Economic Analysis of Supplemental Deductible Coverage as Recommended in the USDA's 2007 Farm Bill Proposal

Paul D. Mitchell and Thomas O. Knight

A primary change to crop insurance contained in the USDA's Farm Bill proposal is supplemental deductible coverage (SDC). SDC would allow farmers who purchase individual crop insurance coverage to purchase area-wide coverage in the amount of the individual policy deductible. This supplemental area-wide coverage would be similar to the existing Group Risk Plan policy, but with an accelerated indemnity schedule. Analysis indicates that SDC increases farmer certainty equivalents. The largest benefits are realized by farmers with high yield potential in counties with greater systemic risk. In general, optimal individual policy coverage levels modestly decrease when SDC is taken.

Key Words: crop insurance, area-wide coverage, actual production history (APH), group risk plan (GRP), yield distribution

The Administration released the USDA 2007 Farm Bill proposal in early 2007 (USDA 2007a). Among its recommendations were several proposed modifications of current crop insurance programs under Title X (USDA 2007b). The first of these recommended offering supplemental deductible coverage (SDC). This proposed SDC would "Allow farmers to purchase supplemental insurance that would cover all or part of their individual policy deductible in the event of a county or area wide loss" (USDA 2007b, p. 151). Additional discussion indicates that the intent of this provision was to improve the safety net for crop producers by offering full coverage (100 percent of the value of expected yield).

The current federal crop insurance program offers two types of yield insurance for farmers—individual coverage and area-wide coverage. The individual coverage pays indemnities when a farmer's harvested yield falls below a chosen percentage of the farmer's individual average yield. This individual average yield is calculated based on a farmer's actual production history (APH); hence the name of the policy is APH.[1] Area-wide coverage as provided by the current program pays indemnities when the actual county average yield officially reported by the USDA falls below a chosen percentage of the expected county yield. This policy is called the Group Risk Plan (GRP). As proposed in the USDA 2007 Farm Bill proposal, SDC would allow farmers to combine a modified form of area-wide GRP coverage with individual APH coverage. This layered

Paul Mitchell is Assistant Professor in the Department of Agricultural and Applied Economics at the University of Wisconsin-Madison in Madison, Wisconsin. Thomas Knight is Professor in the Department of Agricultural and Applied Economics at Texas Tech University in Lubbock, Texas.

This paper was presented as a selected paper at the Crop Insurance and Risk Management Workshop, sponsored jointly by the Northeastern Agricultural and Resource Economics Association, the Risk Management Agency, the Farm Foundation, the Food Policy Institute at Rutgers University, and Cornell University, in Rehoboth Beach, Delaware, on June 12–13, 2007. The workshop received financial support from the Northeast Regional Center for Rural Development. The views expressed in this paper are the authors' and do not necessarily represent the policies or views of the sponsoring agencies.

The authors would like to thank those attending the workshop, the two anonymous reviewers, and Jean-Paul Chavas for their helpful comments.

[1] Although the intent of the APH program is to provide coverage based on the historical average yield for an insured unit, practical considerations in implementation have given rise to a number of exceptions. For example, alternative procedures are used in determining the insured yield for (i) new producers, (ii) producers adding land not previously planted to the crop, (iii) producers with average yield less than a given percentage of a county yield (t-yield) specified in the policy, with the percentage depending on the number of years of yields in the yield series, (iv) producers who would experience a large change in their insured yield from one insurance year to the next, and (v) producers experiencing a yield less than 60 percent of the county t-yield in one or more years.

Agricultural and Resource Economics Review 37/1 (April 2008) 117–131

coverage would offer producers a higher level of yield risk protection while avoiding excessive government exposure to adverse selection and moral hazard that could result if such high levels of individual coverage were offered.

The SDC concept raises interesting policy questions, a few of which we examine here. Specifically, for a variety of empirically based assumptions regarding farm and county yields, we estimate changes in farmer welfare when moving from the current program of using either APH or GRP alone to a combination of APH and area-based coverage under SDC. This analysis identifies the types of farmers who would find SDC most beneficial—in particular, indicating how much SDC benefits farmers in high-risk areas relative to those in low-risk areas. The analysis also identifies the preferred APH coverage level under the current program and when SDC is available, thus determining how farmers would likely adjust individual APH coverage levels if SDC became available. Thus, the analysis identifies the characteristics of farmers who would find SDC most useful, provides monetary estimates of its farm-level benefits, and indicates how farmers would likely use SDC to manage their risk.

Proposed SDC Program Structure

The description of the proposed SDC program structure (USDA 2007b) indicates that SDC would be an option farmers could add to their existing APH yield insurance, with additional indemnity payments handled similarly to the current GRP policy. Hence, before explaining SDC, we first describe APH and GRP. With APH, farmers choose an APH coverage level as a percentage of their historical average yield. Available coverage levels range from 50 percent to 85 percent in 5 percent intervals (some counties are limited to a maximum of 75 percent). With GRP, farmers choose a GRP coverage level as a percentage of the expected county average yield, with available coverage levels ranging from 65 percent to 90 percent in 5 percent intervals. For APH, 100 percent minus the chosen APH coverage level serves as a deductible, so that insured farmers share in the risk of loss and thus have incentives to use appropriate production practices to mitigate the potential for losses. Nevertheless, APH is subject to adverse selection and moral hazard, especially at high coverage levels.

Adverse selection occurs with APH because farmers who know that they are more likely to trigger indemnities are more likely to buy APH and use higher coverage levels (Goodwin 1993, Just, Calvin, and Quiggin 1999, Coble and Knight 2002). Furthermore, APH also suffers moral hazard problems because farmers who have APH coverage face incentives to adjust input use and other production practices so as to trigger or increase the magnitude of indemnities, with such incentives increasing in the chosen APH coverage level (Chambers 1989, Babcock and Hennessy 1996). A major advantage of GRP from the perspective of the insurer is that it is much less susceptible to these adverse selection and moral hazard problems—no individual farmer is more or less likely to trigger a GRP indemnity in a county, nor can an individual farmer meaningfully change the county average yield (Miranda 1991, Skees, Black, and Barnett 1997). However, though GRP has lower premiums, farmers generally prefer APH, since it pays indemnities for yield losses in excess of their deductible, while GRP does not guarantee this outcome.

In high-risk areas, buying APH with 85 percent coverage (the maximum available) is quite expensive and still requires the farmer to bear the first 15 percent of any yield loss. Increasing the maximum APH coverage level to 100 percent to help such farmers would greatly exacerbate adverse selection and moral hazard problems, and so is not proposed. Rather, SDC would allow farmers to buy additional GRP-like coverage to add on top of their existing APH coverage, so that farmers could obtain full coverage equal to 100 percent of the value of their expected (average) yield without exacerbating adverse selection and moral hazard problems. Specifically, SDC would allow insured farmers to buy GRP as a supplement to their APH policy, with supplemental indemnities triggered by shortfalls in county yields, and with a maximum liability for this supplemental coverage equal to their APH deductible.

Specific language in the Farm Bill proposal (USDA 2007b, p. 154) indicates that 90 percent GRP coverage level will be used for SDC; that is, the county yield would have to be less than 90 percent of the GRP expected county yield before an SDC indemnity would be paid. In addition, the Farm Bill proposes a more rapid payout of indemnities than is the case for the standard GRP. GRP currently pays indemnities proportional to the county yield loss, with 100 percent of the GRP liability paid only when the county yield is zero. However, a total crop loss for a whole county is a highly unlikely event for most crops in most counties. To improve the effectiveness of SDC coverage, the Farm Bill proposal indicates that 100 percent of the SDC liability would be paid when the county yield is 70 percent of the expected county yield (as opposed to 0 percent for GRP) (USDA 2007b, p. 154). Figure 1 graphically illustrates the difference between the two indemnity schedules—both have the same maximum payout, but this maximum is reached more quickly with the accelerated payment rate. Indemnity schedules of this sort have also been examined when evaluating weather derivatives for agricultural applications (Turvey, Weersink, and Chiang 2006, Vedenov, Epperson, and Barnett 2006, Martin, Barnett, and Coble 2001).

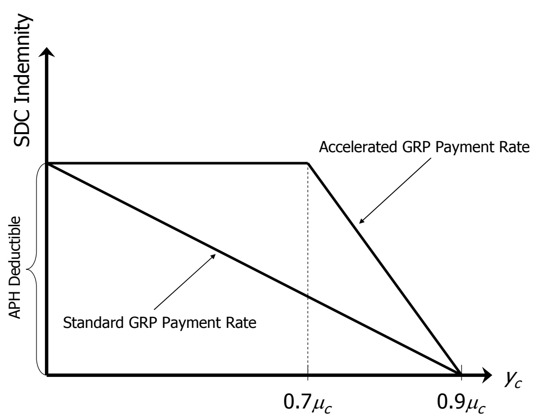


Figure 1. SDC Indemnities Plotted versus County Yield with a Standard GRP Payment Rate and with an Accelerated Payment Rate

Indemnities

To formalize these verbal descriptions, we report specific equations for farmer indemnities under the different policies. These equations define the existing APH and GRP policies and how the proposed SDC program would modify them. A farmer's indemnity (\$/ac) with APH (I_{aph}) is

$$(1) \qquad I_{aph}(\alpha) = P \times \max(\alpha\mu_f - y_f, 0),$$

where α is the chosen APH coverage level, μ_f is the farm unit's mean yield as determined by the actual production history, y_f is the realized farm unit yield, and P is the APH price determined by the USDA Risk Management Agency (RMA) and used to value yield losses.[2] The APH coverage level α is the proportion of the unit's average yield (μ_f) chosen by the farmer as the unit's yield guarantee, with available coverage options ranging from 50 percent to 85 percent in 5 percent increments. Hence, $\alpha\mu_f$ in equation (1) is the farm unit's per acre yield guarantee, the expression in the max(·) operator determines the unit's per acre yield loss relative to this guarantee, and this loss is valued at the pre-established APH price P used to determine the amount of coverage and to pay indemnities.

A farmer's indemnity (\$/ac) with GRP (I_{grp}) is

$$(2) \qquad I_{grp}(\gamma) = \Lambda \times \max\left(\frac{\gamma\mu_c - y_c}{\gamma\mu_c}, 0\right),$$

where Λ is the GRP maximum protection per acre (\$/ac) established by the RMA (equal to the policy's maximum liability), γ is the GRP coverage level, μ_c is the county mean yield, and y_c is the realized county yield. The GRP coverage level γ is the proportion of the county average yield (μ_c) the farmer chooses as the county yield guarantee for triggering indemnities. For GRP, multiple coverage levels are available, but SDC as proposed would use the equivalent of the 90 percent GRP coverage level. In equation (2), $\gamma\mu_c$ is the GRP per acre county yield guarantee based on the coverage level chosen, the expression in the max(·) operator is proportional yield loss (i.e., the proportion that the observed county yield falls below the county yield guarantee), and the indemnity is the product of this proportional loss and total liability Λ.[3]

[2] Farmers have the option of insuring at less than 100 percent of the RMA determined expected price, but insurance program experience has shown that the vast majority of participants choose coverage based on the maximum available price election.

[3] We assume that producers take the GRP maximum protection per acre published in the RMA county actuarial documents. Producers are allowed to choose amounts of coverage per acre less than this value, but most GRP participants choose to insure the maximum protection per acre.

A farmer's indemnity (\$/ac) for APH with SDC coverage using a standard GRP payment rate (I_{sdc_st}) is

$$(3) \qquad I_{sdc\_st}(\alpha) = I_{aph}(\alpha) + D(\alpha) \times \max\left(\frac{0.9\mu_c - y_c}{0.9\mu_c}, 0\right),$$

where $D(\alpha) = P(1 - \alpha)\mu_f$ is the APH deductible (\$/ac) as a function of the APH coverage level. Equation (3) is the APH indemnity plus a GRP-like indemnity using a 90 percent GRP coverage level trigger, but with the APH deducible (D) replacing the GRP maximum protection per acre (Λ). APH combined with SDC coverage with a standard GRP payment rate is not the policy proposed in the USDA's 2007 Farm Bill, but is analyzed here as a useful counterfactual for comparison.

A farmer's indemnity (\$/ac) for APH with SDC coverage using an accelerated GRP payment rate (I_{sdc_ac}) is

$$(4) \qquad I_{sdc\_ac}(\alpha) = I_{aph}(\alpha) + D(\alpha) \times \min\left(\max\left(\frac{0.9\mu_c - y_c}{0.9\mu_c - 0.7\mu_c}, 0\right), 1.0\right),$$

where all variables are as previously defined. Equation (4) is the APH indemnity plus a modified GRP indemnity. Again, a 90 percent GRP coverage level is used and the APH deductible replaces the GRP maximum protection per acre. However, proportional yield loss [the term in the max(·) operator] is calculated as a proportion of $0.9\mu_c - 0.7\mu_c = 0.2\mu_c$, not the county yield guarantee of $0.9\mu_c$. Since the term in the denominator in equation (4) is smaller than in equation (3), proportional yield loss in equation (4) is larger than in equation (3), so indemnities are larger. However, because proportional yield loss in this calculation can exceed 100 percent, the min(·) operator limits the proportional yield loss used to pay indemnities to 100 percent. Figure 1 illustrates the difference between the GRP-based components of the SDC indemnity in equation (3) and equation (4). Also, to follow the USDA's 2007 Farm Bill proposal, equation (4) uses 70 percent of the county expected yield as the yield level by which the GRP component pays 100 percent of the APH deductible; other percentages are possible, but not examined here.

Conceptual Framework and Analytical Methods

Farmers currently buying yield insurance must choose APH or GRP. The goal of the analysis is to determine how adding SDC to the farmer choice set affects farmer welfare as measured by changes in certainty equivalents (\$/ac) and farmer behavior as indicated by changes in optimal coverage levels. Here we explain our modeling approach and its empirical implementation. First, we specify a parametric model of correlated county and farm yields, and then farmer revenue and utility. Next, we describe empirical implementation of Monte Carlo integration for calculating expected utility and actuarially fair premiums. Finally, we specify the farmer's optimization problem—choosing the coverage level to maximize the expected utility of revenue from crop production—and then explain how the solutions will be used to examine the effects of SDC on farmer welfare and optimal coverage levels.

County and Farm Yields

An important aspect of this analysis is the connection between farm yields and county yields. Several approaches have been developed for modeling this connection. Deng, Barnett, and Vedenov (2007) describe a multiplicative model in which farm yield is a random proportion of the realized county yield. The mean of the random proportion determines the mean farm yield relative to the county yield, while the variance of the random proportion partly determines the proportion of the farm yield variability due to idiosyncratic effects. More common is an additive model with farm yield equal to the product of a constant factor and the realized county yield, plus a random idiosyncratic error. Miranda (1991) used the model to examine area yield crop insurance comparable to GRP; Atwood, Baquet, and Watts (1996) used it to develop premiums for Income Protection (a different crop insurance policy); Carriquiry, Babcock, and Hart (2005) used it to propose improvements for developing APH premiums; and Ramaswami and Roe (2004) derived its micro-production function foundations.

Unlike these studies, actual farm yield history data were unavailable for this analysis. By combining farm yield histories with the associated county yield data, an empirical model of the mean and variability of county yield could be estimated, and more importantly, the mean and variance of farm yield and its stochastic relationship with county yield could also be estimated for each individual farmer in a population. Based on this empirical foundation, the welfare effect of offering SDC and the effect of SDC on the optimal APH coverage level could be estimated for each farmer, and these effects aggregated or their distribution examined. However, not having such data, we used a parametric approach, specifying a joint distribution for county and farm yields with known marginal distributions. The final stochastic model of farm and county yields is specified by five parameters—the mean and variance for both county and farm yield and their correlation. We examine "typical" extreme cases—farmers with mean yields well above and well below the county average—both for farmers with a relatively low and a relatively high level of correlation with the county yield, and then identify the implied effects of SDC on farmer welfare and optimal APH coverage. Thus, our estimates serve as reasonable bounds on the magnitude of these effects for the majority of individual farmers.

For this analysis, we use beta distributions for both county and farm yields, a common assumption for crop yields [Goodwin and Ker (2002) review several examples; also, see Sherrick et al. (2004)]. An important advantage of the beta distribution is that negative realizations do not occur. In high-risk counties with relatively low mean yields and high standard deviations, the likelihood of negative yields is not negligible for normal and similar distributions, so that ad hoc fixes would be required for simulated yields.

For each county examined here, mean county yield is set equal to the 2007 GRP expected county yield published in the county actuarial documents (USDA 2007c). The standard deviation for each county was calibrated so that the actuarially fair premium rate for the simulated county yields with 90 percent GRP coverage matched the unsubsidized GRP rate for 90 percent coverage published in the county actuarial documents (USDA 2007c). Finally, since the beta distribution requires specifying the minimum and maximum, we follow Babcock, Hart, and Hayes (2004) and set minimum yield to the maximum of zero and the mean minus four standard deviations, and set maximum yield to the mean plus two standard deviations.

Table 1 lists the resulting means and standard deviations of county yield for the four counties examined here (as well as the yield coefficient of variation, APH price, and GRP maximum protection per acre). Tripp County in South Dakota and Hamilton County in Iowa respectively represent a high-risk and a low-risk county for producing corn, while Lubbock County in Texas and Coahoma County in Mississippi respectively represent a high-risk and a low-risk county for producing cotton. These interpretations as low and high risk are based on the size of the GRP premium rate—for these counties, those with high average yields have lower premium rates than those with low average yields. This inverse relation between county average yield and yield risk is typical for most crops and counties and so we will follow it in our discussion here, but exceptions likely occur for some crops and counties. Finally, the beta distributions for yields implied by the parameters in Table 1 are fairly symmetric with slight negative skews, the skewness ranging between -0.13 and -0.44 for the four counties.

This analysis also uses a beta distribution for farm unit yields (Goodwin and Ker 2002, Sherrick et al. 2004). Within each county, we examine two types of producers—farmers with mean yield 25 percent below the county average yield and farmers with mean yield 25 percent above the county average yield. The standard deviations for farm yields were calibrated so that the actuarially fair premium with the simulated farm yields matched the unsubsidized APH premium for 65 percent coverage for the respective mean farm yield as published in the county actuarial documents (USDA 2007c). Farmers with above average yields are lower risk than farmers with below average yields for the same APH coverage, since for the cases examined here, APH premium rates decrease as average farm yield increases. Thus we follow this generalization in our discussion—that farmers with higher average yields are lower risk than farmers with lower average yields—though exceptions to this generalization likely exist for

Table 1. Parameters Used for Empirical Analysis of Supplemental Deductible Coverage

	Corn		Cotton	
Parameter	Tripp, SD	Hamilton, IA	Lubbock, TX	Coahoma, MS
County mean μ_c	56.9 bu/ac	176.4 bu/ac	232.0 lbs/ac	852.0 lbs/ac
County st. dev. σ_c	16.26 bu/ac	24.9 bu/ac	97.35 lbs/ac	187.1 lbs/ac
County CV	28.6%	14.1%	42.0%	22.0%
APH price P	\$3.50/bu	\$3.50/bu	\$0.52/lb	\$0.53/lb
GRP maximum protection per acre Λ	\$251.78/ac	\$780.57/ac	\$187.92/ac	\$690.12/ac
Farm mean 25% below county mean				
Farm mean μ_c	43.0 bu/ac	132.0 bu/ac	174.0 lbs/ac	639.0 lbs/ac
Farm st. dev. σ_c	37.3 bu/ac	38.0 bu/ac	199.7 lbs/ac	277.7 lbs/ac
Farm CV	86.7%	28.8%	114.7%	43.5%
65% APH premium M_{aph}	\$12.32/ac	\$3.68/ac	\$10.88/ac	\$7.87/ac
Farm mean 25% above county mean				
Farm mean μ_c	71.0 bu/ac	221.0 bu/ac	290.0 lbs/ac	1065.0 lbs/ac
Farm st. dev. σ_c	39.5 bu/ac	53.7 bu/ac	227.2 lbs/ac	399.8 lbs/ac
Farm CV	55.6%	24.3%	78.3%	37.5%
65% APH premium M_{aph}	\$9.61/ac	\$3.50/ac	\$10.57/ac	\$9.34/ac

some crops in some counties. Finally, we follow Babcock, Hart, and Hayes (2004) and set minimum yields to the maximum of zero and the mean minus four standard deviations, and maximum yields to the mean plus two standard deviations. Table 1 reports the resulting means and standard deviations of farm yield for farms with below average (high-risk) and with above average (low-risk) yields in the four counties examined, as well as the associated APH premiums for 65 percent coverage. The resulting distributions of farm yield are generally consistent with published results for dryland production of corn and cotton (Coble, Heifner, and Zuniga 2000, Coble, Zuniga, and Heifner 2003, Hennessy, Babcock, and Hayes 1997).

The final parameter needed to specify the relationship between farm and county yields is their correlation. Little published data regarding observed farm and county yield correlations for a range of crops and counties exist. A rare example is Hennessy, Babcock, and Hayes (1997), who report 0.8 as the average correlation for ten farms for a single crop in a single county. However, actual farm yield histories, from which we could derive empirical estimates of the distribution of the correlation between county and farm yields, were unavailable for this study. As a result, we selected two levels for Pearson's correlation coefficient between farm and county yields (0.3 and 0.9) as examples of farms with low and high yield correlation with the county yield to capture a wide range of conditions. Our purpose is to examine results at these reasonable extremes in order to estimate the range of the expected effects of SDC for most farmers.

Farmer Revenue and Insurance Premiums

For this analysis, farm revenue is crop revenue (the product of the non-random price P and random yield y_f), plus the insurance indemnity minus the premium, where the indemnity and the premium depend on the chosen insurance coverage level. We do not include non-random production costs, given the difficulty in consistent estimation of such costs for different types of producers in different counties across states. Thus, farmer returns ($/ac) for insurance program $i \in \{none, aph, grp, sdc\_st, sdc\_ac\}$ are

$$\pi_i(\alpha) = Py_f + I_i(\alpha) - M_i(\alpha), \quad (5)$$

where $M_i(\alpha)$ is the per acre farmer premium for insurance program i as a function of the APH coverage level. The subscript *none* implies no insurance, with I_{none} and M_{none} equal to zero. The analysis uses a non-random price to focus only on yield risk and uses the published APH price for all crops and policies as an easily available estimate of the expected crop price at harvest.

For farmer premiums, we analyze these insurance policies using actuarially fair premiums equal to the expected value of the indemnity derived through Monte Carlo integration. Farmer premiums currently include subsidies so that farmers pay less than what the RMA estimates to be actuarially fair. Table 2 reports the current premium subsidy rates for all APH and GRP coverage levels. Since these premium subsidies are included in all current actual premiums, we use these same subsidy rates in our analysis. Since indemnities for SDC combined with APH are a combination of APH- and GRP-based indemnities, premiums for APH combined with SDC use the appropriate APH subsidy rate for the APH portion of the premium and the 90 percent GRP subsidy rate for the SDC portion of the premium. Since all crop insurance premiums are currently subsidized, we do not report results for unsubsidized premiums.

Table 2. Current Premium Subsidy Rates for Federal Crop Insurance Policies

Coverage Level	APH Subsidy Rate	GRP Subsidy Rate
50%	67%	---
55%	64%	---
60%	64%	---
65%	59%	---
70%	59%	64%
75%	55%	64%
80%	48%	59%
85%	38%	59%
90%	---	55%

Source: USDA (2007c).

As previously explained, the county yield standard deviations were calibrated so that the simulated fair GRP premium rate matched the actual GRP rate. Thus by construction, our subsidized SDC premiums are equal to actual 90 percent coverage GRP premiums, with the protection per acre equal to the APH deductible. However, for SDC with an accelerated payment rate, the available GRP premium information does not allow calibration of simulated premiums to equal published premiums. Therefore, premium rates for accelerated coverage were derived through Monte Carlo integration using the accelerated indemnity function reported in equation (4). APH premiums used in the analysis were also derived through the Monte Carlo integration. As previously explained, farm yield standard deviations were calibrated so that the simulated fair APH premium with a 65 percent coverage level matched the actual APH rate for the same mean yield. Because APH premiums are not exactly consistent with a single yield distribution (Babcock, Hart, and Hayes 2004), the simulated APH premiums used for this analysis for coverage levels other than 65 percent will not match the actual premiums for these coverage levels, though they will be relatively close in value.

Farmer Utility

For farmer risk preferences, we use a power utility function, which implies constant relative risk aversion (CRRA). Following Chavas (2004, p. 46), farmer utility from per acre returns for insurance program $i \in \{none, aph, grp, sdc\_st, sdc\_ac\}$ is

$$U_i(\alpha) = -\pi_i(\alpha)^{1-R}, \quad (6)$$

where $R > 1$ is the coefficient of relative risk aversion and π_i is as defined by equation (5). Following Coble, Heifner, and Zuniga (2000) and Coble, Zuniga, and Heifner (2003), we use $R = 2.0$ to reflect a moderate level of risk aversion.[4]

Farmer expected utility for each policy is the expected value of equation (6):

[4] Gollier (2001, p. 31) provides basic calculations to support the general conclusion that a reasonable range for R is 1 to 4. However, it has been a common regularity (as of yet without a generally accepted explanation) that empirical estimates of R commonly exceed this range (e.g., Chavas and Holt 1996, Cohen and Einav 2007, Schechter 2007).

$$(7)\qquad EU_i(\alpha) = \mathrm{E}[-\pi_i(\alpha)^{1-R}] = \int_\pi -\pi_i(\alpha)^{1-R}\, dF(\pi_i \mid \alpha),$$

where $F(\pi_i|\alpha)$ is the cumulative distribution function of random farmer returns π_i conditional on the APH coverage level α. As equation (5) indicates, π_i is a transformation of farm yield y_f, directly through crop revenue and indirectly through the indemnity, so that for most of the policies analyzed, the actual conditional distribution function $F(\pi_i \mid \alpha)$ is generally difficult to express as a closed-form equation due to the farm and county yield distributions used and the truncated nature of insurance indemnities. Furthermore, the transformation of returns π_i by the utility function creates additional nonlinearity so that closed-form analytical solutions for expected utility do not exist for any of the policies analyzed. As a result, numerical methods are needed to calculate expected utility; for the analysis here, we use Monte Carlo integration.

Empirical Implementation

Greene (2003) provides an overview of Monte Carlo integration, widely used to approximate multiple integrals of complex functions. Numerous applications in agriculture and crop insurance exist (e.g., Hennessy, Babcock, and Hayes 1997, Hurley, Mitchell, and Rice 2004, Mitchell, Gray, and Steffey 2004). We use the method to approximate the integrals for calculating expected utility in equation (7) and actuarially fair premiums equal to the expected indemnities.

County and farm yields are the fundamental random variables in this analysis; all other random variables are functions of these two variables, their moments, and other parameters. We use the method of Richardson and Condra (1981), explained in more detail by Fackler (1991), to draw vectors of county and farm yields with the required correlation. Goodwin and Ker (2002) discuss the merits and weaknesses of this method for correlating random variables. Monte Carlo integration for this analysis was implemented using Microsoft Excel 2003. Experimentation indicated that 10,000 random draws were sufficient for results to converge.

Analyzing Supplemental Deductible Coverage

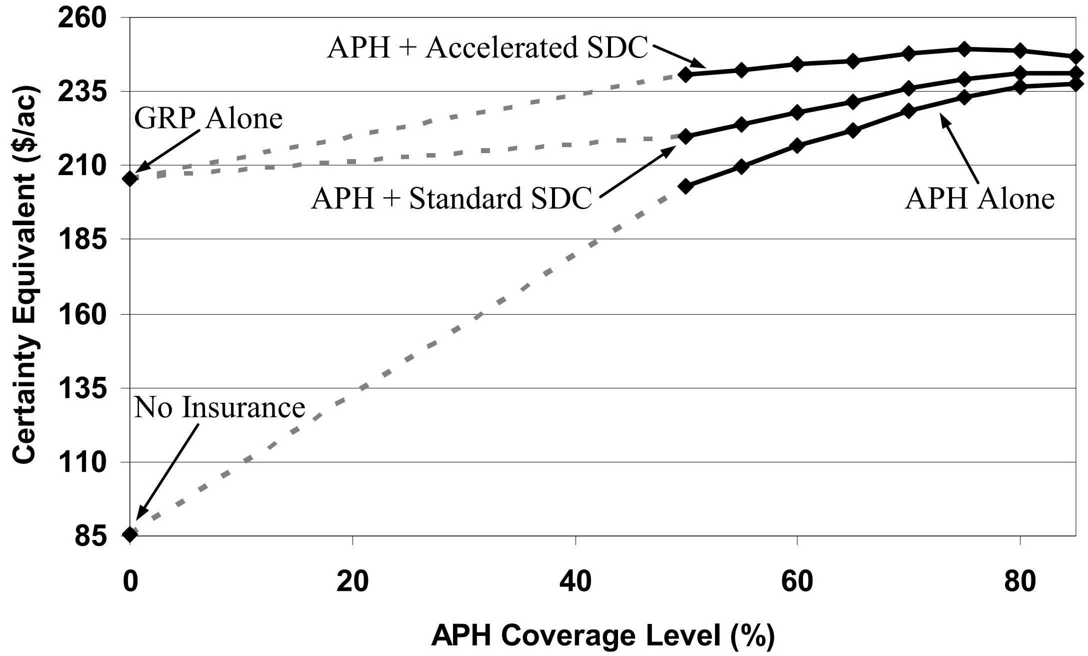
The analysis assumes that farmers choose the APH coverage level to maximize their expected utility. Mathematically, the farmer's problem is

$$(8)\qquad \max_\alpha EU_i(\alpha) = \max_\alpha \int_\pi -\pi_i(\alpha)^{1-R}\, dF(\pi_i \mid \alpha),$$

where $\alpha \in$ {0%, 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%) is the farmer's choice variable. Note that α = 0% is a special case used here to incorporate no insurance and GRP coverage into the choice set without creating separate scenarios for these two policies. For the current APH policy ($i = aph$), α = 0% indicates no insurance ($i = none$), and when examining either of the SDC policies ($i = sdc\_st$ or $i = sdc\_ac$), α = 0% indicates 90 percent GRP coverage ($i = grp$). This notation collapses the five insurance policies into three scenarios to analyze: APH alone (or no insurance if α = 0%) ($i = aph$), APH combined with SDC using a standard GRP payment rate (or GRP alone if α = 0%) ($i = sdc\_st$), and APH combined with SDC using an accelerated GRP payment rate (or GRP alone if α = 0%) ($i = sdc\_ac$). Simulations were conducted with each APH coverage level (0 percent, 50 percent to 85 percent in 5 percent steps), and a simple search identified the optimal APH coverage level (α_i^*) and associated optimal expected utility (EU_i^*) for each of the three scenarios. These optimal expected utilities were then converted into the associated optimal certainty equivalents ($/ac) for each scenario:

$$(9)\qquad CE_i^* = \left(-EU_i^*\right)^{1/(1-R)}.$$

Figure 2 illustrates example results for Tripp County in South Dakota and Hamilton County in Iowa with parameterizations as reported in the figure caption. The three lines in each plot indicate farmer certainty equivalents for all APH coverage levels for all policies as labeled. The "No Insurance" or "GRP Alone" choices of α = 0% are the points on the vertical axis, connected by dashed lighter lines to results with "APH Alone" (α = 50 percent to 85 percent in 5 percent steps). From the data used to generate plots such as those illustrated in Figure 2, the optimal APH coverage level (α_i^*) and associated optimal certainty equiva-



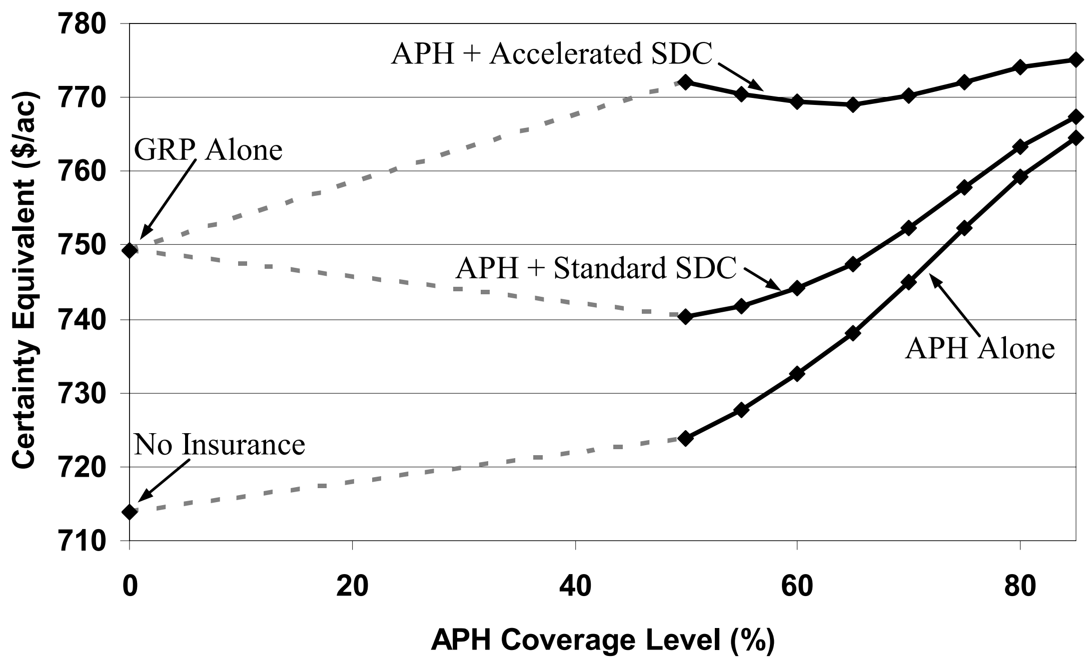


Figure 2. Certainty Equivalent Returns for Corn in Tripp County, South Dakota (top), and Hamilton County, Iowa (bottom), for the Three Insurance Scenarios

Note: With fair subsidized premiums, a farm mean yield 25 percent above the county average, and a county-farm yield correlation of 0.9.

lent (CE_i^*) were identified for the three scenarios for each parameterization. The vertical gap between the three lines is the increase in farmer certainty equivalents when a farmer switches from APH alone to APH with SDC with a standard or with an accelerated payment rate. Because so many parameterizations were analyzed, the optimal coverage levels and certainty equivalents for each parameterization are not reported, but are available upon request from the authors.

Results and Discussion

The presentation of results first discusses general findings for the data, such as those illustrated in Figure 2. However, primary presentation of results uses tables to focus on changes in certainty equivalents and optimal coverage levels between the scenarios to provide monetary estimates of farmer benefits from SDC and to determine how farmers would likely adjust APH coverage levels if SDC became available. Changes in optimal certainty equivalents between using either the current APH or GRP policy alone and either APH combined with SDC using a standard GRP payment rate or with SDC using an accelerated GRP payment rate are estimates of the farm-level benefits of the proposed SDC policy. Changes in the optimal APH coverage levels between using either the current APH or GRP policy alone and either APH combined with SDC using a standard GRP payment rate or with SDC using an accelerated GRP payment rate indicate how farmers would likely adjust APH coverage levels if SDC became available.

Figure 2 shows the general results that occur for each county and farm type examined. First, farmer certainty equivalents with APH always exceed the "No Insurance" case (even for risk-neutral farmers) and, at any given coverage level, certainty equivalents with APH plus SDC with an accelerated payment rate always exceed certainty equivalents with APH plus SDC using the standard payment rate. SDC increased farmer welfare more at lower APH coverage levels than at higher levels, i.e., the gap between the "APH Alone" and the "APH + Accelerated SDC" curves is larger at lower coverage levels in Figure 2. Relative to the "APH Alone" curve, accelerated SDC "lifts" farmer certainty equivalents more at the lower APH coverage levels, so that the "APH + Accelerated SDC" curve becomes very "flat," as for Tripp County, or "U-shaped," as for Hamilton County. In general, optimal APH coverage levels for risk-averse farmers ranged from 75 percent to 85 percent. Only for a few of the risk-neutral cases examined did this "lifting" of the lower end of the accelerated SDC curves cause the optimal APH coverage level to jump across the "U-shaped" curve to α = 50%. In addition, GRP (α = 0%) was optimal relative to APH or APH with SDC using a standard payment rate in only one county, and then only for the risk-neutral case.

Table 3 reports the increase in farmer certainty equivalents as $/ac when switching from using APH alone to using APH combined with SDC using either the standard GRP payment rate or the accelerated payment rate. Table 4 reports the decrease in the optimal APH coverage level associated with switching from APH alone to APH combined with either type of SDC examined. Based on the results in these tables, we draw several generalizations regarding the effect of SDC.

Farmer Benefits from SDC

For all cases in Table 3, SDC generates positive benefits relative to the current program of using either APH or GRP alone, implying that most farmers would find some benefit from SDC. We focus initially on results with the accelerated payment rate, as this is the proposed program. In Tripp County, SDC generates a benefit for corn farmers ranging from about $5/ac to over $11.40/ac with the accelerated payment rate; benefits for Hamilton County corn farmers are fairly similar in magnitude. Though the magnitude of the benefit of SDC is similar for corn farmers in these two locations, the relative benefit of SDC in Tripp County is much larger, since the revenue potential for corn in Tripp County is much lower. For cotton farmers, SDC with the accelerated payment rate generates benefits ranging from about $4/ac to $11.50/ac in Lubbock County and over $6/ac to $16.50/ac in Coahoma County. However, again, since the revenue potential for cotton is lower in Lubbock County, the relative benefit of SDC is larger. Relative to the risk-averse cases examined, results for the risk-neutral cases are almost uniformly dampened—the low ends of the ranges are not as low and the high ends of the ranges are not as high. Thus, the reported ranges for the benefit

Table 3. Net Benefit of APH Plus SDC with a Standard and with an Accelerated Payment Rate[a]

			Standard Rate		Accelerated Rate	
County	Mean Yield[b]	ρ_{fc}	Risk Averse	Risk Neutral	Risk Averse	Risk Neutral
Tripp County, SD	25% below	0.3	2.04	1.76	5.06	5.59
		0.9	2.99	1.76	8.19	5.61
	25% above	0.3	2.36	2.84	6.72	8.91
		0.9	3.52	2.86	11.40	8.95
Hamilton County, IA	25% below	0.3	1.26	1.11	4.74	5.36
		0.9	1.70	1.10	6.52	5.31
	25% above	0.3	2.06	1.63	7.75	11.00
		0.9	2.76	1.63	10.59	10.94
Lubbock County, TX	25% below	0.3	2.01	1.93	4.17	4.78
		0.9	3.11	1.93	7.10	4.78
	25% above	0.3	3.28	3.03	6.61	7.86
		0.9	4.97	3.03	11.53	7.87
Coahoma County, MS	25% below	0.3	2.10	5.17	6.36	8.56
		0.9	2.93	5.18	10.43	8.55
	25% above	0.3	3.41	3.52	10.35	15.60
		0.9	4.73	3.52	16.54	15.53

[a] Benefits measured as the increase in farmer certainty equivalents ($/ac) relative to the current program of using either APH or GRP alone.
[b] Relative to county mean.

of SDC encompass results for the risk-averse and risk-neutral cases examined. Finally, farmer benefits from SDC with the standard payment rate are lower, indicating the essential nature of the accelerated payment rate in order for SDC to generate a significant farmer benefit. Farmer benefits with the standard payment rate are less than about $3.50/ac for the corn cases examined, and less than $5.20/ac for the cotton cases.

Among the trends in Table 3, note that as the farm-county yield correlation increases, the benefits from SDC increase for risk-averse farmers, but remain relatively unchanged for risk-neutral farmers. Risk-averse farmers derive greater benefit from SDC as their yields more closely follow county yields because SDC indemnities become more likely to coincide with low farm yield outcomes and thus reduce revenue variance. Risk-neutral farmers do not respond to changes in revenue variance due to SDC, but rather seek the APH coverage level that maximizes their expected revenue when APH is combined with SDC.

For all the cases examined in Table 3, within the same county, low-risk farmers (those with mean yields 25 percent above the county mean) receive larger benefits from SDC than high-risk farmers (those with mean yields 25 percent below the county mean). This result occurs because of the difference in yield (and hence revenue) potential between the high- and low-risk farmers in a county. For a given coverage level, the APH deductible is larger for low-risk (high mean) farmers because they have a larger yield guarantee due to their greater yield potential. For a given county yield outcome, SDC pays the same proportion of the APH deductible for both types of farmers, but the indemnity is larger for the low-risk (high mean) farmers because they have a larger APH deductible.

When comparing farmers in a low-risk county to comparable farmers in a high-risk county in Table 3, this yield potential effect does not always hold. In most cases, farmers in high-risk counties derive smaller benefits from SDC than comparable farmers in low-risk counties, which is consistent with their difference in yield potentials. For example, both high-risk and low-risk cotton farmers in Lubbock County derive smaller benefits from SDC than comparable high- and low-

Table 4. Percentage Point Decrease in the Optimal APH Coverage Level with APH Plus SDC with the Standard and with an Accelerated SDC Payment Rate[a]

County	Mean Yield[b]	ρ_{fc}	Standard Rate: Risk Averse	Standard Rate: Risk Neutral	Accelerated Rate: Risk Averse	Accelerated Rate: Risk Neutral
Tripp County, SD	25% below	0.3	0%	0%	0%	5%
		0.9	0%	0%	5%	5%
	25% above	0.3	0%	5%	5%	10%
		0.9	5%	5%	10%	10%
Hamilton County, IA	25% below	0.3	0%	5%	0%	10%
		0.9	0%	5%	0%	10%
	25% above	0.3	0%	0%	0%	35%
		0.9	0%	0%	0%	35%
Lubbock County, TX	25% below	0.3	0%	5%	5%	5%
		0.9	5%	5%	5%	5%
	25% above	0.3	0%	0%	0%	15%
		0.9	0%	0%	5%	15%
Coahoma County, MS	25% below	0.3	0%	80%[c]	0%	10%
		0.9	0%	80%[c]	5%	10%
	25% above	0.3	0%	0%	0%	30%
		0.9	0%	0%	5%	30%

[a] Decreases measured relative to the current program of using either APH or GRP alone.
[b] Relative to county mean.
[c] Shift from 80 percent APH coverage to GRP.

risk farmers in Coahoma County. However, for the corn counties examined, this trend no longer consistently occurs. Low-risk corn farmers in Tripp County with a yield correlation of 0.3 derive smaller benefits from SDC than low-risk farmers in Hamilton County, which is consistent with the yield potential effect, but this outcome reverses with a yield correlation of 0.9. Also, high-risk corn farmers derive greater benefit from SDC in Tripp County than in Hamilton County, which again is opposite the outcome implied by the difference in yield potentials.

The benefits of SDC arise from two primary sources. First, SDC allows a farmer to increase insurance coverage to also include the APH deductible. In general, the larger the yield potential, the larger this benefit becomes. Thus, counties with high yield potential (low risk) will derive greater benefit from SDC. Second, SDC provides some protection from systemic risk as captured in the county yield. APH provides a measure of protection against both idiosyncratic and systemic risk, while GRP provides protection only against systemic risk; SDC combines both to provide increased protection against systemic risk. The greater the systemic risk, the larger the benefit of SDC becomes. Thus, counties with high systemic risk will derive greater benefit from SDC. The yield potential and systemic risk effects of SDC counteract each other so that the types of farmers who will derive the greatest benefit from SDC is an empirical issue—high-risk farmers with low average yields or low-risk farmers with high average yields.

The results in Table 3 show that within a county, where the systemic risk is held constant, low-risk farmers derive greater benefit from SDC, which is to be expected. Comparing across counties, where the systemic risk is no longer held constant, high-risk farmers in one county generally derive greater benefit relative to the low-risk case (corn in Tripp County versus in Hamilton County), while the reverse occurs in another county relative to its low-risk case (cotton in Lubbock County versus in Coahoma County). For the corn examples, the systemic risk benefit of SDC dominates the yield potential effect, while for cotton, the yield potential effect dominates. If other counties and crops were examined, which effect dominated could change.

Effect of SDC on Optimal APH Coverage Levels

Because SDC provides protection from systemic risk, SDC can serve as an imperfect substitute for higher APH coverage, which can imply a reduction in the optimal APH coverage level. Thus, for all cases in Table 4, the optimal APH coverage with SDC either decreases or remains unchanged—the optimal APH coverage level never increases when APH is combined with SDC. With the accelerated payment rate, the decrease is as large as 35 percentage points (i.e., a shift from 85 percent to 50 percent coverage), but these large decreases occur for the risk-neutral cases. For the risk-averse cases, the decrease is generally 0 or 5 percentage points, with one case of 10 percentage points. The implication is that as farmers become less risk-averse, SDC decreases the optimal APH coverage level more. With the standard payment rate, the optimal coverage level decreases no more than 5 percentage points, except for a few cases when it becomes optimal to choose GRP over SDC. However, the difference between the risk-averse and risk-neutral cases is much smaller.

For the risk-averse cases with an accelerated payment rate, no consistent pattern emerges regarding whether SDC has a larger effect on optimal APH coverage levels for low-risk or high-risk farmers. In the two low-risk counties (corn in Hamilton County and cotton in Coahoma County), no difference exists between the decrease in optimal APH coverage for high- and low-risk farmers. The same occurs in Lubbock County (a high-risk cotton county), except for one case in which the optimal APH coverage level decreases more for the high-risk cotton farmer. In Tripp County, a high-risk corn county, low-risk (high mean) corn farmers have a larger decrease in optimal APH coverage than high-risk farmers with low mean yields.

When examining the risk-neutral cases, however, a consistent pattern emerges—low-risk farmers experience a larger decrease in the optimal APH coverage level with SDC. This larger decrease in optimal APH coverage for low-risk farmers holds when comparing low- and high-risk farmers within a county and when comparing comparable farmers in low- and high-risk counties. The implication is that the effect of SDC on expected revenue decreases the optimal APH coverage level more for low-risk farmers, but risk aversion dampens this expected revenue effect of SDC because risk-averse farmers derive risk management benefits from higher APH coverage levels. These dampening effects of risk aversion depend on the specifics of the yield distributions and lead to the difficult-to-interpret pattern of effects of SDC on optimal APH coverage levels in Table 4.

As the farm yield becomes more correlated with the county yield, the effectiveness of SDC as a substitute for APH increases, and so the optimal APH coverage level with SDC should decrease or remain unchanged. For the results in Table 4, this effect of the correlation between the farm and county yields is minimal. For most cases, as the correlation increases, the optimal APH coverage level remains unchanged. However, for a few risk-averse cases, the optimal coverage decreases, e.g., Coahoma County and low-risk farmers in Lubbock County and Tripp County. The main implication is that the reduction in the optimal APH coverage level is fairly non-responsive to the correlation between farm and county yields.

Conclusion

We examined the farm-level effects of Supplement Deductible Coverage (SDC) as contained in the USDA Farm Bill proposal. Our empirical analysis used a variety of assumptions to parameterize a model of correlated county and farm yields, in particular calibrating the mean and standard deviation of yields to match crop insurance premium rates. We developed corn and cotton examples for farms in low-risk/high-yield and high-risk/low-yield counties, examining results at reasonable extremes for county-farm yield correlations. We used the results of these numerical experiments to estimate the range of effects to expect for most farmers if a study were to be conducted using actual farm and county yield histories. We focused our analysis on the effects of SDC on farmer welfare and the optimal level of insurance coverage.

Our results indicate that SDC, as structured under the USDA Farm Bill proposal, generates welfare benefits for all farms analyzed. SDC increased farmer welfare from $5 to over $11/ac for the corn examples examined, and from $4 to over $16/ac for the cotton examples. However, the incidence of this benefit varied depending on the specific assumptions, which we interpreted as the interaction of two offsetting effects—a yield potential effect and a systemic risk effect.

Farmers with higher yield potential derive greater benefit from SDC because, at any APH coverage level, their APH deductibles insurable under SDC are larger. In addition, because SDC provides increased protection against systemic risk, farmers in counties with greater systemic risk derive greater benefit from SDC. However, crop insurance premiums for both GRP and APH indicate that, for most crops in most counties, as yield potential increases, yield variability decreases. As a result, areas with high yield potential tend to have lower levels of systemic risk and vice versa. This general trend implies that the yield potential effect tends to work in the opposite direction of the systemic risk effect, so that the net effect of SDC on farmer welfare is an empirical issue depending on the specifics of the yield distributions.

SDC also decreased the optimal APH coverage level, generally by at most 5 percentage points for the risk-averse cases examined, but from 5 to 35 percentage points for the risk-neutral cases. Thus SDC provides incentives for many farmers to shift from individual coverage to area coverage, and so reduces the potential for moral hazard, adverse selection, fraud, and program abuse for the crop insurance program, since these problems are typically less serious when individual coverage levels are lower.

References

Atwood, J., A. Baquet, and M. Watts. 1996. "Income Protection." Technical report, Montana State University. Submitted to the U.S. Department of Agriculture, Economic Research Service, Commercial Agricultural Division (February 16). Available at http://www.rma.usda.gov/pilots/mis[-]cproj/techsum.pdf.

Babcock, B., C. Hart, and D. Hayes. 2004. "Actuarial Fairness of Crop Insurance with Constant Rate Relativities." *American Journal of Agricultural Economics* 86(3): 563–575.

Babcock, B., and D. Hennessy. 1996. "Input Demand under Yield and Revenue Insurance." *American Journal of Agricultural Economics* 78(2): 416–427.

Carriquiry, M., B. Babcock, and C. Hart. 2005. "Using a Farmer's Beta for Improved Estimation of Actual Production History (APH) Yields." Working Paper No. 05-WP-387, Center for Agricultural and Rural Development, Iowa State University, Ames, IA. Available at http://www.card.iastate.edu/publications/DBS/PDFFiles/05wp387.pdf.

Chambers, R.G. 1989. "Insurability and Moral Hazard in Agricultural Insurance Markets." *American Journal of Agricultural Economics* 71(3): 604–616.

Chavas, J.P. 2004. *Risk Analysis in Theory and Practice*. New York: Elsevier.

Chavas, J.P., and M.T. Holt. 1996. "Economic Behavior under Uncertainty: A Joint Analysis of Risk Preferences and Technology." *The Review of Economics and Statistics* 78(2): 329–335.

Coble, K., R. Heifner, and M. Zuniga. 2000. "Implications of Crop Yield and Revenue Insurance for Producer Hedging." *Journal of Agricultural and Resource Economics* 25(2): 432–452.

Coble, K.H., and T.O. Knight. 2002. Crop Insurance as a Tool for Price and Yield Risk Management." In R.E. Just and R.D. Pope, eds., *A Comprehensive Assessment of the Role of Risk in U.S. Agriculture*. Boston, MA: Kluwer Academic Press.

Coble K.H., M. Zuniga, and R. Heifner. 2003. "Evaluation of the Interaction of Risk Management Tools for Cotton and Soybeans." *Agricultural Systems* 75(2/3): 323–340.

Cohen, A., and L. Einav. 2007. "Estimating Risk Preferences from Deductible Choices." *The American Economic Review* 97(3): 745–788.

Deng, X., B. Barnett, and D. Vedenov. 2007. "Is There a Viable Market for Area-Based Crop Insurance?" *American Journal of Agricultural Economics* 89(2): 508–519.

Fackler, P. 1991. "Modeling Interdependence: An Approach to Simulation and Elicitation." *American Journal of Agricultural Economics* 73(4): 1091–1097.

Gollier, C. 2001. *The Economics of Risk and Time*. Cambridge, MA: MIT Press.

Goodwin, B.K. 1993. "An Empirical Analysis of the Demand for Crop Insurance." *American Journal of Agricultural Economics* 75(2): 425–434.

Goodwin, B.K., and A.P. Ker. 2002. "Modeling Price and Yield Risk." In R.E. Just and R.D. Pope, eds., *A Comprehensive Assessment of the Role of Risk in U.S. Agriculture*. Boston, MA: Kluwer Academic Press.

Greene, W. 2003. *Econometric Analysis* (5th edition). Upper Saddle River, NJ: Prentice Hall.

Hennessy, D., B. Babcock, and D. Hayes. 1997. "Budgetary and Producer Welfare Effects of Revenue Insurance." *American Journal of Agricultural Economics* 79(3): 1024–1034.

Hurley, T.M., P.D. Mitchell, and M.E. Rice. 2004. "Risk and the Value of Bt Corn." *American Journal of Agricultural Economics* 86(2): 345–358.

Just, R., L. Calvin, and J. Quiggin. 1999. "Adverse Selection in U.S. Crop Insurance: Actuarial and Asymmetric Information Incentives." *American Journal of Agricultural Economics* 81(4): 834–849.

Martin, S., B.J. Barnett, and K.H. Coble. 2001. "Developing and Pricing a Rainfall Contingent Claims Contract." *Jour-*

nal of Agricultural and Resource Economics 26(1): 261–274.

Miranda, M. 1991. "Area-Yield Crop Insurance Reconsidered." *American Journal of Agricultural Economics* 73(2): 233–242.

Mitchell, P., M. Gray, and K. Steffey. 2004. "A Composed Error Model for Estimating Pest-Damage Functions and the Impact of the Western Corn Rootworm Soybean Variant in Illinois." *American Journal of Agricultural Economics* 86(2): 332–344.

Ramaswami, B., and T. Roe. 2004. "Aggregation in Area-Yield Crop Insurance: The Linear Additive Model." *American Journal of Agricultural Economics* 86(2): 420–431.

Richardson, J., and G. Condra. 1981. "Farm Size Evaluation in the El Paso Valley: A Survival/Success Approach." *American Journal of Agricultural Economics* 63(3): 430–437.

Schechter, L. 2007. "Risk Aversion and Expected-Utility Theory: A Calibration Exercise." *Journal of Risk and Uncertainty* 35(1): 67–76.

Sherrick, B.J., F.C. Zanini, G.D. Schnitkey, and S.H. Irwin. 2004. "Crop Insurance Evaluation under Alternative Yield Distributions." *American Journal of Agricultural Economics* 86(2): 406–419.

Skees, J.R., J.R. Black, and B.J. Barnett. 1997. "Designing and Rating an Area Yield Crop Insurance Contract." *American Journal of Agricultural Economics* 79(2): 430–438.

Turvey, C.G., A. Weersink, and S.-H.C. Chiang. 2006. "Pricing Weather Insurance with a Random Strike Price: The Ontario Ice-Wine Harvest." *American Journal of Agricultural Economics* 88(3): 696–709.

Vedenov, D.V., J.E. Epperson, and B.J. Barnett. 2006. "Designing Catastrophe Bonds to Securitize Systemic Risks in Agriculture: The Case of Georgia Cotton." *Journal of Agricultural and Resource Economics* 31(2): 318–338.

U.S. Department of Agriculture. 2007a. "USDA 2007 Farm Bill Proposals by Title." Available at http://www.usda.gov/wps/portal/usdahome?contentidonly=true&contentid=view_proposals.xml (accessed February 14, 2007).

____. 2007b. "USDA 2007 Farm Bill Proposal: Title X Miscellaneous: Summary of Miscellaneous Title Reform." Available at http://www.usda.gov/documents/07title10.pdf (accessed February 14, 2007).

____. 2007c. Risk Management Agency's actuarial documents browser. Available at http://www.rma.usda.gov/tools/adb.html.