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ScienceDirect

Agriculture and Agricultural Science Procedia 1 (2010) 136–145

Agriculture and Agricultural Science Procedia

International Conference on Agricultural Risk and Food Security 2010

Analysis and Feasibility of Crop Revenue Insurance in China

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Abstract

This paper describes crop revenue insurance, discusses the important factors in successful contract writing and presents a robust analytical procedure for assessing combined crop yield and price risks. The feasibility of crop revenue insurance for Chinese maize, soybean, wheat, cotton and rice markets is specifically addressed.

Increased crop demand, rising production costs and variable weather necessitate the use of agricultural insurance by producers, input providers and processors. Crop producers and agribusiness entities around the world are realizing that yield-based insurance alone will not offset the risk of adverse price movements during the growing season. Producers may, for example, achieve above-average crop yields only to find that total revenues have substantially declined due to price decreases. Properly constructed and rated, revenue-based crop insurance can provide superior risk management performance to producers. Revenue policies insure producers against declines in expected revenue below a guaranteed revenue amount and thereby aid in budget planning, securing bank loans and reducing credit costs to input suppliers.

The paper provides a brief discussion of revenue insurance for multiple crops in the United States, currently the largest user of crop revenue insurance. Revenue insurance adds price change into the indemnity equation, requiring use of correlated multivariate analyses. The analytical procedure for measuring revenue risks employs Monte Carlo modeling of the state-space comprised of correlated yield and price risks. This procedure is simply described using graphics.

A successful application of revenue insurance in Brazil is described and contract elements deemed necessary for success are outlined. As discussed, to properly incorporate price risk, the indemnity index employed for measuring value change must satisfy five essential criteria. These criteria are applied to the major Chinese agricultural futures markets for maize, soybeans, cotton, wheat and rice. Conclusions on the feasibility of the successful development of revenue insurance for these crops are presented.

"Keywords: Agricultural Insurance; Crop Insurance; Revenue Insurance; Yield Risk; Multi-peril; Monte Carlo Modeling"

2210-7843 © 2010 Published by Elsevier B.V.
doi:10.1016/j.aaspro.2010.09.016

1. Introduction

Increased crop demand, rising production costs and variable weather necessitate the use of agricultural insurance by producers, input providers and processors. Crop producers and agribusiness entities around the world are realizing that yield-based insurance alone will not offset the risk of adverse price movements during the growing season. Producers may, for example, achieve above-average crop yields only to find that total revenues have substantially declined due to price decreases. Properly constructed and rated, revenue-based crop insurance can provide superior risk management performance to producers.

The benefits of revenue insurance to producers are reflected in the large and growing participation by policyholders in the United States. First offered on a pilot program basis in 1996, crop revenue insurance policies achieved almost $7 billion in premium and accounted for 75% of all multi-peril crop insurance (MPCI) premiums in 2009. Over fifty percent of all U.S. MPCI policies sold in 2009 had indemnities linked in some manner to intra-seasonal price changes of the underlying insured crop.

Revenue insurance is now being extended beyond the U.S. borders to other countries and to other parties at risk in the vertical contracting chain. Alberta Financial Services Corporation (AFSC) offers, for example, revenue insurance on several provincial crops. AFSC has recently applied revenue insurance to live cattle in a fashion similar to the U.S. livestock revenue protection policy. In the vertical contracting chain, several private trade credit insurance policies have incorporated an underlying revenue index as a second or dual trigger for indemnity calculation purposes. A specific application of revenue protection for an international grain company in the vertical contracting chain will be described below for Brazilian soybean production.

The purpose of this paper is to provide an overview of crop revenue insurance and its potential application in China from a practitioners' perspective. After a brief description of crop revenue insurance, the rating and pricing procedure for the product is illustrated with simple graphics. The application of revenue insurance to Brazilian soybean production is discussed along with contract details important for successful risk management. Based on practical experience, the price index employed for measuring value change must satisfy five essential criteria. These criteria are applied to the major Chinese agricultural markets for soybeans, wheat, maize, cotton and rice. Conclusions on the feasibility for the successful development of revenue insurance for these crops are presented.

2. Crop Revenue Insurance

In its simplest form, crop revenue insurance is an extension of yield-based crop insurance policies but with the yield indemnity modified by unexpected price changes during the crop season. Revenue policies insure producers against declines in expected revenue below a guaranteed revenue amount and thereby aid in budget planning, securing bank loans and reducing credit costs to input suppliers. Crop revenue insurance also greatly benefits producers and processors that forward contract some portion of their expected output. The indemnity payment on a revenue policy helps the policyholder offset the combined losses of production and selling price especially when the forward contract has replacement cost provisions in the case of delivery shortfalls. For example, if a producer forward sells a portion of his crop and experiences a yield loss, the indemnity payment from a revenue policy would help pay not only for the production decline but also help offset market price increases potentially associated with the shortfall replacement.

Expected revenue is typically calculated prior to planting using an expected, or average historical, production multiplied against an expected harvest price index. The harvest price index could be comprised of expected cash, forward or futures market prices. In practice, the harvest price index is usually based on an average of harvest period futures contract prices calculated before planting. The expected harvest price is often called the base price. The revenue guarantee is a function of the expected revenue and a pre-selected percentage or coverage level. Sometimes a final revenue guarantee is calculated around harvest time and uses the higher of the base price and an estimated harvest price. The estimated harvest price is determined using an average of end-of-season harvest futures contract prices. Actual revenue is computed using actual production and the harvest price. A revenue insurance indemnity is paid if the actual revenue is below the final revenue guarantee.

To better understand the rating and pricing of crop revenue insurance, the basics of rating a yield-based crop insurance policy will be described. Over time, the loss experience for an average individual producer is generally related to the crop characteristics, the production area and the weather. A group of producers in a particular township, county or province will generally exhibit yield risks over time in relationship to the time series of the geographic region. This relationship is illustrated in Figure 1 that portrays the evolution of provincial de-trended yield risks over time and the corresponding set of producers' risk for selected years. When provincial yields increase or decrease around the expected (zero percent) trend level, the producer yield distribution within the province tends to shift in the same direction albeit with differing degrees of skew in the tails. A proper yield-based insurance rating analysis would sample across each producer at various coverage levels and all years to estimate loss costs.

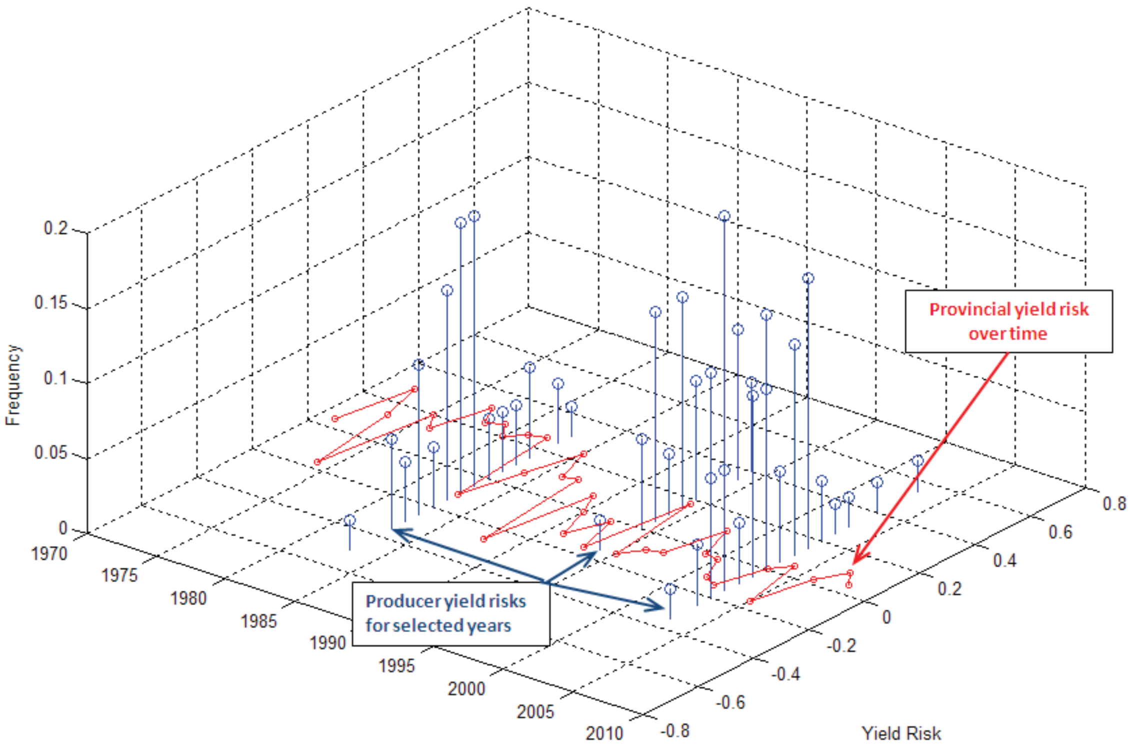

Figure 1 – Times Series of Provincial Yield and Selected Cross-sectional Producer Yield Risks

In contrast to yield-base crop insurance, revenue insurance guarantees a projected amount of revenue rather than production. Therefore, price risk must also be assessed simultaneously with yield risk. Since price and yield changes of agricultural crops tend to move in opposite directions on an aggregate basis, the negative correlation of price and yields must be factored into the rating equation for revenue policies. The essence of rating a crop revenue policy consists of calibrating the annual producer probability density functions to the corresponding provincial yield time series while incorporating the probability of a correlated price change.

Price risk is generally measured using a lognormal distribution with mean and standard deviations estimated using volatility implied by option market prices. Correlations between estimated yield and price movements may also be estimated using historical data. When the yield and price density functions are combined on a correlated basis, a Monte Carlo simulation procedure may be employed to calculate revenue insurance loss costs over a range of coverage levels. As described by Coble et.al. [1], this rating procedure can be accomplished in four steps: (1) calculate yield and price density functions, (2) estimate price and yield correlations, (3) simulate correlated yield and price events, (4) calculate estimated loss ratios at various coverage levels.

A graphic illustration of the Monte Carlo output is presented in Figure 2. Price and yield risks are presented as percent changes from zero. When prices increase greater than yields decline or when yields increase greater than prices decline, revenue increases on an elevated slope. The contour under the revenue surface is directly related to the assumed correlation of price and yield. Figure 2 also illustrates the downside protection or floor established by a 75% coverage level revenue policy. Since yield-based and revenue-based losses may be generated simultaneously

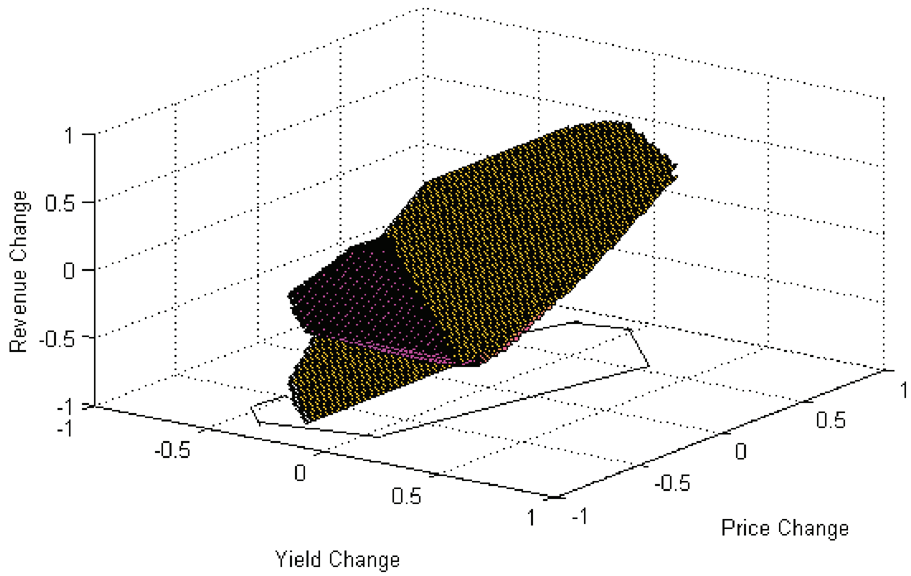

Figure 2 – Monte Carlo Simulation Surface for Correlated Yield and Price Changes

using the same surface, loss costs and rates may be computed and compared over a variety of coverage levels. Relative revenue-to-yield-based crop insurance rates can thus be generated for analysis and marketing purposes.

3. Crop Revenue Insurance in Brazil

The implementation of soybean crop revenue insurance in Brazil by a consulting firm, Agro International, for a major international grain company provides a case study for other crops and countries. The need in Brazil was for the protection of input costs advanced by an international agribusiness firm. This vertical contractor provided input expenses, such as seed, fuel and defensive chemicals, to producers in advance of planting and harvesting. In return, the producers contracted to forward sell their projected soybean production back to the contractor subject to disease and weather perils such as drought and rainfall at harvest.

The major problem in developing a revenue product for Brazil was the ability to determine producers' yields. This data was essential for properly rating an insurance product and to determine if the farmer received adequate coverage for the loans he had accepted. In the initial stages, some University studies were found that presented average soybean yields over certain regions and area. This data was not, however, verifiable with any consistency nor did it provide producer-level data. By conducting producer interviews in the state of Matto Grosso, the consultants were able to determine that most producers had individual yield records, although somewhat inconsistent with the records received from the University. An analytical routine was developed to determine the correspondence of individual yields with University averaged-yield data. During the initial development period, the consultants found many producers were willing to discuss their needs and the type of coverage that they desired for protection in the event of significant weather perils or price volatility.

The next step was to determine how a revenue price index could be determined that would provide protection and at the same time be transparent for all to see and use. In discussions with producers throughout Brazil it was evident that most producers were fully cognizant of, and used, the Chicago Board of Trade (CBOT) as reference pricing for their soybean sales. Based on this observation it was determined that the revenue policy could utilize the CBOT soybean futures contract as the indemnity mechanism. It was also necessary to determine the appropriate contract month which would reflect the average harvest price when the majority of the soybean crop was harvested. Producer interviews determined that the May CBOT soybean contract would be the best value indicator to determine the harvest price. To determine the base price, the revenue policy used the average price of the May contract during the month of September for the planting price. The harvest price employed the average price of the May contract during the month of March.

The final revenue insurance product for Brazil relied on an individual actual production history (APH) to determine a yield and insure coverage level based on a percentage of that expected yield. This yield expectation is coupled with the planting price using the average of the May contract during the month of September and the harvest price of the May contract in March. If yields were less than the coverage level, the producer would be reimbursed for the reduction in yield by whichever price was higher, planting or harvest. Payments for lower prices at harvest are calculated using the actual harvested volume multiplied by the harvest price. If the resulting harvest value is less than the planting guarantee, a payment would be made to bring the harvest value up to the level that it was at the inception of the policy.

To enhance the probability of success for the program, a number of policy conditions and exceptions were implemented. Producers had to qualify for the revenue policy by demonstrating that their technical ability, machinery and management resources matched the expected productivity and production levels. To reduce the policy costs, prevented planting and replant costs were not covered perils. Overall liability for the revenue policy was limited to the loan amount that pre-financed the input costs. In addition, to discourage fraud and encourage contract fulfilment, multiple on-site farm inspections were made throughout the season, including planting, post-emergence, pod-filling, pre-harvest and post-harvest.

Although the actual performance measures and policy count are confidential, this private soybean revenue insurance program in Brazil will soon be entering its ninth year. From humble beginnings, the hectares insured have grown by over ten percent each year without any government subsidization of premiums or losses. The producers and vertical contractor generally agree that the program has been a success.

4. Essential Criteria for Indexation of Price Risk

The preceding example in Brazil and the description of revenue risk rating methodology reinforce the need for accurate yield and reasonable price data to assess policy risk. It’s important to note that the Brazilian soybean revenue insurance policy did not incorporate a Brazilian futures contract for indemnity calculations. The important factor is the acceptance and use by Brazilian producers of the relative price change of CBOT futures for a representation of value change. Had a representative cash market price or other index of value been acceptable by the Brazilian producers, those alternatives could have been employed instead.

In essence the price change incorporated in the indemnity calculations is a type of value index. Over the course of many years and through study of many successful and unsuccessful cash and futures indices, a set of five criteria for a successful index may be identified. (For examples of various applications see Cole [2] and Cole et.al. [3].These five factors are: (1) standardization, (2) verifiable pricing, (3) frequent price dissemination, (4) competitive price determination, and (5) value representation.

Standardization is a basic feature of most futures and cash indexes. Participants need to know that the underlying commodity, futures deliverable or product is consistent and not changing over time. When the deliverable is not standardized as to quality and quantity market participants have difficulty placing a value on the index. Some uncertainty or change in the deliverable is acceptable as long as market participants understand the delivery rules and can adjust pricing to accommodate the variance.

If the futures contract or index is based on a formula, the calculation and its inputs should be well understood and verifiable. Different parties to the same trade should be able to replicate and reasonably forecast the index value. For example, the monthly averaging process should be clearly defined and independent calculations should arrive at the same value. Otherwise, the pricing will suffer enlarged bid/asked spreads to accommodate calculation risk. Trades could also be contested if buyers and sellers disagree as to final value.

To gain general acceptance, recognition and usefulness as a risk measurement over time, the futures or cash index needs to be widely and frequently disseminated. Certainly the internet has made this more possible. But there are some products, such as weather indices, catastrophic insurance risks and even crop yield indices that have “died on the vine” since trading information and price dissemination were fairly infrequent.

The fourth factor of success, competitive determination, is very important. No manipulation of trading, delivery or index inputs should exist. To accurately reflect value and the underlying risk, the futures contract or cash index employed as a price index in a revenue indemnity should consistently respond to free market forces.

Finally, the fifth element of success is acceptance of value representation. Even if participants know an index is not completely accurate in its valuation, as long as it is a consistent measure of value change and no better alternative exists, it may be employed by the market to assess risk and return. Indices that fall into this category are Consumer Prices, Housing values and even Gross Domestic Product. Participants know these indexes are sometime inaccurate but, over time, the changes indicate general valuation and thus may be incorporated in contracts for indemnity calculations.

5. Applying Indexation Criteria to Chinese Futures Contracts

Futures contract prices are natural choices for use as indemnity indexes in crop revenue insurance contracts. Successful futures contracts imply that market participants are utilizing the product for hedging and price discovery purposes. Thus, almost by definition, agricultural futures contracts with substantial volume and open interest meet the five criteria set forward as conditions for success. Price information from harvest contracts during the pre-planting phase may be used as expectations in the base price calculations. The final revenue guarantee would incorporate the average of the harvest futures prices some time before contract expiration.

The major agricultural futures exchanges in China are the Dalian Commodity Exchange (DCE) and the Zhengzhou Commodity Exchange (ZCE). Maize and soybean futures are traded at the DCE while cotton, rice and wheat futures are traded at the ZCE. These contracts are standardized, have verifiable pricing and have frequent price dissemination. The high volume of trading in these contracts implies competitive price determination and value recognition by dealers and traders in the Chinese agricultural markets.

Although the maize, soybean, cotton, wheat and rice futures markets show considerable growth in volume, a comparison with comparable U.S. futures markets is revealing. Table 1 presents the contract sizes for the five selected Chinese futures contracts along with their trading symbols. A comparative analysis is made with the analogous agricultural futures contracts in the U.S. After converting metric tons into bushels or hundredweights, a general observation that results is that U.S. futures contracts are about 11 times larger in weight. (Contract conversion factors and calculations are illustrated in Appendix 1). A similar observation results when measuring contract value over time. Contract value is the multiplication of contract size and price. Using daily contract values and foreign exchange rates, the average value ratios of the selected agricultural futures contracts over the 2006 through 2009 period were about a 9.5 ratio of PRC to US contract values.

These differences are understandable in terms of trading longevity and delivery characteristics. Agricultural futures have a much longer history and level of use by agribusiness in the United States. China's agricultural futures markets are still relatively new and growing. In the U.S., delivery sizes were initially standardized using size of a train railcar (thus the term "cars" as a substitute for "number of contracts"). The commodity exchanges in China may be accommodating smaller delivery sizes by merchants, smaller average farm size and encouraging general use through smaller contract values. The differences in volume may also be a function of national production levels. Based on USDA estimates of five year average production, maize production in China is only 50%, and soybean production in China is less than 20%, of that in the United States. One should not expect these contracts to ever

Table 1 – Contract Size and Value Equivalence Ratios

Commodity	Symbol	Exchange	Contract Size	U.S. Equivalent	unit	Symbol	Exchange	Contract Size	Size Ratio PRC/US	Value Ratio PRC/US
Maize	**AC**	DCE	10 MT	393.7	bu	**C**	CME	5000 bu.	12.70	9.19
Soybeans	**AK**	DCE	10 MT	367.4	bu	**S**	CME	5000 bu.	13.61	9.51
Cotton	**VV**	ZCE	5 MT	110.2	cwt	**CT**	ICE	500 cwt.	4.54	3.12
Rice	**IRI**	ZCE	10 MT	220.5	cwt	**RR**	CME	2,000 cwt.	9.07	9.44
Wheat	**VN**	ZCE	10 MT	367.4	bu	**W**	CME	5000 bu.	13.61	11.84
Wheat	**VN**	ZCE	10 MT	367.4	bu	**MW**	MGE	5000 bu.	13.61	13.79

eclipse U.S. trading levels. On the other hand, China produces almost twice as much cotton and wheat as the United States and dominates it in terms of rice production. Growth in these futures contracts over time could be substantial. Table 2 compares the daily average of open interest, volume and 30-day annualized historical volatility by contract

Table 2 – Annual Comparisons of Average Daily Statistics by Commodity Contract

Futures Contracts in the PRC				Futures Contracts in the US				Ratio Comparisons			
AC	**Open Int.**	**Volume**	**30day σ**	**C**	**Open Int.**	**Volume**	**30day σ**	**Maize**	**PRC C.E.Vol.**	**PRC/US**	**30day σ**
2006	776,572	537,328	17.2	**2006**	156,593	181,287	23.9	**2006**	42,307	23.3%	72.0%
2007	1,066,400	467,031	15.9	**2007**	214,753	207,357	24.5	**2007**	36,772	17.7%	64.7%
2008	692,091	472,542	13.1	**2008**	223,538	232,038	39.1	**2008**	37,206	16.0%	33.4%
2009	312,244	132,999	16.9	**2009**	139,634	196,298	34.6	**2009**	10,472	5.3%	48.8%
AK	**Open Int.**	**Volume**	**30day σ**	**S**	**Open Int.**	**Volume**	**30day σ**	**Soybeans**	**PRC C.E.Vol.**	**PRC/US**	**30day σ**
2006	250,374	73,243	13.7	**2006**	364,211	87,848	19.2	**2006**	5,382	6.1%	71.5%
2007	664,914	391,194	19.8	**2007**	513,280	121,786	22.7	**2007**	28,748	23.6%	87.4%
2008	623,313	899,114	25.1	**2008**	443,405	138,976	45.6	**2008**	66,074	47.5%	55.2%
2009	326,732	344,182	13.5	**2009**	395,326	138,803	35.8	**2009**	25,293	18.2%	37.7%
VV	**Open Int.**	**Volume**	**30day σ**	**CT**	**Open Int.**	**Volume**	**30day σ**	**Cotton**	**PRC C.E.Vol.**	**PRC/US**	**30day σ**
2006	49,567	17,326	15.3	**2006**	156,593	18,599	23.9	**2006**	3,820	20.5%	64.1%
2007	78,445	23,324	12.0	**2007**	214,753	18,480	24.5	**2007**	5,142	27.8%	48.8%
2008	81,805	41,003	12.9	**2008**	223,538	24,227	39.1	**2008**	9,040	37.3%	32.9%
2009	86,091	65,489	10.2	**2009**	139,634	13,485	34.6	**2009**	14,438	107.1%	29.4%
IR	**Open Int.**	**Volume**	**30day σ**	**RR**	**Open Int.**	**Volume**	**30day σ**	**Rice**	**PRC C.E.Vol.**	**PRC/US**	**30day σ**
2006				**2006**	13,047	1,223	21.4	**2006**			
2007				**2007**	16,504	1,380	17.4	**2007**			
2008				**2008**	14,530	1,450	34.0	**2008**			
2009	46,495	21,362	11.3	**2009**	9,880	1,084	26.5	**2009**	2,355	217.2%	42.5%
VN	**Open Int.**	**Volume**	**30day σ**	**W**	**Open Int.**	**Volume**	**30day σ**	**Wheat**	**PRC C.E.Vol.**	**PRC/US**	**30day σ**
2006	192,479	119,983	19.3	**2006**	429,636	62,730	30.1	**2006**	8,817	14.1%	64.0%
2007	254,887	311,416	15.8	**2007**	406,741	74,720	33.5	**2007**	22,885	30.6%	47.2%
2008	262,063	215,928	18.4	**2008**	345,437	74,183	50.4	**2008**	15,868	21.4%	36.5%
2009	153,496	52,501	12.1	**2009**	317,491	68,746	40.8	**2009**	3,858	5.6%	29.6%
				MW	**Open Int.**	**Volume**	**30day σ**	**Wheat**	**PRC C.E.Vol.**	**PRC/US**	**30day σ**
				2006	49,037	6,268	25.3	**2006**	8,817	140.7%	76.1%
				2007	55,814	7,040	27.7	**2007**	22,885	325.1%	57.0%
				2008	41,953	3,823	58.1	**2008**	15,868	415.1%	31.7%
				2009	35,438	4,014	30.1	**2009**	3,858	96.1%	40.1%

over the last four years. As indicated in the second last column, contract equivalent volume ("C.E.Vol." in the table) for Chinese maize and soybean volumes are running on average about 17.5% of comparable U.S. contract volumes. In terms of cotton, rice and high protein wheat (the MGE contract in the U.S.), Chinese contract equivalent volume has at times actually exceeded comparable U.S. futures volumes.

The ratios of historical 30-day volatilities in the last column of Table 2 indicate that Chinese agricultural futures prices are generally less volatile than their U.S. counterparts. These differences could be associated with many factors, such as lack of international arbitrage, use of price controls, state trading to balance inventories, less relative production uncertainty during the last five years or trading regulations on imports and exports. Interestingly, wheat volatility is lower than soybean volatility in China while the opposite is true in the United States. This difference was pointed out by Wang and Ke [4] in their analysis of futures market efficiency in China as a possible indication of public policy and regulation. A similar conclusion may be inferred from the correlations in monthly average price changes. Table 3 presents the correlations of the change in monthly average prices of maize, soybean, cotton, wheat and rice in the United States and China over the 2007 through 2009 period. In the United States, soybean and wheat prices were correlated at approximately the 60% level (highlighted in yellow). In contrast, soybean and wheat prices in China are correlated at only the 16% level despite the fact that U.S. soybean and Chinese soybean contracts are correlated at the 65% level. Additional study of relative price responses for Chinese wheat may be needed to determine competitive price determination and acceptance of value by producers for indexation purposes.

Table 3 – Correlations of Monthly Average Price Changes (2007 – 2009)

	Maize	Soybean	Cotton	Wheat	Maize	Soybean	Cotton	Rice	Wheat	Wheat
	AC1	*AK1*	*VV1*	*VN1*	*C 1*	*S 1*	*CT1*	*RR1*	*W 1*	*MW1*
AC1	100.0%									
AK1	38.4%	100.0%								
VV1	11.9%	11.7%	100.0%							
VN1	-9.6%	15.8%	-0.8%	100.0%						
C 1	32.0%	54.4%	21.6%	-8.0%	100.0%					
S 1	24.9%	65.5%	26.8%	-2.7%	72.7%	100.0%				
CT1	7.3%	23.5%	71.0%	-7.8%	36.0%	54.1%	100.0%			
RR1	16.3%	37.5%	27.4%	2.5%	45.9%	30.1%	25.6%	100.0%		
W 1	-1.2%	40.6%	23.9%	19.3%	46.7%	63.1%	56.1%	13.9%	100.0%	
MW1	-6.1%	40.8%	17.9%	17.9%	38.5%	59.6%	36.5%	20.5%	75.9%	100.0%

6. Conclusion

Revenue insurance is being increasingly used by producers and agribusiness concerns in the vertical contracting chain. The growth exhibited in the United States is likely to be manifested in other countries over time since the simultaneous protection of production and price is of great value to policyholders. Properly constructed and rated, revenue-based crop insurance can provide superior risk management performance to producers.

As illustrated by the Brazilian soybean revenue insurance case study, key elements of successful implementation of revenue insurance are the availability of producer yield data and the acceptability and recognition of value by producers of the price index selected for indemnity calculations. In addition to acceptability and recognition of value, other criteria for indexation success are standardization, verifiable pricing, frequent price dissemination and competitive price determination. These criteria generally apply to futures contracts exhibiting frequent use and high volumes of trading over time.

The maize and soybean futures contracts at the DCE and the cotton futures contract at the ZCE appear to meet these criteria. Some questions remain about price response and relative volatility of the wheat contract at the ZCE.

Although trading volume of the rice futures contract at the ZCE is growing rapidly and has great promise, the lack of trading data makes conclusions somewhat difficult given the recent initiation of trading.

A pilot program for revenue insurance on Chinese maize, soybeans and cotton could be developed in the future if several conditions were met. First, underlying producer data would need to be provided for analysis of relative yield risks and estimation of the producer probability distributions. Second, producer interviews should confirm recognition of value, price availability and acceptability of the respective DCE or ZCE futures contracts for price indemnity calculations. Third, a reliable and representative volatility analysis needs development to create the price probability distribution since options on futures contracts are not traded at these exchanges to date. Once these conditions are satisfied, modeling of the revenue policy risks by coverage levels could deliver relative pricing estimates against yield-base contracts. This output would permit marketing tests with producers to determine usefulness and value. Discussions on the viability and acceptance by processors and other agribusiness concerns in the vertical contracting chain would also be valuable.

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8. Appendix 1 – Calculating Equivalent Contract Size

CME Maize (C)	Size	Units
1 bushel (bu) =	56	pounds
1 contract (C) =	5,000	bushels
1 contract (C) =	280,000	pounds
1 metric ton (MT)=	2,204.6	pounds
1 contract (C) =	127.01	MT
1 contract (AC) =	10	MT
1 contract (AC) =	0.079	C
1 contract (C) =	12.70	AC

ICE Cotton (CT)	Size	Units
1 hundredweight (cwt) =	100	pounds
1 contract (CT) =	500	cwt
1 contract (CT) =	50,000	pounds
1 metric ton (MT)=	2,204.6	pounds
1 contract (CT) =	22.68	MT
1 contract (VV) =	5	MT
1 contract (VV) =	0.220	C
1 contract (CT) =	4.54	VV

CME Soybeans(S)or Wheat(W)	Size	Units
1 bushel (bu) =	60	pounds
1 contract (S) =	5,000	bushels
1 contract (C) =	300,000	pounds
1 metric ton (MT)=	2,204.6	pounds
1 contract (S) =	136.08	MT
1 contract (AK) =	10	MT
1 contract (AK) =	0.073	S
1 contract (S) =	13.61	AK

CME Rough Rice (RR)	Size	Units
1 hundredweight (cwt) =	100	pounds
1 contract (RR) =	2,000	cwt
1 contract (RR) =	200,000	pounds
1 metric ton (MT)=	2,204.6	pounds
1 contract (RR) =	90.72	MT
1 contract (IRI) =	10	MT
1 contract (IRI) =	0.110	RR
1 contract (RR) =	9.07	IRI