How Would Farm Managers Respond to a Limit on Crop Insurance Premium Subsidies?

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The 2014 Farm Bill has made crop insurance the foundation of farm risk management. Over the last twenty years, the total liability of the Federal crop insurance program has increased from $13.6 billion in 1994 to $123.5 billion in 2013 as the insured acres have increased from 99.6 million to 295.7 million over the same period. As a result of the increased adoption of insurance products, crop insurance is now a larger share of farm related farm bill spending compared to commodity programs. Crop insurance spending is projected at 9.4% of the total farm bill spending versus commodity programs spending budgeted at 4.6% of the total farm bill spending. The January 2014 congressional budget office (CBO) cost estimate of the 2014 Farm Bill projects crop insurance spending to increase by $5.72 billion over the 2014-2023 fiscal years.

The increase in spending for crop insurance becomes a political target to those who want to reduce spending or reallocate funds to different programs. Proposed amendments to the 2014 Farm Bill during the legislative process called for premium subsidy limits at $40,000 per farm per year but were defeated. The effort to limit the amount of crop insurance subsidy continues even after passage of the 2014 Farm Bill. For example, Senators Shaheen and Coburn have introduced legislation that would cap federal crop insurance premium subsidies to $70,000 per farm per year.

The proposed subsidy limits will not affect every farm but will have the greatest impact on the large-scale farms which produce the greatest share of total commodity production. The impact of a subsidy limit will depend upon the farm's level of production risk, the value of the insured crop, and the number of insured crops. A lower risk farm, like an Illinois corn-soybean farm, is expected to hit the subsidy constraint at a larger farm size than a more diversified farm like a farm in the Mississippi Delta. The unintended consequence of this proposal may be that the impact of limiting crop insurance premiums subsidies may be greater for those farms that have greater need for crop insurance, like a Mississippi farm, as compared to a lower risk farm in Illinois.

The 2014 Farm Bill also continues to limit farm program payments (Title I) to $125,000 per person with a separate limit of $125,000 for peanuts. This payment limit applies to the Agricultural Risk Coverage (ARC) and the Price Loss Coverage (PLC) farm programs as well as any marketing loan gains/marketing loan deficiency payments (LDP). When the 2014 Farm Bill was drafted, lower commodity prices were not considered to be a likely outcome and there was little discussion on the impact of Title I payment limits on managerial decisions. With grain and oilseed stocks projected to increase both domestically and globally, lower commodity prices triggering maximum ARC payments and large PLC payments may become a reality. Given the current price outlook, it is more likely that some farms will be constrained by payment limits.

How might farms that would be constrained by the subsidy limit or payment limit adjust their risk management plans? One alternative would be to adjust the crop insurance coverage level purchased as the subsidy percentage varies with the coverage level. Another alternative for those eligible to purchase Supplemental Coverage Option (SCO) insurance would be to change the underlying products coverage level and purchase SCO as a way to shift risk from the underlying farm-level product to the area-level insurance product. Another alternative may be to adjust the crop-mix to increase the production of lower liability crops that would have lower levels of insurance subsidies. Another alternative would be to not purchase crop insurance on a proportion of the acreage and only insure the most risky fields.

This paper will evaluate the impact of crop insurance subsidy limits and farm program payment limits for an Illinois corn-soybean farm and a Mississippi corn-soybean-rice and cotton farm. The optimal portfolio of insurance coverage and farm program participation will be determined for a 2,500 acre; 5,000 acre; and 10,000 acre farm for both locations.

Overview of the Agricultural Act of 2014

Title I Commodity Programs

The 2014 farm bill's commodity programs are designed to interact with crop insurance. It is envisioned that farm managers will purchase crop insurance to best cover the yield or revenue risk coupled with the policy tools available in Title I to provide payments for losses that are not significant enough to trigger a crop insurance indemnity.

The farm bill has two different tools for the farm safety-net. A reference price program, called the Price Loss Coverage (PLC) program, would provide protection when the U.S. marketing-year average price is below a reference price. The motivation for this program is that a reference price program may provide better risk protection during periods of sustained low prices. The reference price is defined in legislation at $3.70 per bushel for corn; $8.40 per bushel for soybeans; and $14 per hundredweight for rice. Producers would receive a PLC payment on eighty-five percent of their base acres per their payment yield. Producers have the option of buying crop insurance but it is not required to participate in the PLC program (HR 2642).

The alternative Title I policy is called the Agricultural Risk Coverage (ARC) program (HR 2642). This program is commonly called a "shallow-loss" program where payments would be triggered after a "small" deviation below historic revenue. Farm managers have the choice of participating in either an individual (farm) level or an area (county) level program. For this paper, only ARC at the area level is analyzed.

The ARC program guarantees revenue based on the product of Olympic average county yield and Olympic average U.S. marketing-year average price. The use of Olympic averages provides some protection against multiple years of low commodity prices as the effect of lower prices will reduce the revenue guarantee gradually over time. Conversely, ARC support levels will only rise slowly should market prices jump as has been observed in the recent past.

An ARC payment is made whenever the actual revenue is less than the guaranteed revenue. Payments are made on 85 percent of base acres for the area coverage option. The ARC payment rate is capped at 10 percent of the benchmark revenue. This means that the maximum ARC payment rate is 8.5 percent of the benchmark revenue for the area coverage (HR 2642).

Both the PLC and ARC programs are administered by the Farm Service Agency (FSA) and would have no direct cost to producers for participation in the programs.

Title XI Crop Insurance Programs

The crop insurance title includes a new crop insurance product called the Supplemental Coverage Option (SCO). The SCO program is innovative as it would allow managers to couple their farm-level revenue or yield insurance product with an area product as a wrap to cover losses at the area level that would otherwise not trigger a payment for the underlying product. The SCO insurance policy is designed to insure a portion of the deductible of the underlying crop insurance product. SCO has a 14 percent deductible but then covers revenue or yield, at an area level, from 86 percent to the coverage level of the underlying insurance product. SCO is only available to those who choose the PLC program (HR 2642).

Since SCO is an insurance product, it will be administered by the Risk Management Agency (RMA). Producers will receive a 65 percent subsidy on the premium and a 100 percent subsidy on the Administrative and Overhead expense (A&O). Producers are required to have an underlying insurance product before purchasing SCO (HR 2642).

The crop insurance title also includes a new crop insurance product only available to cotton producers called the Stacked Income Protection Plan (STAX). STAX is similar to SCO as it is consistent with a GRIP insurance policy. STAX, however, producers may elect a protection factor of up to 120 percent which allows producers to increase their protection above the expected county revenue. STAX allows producers to protect against losses at the area level with a product capped at 70 percent of expected county revenue. A STAX payment is triggered after a 10 percent loss at the county-level. Once a loss is triggered, a STAX payment is paid up to the coverage level chosen. Like SCO, STAX can be coupled with an underling individual or area product. However, producers do not have to purchase insurance as a requirement for purchasing STAX. The only requirement is that STAX coverage can't exceed the deductible of the underlying product to avoid double-payments for the same loss (HR 2642).

STAX will also be administered by the Risk Management Agency (RMA) with a premium subsidy of 80 percent and a 100 percent subsidy on A&O. Since STAX is only available to cotton, cotton producers are not eligible to participate in ARC or PLC (HR 2642).

Revenue Protection (RP) Crop Insurance

The risk-management foundation in the Farm Bill is the crop insurance program. For this paper, only the revenue protection (RP) product is analyzed. Revenue protection insurance provides protection against yield risk, price risk or both lower yields and prices. Revenue protection is based on a farm's Actual Production History (APH) yield which is the average of a minimum of four and maximum of 10 consecutive years of farm-level yields. The prices used to determine the revenue guarantees and if an indemnity is paid are from the futures market. RP insurance uses the futures market to determine a projected price before planting to provide a minimum revenue guarantee for the producer. The futures price just before harvest is also used to increase the revenue protection of the crop if the harvest price is greater than the projected price. Insuring at a higher harvest-time price would allow a farmer to forward contract a percentage of production without fear of having to buy more expensive bushels at harvest if there is a production loss. The harvest price is also used to determine if there is a loss and if an indemnity is paid. An indemnity is triggered whenever actual revenue is less than the guaranteed revenue.

Description of Stochastic Simulation Model

A stochastic simulation generates correlated distributions of farm-level and county-level yields; revenue protection (RP) crop insurance projected and harvest prices; and the U.S. marketing-year average prices. These distributions are used to generate distributions of the indemnities for RP crop insurance at the 55% to 85% coverage levels and for SCO insurance for the 55% to 85% coverage levels for the various crops and locations. The crop insurance and SCO premiums will be based on an actuarially fair premium based on 10,000 iterations from the stochastic simulation model. A twenty percent load will be added to the actuarially fair premium with the subsidy percentage used to determine the farmer's share of the premium. The simulation model will value the harvested crop at the U.S. marketing-year average price which assumes no other price risk management is used and the farmer has average marketing skills.

A stochastic simulation model of the return over variable costs including insurance premium is developed for an Illinois corn-soybean farm and a Mississippi rice-cotton farm. This model is used to simulate farm yield, county yield, projected price and harvest price for RP insurance, and marketing-year average price for each crop. Yield and price distributions are used to generate distributions of crop revenue, RP crop insurance indemnities, PLC program payments, ARC program payments for area coverage, and SCO payments for corn, soybeans and rice. The stochastic cotton county yields, farm yields, crop insurance prices and marketing-year average prices are used to generate distributions of cotton revenue, RP insurance indemnities, STAX program payments, and STAX program payments combined with crop insurance.

To simulate yields, county yields for McLean County, Illinois and Bolivar County, Mississippi from 1996 through 2013 were de-trended using OLS regression. To derive a proxy for a farm-level yield series, error terms from the regression were multiplied by an expansion factor, resulting in a series with essentially the same mean but greater standard deviation than the original detrended county data. This empirical data was used to define parameters of beta distributions (one for county and one for farm yield) that were used in the stochastic simulation. A county/farm correlation coefficient (ρ_{fc}) of 0.45 was exogenously imposed.

To simulate prices, for each year of the data[1], the ratio of the projected price to the harvest price and the marketing year average price was calculated. Projected prices were simulated assuming a lognormal distribution, with parameters estimated from the raw data. Price ratios were also simulated from lognormal distributions and used to calculate, for each simulated projected price outcome, a corresponding harvest price and MYA outcome. Simulated price and yield outcomes were correlated using a modification of the procedure described by Anderson, Harri, and Coble (2009).[2] For each crop/county combination, a set of 10,000 yields and prices were simulated.

The farmer's cost of the risk management product is included in the return over variable costs calculation. The PLC and ARC programs will be administered by FSA and will not have a direct cost paid by the farmer. In contrast, SCO and STAX are administered through RMA and

[1] For all states/crops, price data was available through 2013; however, the beginning year was determined by the availability of reported RP projected prices. For Illinois, corn and soybean price data started in 1996. For Mississippi, corn, soybean, rice, and cotton price data started in 1998, 1997, 1999, and 1997, respectively.

[2] The modification to the procedure used by Anderson, Harri, and Coble was to substitute a Cholesky decomposition of the rank correlation matrix for the Eigen decomposition described in their work. This made it possible to implement the procedure in a spreadsheet environment.

producers will pay 35 percent of the insurance premium with RMA subsidizing 65 percent of the premium and 100 percent of the overhead cost. STAX is also administered by RMA and producers will pay 20 percent of the insurance premium with RMA subsidizing 80 percent of the premium and 100 percent of the overhead costs. The distributions of RP, SCO, and STAX insurance payments were used in calculating the actuarially fair insurance premium based on the 10,000 iterations simulated in this study. Because the model lacks farm-level data, the actuarially fair premiums for some risk alternatives are zero whenever zero indemnities are triggered. Therefore, this study assumes that farmers will pay a share of the A&O expense of the crop insurance products to keep RP, SCO and STAX from becoming zero-cost programs in the model. The A&O expense used in this study is the average of RMA's per acre insured cost of administrative expense reimbursement, other program fund costs, and other administrative and operative fund costs from 2003-2012 (USDA-RMA). This average cost is $6.04 per acre insured and is applied to all of the insurance products – RP insurance, SCO, SCO and STAX. The farmer's share of the premium is calculated as the actuarially fair premium plus the A&O expense less the insurance subsidy.

The return over variable costs and insurance costs are calculated using enterprise budgets for 2014 developed by the University of Illinois and Mississippi State University for the McLean County Illinois farm and Bolivar County Mississippi farm, respectively. Using a return over variable costs (including insurance) is important as the optimization model is used to determine the optimal crop mix.

The distribution of returns for the various policy alternatives (PLC / ARC for corn, soybeans and rice); crop insurance coverage levels (55% to 85%); and supplemental crop insurance (STAX for cotton; SCO for corn, soybeans and rice) are used as inputs into a mathematical programming portfolio model. The preliminary focus of this paper assumes risk neutrality so only the expected values of these distributions are used in the model to maximize expected returns. Constraints were used to define the crop-mix and a constraint requiring all acres allocated to a policy/insurance product. Additional constraints were used to limit the farm program payments and the amount of crop insurance subsidy provided to the farm. Four scenarios were solved by the optimization model as defined by Table 1.

Scenario 1 assumes that farm program payments are not constrained. Scenario 2 assumes that farm program payments are constrained at $125,000 but the insurance subsidies are not constrained. Scenario 3 assumes that insurance subsidies are constrained at $40,000 but farm program payments are not constrained. Scenario 4 assumes that both the farm program payments and crop insurance subsidies are constrained (Table 1).

The optimization model includes the alternatives to not purchase crop insurance but participate in ARC or PLC. The option to participate in crop insurance but not the farm programs are also alternatives in the model. There is also a “do-nothing” alternative where the farmer does not use crop insurance or enroll in farm programs.

Results

Illinois Corn-Soybean Farm

The 2,500 acre corn-soybean farm in Illinois was not constrained by a limitation on farm program payments (Table 2). However, the optimal portfolio for the no limitations scenario (scenario 1) would result in a portfolio that would use $47,172 in crop insurance subsidies. When a constraint on the insurance subsidy was imposed (Scenario 3) then the optimal risk management and farm policy choice for corn would be to reduce the RP insurance coverage level on over 50% of the corn acreage from 85% coverage to 75% coverage and to enroll in ARC for both RP coverage levels. Imposing the constraint on crop insurance reduces the portfolio's return over variable costs by $3,425 or about $1.37 per planted acre (Table 2).

The optimal farm policy and crop insurance choice for soybeans for the 2,500 acre farm is to enroll in ARC and to purchase RP insurance at the 85% coverage level. This optimal policy is not affected by the crop insurance subsidy constraint (Table 2).

The 5,000 acre McLean County Illinois farm had a similar change in optimal farm policy and crop insurance portfolio in response to imposing constraints on either farm program payments or crop insurance subsidies. Under the unconstrained scenario (Scenario 1), the optimal policy would be to purchase RP insurance at the highest coverage level and enroll in ARC for both corn and soybeans. This would result in receiving over $141,600 in ARC payments and over $94,000 in crop insurance subsidies (Table 3). When a constraint on farm program payments is imposed (Scenario 2), the risk neutral farmer would reduce the corn RP coverage level from 85% coverage to 75% coverage on 45 percent of the corn acres and to switch from ARC to PLC plus SCO on 45 percent of the corn acres (Table 3). Alternatively, when the crop insurance subsidy constraint is imposed (Scenario 3), the optimal solution is to reduce insurance coverage to 75% coverage on 51 percent of the corn acres and to not use RP insurance at all on 49 percent of the corn acres. The ARC program is used for both corn and soybeans under Scenario 3. When both farm program and crop insurance limits are imposed (Scenario4), the optimal policy is to purchase RP insurance at the 75% coverage level on 52 percent of the corn crop and to enroll in ARC. Another 46 percent of the corn acres are not insured but are enrolled in the PLC program. In addition, 2 percent of the corn acres are not insured but are enrolled in ARC. The optimal farm policy and crop insurance policy for soybeans do not change when payment limitations are imposed. The optimal policies for soybeans are to purchase RP insurance at the 85% coverage level and to enroll in ARC for all Scenarios (Table 3).

Imposing the constraint on farm program payments (Scenario 2) for the 5,000 acre farm reduces the portfolio's return by $5,892 or by about $1.18 per planted acre (Table 3). Imposing a constraint on the insurance subsidy but leaving the farm program unconstrained (Scenario 3) reduces the portfolio's return by $29,154 or $5.83 per planted acre. When both constraints are imposed (Scenario 4), the portfolio's return is reduced by $45,756 from the return of an unconstrained portfolio (Table 3).

When farm program payment limitations (Scenario 2) are imposed on a 10,000 acre Illinois corn-soybean farm, the crop insurance response is to reduce corn coverage from 85% coverage to 75% coverage on 96 percent of the corn acres and to switch from ARC to PLC plus SCO (Table 4). The remaining corn acres are insured at the 85% coverage level but are not enrolled in any farm program. The farm program payment limitation (Scenario 2) switches soybeans from the ARC program to the alternative of not participating in the Title I farm programs (Table 4). The portfolio's return under Scenario 2 is $5,892 less than the portfolio return for Scenario 1 (Table 4).

When crop insurance subsidy limits are imposed (Scenario 3), 82 percent of the corn crop drops all insurance coverage and only participates in ARC. The remaining corn acres are covered by RP insurance at the 75% level and by ARC. The constraint on insurance subsidies does not change the optimal farm policy/insurance choice for soybeans which is to participate in ARC and buy RP at the 85% coverage level (Table 4). The constraint on insurance subsidies (Scenario 3) reduces the portfolio's return by $29,154 as compared to the return from the unconstrained Scenario 1 (Table 4).

When both payment and subsidy limits are imposed (Scenario 4) on the 10,000 acre farm, about 16 percent of the corn acres are insured at the 75% coverage level and participate in PLC. Another 80 percent of the corn acres are enrolled in PLC without RP insurance. The remaining 4 percent of the corn acres are not enrolled in any farm program and do not use crop insurance (Table 4). Imposing a constraint on farm program payments and crop insurance subsidies (Scenario 4) changes the optimal alternative for soybeans to only using RP insurance at the 85% level with no farm program participation (Table 4). The portfolio's return under Scenario 4 is $45,756 less than the return from Scenario 1.

An alternative to making broad changes in insurance coverage or choice of farm program is to change the crop rotation from a 50% corn – 50% soybean rotation to a rotation with a greater percentage of soybeans. The expected program payments under ARC or PLC are lower for soybeans than for corn. In addition, the actuarially fair crop insurance premiums for soybeans are less than those for corn which reduces the impact of the constraint on insurance subsidies.

<u>Mississippi Corn-Soybean-Rice-Cotton Farm</u>

The Mississippi farm was assumed to plant 5% of the acreage to rice with the remaining 95% planted in equal shares to corn, soybean and cotton. The rice constraint was imposed to reflect that specific infrastructure is required to support rice production that may not be available on all acres. If the constraint on rice was not imposed, all acreage would be planted to rice regardless of farm-size.

The 2,500 acre farms did not trigger a farm program payment limitation due to the constraint on rice acres (Table 5). Without a limit on crop insurance subsidies (Scenario 1), the optimal policy and insurance portfolio is to insure corn and soybeans at the 85% coverage level and participate in ARC; couple STAX and RP insurance at the 55% level for cotton; and to insure rice with RP at the 85% coverage level and participate in PLC. This portfolio has insurance subsidies in excess of $91,600.

When the crop insurance subsidy is imposed (Scenario 3), the optimal policy and insurance portfolio is to not use RP insurance on any of the corn acres; to use STAX without insurance on 70 percent of the cotton acres and to not use any policy or risk management tools on the remaining 30 percent of the cotton acres; to not purchase insurance for rice and only use PLC; and to not use insurance for soybeans and to only participate in ARC. The portfolio's return over variable cost is $23,956 less than the unconstrained portfolio (Scenario 1) which amounts to a lower return over variable costs of $9.56 per planted acre (Table 5).

The 5,000 acre farm has a similar portfolio response as the 2,500 acre farm (Table 6). Under the unlimited constraints scenario (Scenario 1), the same farm policy and insurance products are used as in the 2,500 acre. Again, the farm program payment limit is not binding but the crop insurance limit would be binding as the insurance subsidies for Scenario 1 would exceed $183,000. When the crop insurance subsidy limit is imposed (Scenario 3), the optimal portfolio is the same as the 2,500 acre farm. The optimal crop insurance response is to not use crop insurance for corn, soybeans and rice and to only use insurance on 35 percent of the cotton acreage. Risk protection is only provided by the farm programs (ARC for corn and soybeans and PLC for rice). The crop insurance constraint (Scenario 3) would reduce the portfolio's return over variable costs by $76,799 which is a reduction of $15.36 per planted acre (Table 6).

The optimal policy and insurance portfolio for the 10,000 acre Mississippi farm (Table 7) is the same products and farm policies as in the 2,500 acre and 5,000 acre farm under the no constraints scenario (Scenario 1). The portfolio's return for Scenario 1 is $2.39 million. The total farm program payments of $147,220 and total crop insurance subsidies are $366,494 exceed their respective limits (Table 7).

Imposing a constraint on farm program payments (Scenario 2) makes slight changes to the optimal portfolio. About 99 percent of the corn acres would reduce RP coverage from the 85% coverage level to the 75% coverage level and these acres switch from ARC to PLC plus SCO. The portfolio's return under Scenario 2 is reduced by $2,857 from the unconstrained scenario (Scenario 1) (Table 7).

When the crop insurance constraint is imposed (Scenario 3), the optimal policy and insurance portfolio changes significantly from the unconstrained portfolio (Scenario 1). The optimal policy for corn and soybeans are to not purchase RP insurance and to enroll in ARC. The optimal policy for cotton is to not use RP insurance and to use STAX on only 17 percent of the cotton acres while the rest is not covered by insurance. The optimal policy for rice is to not purchase crop insurance but enroll in PLC. This portfolio's return is $182,485 lower than the unconstrained scenario (Scenario 1) which is a reduction in returns of $18.25 per acre (Table 7).

When both the farm program payment limitation and the crop insurance subsidy constraints are imposed (Scenario 4), the optimal portfolio changes slightly from Scenario 3. Combining the constraint on farm programs with the constraint on insurance subsidies shifts about 25 percent of the corn acres into a no risk management solution where they are not covered by either crop insurance or farm programs (Table 7). The portfolio's return under Scenario 4 is $203,993 less than the unconstrained portfolio (Scenario 1) which translates to lower returns of $20.40 per acre (Table 7).

Another way to reduce the burden of the payment limits is to change the crop mix. If the mix of corn, soybeans and cotton were allowed to change, the optimal crop mix would be towards more soybeans and less cotton. That would reduce the impact of the insurance subsidy and farm program payments constraints as the expected farm program payments and insurance subsidies are lower for soybeans than for cotton.

Summary

This paper provides a preliminary evaluation of the impacts of constraining either farm program payments or crop insurance subsidies on the optimal portfolio of revenue protection crop insurance coverage levels and farm programs chosen by an Illinois and Mississippi farm. A simulation model was used to determine the expected returns from crop production, crop insurance expected indemnities and premiums, and expected farm program payments. The optimization model did not incorporate any of the variability of returns to evaluate the impact of risk aversion on the optimal policy and insurance portfolio. These preliminary results would correspond to that of a risk neutral producer that was only concerned in maximizing returns over variable costs. Further research will incorporate risk aversion into the model to analyze how the optimal portfolio changes for increased risk aversion.

In general, the response to either a constraint on crop insurance subsidies or farm program payments is to buy down insurance coverage or to shift to a lower program payment. As the constraints become more binding, the optimal solution is to not use crop insurance or farm programs. The crop insurance constraint could be binding for a 2,500 acre Illinois corn-soybean farm that has relatively low production risk. The constraints become more burdensome as acreage increases and additional crop enterprises are added to the farm. The 2,500 acre Mississippi farm, because of the greater production risk as well as the value of the insured crops, would use 94 percent more crop insurance subsidy dollars than a 2,500 acre corn-soybean farm under the unconstrained scenario (Scenario 1).

Some policy makers continue to discuss ways to limit farm program payments or crop insurance subsidies either for budgetary reasons or other philosophical motivation. This study suggests that risk neutral producers may reduce their insurance coverage thus potentially undermining the role of crop insurance serving as the safety-net in row crop agriculture.

References

Anderson, J.D., A. Harri, and K.H. Coble. 2009. "Techniques for Multivariate Simulation from Mixed Marginal Distributions with Application to Whole-Farm Revenue Simulation." *Journal of Agricultural and Resource Economics* 34(1):53-67.

Mississippi State University Extension Service. "Delta 2014 Planning Budgets." December 2013.

Rain and Hail Insurance Services, Inc. "Quick Reference on Price Elections for Major Crops." www.rainhail.com (Accessed August 1, 2014).

University of Illinois Extension Service. "2014 Crop Budgets for Illinois."

USDA-National Agricultural Statistics Service. "County-Level Yield for Corn and Soybeans from 1996-2013 for McLean County, Illinois." www.nass.usda.gov (Accessed August 1, 2014).

USDA-National Agricultural Statistics Service. "County-Level Yield for Corn, Soybeans Cotton and Rice from 1996-2013 for Bolivar County, Mississippi." www.nass.usda.gov (Accessed August 1, 2014).

USDA-National Agricultural Statistics Service. "U.S. Marketing-Year Average Prices for Corn, Soybeans, Rice, and Cotton." www.nass.usda.gov (Accessed August 1, 2014).

USDA-Risk Management Agency. "Federal Crop Insurance Corporation Summary of Business from 2003-2012." www.rma.usda.gov (Accessed August 1, 2013).

United States House of Representatives of the 113th Congress. "Agricultural Act of 2014." HR 2642. Signed into Law on February 7, 2014.

Table 1. Scenarios Modeled by the Mathematical Programming Portfolio Model.

Scenario	Description
Scenario 1	No constraints on farm program payments or crop insurance subsidies.
Scenario 2	Total farm program payments limited to $125,000. Unlimited crop insurance subsidies.
Scenario 3	Unlimited farm program payments. Crop insurance subsidies limited to $40,000.
Scenario 4	Total farm program payments limited to $125,000. Crop insurance subsidies limited to $40,000.

Table 2. Optimal Farm Bill and Crop Insurance Portfolio for a 2,500 Acre Corn/Soybean Farm in McLean County, Illinois.

McLean County, Illinois 2,500 Acre Farm (50% Corn-50% Soybean Rotation)		
	Scenario 1	Scenario 3
ARC/PLC Limit	Not limited	Not limited
Crop Insurance Subsidy Limit	Not limited	$40,000
Return over Variable Costs	$713,355	$709,929
Total ARC/PLC Payments	$70,802	$70,802
Total ARC Payments	$70,802	$70,802
Total PLC Payments	$0	$0
Total Crop Insurance Subsidy	$47,172	$40,000
	-------- Optimal Acreage --------	
Corn RP75% + ARC	0	677
Corn RP85% + ARC	1,250	573
Soybeans RP85% + ARC	1,250	1,250

Table 3. Optimal Farm Bill and Crop Insurance Portfolio for a 5,000 Acre Corn/Soybean Farm in McLean County, Illinois.

McLean County, Illinois 5,000 Acre Farm (50% Corn-50% Soybean Rotation)				
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
ARC/PLC Limit	Not limited	$125,000	Not limited	$125,000
Crop Insurance Subsidy Limit	Not limited	Not limited	$40,000	$40,000
Return over Variable Costs	$1,426,709	$1,420,818	$1,397,556	$1,380,953
Total ARC/PLC Payments	$141,604	$125,000	$141,604	$125,000
Total ARC Payments	$141,604	$95,270	$141,604	$95,270
Total PLC Payments	$0	$29,730	$0	$29,730
Total Crop Insurance Subsidy	$94,345	$111,507	$40,000	$40,000
	--------------- Optimal Acreage ---------------			
Corn ARC w/o RP	0	0	1,212	68
Corn PLC w/o RP	0	0	0	1,144
Corn RP75% + ARC	0	0	1,288	1,288
Corn RP85% + ARC	2,500	1,356	0	0
Corn RP75% + PLC + SCO	0	1,144	0	0
Soybeans RP85% + ARC	2,500	2,500	2,500	2,500

Table 4. Optimal Farm Bill and Crop Insurance Portfolio for a 10,000 Acre Corn/Soybean Farm in McLean County, Illinois.

McLean County, Illinois 10,000 Acre Farm (50% Corn-50% Soybean Rotation)				
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
ARC/PLC Limit	Not limited	$125,000	Not limited	$125,000
Crop Insurance Subsidy Limit	Not limited	Not limited	$40,000	$40,000
Return over Variable Costs	$1,426,709	$1,420,818	$1,397,556	$1,380,953
Total ARC/PLC Payments	$283,207	$125,000	$283,207	$125,000
Total ARC Payments	$283,207	$0	$283,207	$0
Total PLC Payments	$0	$125,000	$0	$125,000
Total Crop Insurance Subsidy	$188,690	$260,845	$40,000	$40,000
	--------------- Optimal Acreage ---------------			
Corn -- No risk management	0	0	0	190
Corn -- ARC w/o RP	0	0	4,165	0
Corn -- PLC w/o RP	0	0	0	3,975
Corn RP85%	0	190	0	0
Corn RP75% + ARC	0	0	835	0
Corn RP85% + ARC	5,000	0	0	0
Corn RP75% + PLC	0	0	0	835
Corn RP 75% + PLC +SCO	0	4,810	0	0
Soybeans RP85%	0	5,000	0	5,000
Soybeans RP85% + ARC	5,000	0	5,000	0

Table 5. Optimal Farm Bill and Crop Insurance Portfolio for a 2,500 Acre Corn/Soybean/Rice/Cotton Farm in Bolivar County, Mississippi.

Bolivar County, Mississippi 2,500 Acre Farm (5% Rice and Equal Share of Corn, Soybeans and Cotton)		
	Scenario 1	Scenario 3
ARC/PLC Limit	Not limited	Not limited
Crop Insurance Subsidy Limit	Not limited	$40,000
Return over Variable Costs	$597,991	$574,035
Total ARC/PLC Payments	$36,805	$36,805
Total ARC Payments	$32,779	$32,779
Total PLC Payments	$4,026	$4,026
Total Crop Insurance Subsidy	$91,623	$40,000
	--------------- Optimal Acreage ---------------	
Corn ARC w/o RP	0	792
Corn RP85% + ARC	792	0
Cotton -- No risk management	0	243
Cotton STAX Only	0	549
Cotton STAX + RP55%	792	0
Rice PLC w/o RP	0	125
Rice RP85% + PLC	125	0
Soybeans ARC w/o RP	0	792
Soybeans RP85% + ARC	792	0

Table 6. Optimal Farm Bill and Crop Insurance Portfolio for a 5,000 Acre Corn/Soybean/Rice/Cotton Farm in Bolivar County, Mississippi.

Bolivar County, Mississippi 5,000 Acre Farm (5% Rice and Equal Share of Corn, Soybeans and Cotton)		
	Scenario 1	Scenario 3
ARC/PLC Limit	Not limited	Not limited
Crop Insurance Subsidy Limit	Not limited	$40,000
Return over Variable Costs	$1,195,982	$1,119,183
Total ARC/PLC Payments	$73,610	$73,610
Total ARC Payments	$65,559	$65,559
Total PLC Payments	$8,051	$8,051
Total Crop Insurance Subsidy	$183,247	$40,000
	--------------- Optimal Acreage ---------------	
Corn ARC w/o RP	0	1,583
Corn RP85% + ARC	1,583	0
Cotton -- No risk management	0	1,034
Cotton STAX Only	0	549
Cotton STAX + RP55%	1,583	0
Rice PLC w/o RP	0	250
Rice RP85% + PLC	250	0
Soybeans ARC w/o RP	0	1,583
Soybeans RP85% + ARC	1,583	0

Table 7. Optimal Farm Bill and Crop Insurance Portfolio for a 10,000 Acre Corn/Soybean/Rice/Cotton Farm in Bolivar County, Mississippi.

Bolivar County, Mississippi 10,000 Acre Farm (5% Rice and Equal Share of Corn, Soybeans and Cotton)				
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
ARC/PLC Limit	Not limited	$125,000	Not limited	$125,000
Crop Insurance Subsidy Limit	Not limited	Not limited	$40,000	$40,000
Return over Variable Costs	$2,391,963	$2,389,106	$2,209,478	$2,187,970
Total ARC/PLC Payments	$147,220	$125,000	$147,220	$125,000
Total ARC Payments	$131,117	$42,858	$131,117	$108,898
Total PLC Payments	$16,102	$82,142	$16,102	$16,102
Total Crop Insurance Subsidy	$366,494	$406,556	$40,000	$40,000
	---------------- Optimal Acreage ----------------			
Corn -- No risk management	0	0	0	787
Corn ARC w/o RP	0	0	3,167	2,379
Corn RP85% + ARC	3,167	40	0	0
Corn + RP75% + PLC + SCO	0	3,127	0	0
Cotton -- No risk management	0	0	2,618	2,618
Cotton STAX Only	0	0	549	549
Cotton STAX + RP55%	3,167	3,167	0	0
Rice PLC w/o RP	0	0	500	500
Rice RP85% + PLC	500	500	0	0
Soybeans ARC w/o RP	0	0	3,167	3,167
Soybeans RP85% + ARC	3,167	3,167	0	0