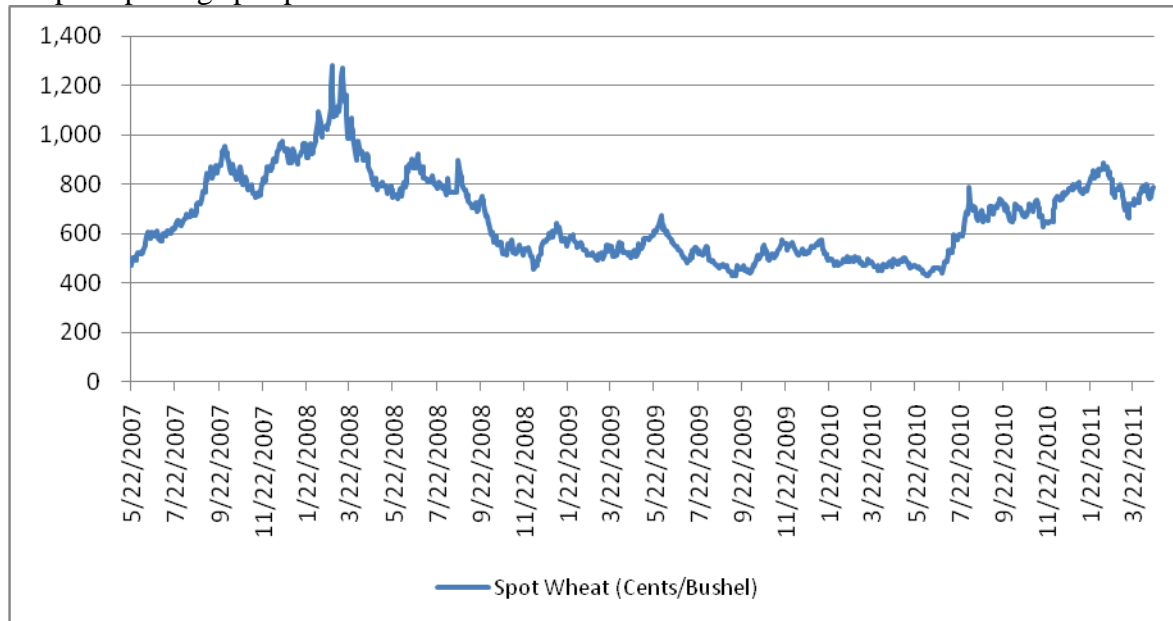


For the long put position, the put buyer would not exercise if the $S_T > E$ so the profit would be $-Pt$. The put buyer would exercise when the $S_T < X$ or E resulting in a payoff of $(X \text{ or } E - S_T) - Pt$. This position has limited downside risk and the upside potential is limited to the commodity price dropping to zero. The put seller or put writer position is contingent upon the put buyer exercising the option. The profit is when the put buyer does not exercise is Pt . If the

put buyer exercises the option the payoff is $(S_T - X \text{ or } E) + Pt$. There is limited upside potential in this position with the downside losses limited and offset by the put premium.

Graph 3

Graph depicting spot prices from 2007 to 2011

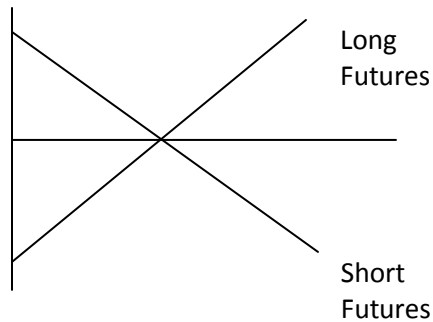


Source: Bloomberg Spot Wheat Prices

The futures contract is similar to options in that there is a contract between a buyer and a seller, and they agree to buy or sell an asset at a certain price and date. The difference is that a future contract must be exercised on the expiration date, and both parties are obligated to buy or sell (Chance and Brooks 3). When there is a price fluctuation, the settlements go through a clearinghouse. The clearinghouse works as an intermediary between buyers and sellers, and guarantees the transaction. The clearinghouse works by making the buyers and sellers settle with each other every day, by making the buyer and seller setup margin accounts. This reduces the counter party default risk attributed to futures contracts since the clearing house acts as the counter party to each futures contract. The initial margin account is a set amount that must be deposited when the transaction is open, typically 5-15% of the contract value. The clearinghouse also sets a maintenance margin, which is an amount that must be kept in the account at all times,

and if the account drops below the maintenance level the buyer or seller must replenish the account back to the initial margin (Chance and Brooks 268-270).

Chart 3 Future Diagram



The final derivative security one could use is options on futures. An option on a future contract gives the buyer the right but not the obligation to buy or sell a future contract at a later date and at an agreed price (Chance and Brooks 4). Just like a traditional option the buyer pays the seller a premium for this right. When purchasing an option on futures contracts you are buying a derivative on a derivative, which means there are two different expiration dates (Chance and Brooks 258).

Options, future contracts, and options on futures are all mostly traded on electronic exchange traded markets. There are many different exchange markets all over the world. Most exchanges have their own unique specifications on their contracts. Some of the specifications for each contract deal with the size, quotation unit, and minimum price fluctuation, grade, and hours of trading. The contract size means how many of one unit is in a contract. For an example, it is the number of bushels in one contract. The quotation unit is the unit in which the price is specified. The minimum price fluctuation is the lowest the quotation unit can fluctuate, and is usually one percent of the smallest unit of the quotation unit. Future contracts on agriculture commodities have grade qualities that the commodity must meet, and there are different prices for each grade (Chance and Brooks 260-261).

Figure 4

Derivative Product	Advantages	Disadvantages
Futures	<ul style="list-style-type: none"> • Reduces spot price risk • Good forward indicator for how market will go • For hedgers with an underlying asset position the margin may be reduced • Low default and credit risk • Liquidity 	<ul style="list-style-type: none"> • Margin account needed • Must settle on contract or buy an offset position • May hedge away some upside potential • Complex securities
Buying Option	<ul style="list-style-type: none"> • Reduces spot price risk • Risk limited to premium paid • No margin account needed • Unlimited return limited risk • Liquidity 	<ul style="list-style-type: none"> • Could lose premium • Premium must be paid up front • Complex securities
Selling Option	<ul style="list-style-type: none"> • Generates income from received income • Liquidity 	<ul style="list-style-type: none"> • Only profit comes from premium • Have to perform option if exercised • Risk of price dropping to zero maximum loss for a put • Selling a call theoretically unlimited downside risk for naked calls • Complex security
Options on Futures	<ul style="list-style-type: none"> • Can lock in an option and future price 	<ul style="list-style-type: none"> • Could be limited on future contracts that have options

Note: Options on futures have the same advantages and disadvantages as options.

Hard red winter wheat is traded on the Kansas Board of Trade. As mentioned before every exchange has their own unique specifications, and it is essential to know these specifications before trading in that market. There are different specifications for both options and futures. The trading hours are in the central time zone, and are between 9:30 a.m. and 1:15 p.m. One contract equals 5,000 bushels, and the ticker symbol for hard red winter wheat is KW.

Future contracts can be traded with two different types of settlement contracts. Future contracts can stipulate physical delivery or cash settlement. Physical delivery contracts are not frequently traded because they require a physical exchange and delivery of the wheat.

The future contracts specification's price quotation is denoted in dollars, cents, and $\frac{1}{4}$ cents per bushel and the minimum price fluctuation is \$12.50 per contract. There are five delivery months, and they are July, September, December, March, and May. All contracts must be settled on the business day proceeding the fifteenth calendar day of the liquidating month. The first notice day, the notice day is where the seller must show intent to deliver the asset, is the business day preceding the first business day of the liquidating month, and the last notice day is the business day preceding the last business day of the liquidating month. The first day for delivery starts on the first business day of the liquidating month.

Options trade from the same time as the futures, and the ticker symbol for options on hard red winter wheat are HC for calls and HP for puts. These wheat options are considered "American options" meaning that they can be traded at any time before the expiration date. The strike prices are listed in intervals of multiples of ten cents per bushel, and show 30 new strike prices above and below the current strike price. The price quotations, for options, are in dollars, cents, and $\frac{1}{8}$ cent per bushel and the minimum price fluctuation is \$6.25 per contracts. The last trading day is the Friday at least two business days before the first notice day for wheat futures. The exercise of the option can be made any time, but must be made before 4:00 p.m. on the last trading day.

Farmer John in our example is considering the optimal hedging decisions between insurance and derivatives to hedge price risk due to adverse price fluctuation for wheat. Farmer John would encounter basis risk in utilizing derivatives contracts to hedge commodity price risks

for wheat. Basis risk could arise from the uncertainty in the relationship between the wheat being hedged and the derivative security used to hedge. For example: Delivery could be made in one location, Fresno, CA for Farmer John, while prices are based on spot prices for wheat in Kansas. The grade of wheat also introduces basis risk. The grade of wheat in the contract specifications may differ from the wheat harvested. Insurance has considerably lower basis risk due to coverage being written specifically for the farmer and the farmer's specific underwriting characteristics. Insurance provides a hedge for firm specific risk while derivatives hedge market price risks.

Figure 5
Payoffs from long puts and short calls

Purchase Long Puts		Sell Short Calls	
3/18/10		3/11/10	
WP strikes	Pt on 3/18/10	WC strikes	Ct on 3/11/10
410	66	530	377
430	106	540	341
450	161	550	305
460	193	570	245
470	210	600	173
480	267	700	50
500	360		
510	411		
520	464		
530	521		
550	644		
570	780		
600	1003		

Figure five represents a snapshot of two different positions a farmer could take to hedge, and the total pay structure can be found in Appendix A. Contracts purchased at the issuance, the maximum time value of money is in the premium. Contracts are evaluated using the maximum and minimum spot price during the options life, and also at expiration to determine payoffs. The

range was 432 to 786 for wheat spot prices, at issuance spot was 489 3/18/10 and 469 on 3/11/10. The spot price at expiration was 675.

If the farmer held his long put option till expiration, the put would have expired out-of-the money and the farmer would lose the premium paid in all situations. The other position that the farmer could have taken would be to sell short calls. This wouldn't be a smart hedging position because the wheat hasn't been harvested yet. The farmer runs the risk of losing his crop and writing a naked call. Selling short calls can be useful for the farmer if he is storing wheat from last year's harvest, and then the farmer could write covered calls and try to make money from premium. If the buyer held onto the option till expiration, the farmer would have made money in all situations. It is expected that the results in 2010 will be consistent in 2011 as attributed to the continued high volatility in the wheat market. In nearly all cases the farmer was better off financially and protected against adverse price losses and in several cases against substantial crop losses through one of the various methods for risk transfer available through the insurance industry or the derivatives markets

Insurance contracts guarantee payments for covered losses and the farmer may influence the payoffs and benefits of protection for adverse price movements. Farmers can influence the payoff structure from an insurance contract through loss control activities. Farmers have negligible or non-existent influence over payoff structures from derivative securities. With insurance contracts there is more potential for moral hazard necessitating the use of deductibles, claims investigations, and coinsurance provision. Insurers also are required to hold surplus capital increasing the costs of insurance premiums.

In recent studies futures and crop yield insurance may be construed as complements, while futures and crop revenue insurance are more appropriate as substitutes. Using options and

futures can be a viable alternative risk transfer technique and can be successfully implemented. Derivative products can be more useful where insurance products aren't available or not subsidized by the government. Crop insurance is heavily subsidized through the federal government, and they are continually making cuts to these subsidies to lower the American deficit. In 2010, they cut six billion dollars to this program over a ten year span. The government used these subsidies to set rates, and help share risk with private insurers. The long-term returns to the insurer are projected to drop by 14% (Gusman & Ruquet 2010). The government also helps by paying a percentage of the farmer's premium. The higher the level of coverage the more percent the government covers, and with these cuts insurance costs are getting higher for farmers. In the future the derivative products might end up being a more cost effective risk transfer technique.

There is also more speculation expected in derivatives contracts, whether from a desire to retain additional upward potential or basis risk exposure. The risk of production and adverse price movement are too great for the farmer not to use risk transfer techniques. The wheat spot and futures market have high volatility characteristics and the uncertainty regarding spot prices in the future warrant the expense incurred of hedging wheat crop risks. In the event of no loss the insured or hedged farmer may be worse off financial than without the risk protection, but risk management protocol is to protect against adverse price movements and reduce the uncertainty surrounding losses, not to speculate or maximize wealth.

Insurance is a particular cost effective risk transfer technique and for farmers purchasing crop yield insurance futures contracts may be redundant and less cost effective in part due to the substantial government subsidy. A short futures hedge will also reduce profits if wheat price movements are favorable for the underlying exposure, whereas the insurance contract will not

reduce the potential for gain leaving the farmer with more upside potential. With crop revenue insurance there may be certain circumstances where the farmer optimizes risk transfer through the options market.

For the options contracts to be comparable to the insurance purchased in our example, two contracts of 5,000 bushels each would need to be purchased. This amounts to the same level of protection afforded through the insurance contract covering 10,000 bushels. Options contracts offer the following advantages over insurance contracts; there aren't any exclusions of crop coverage that impacts payouts and there isn't a co-insurance provision. The crop insurance offers substantial advantages; the government subsidy reduces costs to acquire the insurance and the insured is still able to participate in increased profits from wheat price increases. The options and futures contracts provide flexibility, liquidity, and timing advantages.

Appendix A

Payoffs from long puts and short calls

Min. spot price 6/7/10 & 6/8/10	Max. spot price 8/5/10	Spot price at expiry	
432	786	675	
Payoff from long put Strike of 410 best case @432	equals - Pt or X-St-Pt -66	Payoff from short call Strike of 530 best case @432	equals +Ct or X-St+Ct 377
worst case @786	-66	worst case @786	121
expiry @ 675	-66	expiry @ 675	232
Payoff from long put Strike of 430 best case @432	equals - Pt or X-St-Pt -106	Payoff from short call Strike of 540 best case @432	equals +Ct or X-St+Ct 341

worst case		worst case	
@786	-106	@786	95
expiry @ 675	-106	expiry @ 675	206

Payoff from long put	equals - Pt or X-	Payoff from short call	equals +Ct or
Strike of 450	St-Pt	Strike of 550	X-St+Ct
best case		best case	
@432	-143	@432	305
worst case		worst case	
@786	-161	@786	69
expiry @ 675	-161	expiry @ 675	180

Payoff from long put	equals - Pt or X-	Payoff from short call	equals +Ct or
Strike of 460	St-Pt	Strike of 570	X-St+Ct
best case		best case	
@432	-165	@432	245
worst case		worst case	
@786	-193	@786	29
expiry @ 675	-193	expiry @ 675	140

Payoff from long put	equals - Pt or X-	Payoff from short call	equals +Ct or
Strike of 470	St-Pt	Strike of 600	X-St+Ct
best case		best case	
@432	-172	@432	173
worst case		worst case	
@786	-210	@786	-13
expiry @ 675	-210	expiry @ 675	98

Payoff from long put	equals - Pt or X-	Payoff from short call	equals +Ct or
Strike of 480	St-Pt	Strike of 700	X-St+Ct
best case		best case	
@432	-219	@432	50
worst case		worst case	
@786	-267	@786	-36
expiry @ 675	-267	expiry @ 675	50

Payoff from long put	equals - Pt or X-
Strike of 500	St-Pt
best case	
@432	-292
worst case	-360

@786
expiry @ 675 -360

Payoff from equals -
long put Pt or X-
Strike of 510 St-Pt
best case
@432 -333
worst case
@786 -411
expiry @ 675 -411

Payoff from equals -
long put Pt or X-
Strike of 520 St-Pt
best case
@432 -376
worst case
@786 -464
expiry @ 675 -464

Payoff from equals -
long put Pt or X-
Strike of 530 St-Pt
best case
@432 -423
worst case
@786 -521
expiry @ 675 -521

Payoff from equals -
long put Pt or X-
Strike of 550 St-Pt
best case
@432 -526
worst case
@786 -644
expiry @ 675 -644

Payoff from equals -
long put Pt or X-
Strike of 570 St-Pt
best case
@432 -642
worst case
@786 -780

expiry @ 675 -780

Payoff from equals -
long put Pt or X-
Strike of 600 St-Pt

best case

@432 -835

worst case

@786 -1003

expiry @ 675 -1003

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