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The SURE Program and Its Interaction with Other Federal Farm Programs

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We investigate potential effects of the Supplemental Revenue Assistance Payments (SURE) program introduced in the 2008 Farm Bill. Results suggest little impact on optimal crop insurance purchase decisions, though the SURE program does seem to provide an incentive for mid-level insurance coverage. For producers in the price counter-cyclical payment (PCCP) program, SURE payments are actually higher (lower) when commodity prices are high (low). This is not the case for producers in the Average Crop Revenue Election (ACRE) program.

Key words: crop insurance, disaster assistance, farm bill, SURE

Introduction

In 1887, President Grover Cleveland vetoed an emergency appropriation of $10,000 for drought victims in Texas. He explained his decision by saying that the federal government had no "... warrant in the Constitution ... to indulge a benevolent and charitable sentiment through the appropriation of public funds ... [for] relief of individual suffering which is in no manner properly related to the public service" (Barry, 1997, p. 369). Over time, public perceptions of the federal role in disaster relief changed considerably. By the mid-1970s the federal government provided more than 70% of disaster relief funding in the United States (Clary, 1985).

The U.S. government's role in providing agricultural disaster relief expanded greatly in 1949 when Congress established a program that would provide low-interest loans to individual farmers and ranchers who suffered losses due to natural disasters. Later the secretary of agriculture was given the authority to make direct disaster relief payments to producers who participated in federal price and income support programs. This authority was suspended in 1981 (and by legislation adopted in subsequent years) for all situations where federal crop insurance was available. Due to the widespread availability of federal crop insurance, this implied that future federal agricultural disaster payments would require *ad hoc* authorizing legislation.

Such *ad hoc* legislation became common. Between 1987 and 1994, more than 60% of U.S. farms received federal disaster payments at least once, with many farms receiving payments every year (Barnett, 1999). In some cases the *ad hoc* legislation authorized disaster payments only for specific crops in specific areas that were affected by specific natural disasters. In other cases, the legislation authorized payments for all crops in all areas that had been affected by any disaster (including the explosion of the space shuttle Columbia over Texas in 2003). Payments were also made to livestock producers (primarily for forage losses) and to crop producers who were affected by adverse economic events (e.g. low prices) rather than natural disasters. All of these *ad hoc* payments were funded by off-budget emergency supplemental appropriations.

Ad hoc payments were also made in a context of increasing on-budget funding for subsidized crop insurance. Crop insurance reform legislation was adopted in 1980, 1994, and 2000; each time

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the expressed intent was to eliminate or at least reduce the need for *ad hoc* disaster payments (Glauber, 2004). These reforms generally increased crop insurance premium subsidies to stimulate higher levels of participation. As a result the cost of the program to the government (indemnities net of premiums, premium subsidies, and delivery cost) rose considerably.

Despite frequent implementation of *ad hoc* disaster payments, there was no standing program that provided disaster payments to farmers and ranchers in the U.S. after 1981. This changed with passage of the Food Conservation and Energy Act of 2008 (hereafter referred to as the 2008 farm bill) which authorized the Supplemental Agricultural Disaster Assistance (SADA) program. The SADA program is fairly comprehensive, including components to cover losses in crop production (the Supplemental Revenue Assistance or SURE program), livestock mortality due to adverse weather (Livestock Indemnity Payments), forage losses (Livestock Forage Disaster Program), orchard and nursery tree losses (Tree Assistance Program), and other production losses on livestock, honeybees, or farm-raised catfish (Emergency Assistance program).

This paper focuses on the commercial row-crop provisions of the SURE program. The SURE program differs considerably from the standing disaster program that was in place prior to 1981. For example, the pre-1981 program was based on yield losses, whereas the SURE program is based on revenue losses. Also, the pre-1981 program provided compensation for losses on individual crops, while SURE provides compensation based on shortfalls in "whole farm" revenue, including all crops produced on the farm.

To be eligible for SURE payments, farms are required to purchase at least the catastrophic level of federal crop insurance. SURE payments are triggered if the farm is located in or adjacent to a county declared a disaster area (or the farm has a 50% loss) and one crop has a loss of at least 10%. The program will compensate farms for 60% of the difference between their disaster payment program guarantee and their realized total farm revenue. For purposes of this program, realized farm revenue includes market revenue, any crop insurance indemnities, 15% of any federal direct fixed payments, any loan deficiency payments or marketing loan gains, and any federal price-based counter-cyclical payments (PCCP) or revenue-based Average Crop Revenue Election (ACRE) payments.

The research presented here analyzes the impact of the SURE program at the farm level under participation in either the PCCP program or the ACRE program. Specifically, we:

1. Investigate the impact of the SURE program on federal crop insurance purchase decisions;
2. Analyze expected disaster payment benefits for different crops and regions;
3. Analyze expected disaster payment benefits for different degrees of on-farm crop diversification; and
4. Analyze effects of moral hazard behavior on crop insurance purchase decisions.

We hypothesize that expected SURE payments will be lower in regions with lower production risk and lower for more diversified farms (since the payment trigger is based on whole farm revenue, which should be less variable on a diversified operation). Finally, we expect that moral hazard incentives will increase SURE payments. However, the primary question that we intend to answer is whether or not participation in the SURE program will affect optimal crop insurance coverage levels.

Conceptual Framework

When farmers plant crops, they are making financial investments in a portfolio of enterprises that they hope will generate positive net income. In this sense, farmers are no different than those who invest in stocks, bonds, or other financial assets.

Consider a portfolio consisting of n different crop enterprises. The expected return on the portfolio is:

$$E(r_{portfolio}) = \sum_{i=1}^{n} s_i E(r_i), \tag{1}$$

where $E(r_i)$ is the expected return for crop i, s_i is the proportion of the total value of the portfolio that is in crop i, and $\sum_{i=1}^{n} s_i = 1$.

For a portfolio consisting of two crops, j and k, the variance in returns for the portfolio would be measured as:

$$\sigma^2_{portfolio} = s_j^2\sigma_j^2 + s_k^2\sigma_k^2 + 2s_js_k\sigma_j\sigma_k\rho_{j,k}, \tag{2}$$

where $\rho_{j,k}$ is the correlation coefficient between returns on crop j and crop k. By changing the notation for variance from σ^2_{crop} to $\sigma_{crop,crop}$, equation (2) can be generalized to allow for portfolios of n crops:

$$\sigma^2_{portfolio} = \sum_{g=1}^{n}\sum_{h=1}^{n} s_g s_h \sigma_g \sigma_h \rho_{g,h}. \tag{3}$$

In addition, the farm participates in various available federal programs so the realized stochastic whole-farm annual return, R_w, is also a function of stochastic crop returns and any payments received from the federal programs. Following standard financial theory, we assume that farmers manage their portfolios by making decisions that weigh expected returns against risk. Specifically, it is assumed that farmers maximize a constant relative risk aversion (CRRA) utility function, which is represented mathematically as:

$$U = \begin{cases} \frac{R_w^{1-\phi}}{1-\phi} & \text{if} \quad \phi \neq 1 \\ \ln(R_w) & \text{if} \quad \phi = 1. \end{cases} \tag{4}$$

The farmer's expected utility is:

$$E(U) = \begin{cases} \sum_{W=1}^{n} \omega_t \frac{R_w^{1-\phi}}{1-\phi} & \text{if} \quad \phi \neq 1 \\ \sum_{W=1}^{n} \omega_t \ln(R_w) & \text{if} \quad \phi = 1, \end{cases} \tag{5}$$

where ϕ is the relative risk aversion coefficient and ω_t is the probability weight associated with each possible outcome, R_w.

Federal commodity program payments included in the analysis are Direct Payments (DPs), Loan Deficiency Payments (LDPs), and either Price Counter-Cyclical Payments (PCCPs) or Average Crop Revenue Election (ACRE) revenue counter-cyclical payments. For each program crop, commodity program payments, crop insurance indemnities, and disaster program payments are modeled as follows. The LDP is calculated as:

$$LDP_i = \max\{0, (LR_i - HP_i)\} \times HA_i \times FY_i, \tag{6}$$

Where LR_i is the loan rate, HP_i is the harvest time cash price, HA_i is harvested acres, FY_i is the realized farm yield, and the subscript i indicates a specific crop. Consistent with the ACRE program authorizing legislation, the loan rate is reduced by 30% when calculating LDPs for farms enrolled in ACRE. The DP is calculated as:

$$DP_i = DPR_i \times 83.3\% \times BA_i \times BY_i, \tag{7}$$

where DPR_i is the direct payment rate (specified in the authorizing legislation), BA_i is the base acreage, and BY_i is the base yield. For farms enrolled in ACRE, direct payments are reduced by 20% from the value calculated in equation (7). The PCCP is calculated as:

$$PCCP_i = \max\{0, (TP_i - DPR_i - \max(LR_i, MYA_i))\} \times 85\% \times BA_i \times BY_i, \tag{8}$$

where TP_i is the target price, MYA_i is the national marketing year average price, and all other variables are as defined previously.[1] ACRE payments are calculated as:

$$ACRE_i = \phi \times 83.3\% \times \left[\max\{0, (\min\{(0.25 \times SREVB_i), (SREVB_i - SREVA_i)\})\} \times \frac{\overline{FY_i}}{\overline{SY_i}} \times PA_i\right], \tag{9}$$

where ϕ is a dummy variable with a value of one if realized farm revenue is below the farm-level benchmark revenue (which is a product of the Olympic average farm yield over the previous five years and the average marketing year average price over the previous two years plus any crop insurance premium paid) and a value of zero otherwise; $SREVB_i$ is the benchmark state revenue calculated according to ACRE provisions (note, that ACRE payment is capped at 25% of the state benchmark guarantee); $SREVA_i$ is actual state revenue to count under ACRE provisions; $\overline{FY_i}$ is the farm-level benchmark yield; $\overline{SY_i}$ is the state level benchmark yield; and PA_i is planted acres.[2]

Crop revenue insurance is modeled at coverage levels ranging from 50 to 85% in 5% increments, as in the actual crop insurance program. Indemnities are computed as:

$$IND_i = \max\{0, [(\mathrm{CL_i} \times \mathrm{APH_i} \times \max\{\mathrm{EP_i}, \mathrm{FP_i}\}) - \mathrm{FY_i} \times \mathrm{FP_i}]\} \times \mathrm{IA_i}, \tag{10}$$

where EP_i is the crop insurance pre-planting expected price, FP_i is the harvest time futures price, CL_i is the coverage level selected, APH_i is the farm's crop insurance actual production history (APH) yield, and IA_i is the insured acreage. Crop insurance is assumed to be priced at the actuarially-fair rate adjusted by a 25% multiplicative load.[3] The current enterprise unit federal premium subsidy structure is imposed, which ranges from an 80% subsidy for the 50% coverage level to a 53% subsidy for the 85% coverage level.[4] All acreage for a particular crop is assumed to be insured as one unit.

The SURE program is designed to interface with crop insurance. This is clearly observed when one examines the SURE payment function for a farm producing i crops:

$$SURE = \theta \times 0.6 \times \max\{0, (G - R)\}, \tag{11}$$

where: $G = \max\{(115\% \times \sum_i APH_i \times CL_i \times EP_i \times IA_i), (90\% \times \sum_i APH_i \times EP_i \times IA_i)\}$,

[1] It is technically possible for base yields for direct payments and base yields for counter-cyclical payments to differ; however, in this analysis, they are assumed to be the same.

[2] A full discussion of ACRE provisions is beyond the scope of this paper; however, a brief explanation of the broad outlines of the program is useful in the current context. Basically, the ACRE program provides a payment to the producer when actual state revenue (as defined in the Farm Bill) falls below a benchmark level based on past state- level yields (five-year Olympic average) and national marketing year average prices. This state-level payment rate is scaled by the ratio of average farm yields to average state yields in order to determine the farm-specific payment rate. The payment is based on planted acres where sum of payment across crops cannot exceed total base acres on a farm. It is notable that due to a very nature of the benchmark calculation, the ACRE program is "time dependent" and payments may vary across different years depending on yield and price realizations during previous years. For a more detailed explanation of ACRE provisions see Zulauf (2008).

[3] This load factor is somewhat arbitrary; however, some load is required to account for the load that is applied to actual crop insurance rates as well as for other subjective factors that influence producers to purchase lower crop insurance coverage levels (e.g., downward-biased estimates of yield and/or price risk, perceived presence of yield trends, perception of moral hazard influencing rates, etc.). Along with the 25% load, we also considered 35% and 10% loads. There were no apparent qualitative changes. The sensitivity analysis results are available in the technical appendix. For a more detailed discussion of subjective issues affecting crop insurance coverage level decisions see, Pease (1992), Eales et al. (1990) and Egelkraut et al. (2006).

[4] Free catastrophic coverage crop yield insurance is available with a 50% guarantee and the crop value capped at 55% of the expected price.

$$R = \sum_i FY_i \times MYA_i \times HA_i + \sum_i 0.15DP_i + \delta \sum_i PCCP_i + (1-\delta) \sum_i ACRE_i + \sum_i LDP_i + \sum_i IND_i,$$

and θ is a dummy variable taking a value of 1 if the SURE payment is triggered and zero otherwise.

SURE regulations state that θ will be equal to 1 if the following three conditions are met: 1) the farmer has purchased crop insurance on all acres; 2) the farm has a 50% loss (or is in, or adjacent to, a county declared a disaster area); and 3) one crop has a loss of at least 10%. For this analysis, the first and third conditions are incorporated, as is the 50% farm-level loss trigger for the second condition. As a proxy for the political decision of a county being declared a disaster area (in the second condition) we assume that a disaster declaration will be made only if the simple average yield shortfall across all crops considered for the county is greater than 35%. No attempt is made to include the adjacent county trigger for the second condition due to the large number of *ad hoc* assumptions that would be required and the low probability that this trigger would be met when neither of the other triggers for the second condition are met.

G on the right-hand side of equation (11) is the guarantee equal to 115% of the insured value of all crops. The guarantee is capped at 90% of the expected crop revenue, so only for crop insurance coverage levels up to 80%, choosing higher crop insurance coverage levels results in a higher SURE guarantee. For crop insurance coverage levels higher than 80%, the 90% SURE guarantee becomes binding. R on the right-hand side is the sum across crops of crop revenue, 15% of all direct payments per acre, all PCCP or ACRE payments, all LDPs, and all crop insurance indemnities. Finally, δ is a dummy variable taking a value of 1 if the farm is enrolled in the current PCCP program and a value of 0 if the farm is enrolled in the new ACRE program.

Data and Modeling

A stochastic simulation model is developed to evaluate SURE program payments, crop insurance indemnities, and other farm program payments for a representative Illinois soybean-corn farm in McLean county, a representative Kansas wheat-corn farm in Sheridan county, a representative Mississippi cotton-soybean-corn farm in Yazoo county, and a representative North Dakota wheat-corn farm in Barnes county. These counties were selected because they are representative of major production regions with each having different crop mix, production risk, and price-yield correlation characteristics. McLean County, Illinois is representative of Midwestern corn-soybean production where yield risk is relatively low and price and yield tend to be highly negatively correlated. Sheridan County Kansas, is representative of plains winter wheat and corn production. Production risk in this region is higher than in the Midwest and price-yield correlation is lower (in absolute value terms). Yazoo County, Mississippi is typical of the mid-south where farms often produce several commodities, production risk for cotton, soybeans, and corn is relatively high, and price and yield are largely uncorrelated. Barnes County, North Dakota is representative of a northern plains spring wheat and corn production region with relatively high yield risk. Yields and prices are not highly correlated for corn in this region but are highly negatively correlated for spring wheat.

Certainty equivalents of gross revenue are calculated for each crop insurance coverage level from 50 to 85%, both with and without SURE to determine any impact of SURE on optimal crop insurance purchase decisions. SURE payments were calculated assuming enrollment in the PCCP program and the ACRE program to see what effect this enrollment decision would have on SURE program outcomes.

As equation (11) makes clear, to accurately assess the potential impacts of the SURE program, it is necessary also to model returns from crop production, other government programs, and crop insurance. Simulating outcomes for these different revenue streams requires a relatively large number of variables, including futures prices, cash prices, farm-level yields, county-level yields, and state-level yields for each of the crops considered.

The price data used in the model consist of beginning and ending prices as defined in the crop revenue coverage (CRC) insurance product provisions as well as harvest time cash prices and marketing year average prices.[5] State-level, county-level, and farm-level yields are simulated in the model. Clearly, farm-level yields are required to calculate crop returns, crop insurance indemnities, and loan deficiency payments. Farm-level yields are also used to calculate production loss, which is one of the necessary conditions for a SURE program payment. As well, farm-level yields are required to assess a farm trigger under the ACRE program. County-level yields are simulated in order to define an event triggering a disaster program payment. If county-level yields for any crop fall below a defined threshold, a disaster declaration is assumed, which is one of the necessary conditions for producers in the county to be eligible for SURE payments. State-level yields are necessary to assess a state trigger under the ACRE program.

To simulate price outcomes, beginning prices were set to 2010 ACRE guarantee prices (simple average of 2008 and 2009 marketing year prices) for each crop.[6] Futures price changes over the production season and harvest time basis values were simulated using parameters calculated from historic data obtained from the Commodity Research Bureau (CRB) database and the U.S. Department of Agriculture's National Agricultural Statistical Service (NASS). This information was used to simulate harvest time futures and cash prices for each crop and location, as well as national level MYA prices.

Yields were simulated from a Beta distribution, with parameters of the distribution for each crop derived from historic data. State and county yields were obtained from NASS. Farm yields were simulated from the county-level series using the method described in Coble and Barnett (2007) to increase county-level yield variability to a level consistent with APH crop insurance rates for that county. The farm yield series was further calibrated to have a correlation of 0.85 with the county yield series using the procedure described in Iman and Conover (1982).[7] Correlated yields, futures price changes, and basis values were simulated (correlation tables are provided in the Technical Appendix). Data covered the period from 1980 through 2009. Table 1 provides descriptive statistics for the yield and price data used in the simulation.

A total of 100,005 correlated price changes, basis values, and yields were simulated for each representative farm.[8] Correlated price variables were simulated using the procedure described by (Anderson, Harri, and Coble, 2009). In this procedure, a rank correlation matrix, $\boldsymbol{\rho}_s$, is calculated. An eigen decomposition of $\boldsymbol{\rho}_s$ results in a matrix of eigen values, ε, and eigen vectors, $\hat{\varepsilon}$. Correlated standard normal deviates ($\hat{Z}$) are generated using:

$$\hat{Z} = \sqrt{\varepsilon} Z \hat{\varepsilon}, \tag{12}$$

where Z is a vector of independent standard normal deviates. These correlated standard normal deviates are converted to correlated uniform deviates on the (0, 1) interval by a transformation on the standard normal cumulative distribution function. The uniform deviates are used as probabilities

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[5] The CRC Commodity Exchange Endorsement describes how base (i.e., beginning) and harvest (i.e., ending) prices are to be established for each crop and location. For example, the base price for corn in counties with a March 15 cancellation date for CRC policies is the average daily settlement price on the Chicago Board of Trade's December corn contract during the month of February. The harvest price is the average daily settlement price on that same contract during the month of October. Additional details about the beginning and ending prices used in this study can be found in the CRC Commodity Exchange Endorsement (USDA/RMA, 2003).

[6] The choice of price level does affect the results (especially for PCCP and ACRE payments). Current levels are assumed here to represent the most "realistic" scenario.

[7] The Iman and Conover procedure permits simulation of a data series that is correlated at the specified level with some existing series. Thus, a farm-level yield series matching the length of the original county yield series was simulated using parameters based on the expanded variance of the county-level series. These farm-level series are used in all subsequent analysis. Sensitivity analysis using farm yields correlated to the county yield at 0.50 and 0.25 was conducted. The results of the sensitivity analysis are presented in the Technical Appendix.

[8] Results are based on 100,000 simulated observations. The additional 5 observations are required to calculate 5-year Olympic averages of farm- and state-level yields used to establish the ACRE guarantee.

in an inverse transformation on each of the marginal distributions for the variables being simulated (in this case, price changes, basis values, and yields).[9]

Simulated prices and yields are used to calculate crop returns, crop insurance indemnities, government payments (e.g., LDPs, PCCPs and ACRE payments), and any payments under the SURE program. To calculate the direct and counter-cyclical payments, crop base acres and yields must be assumed. In this model, base acres and planted acres are assumed to be the same. All four representative farms are assumed to have 1,500 acres of cropland. Representative farm base yields are assumed equal to the county average base yield for each crop. Finally, for each representative farm we assume crop insurance APH yields that are equal to 96% of the expected county yield, where expected county yields are obtained by detrending the historical NASS county yield data.[10]

Returns from all sources are converted to utility values using the constant relative risk aversion (CRRA) utility function shown in equation (4). Following Lien and Hardaker (2001) and Lusk and Coble (2005) we assume a risk aversion coefficient of 2, representing a moderately risk-averse decision maker.[11] Certainty equivalents (CEs) for crop insurance coverage levels from 50% to 85% are then calculated to define the optimal coverage level both with and without the SURE program. The CE represents the highest certain payment a decision maker would be willing to take to avoid a risky outcome (Hardaker, Huirne, and Anderson, 1997). For any two alternatives l and m, if $CE_l > CE_m$, then alternative l is preferred to m.

For this investigation, the optimal crop insurance coverage level is that which results in the highest CE. Comparing optimal coverage levels with and without SURE payments will reveal what effect, if any, the SURE program is likely to have on optimal insurance purchase decisions. The equations for calculating the CE from the CRRA utility functions used here are

$$CE_r = \begin{cases} [E(U)(1-\phi)]^{\left(\frac{1}{1-\phi}\right)} & \text{if} \quad \phi \neq 1 \\ e^{E(U)} & \text{if} \quad \phi = 1. \end{cases} \tag{13}$$

where $E(U)$ is a value for expected utility calculated from equation (5).

Results and Discussion

SURE, similar to ACRE, is a revenue-based program, while PCCP is a price-based program. Therefore, while there should be a positive correlation in payments from these programs, ACRE and SURE will reveal stronger complementarities than PCCP and SURE. Notably, however, SURE is a whole farm program, while ACRE is crop-specific. ACRE is triggered in relation to the state-level revenue benchmark, while SURE is triggered in relation to county- and farm-level revenue benchmarks. The latter also creates incentives for moral hazard (see Smith and Watts, 2010). The described complexity in the relationship between the SURE and ACRE programs, as well as between SURE and crop insurance programs, makes it difficult to generalize the expected outcome of SURE participation on optimal crop insurance coverage levels and motivates research on a case-by-case basis.

SURE Impact on Crop Insurance Coverage Levels

Figure 1 presents calculated certainty equivalents at each insurance coverage level for each farm with a diversified crop mix. It does not appear that optimal crop insurance coverage levels are greatly

[9] For a more detailed description, see (Phoon, Quek, and Huang, 2004).

[10] The APH yield is a simple moving average of the most recent 4-10 years of yields on the insured unit. If there is a positive yield trend, the APH yield will be less than the expected yield.

[11] Additionally, we simulated scenarios with risk aversion coefficients set to 1 and 4, representing lower and higher levels of risk aversion, respectively. This sensitivity analysis did not yield qualitatively different results from those reported here. Those results are available from the authors upon request.

Table 1. Descriptive Statistics of Data used in Representative Farm Models

	Illinois		Kansas		Mississippi		North Dakota	
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Farm-Level Yields								
Corn	177.64	29.67	158.57	70.59	149.28	40.46	140.48	68.65
Soybeans	46.38	12.24			37.29	22.21		
Wheat			38.99	22.61			44.03	19.09
Cotton					861.31	436.86		
County-Level Yields								
Corn	177.93	22.13	140.69	19.43	147.87	12.41	118.10	22.24
Soybeans	52.15	5.35			32.02	6.40		
Wheat			35.56	11.87			44.81	8.67
Cotton					846.19	126.65		
State-Level Yields								
Corn	165.31	17.79	144.54	15.16	138.74	11.46	116.15	15.98
Soybeans	46.44	3.74			33.94	5.02		
Wheat			37.08	6.60			34.97	5.98
Cotton					901.64	113.29		
Benchmark Farm-Level Yields (ACRE)								
Corn	177.55	14.98	155.65	35.58	149.00	20.76	139.83	36.66
Soybeans	46.16	6.27			35.63	11.07		
Wheat			37.66	12.17			43.12	9.70
Cotton					842.26	226.74		
Benchmark State-Level Yields (ACRE)								
Corn	165.54	8.79	144.54	7.50	138.71	5.65	116.51	7.96
Soybeans	46.48	1.82			33.89	2.55		
Wheat			37.03	3.33			35.00	2.96
Cotton					900.78	56.10		
Harvest Time Futures Prices								
Corn	3.56	0.63	3.56	0.63	3.56	0.63	3.56	0.63
Soybeans	9.68	1.74			9.68	1.74		
Wheat			5.68	1.08			5.62	0.90
Cotton					0.54	0.11		
Harvest Time Cash Prices								
Corn	3.38	0.56	3.50	0.57	3.71	0.57	3.21	0.55
Soybeans	9.49	1.54			9.58	1.5		
Wheat			5.42	1.06			5.57	0.75
Cotton					0.48	0.09		
Benchmark Prices (ACRE)								
Corn	3.92	0.57						
Soybeans	10.12	1.41						
Wheat	5.94	0.79						
Cotton	0.56	0.08						

Notes: Cotton prices given in $/lb; corn, soybean, and wheat prices are given in $/bushel.

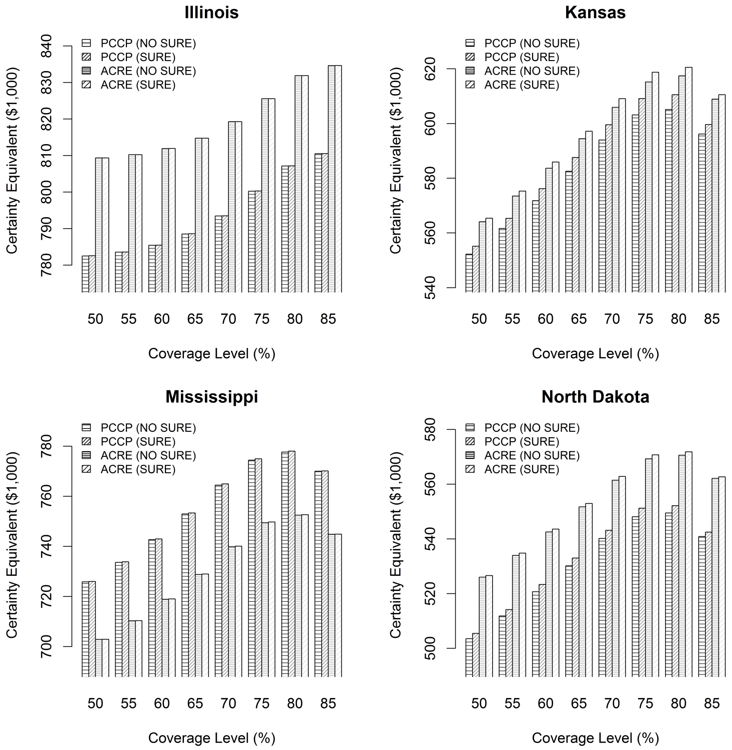

Figure 1. SURE Program Effects on Optimal Crop Insurance Coverage Levels for a Diversified Crop Mix

influenced by the availability of the SURE program. This is partly due to the fact that expected SURE payments constitute a very small share of total farm revenue (see table 2). SURE payments are a small portion of total revenue when compared to crop returns and even other program payments (such as the direct payment, ACRE payments, and PCCP payments). Certainly, the calculation of the SURE revenue guarantee–guaranteeing 115% of insured value but with a cap at 90% of expected revenue–suggests that the SURE program makes the highest crop insurance coverage levels less attractive. Otherwise, it appears that differences in SURE payments across insurance coverage levels are not sufficient to have a significant influence on coverage level decisions. To be more precise, the SURE program guarantee encourages crop insurance at up to the 80% coverage level. Above this level, the cap on SURE payments at 90% of expected revenue becomes binding; below this level, SURE payments are reduced by the lower SURE benchmark revenue. But these coverage levels (except for the Illinois representative farm) seem to be preferred even without SURE. So, if anything, SURE participation only further encourages producers to select mid-level crop insurance coverage.

Relationship between SURE Payments and Other Program Payments

Figure 2 presents results related to the interaction between the SURE program and other farm programs. Results vary substantially across the different locations. In particular, SURE payments are higher for a single crop compared to the diversified crop situation for the Kansas representative farm. However, at optimal crop insurance coverage levels, SURE payments are higher for a diversified crop mix scenario as compared to the corn-only situation in Illinois and wheat-only situation in North Dakota. Interestingly, in North Dakota, at lower crop insurance coverage levels single crop

Table 2. SURE Payments as a Percentage of Expected Crop Revenues

Coverage	Illinois		Kansas		Mississippi		North Dakota	
Level	*PCCP*	*ACRE*	*PCCP*	*ACRE*	*PCCP*	*ACRE*	*PCCP*	*ACRE*
CL50	< 0.01%	< 0.01%	0.17%	0.07%	0.01%	< 0.01%	0.14%	0.04%
CL55	< 0.01%	< 0.01%	0.24%	0.11%	0.01%	0.01%	0.18%	0.06%
CL60	< 0.01%	< 0.01%	0.31%	0.15%	0.02%	0.01%	0.22%	0.08%
CL65	< 0.01%	< 0.01%	0.38%	0.20%	0.03%	0.01%	0.27%	0.10%
CL70	0.01%	< 0.01%	0.45%	0.25%	0.03%	0.02%	0.30%	0.13%
CL75	0.01%	< 0.01%	0.52%	0.30%	0.04%	0.02%	0.33%	0.15%
CL80	0.01%	< 0.01%	0.48%	0.28%	0.03%	0.02%	0.30%	0.13%
CL85	< 0.01%	< 0.01%	0.31%	0.15%	0.01%	< 0.01%	0.18%	0.06%

production generates higher SURE payments as compared to the diversified crop scenario. Finally, in the Mississippi PCCP scenario cotton-only SURE payments are substantially lower than multi-crop SURE payments, but the opposite is true for the ACRE scenario. These results map back to SURE payments being triggered by whole farm revenue so that not only does the risk associated with each crop matter, but also the overall relative risk associated with all the crops produced. For example, in the case of the North Dakota farm, the underlying production risk of corn is higher compared to the wheat production risk. Therefore, when corn is added to the production mix, the likelihood of SURE payments being triggered increases relative to the wheat-only production scenario.

Additionally, the cotton-only SURE payment with PCCP is much lower than the cotton-only SURE payment under ACRE participation. This result points to a rather curious feature of the SURE program as it relates to other farm programs, particularly the PCCP and the marketing loan programs. Under SURE, the farm's payment trigger is essentially 115% of the farm's total insurance liability. Expectations of government program payments are not included in this benchmark revenue. However, program payments are included in revenue to count at the end of the year. When prices are low (as was the case with cotton during the time period used to initialize the simulation), the SURE benchmark revenue is also low. However, the likelihood of receiving substantial PCCPs and LDPs is high. Thus, it becomes much more likely that revenue to count will exceed the SURE benchmark revenue, resulting in no SURE payment. When prices are high, the correspondence between benchmark revenue and revenue to count will be greater because PCCPs and LDPs will be a much less significant component of revenue. The interesting result is that for producers in the PCCP program, SURE will be expected to pay out more when prices are high than when prices are low. The effect noted above should be reduced for producers enrolled in the ACRE program because ACRE price guarantees are not fixed. In general, the likelihood of an ACRE payment should be about the same whether prices are high or low. This is reflected in the results in figure 2. Except for the case of cotton-only in Mississippi, SURE payments are much higher under PCCP enrollment than under ACRE enrollment. This suggests that ACRE and SURE payments are largely offsetting. That is, when SURE pays out, ACRE is also generally paying out, thus reducing the amount of the SURE payment. This is not necessarily true under the PCCP program, since PCCP programs are based only on price and the target price for PCCP payments is fixed.

SURE Program Experience Across Regions

Results in figure 2 clearly demonstrate substantial differences in expected SURE payments across geographic regions. Because of differences in expected revenue per acre across states, mainly reflecting differences in expected yield, it is somewhat difficult to compare whole-farm SURE payment levels. To better illustrate differences in payment levels across geographic regions, table 2 shows SURE payments with PCCP and ACRE participation as a percentage of expected whole-

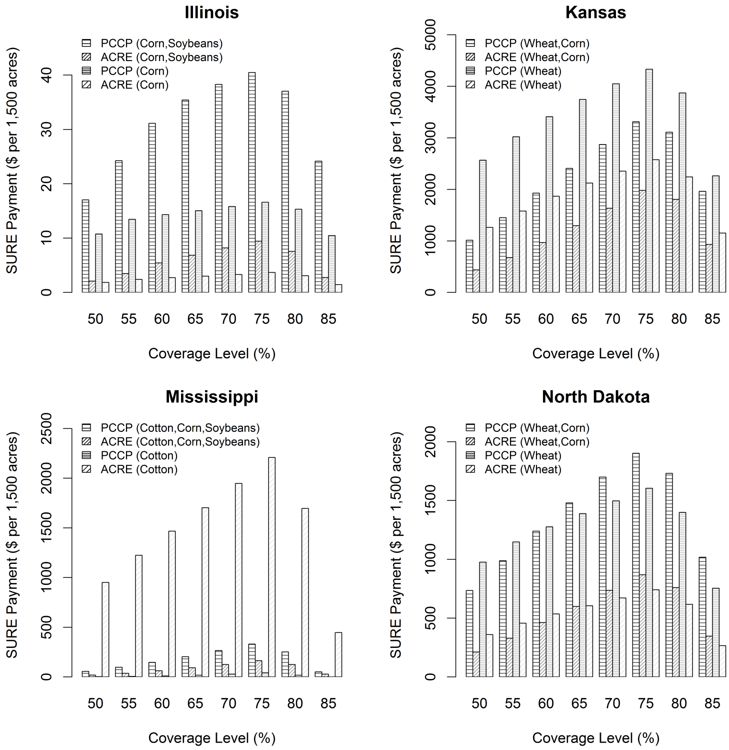

Figure 2. SURE Payments at Different Crop Insurance Coverage Levels for a Mono-Crop and a Diversified Crop Mix

farm revenue. In these terms, SURE payments are smallest in Illinois and largest in Kansas, with Mississippi and North Dakota payments falling between these two. Differences in SURE payments are by no means trivial and largely reflect differences in production risk across the different regions (shown in table 1).

SURE Program and Moral Hazard

As noted by Smith and Watts (2010), the SURE program creates incentives for moral hazard. This is mostly due to one of the necessary conditions, that SURE will be triggered if a farm production loss exceeds 50% of the average production. Smith and Watts (2010) present peculiarities of this incentive (with a number of alternative price scenarios). We examine whether SURE-induced moral hazard behavior affects optimal crop insurance coverage levels. In order to illustrate the moral hazard behavior, we assume that during the growing season the farmer would take actions, or fail to take actions, that further reduce production if the simulated average yield shortfall, relative to historical average yields, across all crops produced on the farm exceeds 40%. When this occurs, we assume that moral hazard behavior will further reduce the realized yield by an additional 20% (relative to the initial simulated level).[12] Additionally, we use average yield shortfalls across all crops when modeling opportunities for SURE-induced moral hazard behavior, because SURE payments are

[12] These values are, of course, somewhat arbitrary due to the difficulty of quantifying moral hazard behavior. The assumed 20% reduction in crop yield, due to moral hazard behavior is motivated, in part, by estimates of the yield impacts of delayed or reduced use of fertilizers (e.g., Scharf, Wiebold, and Lory, 2002; Stewart et al., 2005). While we consider the assumptions to be reasonable, the findings from this exercise should be interpreted as illustrative rather than definitive.

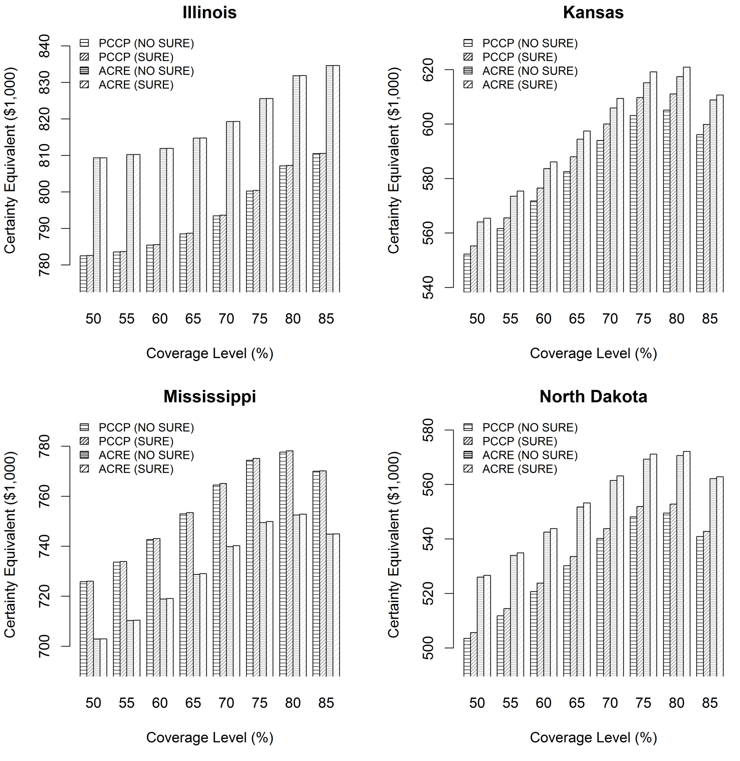

Figure 3. SURE Program Effects on Optimal Crop Insurance Coverage Levels for a Diversified Crop Mix Assuming Moral Hazard

based on whole farm outcomes. Note that this moral hazard behavior does not necessarily guarantee that a SURE payment will occur or that realized crop insurance revenue will be less than 75% of the revenue guarantee, because realized revenue is also a function of price, over which the farmer has no control.

As shown in table 3, the assumed SURE-induced moral hazard behavior increases SURE payments. In particular, SURE payment increases due to moral hazard range from 5% to 80% in Kansas, Mississippi and North Dakota. The percentage increase in Illinois is much larger (up to 331%), but these large percentage increases reflect the fact that the expected level of SURE payments is low (see table 2). The change in absolute terms is rather modest. For all four states, these changes in SURE payments have little effect on optimal crop insurance coverage levels, which can be seen by comparing figure 3 to figure 1. This is not unexpected, given that SURE payments constitute such a small share of expected revenue. Finally, these effects would be even further mitigated if farmers were less successful in implementing the SURE-induced moral hazard behavior than is assumed here.

Summary and Conclusions

The SURE standing disaster payment program represents an attempt by policy-makers to provide a systematic means of compensating crop producers for revenue shortfalls. Because the revenue trigger established under this proposed program is tied to the producer's crop insurance coverage level and because the program would function in much the same way as a crop insurance product, it is feasible that the program could influence crop insurance purchase decisions.

Table 3. Percentage Change in SURE Payments as a Result of Moral Hazard

Coverage	Illinois		Kansas		Mississippi		North Dakota	
Level	*PCCP*	*ACRE*	*PCCP*	*ACRE*	*PCCP*	*ACRE*	*PCCP*	*ACRE*
CL50	123.6%	75.8%	4.7%	5.8%	11.8%	14.8%	12.2%	11.4%
CL55	160.3%	137.1%	6.8%	8.6%	20.3%	28.3%	16.2%	16.5%
CL60	192.2%	210.8%	8.3%	10.6%	27.7%	43.3%	19.5%	20.8%
CL65	222.5%	294.2%	9.8%	12.0%	35.2%	54.5%	22.1%	23.9%
CL70	233.3%	331.2%	11.2%	13.4%	41.3%	62.5%	24.3%	26.2%
CL75	230.1%	317.1%	12.5%	14.7%	45.3%	66.7%	26.0%	27.7%
CL80	220.2%	307.1%	12.5%	14.7%	48.5%	72.2%	25.7%	27.2%
CL85	195.9%	303.3%	10.0%	12.2%	54.2%	83.5%	21.9%	23.1%

Simulation results suggest that SURE payments could have some effect on the optimal crop insurance coverage level, moving producers toward mid-level coverage from either lower or higher levels. However, SURE payments are, on average, small relative to crop revenues, other program payments, and insurance indemnities. Thus, the actual impact of SURE payments on producer decisions is not likely to be that great.

Results also demonstrate interesting interactions between the SURE program and other federal commodity programs. Surprisingly, for producers who participate in the PCCP program, the method of establishing SURE benchmark revenue (which ignores expected PCCP and marketing loan program payments) will result in lower SURE payments when prices are low and higher SURE payments when prices are high. For producers participating in the ACRE program, SURE and ACRE payments will overlap to a substantial degree, generally resulting in small expected SURE payments. These results provide a useful illustration of the complex inter-relationships that now exist between the various farm programs.

Finally, results illustrate the influence of crop diversification and production risk on SURE payments. In general, the program will pay more to less diversified operations in areas characterized by greater production risk. This may seem an intuitively obvious finding, but it is often overlooked by policy-makers. The SURE program implicitly establishes fixed coverage levels across very diverse production regions, resulting in considerable inequities in the distribution of SURE payments, with areas of relatively less (more) risky production receiving relatively lower (higher) SURE payments.

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Technical Appendix

This technical appendix contains correlation matrices for variables used in the simulation analysis (tables A1 - A3) and certainty equivalent measures for different scenarios of farm-county yield correlations, multiplicative crop insurance premium loads and risk aversion coefficients (tables A5 - A7). In the tables that follow ΔP is the percentage change in price between planting and harvest of a harvest-time futures contract, B is harvest-time basis (cash price relative to futures price), Y is yield, and the subscripts C, S, and CT indicate corn, soybeans, and cotton, respectively.

Table A1. Matrix of Variables Used in Simulations for a Representative Farm of Illinois

	ΔP_C	ΔP_S	B_C	B_S	$Y_C(F)$	$Y_S(F)$	$Y_C(C)$	$Y_S(C)$	$Y_C(S)$	$Y_S(S)$
ΔP_C	1.00									
ΔP_S	0.69	1.00								
B_C	−0.49	−0.40	1.00							
B_S	−0.34	−0.63	0.70	1.00						
$Y_C(F)$	−0.64	−0.41	0.32	0.08	1.00					
$Y_S(F)$	−0.33	−0.24	0.14	0.12	0.43	1.00				
$Y_C(C)$	−0.78	−0.50	0.41	0.17	0.82	0.56	1.00			
$Y_S(C)$	−0.42	−0.43	0.17	0.23	0.49	0.82	0.60	1.00		
$Y_C(S)$	−0.79	−0.52	0.35	0.18	0.78	0.45	0.94	0.49	1.00	
$Y_S(S)$	−0.64	−0.69	0.22	0.35	0.56	0.66	0.71	0.83	0.69	1.00

Table A2. Correlation Matrix of Variables Used in Simulations for a Representative Farm of Kansas

	ΔP_C	ΔP_W	B_C	B_W	$Y_C(F)$	$Y_W(F)$	$Y_C(C)$	$Y_W(C)$	$Y_C(S)$	$Y_W(S)$
ΔP_C	1.00									
ΔP_W	0.41	1.00								
B_C	−0.42	0.31	1.00							
B_W	0.00	−0.18	0.01	1.00						
$Y_C(F)$	−0.22	−0.20	−0.13	−0.16	1.00					
$Y_W(F)$	−0.03	−0.29	−0.13	−0.28	0.15	1.00				
$Y_C(C)$	−0.29	−0.32	−0.14	−0.10	0.81	0.32	1.00			
$Y_W(C)$	−0.09	−0.29	−0.06	−0.38	0.22	0.80	0.35	1.00		
$Y_C(S)$	−0.50	−0.19	0.00	0.03	0.54	0.07	0.72	0.14	1.00	
$Y_W(S)$	−0.09	−0.51	0.03	−0.26	0.11	0.56	0.25	0.67	0.05	1.00

Table A3. Correlation Matrix of Variables Used in Simulations for a Representative Farm of North Dakota

	ΔP_C	ΔP_W	B_C	B_W	$Y_C(F)$	$Y_W(F)$	$Y_C(C)$	$Y_W(C)$	$Y_C(S)$	$Y_W(S)$
ΔP_C	1.00									
ΔP_W	0.59	1.00								
B_C	−0.47	−0.28	1.00							
B_W	−0.06	−0.54	0.19	1.00						
$Y_C(F)$	−0.23	0.16	−0.08	−0.50	1.00					
$Y_W(F)$	−0.43	−0.45	0.34	0.03	0.03	1.00				
$Y_C(C)$	−0.21	0.12	−0.16	−0.28	0.83	−0.06	1.00			
$Y_W(C)$	−0.53	−0.45	0.49	0.06	0.07	0.83	0.03	1.00		
$Y_C(S)$	−0.34	−0.03	−0.10	−0.21	0.69	−0.03	0.92	0.08	1.00	
$Y_W(S)$	−0.63	−0.42	0.39	0.10	0.01	0.66	0.02	0.86	0.08	1.00

Table A4. Correlation Matrix of Variables Used in Simulations for a Representative Farm of Mississippi

	ΔP_C	ΔP_{CT}	ΔP_S	B_C	B_{CT}	B_S	$Y_C(F)$	$Y_{CT}(F)$	$Y_S(F)$	$Y_C(C)$	$Y_{CT}(C)$	$Y_S(C)$	$Y_C(S)$	$Y_{CT}(S)$	$Y_S(S)$
ΔP_C	1.00														
ΔP_{CT}	0.37	1.00													
ΔP_S	0.69	0.62	1.00												
B_C	−0.43	−0.23	−0.47	1.00											
B_{CT}	−0.33	−0.50	−0.41	0.37	1.00										
B_S	−0.32	−0.34	−0.66	0.26	0.24	1.00									
$Y_C(F)$	−0.02	−0.07	0.18	−0.24	−0.09	−0.11	1.00								
$Y_{CT}(F)$	0.08	−0.03	0.07	0.29	0.19	0.06	0.04	1.00							
$Y_S(F)$	−0.27	−0.22	−0.11	0.24	0.30	−0.05	−0.11	0.05	1.00						
$Y_C(C)$	−0.22	−0.16	0.07	−0.11	−0.14	−0.02	0.82	0.17	−0.09	1.00					
$Y_{CT}(C)$	−0.14	−0.28	−0.13	0.54	0.31	0.11	0.14	0.81	0.28	0.22	1.00				
$Y_S(C)$	−0.33	−0.35	−0.13	0.37	0.36	−0.07	−0.07	0.37	0.81	0.05	0.56	1.00			
$Y_C(S)$	−0.36	−0.23	−0.01	0.30	0.05	−0.09	0.44	0.02	0.24	0.64	0.28	0.38	1.00		
$Y_{CT}(S)$	−0.19	−0.25	−0.19	0.63	0.31	0.13	0.20	0.68	0.35	0.22	0.92	0.59	0.39	1.00	
$Y_S(S)$	−0.40	−0.28	−0.06	0.36	0.25	−0.18	0.05	0.16	0.76	0.16	0.43	0.90	0.56	0.54	1.00

Table A5. SURE Program Effects on Optimal Crop Insurance Coverage Levels with Farm-County Yield Correlations at 0.85 (base case scenario), 0.50, and 0.25 Levels

	IL				KS				MS				ND			
	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE
Correlation = 0.85																
CL50	782,502	782,536	809,330	809,333	552,260	555,149	564,094	565,386	725,843	725,987	702,896	702,944	503,510	505,435	525,994	526,592
CL55	783,528	783,573	810,228	810,233	561,661	565,352	573,518	575,282	733,642	733,861	710,298	710,382	511,812	514,128	533,962	534,788
CL60	785,401	785,453	811,907	811,914	571,772	576,197	583,651	585,908	742,673	742,974	718,909	719,037	520,689	523,317	542,538	543,579
CL65	788,504	788,557	814,729	814,737	582,550	587,601	594,456	597,185	752,962	753,341	728,783	728,953	530,154	533,005	551,725	552,944
CL70	793,428	793,480	819,258	819,267	593,966	599,520	605,906	609,057	764,482	764,935	739,880	740,093	540,159	543,157	561,471	562,834
CL75	800,233	800,282	825,542	825,551	603,159	609,124	615,183	618,717	774,425	774,948	749,467	749,725	548,120	551,213	569,268	570,749
CL80	807,132	807,174	831,850	831,857	**605,129**	**610,523**	**617,414**	**620,516**	**777,651**	**778,029**	**752,493**	**752,680**	**549,486**	**552,168**	**570,596**	**571,833**
CL85	**810,471**	**810,497**	**834,607**	**834,610**	596,137	599,616	608,894	610,536	770,038	770,111	744,856	744,897	540,876	542,462	562,130	562,712
Correlation = 0.50																
CL50	784,938	785,006	811,986	811,991	548,851	554,441	564,416	566,826	734,292	734,381	709,683	709,729	501,562	504,874	521,468	522,786
CL55	786,266	786,350	813,127	813,136	558,356	565,019	573,697	576,850	741,767	741,911	716,951	717,030	509,964	513,864	529,609	531,359
CL60	788,566	788,660	815,156	815,169	568,649	576,229	583,784	587,644	750,434	750,636	725,402	725,520	519,029	523,367	538,436	540,564
CL65	792,293	792,388	818,496	818,512	579,705	588,031	594,650	599,150	760,299	760,561	735,044	735,203	528,690	533,327	547,892	550,333
CL70	798,044	798,136	823,737	823,754	591,424	600,341	606,203	611,272	771,375	771,695	745,909	746,109	538,874	543,701	557,880	560,565
CL75	805,510	805,599	830,613	830,631	600,874	610,271	615,547	621,121	780,765	781,141	755,150	755,392	546,973	551,923	565,865	568,743
CL80	812,442	812,516	836,948	836,961	**602,896**	**611,512**	**617,645**	**622,632**	**783,262**	**783,537**	**757,648**	**757,827**	**548,366**	**552,750**	**567,308**	**569,803**
CL85	**814,914**	**814,959**	**838,905**	**838,909**	593,772	599,701	608,809	611,688	774,786	774,841	749,365	749,403	539,639	542,465	558,857	560,225
Correlation = 0.25																
CL50	785,441	785,598	812,488	812,503	547,237	553,349	563,153	565,995	734,713	734,823	706,786	706,886	498,383	502,541	516,011	517,976
CL55	787,235	787,423	814,030	814,050	556,587	563,830	572,271	575,914	742,450	742,624	714,421	714,582	507,054	511,930	524,495	527,013
CL60	790,166	790,368	816,610	816,637	566,777	574,962	582,241	586,641	751,384	751,628	723,257	723,482	516,379	521,796	533,640	536,639
CL65	794,660	794,860	820,648	820,679	577,775	586,700	593,036	598,092	761,510	761,824	733,288	733,581	526,283	532,081	543,398	546,789
CL70	801,185	801,380	826,618	826,651	589,511	599,006	604,583	610,199	772,824	773,206	744,516	744,874	536,744	542,793	553,735	557,440
CL75	809,218	809,409	834,058	834,093	598,994	608,936	613,950	620,045	782,404	782,850	754,067	754,488	545,081	551,292	562,010	565,964
CL80	816,238	816,397	840,520	840,544	**601035**	**610133**	**616029**	**621,467**	**785,026**	**785,347**	**756,806**	**757,118**	**546,661**	**552,194**	**563,715**	**567,165**
CL85	**818,227**	**818,317**	**842,045**	**842,052**	591,887	598,156	607,126	610,294	776,626	776,691	748,696	748,767	538,067	541,693	555,478	557,418

Notes: Values are certainty equivalents measured in U.S. dollars. Bold figures are the maximum values.

Table A6. SURE Program Effects on Optimal Crop Insurance Coverage Levels with Loads at 35%, 25% (base case scenario), and 10% Levels

	IL				KS				MS				ND			
	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE
Load = 1.35																
CL50	782,493	782,526	809,321	809,324	551,805	554,697	563,647	564,940	725,397	725,541	702,462	702,510	503,073	504,999	525,567	526,165
CL55	783,503	783,547	810,203	810,207	561,050	564,744	572,918	574,684	733,048	733,268	709,714	709,799	511,235	513,553	533,397	534,225
CL60	785,345	785,397	811,852	811,859	570,978	575,408	582,871	585,130	741,902	742,203	718,156	718,284	519,950	522,581	541,814	542,856
CL65	788,393	788,446	814,619	814,628	581,547	586,604	593,475	596,207	751,983	752,362	727,822	727,992	529,229	532,083	550,814	552,034
CL70	793,226	793,277	819,058	819,067	592,727	598,288	604,689	607,844	763,261	763,715	738,684	738,896	539,023	542,024	560,356	561,721
CL75	799,829	799,878	825,143	825,153	601,433	607,407	613,488	617,027	772,704	773,228	747,779	748,036	546,542	**549,639**	567,717	569,200
CL80	806,213	806,255	830,940	830,947	**602,262**	**607,667**	**614,608**	**617,715**	**774,761**	**775,139**	**749,652**	**749,839**	**546,872**	549,558	**568,031**	**569,271**
CL85	**808,376**	**808,402**	**832,523**	**832,525**	591,170	594,664	604,024	605,671	764,976	765,050	739,866	739,906	536,358	537,948	557,682	558,266
Load = 1.25																
CL50	782,502	782,536	809,330	809,333	552,260	555,149	564,094	565,386	725,843	725,987	702,896	702,944	503,510	505,435	525,994	526,592
CL55	783,528	783,573	810,228	810,233	561,661	565,352	573,518	575,282	733,642	733,861	710,298	710,382	511,812	514,128	533,962	534,788
CL60	785,401	785,453	811,907	811,914	571,772	576,197	583,651	585,908	742,673	742,974	718,909	719,037	520,689	523,317	542,538	543,579
CL65	788,504	788,557	814,729	814,737	582,550	587,601	594,456	597,185	752,962	753,341	728,783	728,953	530,154	533,005	551,725	552,944
CL70	793,428	793,480	819,258	819,267	593,966	599,520	605,906	609,057	764,482	764,935	739,880	740,093	540,159	543,157	561,471	562,834
CL75	800,233	800,282	825,542	825,551	603,159	609,124	615,183	618,717	774,425	774,948	749,467	749,725	548,120	551,213	569,268	570,749
CL80	807,132	807,174	831,850	831,857	**605,129**	**610,523**	**617,414**	**620,516**	**777,651**	**778,029**	**752,493**	**752,680**	**549,486**	**552,168**	**570,596**	**571,833**
CL85	**810,471**	**810,497**	**834,607**	**834,610**	596,137	599,616	608,894	610,536	770,038	770,111	744,856	744,897	540,876	542,462	562,130	562,712
Load = 1.10																
CL50	782,516	782,549	809,344	809,347	552,943	555,829	564,765	566,055	726,513	726,657	703,549	703,596	504,166	506,088	526,638	527,235
CL55	783,566	783,610	810,265	810,269	562,578	566,264	574,420	576,182	734,533	734,752	711,168	711,252	512,677	514,990	534,810	535,635
CL60	785,485	785,538	811,991	811,998	572,963	577,381	584,823	587,077	743,829	744,130	720,040	720,168	521,797	524,421	543,624	544,663
CL65	788,670	788,723	814,892	814,900	584,054	589,096	595,930	598,655	754,431	754,810	730,219	730,389	531,542	534,389	553,085	554,302
CL70	793,732	793,784	819,558	819,567	595,823	601,367	607,727	610,872	766,313	766,766	741,679	741,891	541,863	544,856	563,146	564,507
CL75	800,838	800,887	826,140	826,150	605,747	611,700	617,724	621,251	777,005	777,528	752,001	752,258	550,485	553,573	571,580	573,058
CL80	808,511	808,553	833,219	833,226	**609,428**	**614,804**	**621,628**	**624,720**	**781,986**	**782,363**	**756,751**	**756,938**	**553,405**	**556,080**	**574,448**	**575,682**
CL85	**813,614**	**813,640**	**837,734**	**837,736**	603,580	607,038	616,200	617,832	777,627	777,700	752,334	752,374	547,650	549,228	568,797	569,375

Notes: Values are certainty equivalents measured in U.S. dollars. Bold figures are the maximum values.

Table A7. SURE Program Effects on Optimal Crop Insurance Coverage Levels with Risk Aversion at 1, 2 (base case scenario), and 4 Levels

	IL				KS				MS				ND			
	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE	PSSP w/o SURE	PSSP with SURE	ACRE w/o SURE	ACRE with SURE
Risk Aversion Coefficient = 1																
CL50	792,145	792,169	817,271	817,274	579,637	581,422	590,160	590,941	744,090	744,182	718,657	718,688	523,575	524,807	544,246	544,613
CL55	792,930	792,964	818,003	818,007	586,843	589,247	597,386	598,519	750,607	750,756	725,018	725,075	530,120	531,679	550,643	551,179
CL60	794,418	794,459	819,407	819,413	594,874	597,893	605,437	606,963	758,304	758,519	732,545	732,636	537,361	539,215	557,751	558,461
CL65	796,967	797,011	821,831	821,839	603,705	607,297	614,299	616,231	767,240	767,523	741,314	741,441	545,314	547,416	565,583	566,454
CL70	801,149	801,193	825,833	825,842	613,322	617,421	623,956	626,281	777,420	777,772	751,318	751,483	553,951	556,255	574,103	575,122
CL75	807,035	807,080	831,481	831,491	620,940	625,488	631,660	634,362	786,093	786,515	759,868	760,076	560,732	563,201	580,851	582,002
CL80	812,932	812,972	837,118	837,125	**621,629**	**625,811**	**632,610**	**635,023**	**788,182**	**788,494**	**761,963**	**762,117**	**561,163**	**563,353**	**581,358**	**582,341**
CL85	**815,296**	**815,321**	**839,247**	**839,250**	611,672	614,337	623,110	624,369	779,590	779,652	753,520	753,554	551,870	553,160	572,312	572,766
Risk Aversion Coefficient = 2																
CL50	782,502	782,536	809,330	809,333	552,260	555,149	564,094	565,386	725,843	725,987	702,896	702,944	503,510	505,435	525,994	526,592
CL55	783,528	783,573	810,228	810,233	561,661	565,352	573,518	575,282	733,642	733,861	710,298	710,382	511,812	514,128	533,962	534,788
CL60	785,401	785,453	811,907	811,914	571,772	576,197	583,651	585,908	742,673	742,974	718,909	719,037	520,689	523,317	542,538	543,579
CL65	788,504	788,557	814,729	814,737	582,550	587,601	594,456	597,185	752,962	753,341	728,783	728,953	530,154	533,005	551,725	552,944
CL70	793,428	793,480	819,258	819,267	593,966	599,520	605,906	609,057	764,482	764,935	739,880	740,093	540,159	543,157	561,471	562,834
CL75	800,233	800,282	825,542	825,551	603,159	609,124	615,183	618,717	774,425	774,948	749,467	749,725	548,120	551,213	569,268	570,749
CL80	807,132	807,174	831,850	831,857	**605,129**	**610,523**	**617,414**	**620,516**	**777,651**	**778,029**	**752,493**	**752,680**	**549,486**	**552,168**	**570,596**	**571,833**
CL85	**810,471**	**810,497**	**834,607**	**834,610**	596,137	599,616	608,894	610,536	770,038	770,111	744,856	744,897	540,876	542,462	562,130	562,712
Risk Aversion Coefficient = 4																
CL50	763,578	763,640	793,649	793,653	503,343	509,326	517,137	519,951	691,284	691,593	673,513	673,618	466,767	470,639	491,559	492,899
CL55	765,200	765,277	794,936	794,943	517,021	524,112	530,950	534,466	701,833	702,256	683,060	683,228	478,502	482,824	502,718	504,417
CL60	767,975	768,057	797,238	797,247	530,993	538,962	545,048	549,216	713,635	714,165	693,846	694,078	490,457	495,035	514,167	516,146
CL65	772,314	772,389	800,918	800,927	545,255	553,833	559,410	564,119	726,651	727,269	705,884	706,167	502,694	507,336	525,932	528,080
CL70	778,821	778,887	806,548	806,557	559,799	568,731	574,041	579,155	740,802	741,490	719,079	719,406	515,141	519,710	537,940	540,173
CL75	787,501	787,558	814,121	814,131	571,665	580,797	586,043	591,472	753,186	753,936	730,617	730,987	525,160	529,591	547,626	549,897
CL80	796,371	796,417	821,756	821,763	**575,765**	**583,836**	**590,447**	**595,100**	**758,577**	**759,094**	**735,378**	**735,636**	**528,123**	**531,826**	**550,393**	**552,233**
CL85	**801,567**	**801,594**	**825,731**	**825,733**	568,314	573,680	583,545	586,105	752,812	752,909	729,232	729,287	520,636	522,855	542,894	543,797

Notes: Values are certainty equivalents measured in U.S. dollars. Bold/underline figures are the maximum values.