

# **Get a GRIP: Should Area Revenue Coverage Be Offered through the Farm Bill or as a Crop Insurance Program?**

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## **Abstract**

The successful expansion of the U.S. crop insurance program has not eliminated ad hoc disaster assistance. An alternative currently being explored by members of Congress and others in preparation of the 2007 farm bill is to simply remove the “ad hoc” part of disaster assistance programs by creating a standing program that would automatically funnel aid to hard-hit regions and crops. One form such a program could take can be found in the area yield and area revenue insurance programs currently offered by the U.S. crop insurance program. The Group Risk Plan (GRP) and Group Risk Income Protection (GRIP) programs automatically trigger payments when county yields or revenues, respectively, fall below a producer-elected coverage level. The per-acre taxpayer costs of offering GRIP in Indiana, Illinois, and Iowa for corn and soybeans through the crop insurance program are estimated. These results are used to determine the amount of area revenue coverage that could be offered to farmers as part of a standing farm bill disaster program. Approximately 55% of taxpayer support for GRIP flows to the crop insurance industry. A significant portion of this support comes in the form of net underwriting gains. The expected rate of return on money put at risk by private crop insurance companies under the current Standard Reinsurance Agreement is approximately 100%. Taking this industry support and adding in the taxpayer support for GRIP that flows to producers would fund a county target revenue program at the 93% coverage level.

**Keywords:** area revenue insurance, commodity programs, crop insurance, Group Risk Income Protection.

## **Introduction**

A common justification given for the continued funding of U.S. crop insurance program subsidies is that it will eliminate the need for ad hoc disaster programs. For example, part of President Clinton's statement upon signing the Agricultural Risk Protection Act (ARPA) of 2000 was as follows: "I have heard many farmers say that the crop insurance program was simply not a good value for them, providing too little coverage for too much money. My FY 2001 budget proposal and this bill directly address that problem by making higher insurance coverage more affordable, which should also mitigate the need for ad hoc crop loss disaster assistance such as we have seen for the last three years." In 2006 testimony before the House Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies, former USDA under secretary J.B. Penn said, "One of the overarching goals of the crop insurance program has been the reduction or elimination of ad hoc disaster assistance."

By almost any measure, the drive to induce farmers to increase their purchase of crop insurance through increased premium subsidies and support for the crop insurance industry has been a resounding success. Over 80% of insurable crop acreage was enrolled in the program in 2005, and more than half of those acres were insured at coverage levels of 70% or higher. Total liability for the 2006 crop year was approximately \$50 billion. Despite this success, Congress once again seems poised to pass another disaster assistance program in 2007.

Given that Congress has largely succeeded in its effort to expand the crop insurance program, one can only conclude that crop insurance cannot substitute for disaster assistance programs. Policymakers are then left with a choice of either

continuing to live with the overlapping coverage offered by crop insurance and disaster programs or designing a new approach to the problem of providing farmers with an efficient financial safety net.

One problem with continuing the current crop insurance program is that it provides a relatively inefficient way of providing coverage to farmers. Glauber (2007) calculates that the marginal cost of inducing farmers to increase their coverage level is approximately \$26/ac. This high marginal cost is reflected in the average cost of supporting farmers' incomes through the crop insurance program. Over the first five crop years under ARPA (2001 to 2005), the net transfer to producers (indemnities paid less producer premiums) has totaled \$8.8 billion. However, the cost to taxpayers of delivering these funds has totaled \$15.5 billion.

Another way of providing farmers with financial assistance is through group or area crop insurance. It is well recognized that crop insurance plans based on area yields rather than individual farm yields offer many advantages. Halcrow (1949) first promoted area yield insurance as a way around the problems inherent in basing guarantees and premium rates on individual farm yields, noting that yield variability is largely driven by systemic factors in many areas. Miranda (1991) notes that area yield insurance offers a solution to the adverse selection and moral hazard problems that plague crop insurance products that are based on individual yields. Miranda (1991) models farm yields as a decomposition of systemic and poolable components and demonstrates that an area yield product can offer better protection against yield losses than does individual yield insurance. Barnett et al. (2005) also show that the Group Risk Plan (GRP), introduced in 1993 as the first area yield plan of insurance in the United States, outperforms individual

yield insurance for some crops and regions. Skees, Black, and Barnett (1997) document the development of the GRP program.

An often over-looked advantage of an area insurance product is that it would automatically provide disaster aid to farmers faced with unexpectedly low prices or who reside in areas with low yields. Miranda and Glauber (1991) proposed an area revenue program that would indemnify producers whenever area revenue fell below a target revenue program. The program would protect producers against systemic price or yield drops. As Congress moves toward a new 2007 farm bill, serious consideration is being given to a Miranda-Glauber area revenue plan as the basis of a new safety net that would also serve as a standing disaster program.

In this paper we examine how provision of an area revenue program could be implemented as the basis for a safety net for agriculture. We use the Group Risk Income Protection (GRIP) program as the area revenue insurance that would be provided to farmers. We compare two different delivery mechanisms for GRIP. The first is delivery as a crop insurance product in the current crop insurance program. The second is as a program in the commodity title of the farm bill that would replace marketing loan and countercyclical programs. We compare program costs under the two approaches and discuss the advantages and disadvantages of each delivery approach.

## **Background**

Two area crop insurance products, GRP and GRIP, are currently eligible for federal reinsurance, premium subsidy, and administrative and operating (A&O) expense reimbursement as part of the U.S. crop insurance program. GRP is an area plan of insurance that pays all insured farmers in a county an indemnity when the county average

yield falls below a trigger yield. The trigger yield is chosen by the insured as a percentage (up to 90%) of the expected (trend) county yield. GRIP is an area revenue plan that pays an indemnity when county average revenue falls below a trigger revenue level. The trigger revenue is chosen by the insured as a percentage of expected county revenue, which is the product of the GRP trend yield and the expected price as measured by futures markets. GRIP was developed by IGF Insurance Company and first sold in 1999. In 2004, NAU Companies developed and introduced an optional endorsement to GRIP called the Harvest Revenue Option (HRO).<sup>1</sup> The HRO endorsement turns GRIP into a GRP policy when the harvest price is greater than the expected price. Any production losses under the resulting GRP policy are valued at the harvest price.

Availability of the HRO endorsement corresponds to a dramatic increase in acreage insured under GRIP. Insured acreage more than doubled in 2004, doubled again in 2005, and doubled yet again in 2006, when a total of 11.7 million acres were insured.<sup>2</sup> For the first time, an area plan of insurance now ranks among the most widely used crop insurance products.<sup>3</sup> In Illinois, 37% of the insured corn acres were insured under GRIP in 2006, compared to 28% insured under Crop Revenue Coverage (CRC) and 22% insured under Revenue Assurance (RA). In 2003, the GRIP market share was less than 2% for Illinois corn.

The incentives to buy and sell GRIP are high. The average 2006 premium of a GRIP-insured corn acre in Illinois was \$46.36 compared to approximately \$26 per acre

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<sup>1</sup> As a note of disclosure, Bruce Babcock was involved as a consultant with the development and rating of GRIP and GRIP-HRO.

<sup>2</sup> Only 18% of the increased GRIP acreage is accounted for by the 2004 expansion in the number of states able to offer GRIP and the 2005 expansion to coverage of grain sorghum, cotton, and wheat. Illinois, Indiana, Iowa, Michigan, and Ohio had GRIP in 2003 and account for 82% of the acreage increase.

<sup>3</sup> Acreage insured under GRP in 2006 totaled 34.1 million, but only 2.6 million acres of crops were insured. The rest of the insured acreage was in forage and rangeland.

for RA and CRC, the next two highest-premium products. The average premium subsidy rate for GRIP is 55%, which means that corn farmers paid less than \$21 per acre of the \$46-per-acre insurance premium. If GRIP is actuarially fair, then farmers paid \$21 for an expected net (of premium) gain of \$25. This compares to a net gain of about \$13 under RA and CRC assuming actuarial fairness. The \$20-per-acre additional premium from GRIP (relative to RA and CRC) means that agent commissions under GRIP are also higher than under RA and CRC, unless their commission rates under GRIP are much lower than for other products.

Prior to 2004, the incentives to buy and sell GRIP without the HRO endorsement were much lower. The average premium in Illinois on corn acreage insured under GRIP in 2003 was \$23.37, which was nearly identical to the premium collected for RA and CRC in 2003. Thus, neither agents nor farmers had an increased incentive to seek out an alternative product.

The dramatic increase in GRIP usage demonstrates that many farmers recognize that an area plan of insurance offers sufficient risk management benefits. Overall, continued adoption of GRIP should improve the actuarial performance of the crop insurance program as adverse selection and moral hazard are reduced. But the dramatic growth in acres insured under GRIP raises important policy questions.

Because GRIP indemnities can be triggered by low prices, GRIP can duplicate coverage provided by marketing loans and countercyclical payments available to producers of program crops in U.S. commodity programs. Producers pay an average of only 45% of the insurance premium for GRIP, and they are given free farm bill put options under the marketing loan and countercyclical programs. This suggests that

reconciliation of the two programs would increase efficiency as measured by the program cost per dollar of producer risk management benefit.

This raises the more fundamental policy question of whether GRIP should be part of the crop insurance program or part of the farm bill. As noted by Miranda and Glauber (1991), an area revenue program provides cost-effective support for farmers faced with recurring low prices or low yields. Farmers who purchased GRIP before 2004 were purchasing a Miranda-Glauber area revenue program. This suggests that pre-2004 GRIP could provide an effective Miranda-Glauber farm bill safety net program.

Farm bill commodity programs and crop insurance commodity programs share the objective of giving financial support to farmers. However, Congress has mandated different mechanisms for accomplishing this objective. Farm bill commodity programs are administered through the Farm Service Agency, and they are made available to farmers at minimal administrative cost. Crop insurance commodity programs are administered through a public-private partnership between the Risk Management Agency, crop insurance companies, and crop insurance agents. Farmers must pay a portion of program costs.

Interest is growing in adopting a Miranda-Glauber style of area revenue plan as the basis for farm bill commodity programs. For example, Babcock and Hart (2005) showed how an area revenue plan can be designed to help the United States achieve proposed limits on commodity support as part of the Doha Round negotiations in the World Trade Organization. American Farmland Trust (2006) has proposed moving to an area revenue program as part of an overhaul of U.S. farm bill programs. Additionally, the



National Corn Growers Association is working with an area revenue plan as the basis for their 2007 farm bill proposal.

One consideration in choosing whether to run GRIP as a farm bill program or a crop insurance program is the cost and effectiveness of meeting program objectives. Expected program costs for GRIP in the crop insurance program include easily calculated A&O reimbursements and premium subsidies and the more difficult to calculate expected underwriting gains and expected indemnities, which require stochastic models for analysis. Expected program costs of GRIP as a farm bill program equal expected payments. In this paper, we estimate these costs for GRIP for corn and soybeans in the three states where GRIP was first introduced: Illinois, Indiana, and Iowa. To estimate these costs, we document and use the rating procedures that were used to originally rate GRIP. These procedures are directly conducive to estimating expected underwriting gains under the current Standard Reinsurance Agreement (SRA). We find that, on average, the per-acre taxpayer cost of supporting GRIP in its current form as a crop insurance product is equivalent to the expected payments that would be generated by a Miranda-Glauber area revenue farm bill program that guarantees county revenue at a coverage level of at least 93%.

### **Methodology**

The procedures used to rate GRIP and GRIP-HRO are presented below. The resulting premium rates may differ from current GRIP rates because RMA now uses a smoothing technique to reduce rate variations across county boundaries, and the degree of correlation between yields and prices in this study are based on a different time period than when GRIP rates were calculated.

### *Data*

The data used in the analysis include GRP corn and soybean trend yield data for Iowa, Illinois, and Indiana counties from 1957 to 2004.<sup>4</sup> NASS yield data for corn and soybeans over the same time period were also collected for each county in these three states, as well as at the national level. Actual rates used in the third scenario were the “pre-smoothed” 2005 GRIP-HRO premium rates for corn and soybean coverage for each county in the included states that were provided to RMA by NAU Companies.<sup>5</sup> Chicago Board of Trade (CBOT) corn and soybean price data from 1975 to 2004 were also used in the analysis.

### *Imposing Correlation*

Using the yield and price deviates<sup>6</sup> for U.S. corn and soybean yields and CBOT corn and soybean price data, the historical correlation structure of the deviates was examined over three different time periods. The correlation structures calculated from 1975 to 2005 and 1980 to 2005 showed a lower level of (negative) own-price correlation than did the same measure from 1990 to 2005. The Pearson correlation coefficient between the percent deviation in U.S. corn yield from trend and the percent change in the December futures price from spring to fall is -0.66 for the period 1975 to 2005, -0.76 for the period 1980 to 2005, and -0.81 for the period 1990 to 2005. The stronger relationship between yield and

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<sup>4</sup> GRP trend yields are calculated by the Risk Management Agency (RMA). The trend yield is the level used for the yield guarantee portion for area yield and revenue coverage policies (i.e., GRP, GRIP, and GRIP-HRO).

<sup>5</sup> This paper focuses on GRIP-HRO as a crop insurance program instead of GRIP because the HRO option is selected by most farmers. In addition, we assume that farmers choose the maximum liability and coverage level because this reflects current program preferences. For example, in McLean County, Illinois, 96% of corn farmers who purchased GRIP did so at the 90% coverage level, and of these, approximately 90% purchased the HRO option. The average percentage of maximum liability selected was 90%. These estimates were calculated using RMA’s Summary of Business data.

<sup>6</sup> The yield deviates were calculated as the percent deviation from trend. The price deviates were calculated as the percent change in price from the spring to the fall for the December futures contract.

price levels can be explained by changes in farm policy starting with the 1995 farm bill, which increased price responsiveness by reducing the role of government in stockholding activities (Lence and Hayes, 2002). The more recent correlation structure from 1990 to 2005 was chosen for use in the analysis assuming it would more accurately reflect both current and future price-yield relationships.

The U.S. corn and soybean yield deviates from trend from 1957 to 2004 were vertically concatenated 500 times, yielding 24,000 yield deviate draws from the empirical yield distribution (Goodwin and Ker, 1998; Ker and Coble, 2003; Vedenov et al., 2004). The empirical distribution maintains the actual historical correlation structure between U.S. corn and soybean yields for a large number of yield realizations without relying on a potentially misspecified parametric form for the marginal yield distributions (i.e., the beta distribution).

Using a re-sorting method outlined by Iman and Conover (1982), the empirical yield draws were correlated with two standard uniform draws to match the historical rank correlation matrix from 1990 to 2004. The corn and soybean yield deviate draws were not re-sorted in the process to preserve the year-to-year realizations for the corn and soybean yield deviates. The standard uniform draws were then transformed to harvest price draws assuming lognormality, a mean corn price of \$3.75, a mean soybean price of \$7.00, a corn price volatility of 27%, and a soybean price volatility of 20%.<sup>7</sup> Tables 1a and 1b report the historical rank correlation matrix for U.S. corn and soybean yields and prices, and the rank correlation matrix for the corn and soybean yield deviates and price draws, respectively. The re-sorting method (Iman and Conover) does an excellent job of

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<sup>7</sup> The corn and soybean price levels and volatilities were based on the settlement of the December 2007 corn and November 2007 soybean futures and options contracts on December 21, 2006.

replicating the historical correlation structure. The correlation matrix of the yield and price draws and the target historical correlation matrix differ by a maximum of 0.02.<sup>8</sup>

**Table 1a. Rank correlations for U.S. corn and soybean yields and prices, 1990-2004**

	Corn Yield	Soybean Yield	Corn Price	Soybean Price
Corn yield	1			
Soybean yield	0.65	1		
Corn price	-0.87	-0.72	1	
Soybean price	-0.74	-0.69	0.81	1

**Table 1b. Rank correlations for corn and soybean yield and price draws**

	Corn Yield	Soybean Yield	Corn Price	Soybean Price
Corn yield	1			
Soybean yield	0.50	1		
Corn price	-0.86	-0.70	1	
Soybean price	-0.72	-0.67	0.79	1

### *Empirical Yield Distributions*

National Agricultural Statistics Service (NASS) county-level yield data for corn and soybeans were detrended to 2004 equivalents ( $y_t^{det}$ ) following Vedenov et al. (2004).

This was done by dividing each county yield observation ( $y_t$ ) by the corresponding GRP trend yield ( $y_t^{tr}$ ) for the same year and county. The yield ratio was then multiplied by the 2004 trend yield level ( $y_{2004}^{tr}$ ) for that county.

$$y_t^{det} = \frac{y_t}{y_t^{tr}} y_{2004}^{tr}, \text{ for } t = 1957 \dots 2004. \quad (1)$$

The detrended county-level yield data were then vertically concatenated 500 times, providing 24,000 yield realizations from the 48-year empirical yield distribution for each county in Iowa, Illinois, and Indiana. Each row (year) of the detrended corn and soybean

<sup>8</sup> An exception is the correlation between corn and soybean yields. To ensure that the yield deviates were not re-sorted (i.e., to preserve the true empirical distribution) in the process, the target correlation between corn and soybean yields was set to the actual rank correlation of the 24,000 yield deviates (0.50). This differed from the rank correlation between corn and soybean yields from 1990 to 2004 (0.65).

realizations corresponds to the corresponding row of the empirical distribution for U.S. corn and soybean yield deviates. Thus, the rank correlation between corn and soybean yield deviates and prices at the national level is preserved, while the relationships between county yields and prices are carried through by means of the relationship between county and national yield levels. Retention of the cross-county and cross-crop yield correlations is crucial for conducting valid reinsurance analysis.

#### *GRIP-HRO Policy Distributions*

County-level distributions of GRIP-HRO indemnities were then calculated using the empirical county yield distributions and correlated price draws. GRIP-HRO indemnities in any year  $t$  are based on a trigger revenue ( $TrigRev_t^{HRO}$ ) that is equal to the product of the coverage level ( $C$ ), the GRP trend yield for the county, and the maximum of the expected harvest price level taken from CBOT futures ( $E[P_t]$ ) and the actual price realization at harvest ( $P_t$ ). The standard GRIP policy uses a similar trigger revenue structure ( $TrigRev_t^{GRIP}$ ), except the price component is equal to the expected harvest price level.

$$TrigRev_t^{HRO} = C * y_t^{tr} * \max[E[P_t], P_t] \quad (2a)$$

$$TrigRev_t^{GRIP} = C * y_t^{tr} * E[P_t] \quad (2b)$$

An indemnity ( $Indem_t$ ) is paid if actual revenue at harvest ( $ActRev_t$ ), defined by the product of actual yield ( $y_t$ ) and actual harvest price, falls below the trigger revenue. Indemnities ( $Indem_t$ ) are calculated based on a percent loss ( $\%loss_t$ ) multiplied by the liability level ( $Liab_t$ ). The liability level is the product of the county trend yield, the expected harvest price, and a liability factor ( $L$ ), which was set equal to 1.5. The percent

loss is equal to the maximum of zero and the difference between the trigger and actual revenue levels divided by the trigger.

$$ActRev_t = y_t * P_t \quad (3)$$

$$Liab_t = L * y_t^{tr} * E[P_t] \quad (4)$$

$$\%loss_t = \max \left[ \frac{TrigRev_t - ActRev_t}{TrigRev_t}, 0 \right] \quad (5)$$

$$Indem_t = \%loss_t * Liab_t \quad (6)$$

County premium levels ( $Prem_t$ ) were calculated by multiplying 2005 GRIP-HRO rates ( $HROrate_t^{90\%}$ ) at a 90% coverage level by the liability levels for the corresponding counties for both corn and soybean coverage. Distributions of gross underwriting gains ( $GrossGain_t$ ) at the county level were calculated as the difference between the indemnity realizations and premium levels for each county. Loss ratio distributions ( $LR_t$ ) were also calculated as the ratio of indemnity realizations to premium level.

$$Prem_t = HROrate_t^{90\%} * Liab_t \quad (7)$$

$$GrossGain_t = Prem_t - Indem_t \quad (8)$$

$$LR_t = \frac{Indem_t}{Prem_t} \quad (9)$$

The county-level distributions for gross underwriting gains, indemnities, and loss ratios were then aggregated across counties and crops for each state to define a single distribution for each variable at the state level, which is the level used to calculate underwriting gains and losses under the SRA. Corn and soybean premium levels were also aggregated to define a state-level premium for each of the three states in the analysis.

The aggregation was done with a weighted average using 2005 NASS data on planted acres for corn and soybeans as the weights.

The state-level premiums and each realization from the indemnity and loss ratio distributions were then run through the SRA to determine their effect on the underwriting gains of private crop insurance providers. The GRIP-HRO policies for each state were allocated to the Commercial Fund within the SRA. Net underwriting gains ( $NetGain_t$ ) and net loss ratios ( $NetLR_t$ ) are defined as the underwriting gains and loss ratios resulting from reinsuring the GRIP-HRO policies under the SRA through the Commercial Fund.<sup>9</sup> The net loss ratio is the ratio of gross premium less underwriting gains to the gross premium.

$$NetLR_t = \frac{Prem_t - NetGain_t}{Prem_t} \quad (10)$$

The expected net subsidy ( $NetSub_t$ ) paid by the Federal Crop Insurance Corporation (FCIC) (taxpayer cost) was then calculated as the sum of premium subsidy ( $PremSub$ ), administrative and operating costs ( $A\&O$ ),<sup>10</sup> and the expected net underwriting gains for the crop insurance companies.

$$NetSub_t = (PremSub + A \& O) * Prem_t + NetGain_t \quad (11)$$

The yield and price distributions were then used with equations (2b) and (3)-(6) to calculate the coverage level for a GRIP policy that, when offered to farmers for free as part of a farm bill program, would result in taxpayer costs equivalent to those implied by

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<sup>9</sup> Please refer to the 2005 Standard Reinsurance Agreement (FCIC, 2005) for an explanation of how underwriting gains are calculated. The quota share requirement whereby 5% of total underwriting gains and losses are ceded back to USDA were not accounted for in this analysis because national aggregate gains and losses from a company's entire book of business would need to be calculated.

<sup>10</sup> The premium subsidy and A&O costs for 90% GRIP policies are 55% and 19.1% of gross premium, respectively.

the net premium subsidy and gross underwriting gains for the current GRIP-HRO program. This was done by finding the GRIP coverage level at which the average indemnity is equal to the expected taxpayer cost of GRIP-HRO at 90% coverage. The taxpayer cost ( $TPCost_t$ ) was calculated as the net premium subsidy less the gross underwriting gains for GRIP-HRO as a result of FCIC providing reinsurance through the SRA. Taxpayer costs are calculated as a percentage of gross premium for reporting purposes.

$$TPCost_t = \frac{NetSub_t - GrossGain_t}{Prem_t} \quad (12)$$

Note that the expected value of gross underwriting gains is equal to zero for an actuarially fair policy. However, we use a larger level of negative own-price correlation for corn and soybeans than was used to originally rate GRIP and GRIP-HRO. Thus, the actual GRIP-HRO rates were not actuarially fair in our analysis.<sup>11</sup> We report results for three different scenarios in the following section. The first scenario uses the actuarially fair rates implied by the simulation model (premium set equal to the average indemnity payment for each county); the second scenario uses the fair rates multiplied by the actual loading factors used by RMA;<sup>12</sup> and the third scenario uses actual GRIP-HRO rates for the 2005 crop year.

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<sup>11</sup> Furthermore, if the variability of county average yields when measured as a percentage of trend yield is now lower than in the past, then GRIP is over-rated. Over-rating means that expected underwriting gains will be higher than calculated in this analysis.

<sup>12</sup> RMA uses load rates of 15% and 12% for corn and soybean policies, respectively.



## Results

### *Scenario 1: Actuarially Fair Rates*

Table 2 reports the model results when premiums are set equal to the average indemnities over the simulations. The premiums reported in the first row represent the average premium for corn and soybeans across all counties in the three states, weighted by 2005 planted acres (NASS). Note that the expected net loss ratio for the aggregated book of business is reduced from unity to 0.90, while the expected underwriting gains increase from zero to \$4.54 per acre, or 9.73% of premium, under the SRA. The expected cost borne by taxpayers, assuming fair premiums, is estimated to be \$39.45 per acre, or 84% of gross premium.

**Table 2. Loss ratios and underwriting gains for 90% GRIP-HRO, fair premiums**

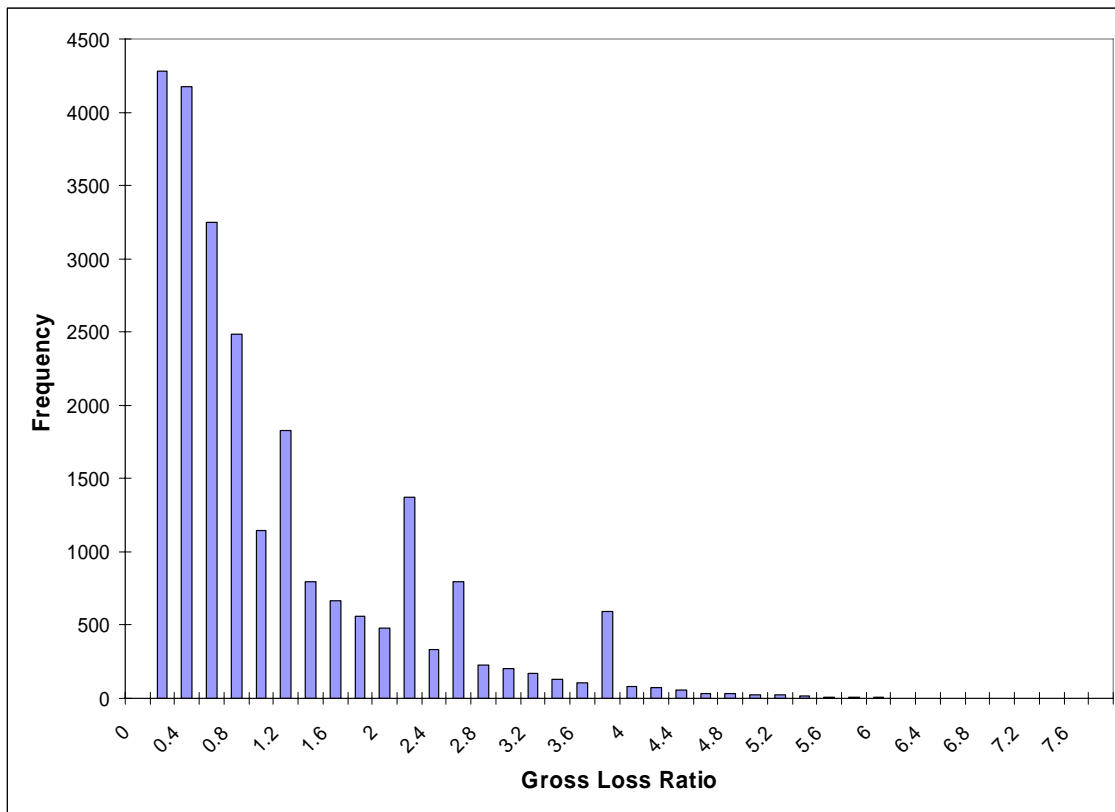
	Iowa	Illinois	Indiana	Aggregate
Premium	48.08	47.41	44.27	47.05
Gross loss ratio	1.00	1.00	1.00	1.00
Net loss ratio	0.90	0.90	0.91	0.90
Gross gain	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Net gain	4.74 (9.8%)	4.61 (9.7%)	4.20 (9.4%)	4.58 (9.7%)
Taxpayer cost	-	-	-	\$39.45 (84.0%)

*Note:* Premiums, underwriting gains, and taxpayer costs are reported in \$/acre (% of premium).

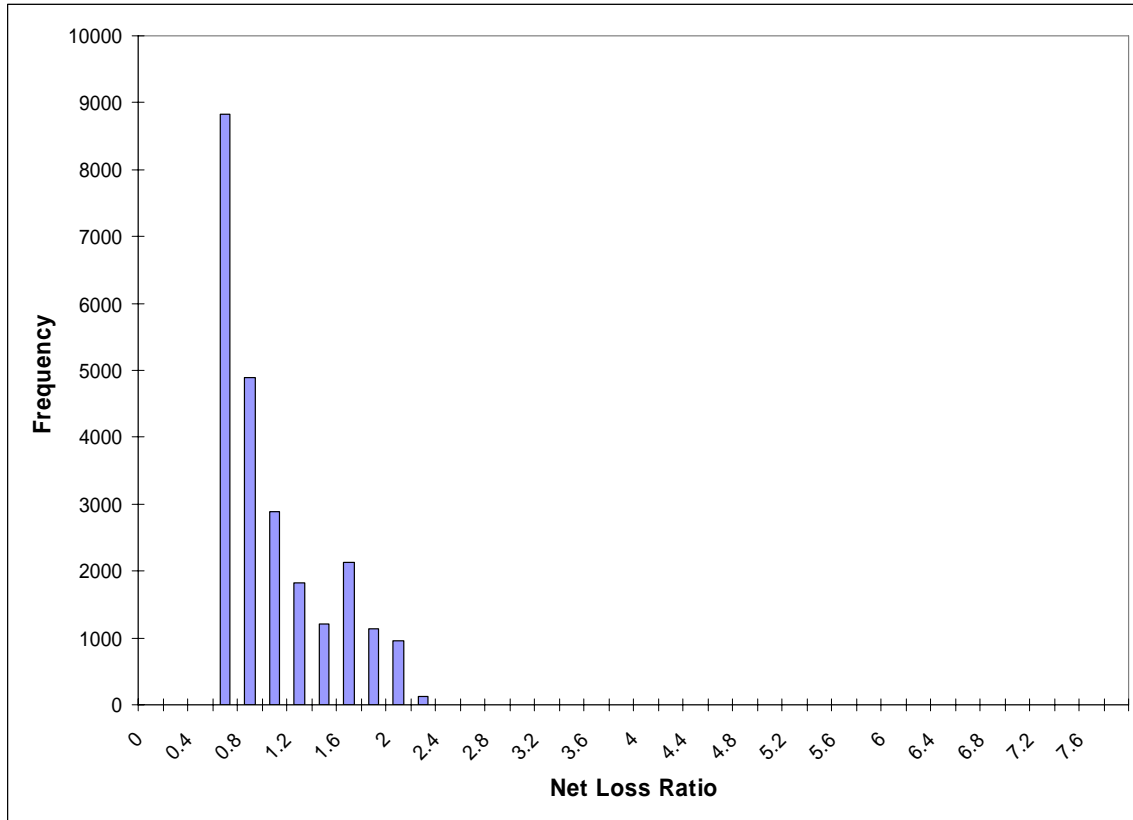
Figures 1 and 2 illustrate the distribution of aggregate gross and net loss ratios, respectively.<sup>13</sup> Gross loss ratios are truncated from below at zero, by definition, and

<sup>13</sup> Figures displaying the distributions of gross and net loss ratios, underwriting gains, and taxpayer costs at the state level for all three scenarios are available upon request from the authors.

follow a right-skewed distribution with a maximum of 7.52. The loss-ratio spikes in Figure 1 represent the large losses that occur in particular years over the study period. For example, the spike of realizations with loss ratios between 4.4 and 4.8 corresponds to the 1988 Corn Belt drought. The peaks at loss ratios between 2.5 and 3.2 correspond to the 1974, 1979, 1983, and 1993 crop years. Shown in Figure 2, the Commercial Fund of the SRA has a significant effect on the distribution of loss ratios by capping the maximum net loss ratio at 2 and the minimum net loss ratio at 0.5.



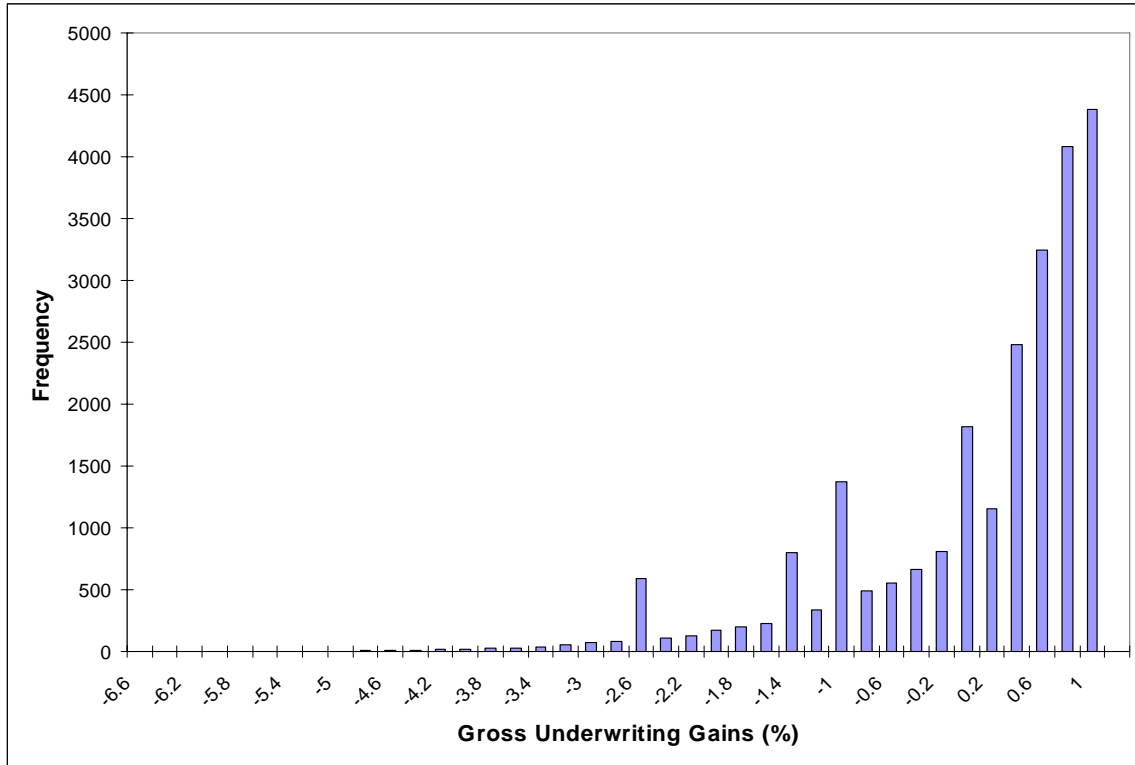
**Figure 1. Distribution of gross loss ratios, fair premiums**



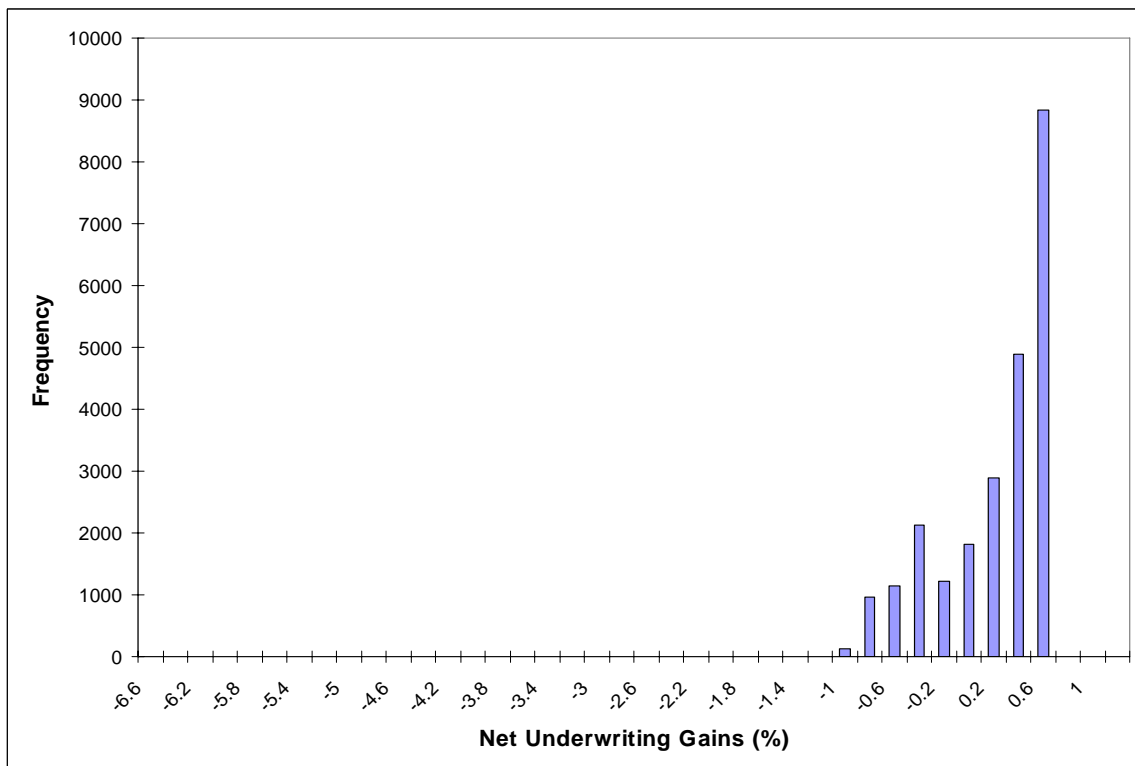
**Figure 2. Distribution of net loss ratios, fair premiums**

The distributions of per-acre gross and net underwriting gains are reported in Figures 3 and 4, respectively. Gross underwriting gains follow a skewed distribution, which is truncated from above at 100% of gross premium.<sup>14</sup> The SRA tightens the distribution of underwriting gains by capping net underwriting losses at 100% of the gross premium and net underwriting gains at 50% of gross premium. With fair premiums, gross underwriting losses have an expected value of \$50.33 per acre (107% of premium) and are estimated to occur one out of every three years. Gross underwriting gains are realized roughly two out of every three years, with an expected gain equal to \$28.32 per acre (60% of premium). A net underwriting loss occurs with a 31% probability and an

<sup>14</sup> While the theoretical maximum underwriting gain is 100% of the gross premium, there are no realizations when no indemnities are paid in the aggregated book of business. The maximum realization in our simulation model was a 99.8% gross underwriting gain.



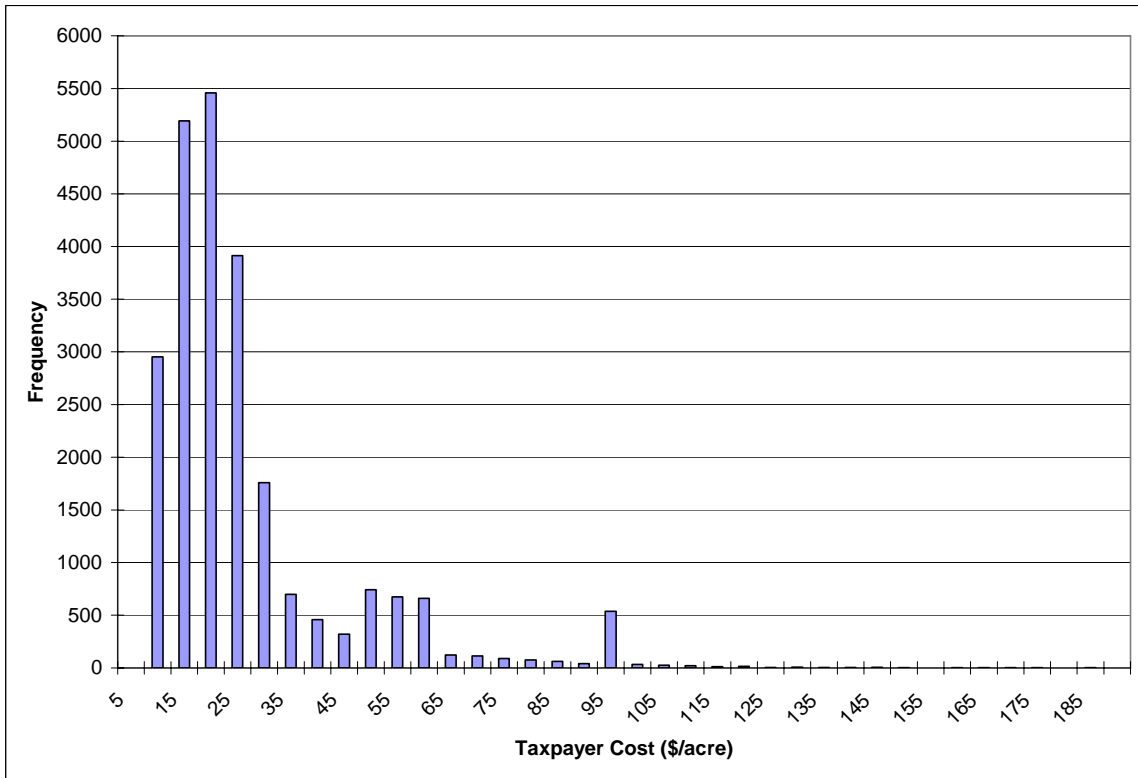
**Figure 3. Distribution of gross underwriting gains, fair premiums**



**Figure 4. Distribution of net underwriting gains, fair premiums**

expected value of \$21.94 per acre. Net underwriting gains average \$16.40 per acre and are estimated to occur with a 69% probability.

Figure 5 illustrates the distribution of the cost to taxpayers of a fairly rated GRIP-HRO program. Taxpayer costs range from \$10.90 to \$290.87 per acre, or 23% to 620% of gross premium. The simulation results imply that the GRIP-HRO program costs taxpayers more than 100% of gross premium (\$47.05 per acre) one out of every four years.



**Figure 5. Distribution of taxpayer costs, fair premiums**

*Scenario 2: Loaded Fair Rates*

In practice, RMA loads GRIP rates above their actuarially fair levels. The justification for these loads is to account for unforeseen risks that have not been accounted for in the

formal rating model and to help insurance companies build a reserve load to cover large loss years. Table 3 reports the results of the model using the fair premiums implied by the simulation model with the actual loading factors applied. Under this scenario, private insurers are estimated to reduce their expected loss ratio from 0.87 to 0.86 and to increase their expected underwriting gains from \$6.73 to \$7.76 per acre, or 12.5% to 14.4% of total premium, by reinsuring under the SRA. Estimated taxpayer costs average \$40.88 per acre, or 76% of gross premium. Because of higher premium rates, underwriting gains are larger than in the first scenario, which, in turn, increases expected taxpayer costs.

**Table 3. Loss ratios, and underwriting gains for 90% GRIP-HRO, loaded premiums**

	Iowa	Illinois	Indiana	Aggregate
Premium	54.96	54.22	50.56	53.79
Gross loss ratio	0.87	0.87	0.88	0.87
Net loss ratio	0.85	0.86	0.86	0.86
Gross gain	6.88 (12.5%)	6.81 (12.5%)	6.29 (12.4%)	6.73 (12.5%)
Net gain	8.05 (14.6%)	7.84 (14.4%)	7.00 (13.8%)	7.76 (14.4%)
Taxpayer cost	-	-	-	40.88 (76.0%)

*Note:* Premiums, underwriting gains, and taxpayer costs are reported in \$/acre (% of premium).

The shapes of the distributions (not reported) of underwriting gains, loss ratios, and taxpayer costs with loaded fair premiums closely resemble those given in Scenario 1. Gross underwriting gains and losses with loaded rates range from a maximum loss of \$299.94 per acre (558% of premium) to a maximum gain of \$53.70 per acre (99.8% of premium), while the distribution of net underwriting gains is truncated between a 100%

loss and a 50% gain under the provisions of the Commercial Fund of the SRA. Gross underwriting losses average \$54.44 per acre and occur with a probability of 29%. Gross underwriting gains occur 71% of the time with an expected gain of \$32.18 per acre. Reinsurance reduces the probability and expected value of underwriting losses to 28% and \$22.64 per acre, respectively. Net underwriting gains are estimated to occur more than three out of four years with an average value of \$19.66 per acre (37% of premium). Estimated taxpayer costs range from 23% to 524% of gross premium (\$12.45 to \$281.92 per acre) with costs exceeding 100% of premium in 20% of the simulations, or once every five years.

*Scenario 3: Actual 2005 GRIP-HRO Rates*

Table 4 reports the results of the simulation model when the actual 2005 GRIP-HRO rates were used for premium calculation. This scenario would be expected to replicate actual GRIP performance within the current crop insurance program. Using actual rates, the aggregated per-acre premium for 90% GRIP-HRO coverage was equal to \$61.49, while the expected gross loss ratio and underwriting gains equal 0.77% and 23% respectively. Our simulation model implies that the actual GRIP-HRO rates may be, on average, 30% higher than actuarially fair rates and 14% higher than loaded fair rates. By reinsuring, private insurers are estimated to achieve an expected net loss ratio and underwriting gain of 0.81% and 19% (\$11.55 per acre), respectively, for their aggregated book of business. Estimated taxpayer costs average approximately 69.4% of gross premium, or \$42.68 per acre.

**Table 4. Loss ratios and underwriting gains for 90% GRIP-HRO, actual premiums**

	Iowa	Illinois	Indiana	Aggregate
Premium	62.37	62.71	57.32	61.49
Gross loss ratio	0.77	0.76	0.77	0.77
Net loss ratio	0.81	0.81	0.82	0.81
Gross gain	14.29 (22.9%)	15.30 (24.4%)	13.05 (22.8%)	14.43 (23.4%)
Net gain	11.72 (18.8%)	12.07 (19.2%)	10.22 (17.8%)	11.55 (18.8%)
Taxpayer cost	-	-	-	42.68 (69.4%)

*Note:* Premiums, underwriting gains, and taxpayer costs are reported in \$/acre (% of premium).

Insurance companies are estimated to give up \$2.88 per acre (4.7% of premium) in underwriting gains to the FCIC while increasing their expected loss ratio by 0.04. This result differs from those of Vedenov et al. and the previous scenarios whereby the SRA is estimated to increase underwriting gains and decrease loss ratios. This is attributed to the non-proportional treatment of gains and losses under the SRA and the 2005 GRIP-HRO rates being actuarially unfair within our simulation model.

Again, the shapes of the distributions of underwriting gains, loss ratios, and taxpayer costs are very similar to those outlined in the scenario with fair premiums and are not reported. Gross underwriting gains range from a maximum loss of \$292.26 (475%) to a maximum gain of \$61.40 (99.8%) per acre. Gross underwriting losses occur with a probability of 27% with an expected loss of \$52.19 per acre. Gross gains average \$38.48 per acre, or 63% of gross premium. Reinsurance reduces the probability of a loss by 2%, and the expected size of a loss to \$23.02 per acre. Net underwriting gains average \$23.37 per acre (38% of premium) and are estimated to occur three out of every four



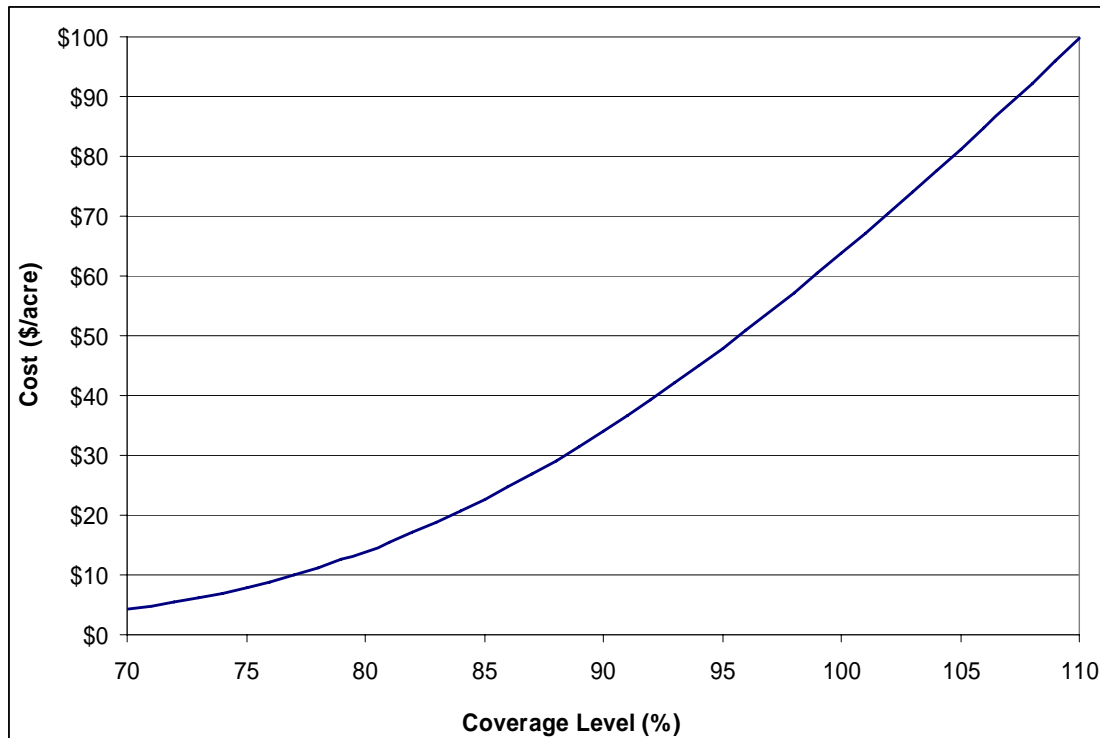
years. Simulated taxpayer costs range from \$14.22 to \$272 per acre, or 23% to 442% of gross premium. Consistent with the other scenarios analyzed, taxpayer costs are estimated to exceed total premium roughly once every five years.

#### *Cost Equivalent GRIP Coverage*

The cost of administering GRIP as a Miranda-Glauber disaster relief program is equal to the GRIP indemnity because there are minimal loss adjustment costs. Using equations (2b) and (3)-(6), indemnities for a standard GRIP policy were calculated over a range of coverage levels from 70% to 110%. Figure 6 plots the expected indemnity payment for each GRIP coverage level. The current GRIP-HRO program at a 90% coverage level and a 150% liability factor was estimated to cost taxpayers \$39.45, \$40.88, and \$42.68 in scenarios 1, 2, and 3, respectively. Given the expected indemnities in Figure 6, a GRIP program at a coverage level between 92% and 94% and a liability factor of 100% would result in the same expected per-acre cost to taxpayers. This program could be offered to farmers in the form of a Miranda-Glauber disaster relief farm program at an equivalent taxpayer cost to insuring the same acreage under GRIP-HRO.

However, there would be important distributional impacts of providing GRIP as a farm bill program. Providing GRIP-HRO coverage to farmers as a crop insurance program provides farmers with a significantly smaller net benefit than providing GRIP in the farm bill because producers must pay a portion of the premium in the crop insurance program. As shown in Tables 2 and 4, producers must pay \$27.67 (45% of \$61.49) to obtain an expected indemnity of \$47.05. Thus, producers' net benefit is \$19.38. However, if GRIP were part of the farm bill, producers would obtain the full net benefit of \$42.68 per acre, an increase of 120%. The difference between \$42.68 and \$19.38 is what flows

to the crop insurance industry in the form of expected underwriting gains and A&O. That is, under the crop insurance program, there is a 55–45 split in taxpayer support, with 55% going to the crop insurance industry and 45% going to producers. If GRIP were moved to the farm bill, all the taxpayer support would flow to producers.



**Figure 6. Expected cost of GRIP at various coverage levels**

The second distributional impact involves taxpayers. Although taxpayer costs would be the same, by definition, the variability of cost is higher when GRIP is in the farm bill rather than in the crop insurance program. The standard deviation (coefficient of variation) of estimated taxpayer costs in scenarios 1, 2, and 3 were estimated to be \$28.24 (72%), \$26.81 (66%), and \$25.44 (60%) per acre, respectively. The standard deviation (CV) of indemnities for a 93% GRIP farm program was estimated to be \$47.55 (113%).

Therefore, while a GRIP disaster program providing 93% coverage is estimated to be cost equivalent to the 90% GRIP-HRO insurance program, costs would also be more volatile.

The decrease in the volatility of taxpayer costs from providing GRIP as a crop insurance program rather than as a farm bill program is the crop insurance industry's primary justification for the subsidies that they receive in the crop insurance program. They argue that it is fair for them to share in the gains if they are required to share in the losses. The question then becomes, at what cost to taxpayers? Using the scenario 3 results, with a 25% probability, taxpayers gain an average of \$23 per acre from the SRA's risk-sharing provisions. However, taxpayers pay for this benefit 75% of the time through positive underwriting gains paid to insurance companies. The average payment from taxpayers to companies in these years is just over \$23 per acre.

Putting these gains and losses into insurance terms, taxpayers essentially receive an insurance payout from the SRA 25% of the time. The average payout in these years is \$23 per acre. Multiplying the probability by the average size of the payout in the years in which a payout occurs results in the overall expected indemnity (taxpayer benefit) from the SRA. This multiplication results in an expected indemnity of \$5.75 per acre. The "premium" that taxpayers pay for this "insurance" is the overall average underwriting gain paid to crop insurance companies, which is \$11.55 per acre in scenario 3.

This insurance program has an expected loss ratio of less than 0.5 ( $5.75/11.55$ ), which means that the annual expected rate of return that crop insurance companies obtain from putting their money at risk is more than 100%. Another way to look at the SRA's effect on the costs of administering GRIP is that taxpayers are effectively accepting a gamble that pays out a given amount with a 25% probability but creates a loss in the

same amount 75% of the time. One would hope that if taxpayers knew that they were paying 100% expected rates of return on money being put at risk by crop insurance companies, they might argue that their money could be put to better use in debt reduction or offsetting other program costs.

Of course, the underwriting gains paid to crop insurance companies are part of the financing for a 93% Miranda-Glauber area revenue program in the farm bill. If taxpayers kept the underwriting gains and financed the area revenue program with only producer premium subsidies and A&O expenses, then the amount of coverage that could be offered on a cost-equivalent basis would be approximately 88%, as shown in Figure 6.

### **Conclusions**

The expected cost of running GRIP through the crop insurance program in 2007 is approximately \$42.68 per acre for corn and soybeans in Iowa, Illinois, and Indiana. If every acre planted to corn and soybeans in 2006 were insured under GRIP in these three states (55.4 million acres), the expected cost would be \$2.36 billion per year, making it by far the most expensive farm program of all current programs. However, farmers would only receive approximately \$1.1 billion of this amount with the rest going to the crop insurance industry. If the purpose of the crop insurance program is to provide support to producers, it would be difficult to design a more inefficient transfer system.

Compare the cost of delivery of this system to one in which a pre-2004 GRIP policy that covered 93% of the product of expected price and expected county yield was given to farmers. The cost of administering this policy would be minimal, so farmers would be receiving one dollar in net payment for each dollar of taxpayer cost.

Although not explicitly examined here, our conclusions about the division of taxpayer support for crop insurance between producers and the insurance industry are applicable to farm-level insurance programs such as RA and CRC. If a similar analysis were conducted for these programs, the split of taxpayer support would be even more skewed to the industry and away from farmers because the expected underwriting gains and A&O would be larger. Much of the increased A&O support for farm-level insurance programs would cover loss adjustment costs rather than agent commissions.

As noted by many, a Miranda-Glauber type of farm program, of which GRIP is simply an example, offers farmers significant risk management benefits because it triggers payments when systemic risk strikes a crop or a region, and it provides a transparent and automatic disaster aid mechanism. Because the program targets revenue rather than price, it would cover risks not currently covered by current marketing loan and countercyclical programs, as well as risks currently covered by crop insurance. Therefore, it could be financed from savings from current farm programs and the current crop insurance program. These cost savings perhaps create a large obstacle to adoption of such an approach. The large and growing tax support of the crop insurance industry has created strong vested interests of some political constituencies who will act to protect these interests.

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