Identifying and Reducing Overlap in Farm Program Support

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Abstract

The current debate surrounding the 2012 Farm Act stresses cutting costs while maintaining, or even strengthening, farmers' "safety net." One way to cut costs is to reduce or eliminate potential overlap of farm program payments. Using simulations, we explore the interaction between the Average Crop Revenue Election (ACRE) program and a revenue assurance (RA) crop insurance program for corn, soybean, and wheat farmers in IL, MN, and SD. Additionally, we examine whether receiving benefits from multiple programs (an RA program, the Supplemental Revenue (SURE) program, and an *ad hoc* disaster assistance program) distorts farmers' business decisions. We find overlap between ACRE and crop insurance, which could lead to budgetary savings if these two programs were to be integrated. Moreover, despite policymakers explicitly incorporating insurance indemnities into SURE payment calculations, access to both programs can alter behavior. Finally, in a counter-factual analysis, we show that removing *ad hoc* payments from the SURE would likely alter farm behavior.

Identifying and Reducing Overlap in Farm Program Support

Introduction

Do farm programs overlap? While providing a support for farmers, do the programs interact efficiently? If policies that currently provide a safety net for farmers interact in ways that duplicate coverage, government savings can be achieved by modifying or even eliminating programs while providing the farmer with the same level of protection against downside risk.

Government policies have long been in place to support U.S. farmers. These policies have addressed issues in many areas, including land distribution, productivity, farmers' standard of living, marketing, risk, and more recently, conservation, biofuels, and trade promotion, changing focus over time in response to an evolving political economy (Gardner, 2002). The evolution of agricultural commodity support programs since their introduction in the 1920s does not necessarily explicitly coordinate on-going and new programs, which can lead to programs overlapping in the measures they target and to potential inefficiencies in addressing those targets, at least from a strict economic standpoint.

Overlap in program support can be defined in a variety of ways. It can refer to a producer receiving compensation in excess of losses, it can refer to receiving compensation in excess of what the individual programs intended, or it may refer to a set of programs that raise program costs while not providing additional security. In this paper, we use the former definition.

From an economic perspective, the scope for government intervention generally revolves around internalizing an externality. While economics tends to be a weak

mechanism for the analysis of allocations based on equity considerations, its strength lies in analyzing allocations based on efficiency arguments. We therefore focus on examining impacts on farm wealth, government costs, transfers between groups, and market impacts.

We begin with an overview of the various forms of support producers receive, e.g., Title I commodity support in the 2008 Farm Act, disaster assistance (both *ad hoc* support and formal support through 2008 Farm Act's Supplemental Revenue Assistance (SURE)), subsidies for Federal crop insurance premiums, commodity loan programs, and support for conservation efforts (both land retirement and working lands), where we focus on taxpayer-funded programs. We discuss how these various forms of support relate to each other based on our definitions of overlap.

The main thrust of our analysis is to demonstrate how to empirically assess the extent to which formally integrating various support policies that target similar aspects of the "farm safety net" can result in reduced government costs while still protecting farmers against downside risk (or other policy goals). We simulate the overlap of crop insurance and counter-cyclical Title I support (in particular, the Average Crop Revenue Election (ACRE) revenue payments) for a set of corn, soybean, and wheat producers. Additionally, using the examples of disaster assistance and federal crop insurance, we demonstrate the use of the expected utility model to explore how overlap in coverage between programs can affect the producer's production decisions.

For our farms, we find that the ACRE program appears to cover significant portions of a farmer's downside revenue risk, even using National-level yield triggers. As we alter the triggers from National- to State- and county-level yield triggers, overlap

with crop revenue insurance products increases. Thus, if ACRE and crop insurance were to be integrated, crop insurance premiums would drop—in some cases significantly (depending on crop and location). Additionally, in a counter-factual analysis, not including *ad hoc* disaster payments in the SURE calculation would likely alter coverage and planting decisions. The directions and magnitudes of the changes depend on the supply elasticity of land and the parameters of federal crop insurance premiums.

Overview of Support

U.S. government payments to farmers effectively fall into four main categories: commodity, conservation, risk management, and disaster assistance programs. Commodity payments tend to reflect present or past production of specific commodities (mostly feed and food grains, cotton, and oilseeds). Commodity program payments generally make up the bulk of all government payments paid directly to farmers. Based on calculations using data from the ERS website, over the 10-year period between 1999 and 2008, commodity payments fluctuated between 53 and 80 percent of total government program payments paid to farmers. These programs include:

- Direct and Counter-cyclical (CCP) payments, together called the DCP program. These payments are based on the producer's historical production of program crops; farmers receive direct payments based on fixed crop rates set in farm legislation and collect CCP payments if market prices fall below statutory target prices.

- Loan deficiency payments (LDPs) and marketing loan gains, collectively called "marketing loan benefits" (MLBs), are tied to current prices and production. To

obtain capital, a farmer may use crop production as collateral to acquire a government commodity loan. If the farmer defaults, the government takes the crop and ends up incurring storage costs. As a result, Congress introduced MLBs to reduce the costs of stock accumulation by providing incentives for farmers to market their commodities. If prices drop below the commodity loan rate, the farmer may pay the loan back at the market rate, generating a marketing loan gain. LDPs provide a way for farmers to obtain the benefits from a marketing assistance loan without actually having to take out a loan.

Commodity programs have traditionally been tied to current production and prices using price supports and supply controls. However, coupled payments distort farmers' production decisions. To minimize these distortions, Congress introduced Production Flexibility Contract (PFC) payments in 1996—the precursor to today's DCP program— that largely decoupled payments from current production decisions and eliminated most supply controls.[1] Today, direct payments make up the bulk of commodity payments, totaling roughly $5 billion per year over the life of the 2008 Farm Act, and farmers receive these payments regardless of planting decisions, production outcomes, or current market conditions. Support in the agricultural sector for these direct payments is mixed. For example, the Iowa Farm Bureau has called for an end to the payments, suggesting that the funds would be put to better use to strengthen the crop insurance program (Pillar, 2010; Anderson, 2010; Laws, 2010a/b).

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[1] Although largely decoupled, with few exceptions, farmers cannot plant fruits and vegetables on the DCP program's base acreage without losing program benefits.

Conservation payments are designed to promote environmentally sound farm business practices. For example, programs encourage goals aimed at reducing soil erosion, improving air and water quality, and maintaining and improving wildlife habitats. They consist of two main types:

- Land-retirement programs—the largest being the Conservation Reserve Program (CRP)—aimed at retiring environmentally sensitive land from production.[2] These types of programs tend to offer annual rental payments and cost-share assistance in return for a farmer establishing long-term land conservation efforts.

- Working land programs, such as the Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CStP), which aim to enhance the farm operators' resource management on cropland and grazing lands currently in production.

In 2008, roughly 60 percent of all conservation payments consisted of land-retirement program funds dedicated to the CRP. The majority of recent increases in conservation payments, however, have accrued to the working-land programs, which target payment to different indicators (e.g., costs of more environmentally benign management practices) than do commodity support programs.

Programs that effectively help farmers mitigate risk include the Average Crop Revenue Election (ACRE) and the federal crop insurance program.[3] Introduced in the 2008 Farm Act, the Average Crop Revenue Election (ACRE) provides eligible farmers with counter-cyclical support tied to crop revenues. To limit the overlap of multiple

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[2] Other land-retirement programs include the Wetlands Reserve Program (WRP), the Farmable Wetlands Reserve Program (FWP), and the Conservation Reserve Enhancement Program (CREP).

[3] We use the term "effective" to denote the quantitative impacts of these programs, and not to necessarily suggest the intended policy goals of the program.

government programs, farmers enrolled in the ACRE program cannot receive CCP payments, must forfeit 20 percent of their direct payments, and take a 30 percent reduction in loan rates for potential marketing loan benefits. In return, farmers can receive state-based revenue guarantees based on the 5-year State Olympic average yield and the 2-year national average prices, with limits on how much the guarantee can rise or fall from one year to the next.

Farmers can also choose to purchase federal crop insurance that is provided via private-sector insurance companies. Although these companies sell and service the individual insurance policies, the government plays a large role—helping develop and approve the premium rates, generating and administering the premium subsidies, and reinsuring the commercial insurance providers (USDA, RMA, 2010). For commodities that are not covered under the crop insurance program, a catastrophic coverage insurance can be obtained, called the Non-Insured Assistance Program (NAP), similar to the catastrophic coverage (CAT) available for program crops. If commodity prices remain high relative to marketing loan rates in Title I of the Farm Act, then price-based support in Title I will fall. Forecasts suggest that in such a case, crop insurance may account for a substantially larger share of total government agricultural support than in the past (CBO; FAPRI, 2011).

Finally, the 2008 Farm Act introduced a permanent disaster assistance program which formally provides disaster payments to eligible farmers. The crop version of this newly created permanent disaster assistance program, the Supplemental Revenue Assistance Payments (SURE) program—a free supplement to crop insurance—provides

additional whole-farm coverage for producers with crop insurance for crop production or crop quality losses.

Together, farm programs were calculated to cost roughly $200 billion dollars over ten years. Based on Congressional Budget Office projections for outlays from 2008-2017 downloaded from the ERS website, the ten-year cost of commodity programs was estimated to be roughly 75 billion dollars, the cost of conservation programs to approach 58 billion dollars, and the cost to provide crop insurance to come to nearly 62 billion dollars.

Potential Program Interactions

Much of the debate on the negotiations for the 2012 Farm Act round stresses the need to cut costs while maintaining, or even strengthening, a safety net for farmers. One way to cut costs is to reduce or eliminate the potential overlap of various programs. Some farm program mechanisms may be designed to protect the farmer in a manner designed explicitly to avoid overlap or duplicative compensation. In other cases, however, if programs have similar goals—protecting farm income, for example—quite different programs may overlap if producers participate in multiple programs for multiple commodities without reference to their cumulative effect on farm revenue.

For example, while ACRE enrollment requires giving up some commodity program benefits, the program's design does not preclude direct overlap with other agricultural support programs (such as crop insurance), allowing for the possibility of duplicating coverage across programs. In contrast, the newly introduced disaster assistance program, SURE, includes both crop insurance and ACRE income in the whole

farm revenue on which the calculation of payments is based, ensuring that farmers do not receive double payments. As a result, the ACRE program has received a lot of recent attention concerning the potential for overlap with other farm programs from both policymakers and researchers alike.

For example, at a House Agriculture Committee hearing in May 2010, Bruce Babcock, Director of the Center for Agriculture and Rural Development and Professor of Agricultural Economics at Iowa State University, testified that the ACRE program "duplicates coverage that is available from the crop insurance program" (Babcock, 2010). While Babcock suggests the two programs are wholly overlapping, others have countered that these programs cover different parts of producer price and revenue risks and only overlap to a small degree (e.g., Zulauf *et al*., 2010). A recent study by Cooper (2010) simulates interaction between the programs and finds overlap that, if accounted for, would lead to 10 to 41 percent drops in crop insurance premiums, depending on the farm/crop combination examined.

Earlier studies have also explored the possibility for overlap between CCPs and crop insurance and the potential for duplication between CCPs and marketing assistance loans. Findings suggest little overlap between the risk protection provided by CCPs and crop insurance since CCPs effectively covers inter-year risk while crop insurance effectively covers intra-year risk (Hauser *et al*., 2004). Additionally, results indicate potential price protection duplication between the loan program and CCPs, resulting from the way in which the production incentives inherent in LDPs interact with the combination of loan rate and target price in the CCP payment calculation –

notwithstanding the fact that the CCP payment calculation explicitly accounts for the loan rate (and direct payment rate) (Hart and Babcock, 2005).

At least one study has also examined how traditional commodity programs and conservation or agri-environmental programs interact (Morehart and Claassen, 2006), finding little, if any, overlap under current program designs; they argue that attempts to meld the two types of programs would likely fail to meet the goals of either. While policymakers might possibly use the Conservation Stewardship Program (CStP), which pays producers for increasing levels of environmentally enhancing farming practices, to target income support, in general, the overlap of conservation programs with income support would likely focus on reducing the costs of investing in potentially revenue-enhancing practices.

Cost-reimbursement programs, typically used with conservation and agri-environmental programs, have been scrutinized by the GAO for the potential of producer overpayment—both in terms of payment beyond costs and for multiple payments under different programs for the same practice (GAO, 2009). Some cases of overcompensation may result from programs designed to make payments based on local cost estimates rather than individual costs, but most examples revolve around fraud rather than inefficient program design.

ACRE

In this paper, we explore the interactions between various commodity support combinations involving ACRE, crop insurance, and SURE. These three programs are

fairly complex, so outlining how they work will be essential to understanding the potential for overlap between these and other farm programs.

ACRE is a state-based revenue guarantee for participants based on the 5-year State Olympic average yield and the 2-year national average price. Once a farm is enrolled in ACRE, all eligible crops on that farm are enrolled in the program.[4] The ACRE revenue payment (denoted as $ACRE_{ijt}$) to producer i of crop j in period t is (leaving out the state subscript):

(1) $\qquad ACRE_{ijt} = \Phi_{ijt} \cdot \max\{\, 0,\, \min[(0.25 \cdot PGR_{tj}),\, (PGR_{tj} - ASR_{tj})]\} \cdot \dfrac{E(Y_{ijt})}{E(YS_{jt})} \cdot \{0.85 \text{ or}$

$\qquad$ 0.83 depending on the year$\} \cdot (A_{ijt})$,

where: Φ_{ijt} is an indicator variable that equals 1 when the farm's actual revenue (farm's

$\qquad$ yield times national crop year price for crop year t) for crop j is less than

$\qquad$ the farm's benchmark revenue ("Olympic" moving average yield per

$\qquad$ planted acre [the average of the prior 5 years of yield data with the highest

$\qquad$ and lowest values removed] times 2-year national moving average crop

$\qquad$ year price plus the premium paid for crop insurance for crop j) for crop

$\qquad$ year t, and 0 otherwise;

$\qquad$ PGR_{tj} is *ACRE Program Guarantee Revenue* for crop j in crop year t, calculated

$\qquad$ as the 5-year State Olympic moving average yield per planted acre

$\qquad$ (removes high and low yield) times the 2-year national moving average

$\qquad$ crop year price times 90%;

ASR_{tj} is *Actual State Revenue* for crop *j* in period *t*, calculated as state yield for

crop year *t* times the higher of the U.S. average cash price for the

marketing year *t* or 70 percent of crop's marketing assistance loan rate;

$E(YS_{jt})$ is *Benchmark State Yield*, calculated as the 5-year Olympic average of

the State's yield per planted acre;

$E(Y_{ij})$ is *Benchmark Farm i Yield*, calculated using the same formula as for the

state benchmark yield *j*; and

A_{ijt} is acres planted to crop *j* in period *t*.

Several limitations apply to the ACRE payments. For example, for 2010-12, *PGR*

cannot increase or decrease more than 10 percent from its value from the previous year.

Further, ACRE payment acreage is limited to the total amount of base acres on the farm.

Base acres are fixed levels of acreage based on historic acreage on the farm and are used

to calculate certain government payment. See USDA (2008) for additional details.

From the producer's perspective, a potential benefit (or liability) of ACRE over

the LDP and the CCP is that the ACRE's guarantee revenue automatically rebalances

itself to relatively recent market prices. Therefore, it can provide payments in situations

in which market prices are well above statutory loan rates and target prices. Of course,

when market prices are low relative to loan rates and target prices, the ACRE revenue

payment would likely provide lower mean benefits than the LDP plus the CCP (albeit

leaving differences in the fixed payments out of the analysis). However, under current

market prices, loan rates, and target prices, feed grain and oilseed producers have a

negligible chance of receiving either CCPs or LDPs. For these producers, the decision to

participate in ACRE is likely to be based instead on the producer's perceived trade-off

between the 20 percent of direct payments forgone when participating in ACRE and the

ACRE revenue payment.   For our national- and county-level ACRE scenarios below, we

replace *PGR*, *ASR*, and *YS* with national or county level values.

Federal Crop Insurance

A farmer's decision to purchase a crop insurance policy depends heavily upon the

premium rates set by the government. While the USDA is tasked with creating

actuarially fair premiums, the rates are, at best, actuarially fair on average, given that the

rates are not determined using individual-specific yield risk measures. Additionally, the

government subsidizes a portion of the rates, increasing farmers' returns to adoption.

While a variety of Federal crop insurance products are available, we focus on Revenue

Assurance (RA), which makes it directly applicable to both the ACRE and SURE

programs. Under the base price option, an RA indemnity is paid when realized revenue

falls below the guarantee, which equals the RA base price multiplied by the producer's

Actual Production History (APH yield) $\bar{y}$ and the coverage level θ. The per-acre

indemnity is:

(2) $I(\theta, \bar{y}_{it}, p_{it}^{b}) = \max\left(0, \theta p_{it}^{b} \bar{y}_{it} - p_{it} y_{it}\right)$

where p_{it}^{b} is the RA base price, p_{it} is the RA realized price (both prices defined by futures

markets), and y_{it} is the actual yield.

SURE

Finally, provided a farmer purchases crop insurance (or NAP, for noninsured crops), the producer immediately becomes eligible for Supplemental Revenue Assistance (SURE), a whole farm revenue program. A farmer may only receive SURE payments if their operation is located in a county where a disaster has been declared, in a county contiguous to a disaster county, or if they personally suffered production losses amounting to 50 percent or more of normal production levels. Additionally, producers must suffer a 10 percent production loss to at least one crop of economic significance on their farm. For an individual, the SURE payment amounts to:

(3) $SURE_t = D_t * \max(0.60(G_t - R_t^T), 0)$,

where G_t is the SURE guarantee and R_t^T is total farm revenue, and where D_t equals 1 if a farmer is eligible for SURE payments, and 0 otherwise. The value of "normal" (i.e., expected) production on the farm is the sum of the expected revenue for each crop on the farm, or $\sum_i (p_{it}^b \bar{y}_{it})$. The value of actual production on the farm is the sum of the value of the production produced, $\sum_i (p_{it}^b y_{it})$. Note that both values of the production are based on the price election for the insured commodity.

The SURE guarantee (G_t) depends on the level of crop insurance coverage selected by the producer, expected prices, and the producer's APH yield, but is limited to no more than 90 percent of typical or expected revenue:

(4) $G_t = \min\left(1.2 \sum_i (a_{it} \theta p_{it}^b \bar{y}_{it}), 0.90 \sum_i a_{ti} p_{it}^b \max(\bar{y}_{it}, y_{it}^C) \right)$

where a_{jt} is planted acreage of crop j (or acreage where planting was prevented) and y_{jt}^C is the producer's counter-cyclical payment program yield or an "adjusted yield". Total

13

farm revenue explicitly includes market revenue, commodity program payments, federal

disaster payments, and net crop insurance indemnities:

$$(5) R_t^T = \left(\sum_j a_{jt} p_{jt}^N y_{jt} \right) + \left(\sum_j a_{jt} * \max\left[0, I(\theta, \bar{y}_{jt}) - PREM(\theta, \bar{y}_{jt}, p_{jt}^b)\right] \right) + MLB_t + 0.15 DP_t$$
$$+ \left(CCP_t \text{ or } ACRE_t \right) + AH_t$$

where $PREM(\theta, \bar{y}_{jt}, p_{jt}^b)$ is the producer paid insurance premium per acre, MLB_t is the

producer's (farm-level) total marketing loan benefits summed across all eligible crops

produced by the farmer, DP_t is the producer's total direct payment, CCP_t is the producer's

total counter-cyclical payment, $ACRE_t$ is the farmer's total revenue payments under the

Average Crop Revenue Election program summed across all the farmer's eligible planted

acres in all eligible crops, where CCP_t and $ACRE_t$ are mutually exclusive, and AH_t are

other federal disaster payments covering the same disaster.[5] The price p_{jt}^N is the "National

Average Market Price" as determined by USDA's Deputy Administrator.

Methods and Data

To estimate the distribution of payments for a given reference crop year t, given

stochastic season average prices and realized yield at pre-planting time in t, we follow the

methods developed in (Cooper 2009, 2010). First, national average yields (obtained from

the National Agricultural Statistics Service (NASS)) are re-expressed as within-season

yield deviations for crop j in year t as $\Delta Y_{jt} = \dfrac{(Y_{jt} - E(Y_{jt}))}{E(Y_{jt})}$, where expected yields,

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[5] If the eligible farmer chooses to be in enrolled in the Average Crop Revenue Election program (ACRE) rather than in the traditional commodity program, then the CCP payment in t is replaced by an ACRE revenue payment, DP's are reduced by 20% and the loan rate in the MLB by 30%.

$E(Y_{jt})$, are estimated by regressing national average yields on a linear trend using data for 1975-2008. County yields, obtained from NASS, are also transformed to deviation form (denoted as ΔY_{jt}^{k}) where k indexes the county.

Realized harvest prices are also transformed into deviation form: $\Delta P_{jt} = \left(P_{it} - E(P_{jt})\right)\big/ E(P_{jt})$ where $E(P_{jt})$ is the planting time expected price. We follow RMA definitions for expected and realized prices used in RA insurance. The expected price of corn is the average of daily closing prices in February for the December Chicago Board of Trade (CBOT) corn contract. The realized price is the average of daily closing prices during October for the CBOT December corn contract. Expected and realized soybean prices are based on the February and October prices, respectively, for the December CBOT soybean contract. For hard red spring wheat, expected and realized prices are based on March and August prices, respectively, for the Minneapolis Grain Exchange (MGE) September contract.

Cooper (*ibid.*) discusses the simulation of P_{jt} in a manner that preserves their inverse correlation with national level yield. The relationship between price and yield vectors is estimated by regressing ΔP_j on ΔY_j and other explanatory variables (z_j):

(6) $\Delta P_{jt} = g\left(\Delta Y_{jt}, z_{jt}\right) + \varepsilon_{jt}$

where ε_{jt} is the error term. We expect that $d\Delta P_{jt}\big/ d\Delta Y_{jt} < 0$, i.e., the greater the realization of national average yield over the expected level, the more likely harvest time price will be lower than the expected price. See Cooper (*ibid.*) for details.

Using a bootstrap approach based on the econometric relationship between national price and yield deviates as well as other variables, S vectors of $(1 \times T)$ prices are simulated for each element of a $(G \times 1)$ vector of a simulated national yields $\mathbf{Y}^{N*}$, where $S = G = 1000$, for a total of 1,000,000 price-yield pairs. Using an inverse PDF approach, the $\mathbf{Y}^{N*}$ is drawn from a kernel density function estimated from NASS national level data over 1975 to 2008, thereby providing support to positively or negatively skewed distributions. A $(G \times 1)$ vector of county yields ($\mathbf{Y}_j^{C*}$) is similarly generated from kernel density functions estimated from NASS county level yield data for each crop and county examined here, as are $(G \times 1)$ vectors of state level yields ($\mathbf{Y}_j^{S*}$). The Pearson correlations observed between national, state, and county yields over the observation period are imposed on the simulated yield vectors using a heuristic combinatorial approach (*ibid.*). In essence, this approach re-sorts the county, state, and national yield values until the correlation between the three simulated vectors converges on the observed correlations. Finally, farm level yields, $\mathbf{Y}^{F*}$, are generated from the county level marginal densities using the approach discussed in the next section.

Figure 1 provides a visual depiction of revenue for a representative corn famer in Hyde County, SD, using 2009 prices. We have not yet discussed the specifics of how the support programs depicted in the figure work, but the motivation for this figure is to provide some intuition for what estimated densities can look like, and to visualy depict the support overlap. The RA insurance net indemnity payment truncates the farmer's revenue density below 70% of his expected revenue. The stylized *ad hoc* payment reimburses the farmer when county actual revenue is below 70% of expected county

revenue. In this example, adding county-based *ad hoc* payment on top of gross revenue

plus the RA net indemnity payment has no impact on the farmer's downside risk. The

shaded area reflects the increase ($8) in the farmer's expected revenue per acre due to

the overlap between the two programs in targeting downside risk.

Cost Savings From Reducing Overlap between Federal Crop Insurance and ACRE

We now examine to what extent crop insurance premiums could decrease if the harvest

time revenue used in the premium calculations included the ACRE revenue payment.

Given that the government subsidizes 59 percent of a farmer's insurance premium, on

average, integrating the two programs and decreasing premiums would likely result in

Federal budgetary savings. If the ACRE and insurance programs were to be formally

integrated, we would expect that the closer the correlation between the ACRE payment

and the farmer's revenue losses, the greater the decrease in the insurance premium.

Given the complex interactions between farm and county level ACRE triggers,

the extent of the budgetary saving is more tractable to address empirically rather than

analytically. We therefore generate farm level yields from the simulated county level

yields using an approach that infers the standard deviation of farm level yields from the

RMA (pre-subsidy) crop insurance premiums, while assuming that the only difference

between a farm and the county yield density is an inflation of the standard deviation of

yield, defined (leaving out subscripts denoting the farmer and the county) for crop *j* in

year *t* as $Y_{jt}^{F*} = Y_{jt}^{C*} + z_t$, where $z \sim N\left(0, \sigma\left(Y_{jt}^{F*} - Y_{jt}^{C*}\right)\right)$, where *z* refers to idiosyncratic risk

that defines the difference between the representative farm yield and the county yield. In

our application of the Coble and Dismukes (2008) approach to backing-out the farm level

standard deviation of yield from crop insurance premiums from the Risk Management

Agency (RMA) of the USDA, we assume that our representative farmers purchase

revenue assurance (RA) with the base price option and 70 percent coverage (USDA,

2009).   The RA indemnity payment per acre for crop j in period t can then be written as:

(7) $RA_{jt} = \max\{0, (0.7 \cdot E(P_{jt}) \cdot Y_{jt}^{APH} - P_{jt} \cdot Y_{jt}^{F*})\}$,

where $E(P_{jt})$ and P_{jt} are expected and harvest time futures prices, respectively, and Y_{jt}^{APH}

is the actual production history for the farm. In our simulation context, the insurance

premium, $PREM_{jt}$, is actuarially correct if it is set equal to $E(RA_{jt})$, the mean of all

outcomes of (7) given our (S x G) matrix of prices and (G x 1) vector of farm yields.

Using a quasi-Newton technique, we find the value of $\sigma(Y_{jt}^{F*} - Y_{jt}^{C*})$ that

minimizes $abs(PREM_{jt} - E(RA_{jt}))$, where $PREM_{it}$ is the full premium including the

farmer paid portion and the portion subsidized by the government. The farmer paid

premium for 2009 is calculated with the RMA website (RMA, 2011) using the APH yield

values in Table 1 and dividing by 0.41 to generate the full premium $PREM_{jt}$.

So that our results for the cost savings of integrating ACRE with crop insurance

are conservative, we use RMA premium rates for basic units (the RMA designation for

specific farm fields) rather than for enterprise units (an aggregation of a farmer's fields),

the latter of which will tend to have lower insurance rates. Similarly, we do not remove

from the premium the load factor that adjusts for catastrophic risk.   Hence, our farm

level risk is likely higher than average, thereby underplaying the potential cost savings.

If *RA* was to explicitly consider ACRE revenue payments as part of harvest time

revenue, the RA_{jt} from (7) would be rewritten as:

(8) $$RA_{jt} = \max\{0,\ 0.7 \cdot E(P_{jt}) \cdot Y_{jt}^{APH} - (P_{jt} \cdot Y_{jt}^{F*} + ACRE_{jt})\}.$$

Table 1 shows the results of the integration for the State level ACRE that was first offered in 2009, as well as for hypothetical national and county level ACRE programs, the latter an idea endorsed by the Iowa Farm Bureau (Clayton, 2010). Cost savings range from 6 to 45 percent across all the tested scenarios and 20 to 38 percent under the state ACRE program. As expected, the reduction in insurance premiums is greater the more closely tied the ACRE payment is to the farm level. Hence, benefits are greatest with a county level ACRE. Nonetheless, benefits are still significant even with national level ACRE.

A more comprehensive analysis of the premium reductions over more crops and counties is outside the scope of this paper, but the examples should suffice to show substantial cost reductions of incorporating ACRE into the crop insurance program. Note however, that the extent of the expected benefits will vary from year to year, and will be particularly sensitive to: (a) the extent that the ACRE guarantee price departs from the arguably less naïve expected price from the futures market; and (b), the extent to which the floor or ceiling on the ACRE program guarantee review is binding.

Producer Response to Overlap in Support: a Simulation for Disaster Assistance

The section above provides an example of the financial accounting for support overlap. However, any support overlap that changes the farmer's density function of wealth, income, or profit can change the farmer's behavior, particularly if the farmer is not risk neutral. While changes in the farmer's behavior can be manifested in a variety of input and output choices decisions, here we focus on how overlap in coverage between SURE and *ad hoc* can affect insurance demand (the farmer's choice of the insurance coverage

19

rate θ), and planted acres. We assume that *ad hoc* disaster assistance comes in the form

of USDA Secretarial declarations, although it can come in a variety of forms (hence the

ad hoc), including Congressional legislation written to cover specific disaster events.

USDA Secretarial disaster declarations require a 30 percent or greater yield loss due to

natural disaster in at least one crop in a county, and require that the state governor make a

request to the USDA for disaster assistance (FSA, 2009).

In our simple quantitative model of the political economy of the *ad hoc* process,

we assume that the state governor makes the request with 100 percent probability

whenever the yield loss criterion is met. We specify the farmer's *ad hoc* disaster

payment rate that is tied to county losses and payable to the farmer's planted acreage in

that crop as $AH_j = \varphi * \left\{ \max\left(0,\ p_j^b\left(r\bar{y}_j^C - y_j^C\right)\right) \right\} * a_j$, where *r* is the disaster trigger rate

(which we set at 0.70, as per current USDA rules for Secretarial disaster assistance), and

φ is the probability that the state governor makes a request for assistance when

$\max\left(0,\ p_j^b\left(r\bar{y}_j^C - y_j^C\right)\right)\ > 0$, where we assume that $\varphi = 1$. To show the potential for

payment overlap of not integrating *ad hoc* and the standing SURE program, we consider

a hypothetical SURE program (denoted as HSURE) that does not include *ad hoc*

payments in the SURE payment calculation.

Given the approach to modeling joint price and yield densities functions described

earlier, Table 2 shows the impact of SURE and HSURE on a spring wheat farmer in

Hyde County, SD. Table 2 shows that the *ad hoc* assistance, as well as SURE or HSURE

and RA insurance, contributes to increasing the expected revenue of the Hyde county

farmer and reducing his downside risk. Note that when we exclude the *ad hoc* assistance

from integration with insurance/HSURE support, the downside risk (as measured in the

lower bound of the 90 percent confidence interval) remains unchanged while mean total

revenue has increased. Thus, the *ad hoc* program appears to overlap the

insurance/HSURE support, inefficiently duplicating payments to farmers.

We use the empirical data summarized in Table 2 in the simulation of expected

utility (EU) maximizing behavior by this Hyde county farmer. *A priori*, we expect actions

that increase the farmer's mean wealth and/or decrease the variance of wealth to be EU

maximizing, and we expect changes in higher moments of the wealth distribution to

affect EU as well.

We assume that the farmer has constant absolute risk aversion (CARA) and

chooses acreage and insurance coverage to maximize the expected value of a negative

exponential utility function over $G{\cdot}S = 1{,}000{,}000$ simulated price and yield, and

insurance combinations as

(9)
$$\underset{a_1, a_2, \theta}{Max}\, EU(w) = \frac{1}{S \cdot G} \sum_{k=1}^{S \cdot G} \left[1 - e^{-\lambda w_k}\right],$$

where λ is the absolute risk aversion coefficient and w is wealth in this concave von

Neumann Morgenstern utility function. Wealth w is w_o plus net returns under six risk

reduction program alternatives: 1) no insurance coverage; 2) insurance coverage; 3)

insurance coverage and *ad hoc* payments; 4) insurance coverage and HSURE payments

(where SURE is same as HSURE in this case); 5) insurance coverage, HSURE, and *ad*

hoc payments; and 6) insurance coverage, SURE, and *ad hoc* payments.   Wealth w_k

under each scenario includes direct payments for corn, soybeans, and wheat, with the

share of payments for each crop based on the number of base acres in each crop in the

county, valued at the base yield rates for that county, with the total value of these

payments being $DP = \$6.86$ per acre for the Hyde farmer. Note that these annual fixed

payments do not require production of the crops; we therefore include the soybean and corn direct payments regardless of whether our farmer has decided to grow only spring wheat.

Wealth w_k for each price-yield realization k is defined (in multicrop format) as:

(10)

$$w_k = w_o + DP + \left(\sum_j a_j p_{jk}^N y_{jk} \right) - \sum_j C_j + D_k + \left(\sum_j a_j I_{jk}(\theta) \right) - \left(\sum_j a_j PREM_{jk}(\theta) \right) + \sum_j AH_j ,$$

where C_j is the production cost for each crop j, D_k is the total HSURE payment (if applicable to the scenario), $I_{jk}(\theta)$ is the per acre insurance indemnity, $PREM_{jk}(\theta)$ is the insurance premium, and AH_j are *ad hoc* disaster payments. Note that under current expected prices, the probability of marketing loan benefits and counter-cyclical payments being issued are zero for the crops in question, and as such, are not included in w_k.

The mean and standard deviation of the spring wheat yield for this farmer are 37.65 and 20 (bu/acre), respectively. The expected output price is \$6.20 (\$/bu, 2009). Fertilizer and all other costs – used for the cost functions C_i – are based on ERS/USDA cost estimates for the region that includes South Dakota. To reflect increasing marginal costs as additional acreage is brought into production, and to reduce the probability of corner solutions in the simulations, we assume quadratic cost functions (e.g., Howitt, 1995) for each crop j, $C_j = v_0 a_j + v_1 (a_j)^2$, where v_0 is the parameter on the constant marginal costs, and is \$65.54. The increasing marginal costs parameter is v_1, which we assume is fertilizer, and $v_1 = \$44.21$.

We assume the farmer has a moderate risk aversion premium of 20 percent (e.g., Hurley, Mitchell, and Rice, 2004; Mitchell, Gray, Steffey, 2004). The associated absolute

risk aversion coefficient λ (equation 9) is scaled to the standard deviation of net revenue

for the one acre farm using the approach in Babcock, Choi, and Feinerman (1993).[6] We

normalize our farm to one acre. For the sake of transparency in the results, initial wealth

w_o is set high enough so that the farmer's budget constraint is never binding, and as such,

relationships between marginal benefits and costs determine the activity levels.

While the actual range for RA coverage is 55 (or 65) to 85 percent, we let the

insurance coverage rate vary between 0 and 100 percent in our constrained optimization

(a Lagrangian function using quadratic optimization), which allows us to find the

farmer's optimal coverage level.   Table 3 provides the simulation results for the 6 risk

reduction program choices for three scenarios with differing combinations of land supply

and actuarial fairness assumptions. The assumptions for actuarial fairness are either : i)

the crop insurance premium is actuarially fair *before* the government insurance subsidy is

applied, and hence, the final premium is "super fair" from an actuarial perspective

(scenario 1); or ii) the actuarially fair premium is multiplied by 1/(1-0.59) *before* the

government insurance subsidy is applied, and hence, the actual farmer paid premium is

close to be being actuarially fair at a 70% coverage level, but fairness at other coverage

rates depends on the RMA subsidy schedule (RMA, 2008), as in scenarios (1) and (3).

In addition, we use two alternatives for the supply of land: i) supply is completely

inelastic (in scenarios 1 and 2), and ii) supply is completely elastic (scenario 3). The

actual cropland situation is closer to those in scenarios (1) and (3), but we include

scenario (3) to show what the farmer would do if land was infinitely obtainable. Of

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[6] For the Hyde farmer, our baseline standard deviation of $107.19 evaluated over
our *SxG* simulated price and yield combinations, $\theta = 0.7$, quadratic cost functions, and no
SURE or *ad hoc* payments yields λ equal to 0.003835.

course, one could use an elasticity of land supply between these two extremes, but doing so would further complicate the results without adding insights pertinent to the issue we examine.

For "RA insurance" (row b) under scenario 1 (actuarially fair premium and completely inelastic land supply) in Table 3, the farmer chooses a 67% insurance coverage rate (θ). As expected, in row (c), adding in *ad hoc* assistance lowers the farmers demand for insurance coverage (to 65%). Also, as expected, making HSURE available (row d) raises the demand for insurance (to 75%), and these results are the same for SURE, given that there is no *ad hoc* assistance in this case. Making *ad hoc* available when the farmer has HSURE (row e) leaves the coverage rate at 75%. Making *ad hoc* available when the farmer has the actual SURE (row f) also leaves the coverage rate at 75%. Note that this 75% figure is actually infinitesimally below 75%, as moving to 75% lowers the RMA premium subsidy rate, and hence, the stickiness at (slightly below) 75%.

For scenario 2 (actuarially super fair premium and completely inelastic land supply) in Table 3, the farmer chooses an 80% insurance coverage rate θ in each case in rows (b)-(f). This choice level is unaffected by the presence of *ad hoc* payments or SURE. Note that the stickiness at 80% is in part due to the premium subsidy rates falling for insurance coverage 80% and over.

Our Scenario 3 (actuarially fair premium and completely elastic land supply) is the most complex of the three as planted acres can vary, thus allowing us to examine production impacts. In this scenario, the famer chooses an insurance coverage rate of 80% in rows (a) – (f), and what varies is planted acreage. Relative to the base scenario (row a), adding crop insurance (row b) increases planted acreage, which is not a

surprising result. Adding *ad hoc* on top of insurance (row c) further increases acreage; again, not surprising. The combination of RA insurance and HSURE – or equivalently in this *ad hoc*-free case – SURE (row d) results in the highest planted acreage. Interestingly, adding *ad hoc* payments to insurance and HSURE or SURE (rows e and f) actually results in lower planted acreage than in rows (c) or (d), but still higher than with RA insurance alone (row b); interactions between crop insurance, SURE, and *ad hoc* assistance are complex enough that relative production impacts are not always *a priori* evident. Because SURE explicitly account for *ad hoc* support (row f), it does have a smaller impacts on planted acreage than HSURE (row e).

In a deterministic analysis, Smith and Watts (2010) find that SURE has the potential for creating moral hazard conditions on top of those already associated with Federal crop insurance. That is a result we expect in a stochastic analysis as well, and is suggested by the production impacts in our simulations. However, our simulation exercise makes the point that allowing multiple inputs to simultaneously change makes it not only more difficult to judge *a priori* the effects of adding a non-overlapping programs (i.e., SURE on top of RA), but overlapping support (*ad hoc* assistance) as well.

Conclusions

Our simulation results show that reducing overlap between the ACRE program and crop insurance would save the government money while maintaining farmers' protection against downside risk. By integrating the two programs, the government could eliminate duplicate payments to farmers when production losses occur. Moreover, crop insurance policy premiums would drop over time.

Despite lower premiums, integrating support would probably generate a negative net benefit to the producer since the farmer would no longer receive duplicative payments— the reduction in overlap would likely mean a lower total expected revenue (including the government support). Hence, integrating these programs could lower incentives for farmers to enroll in ACRE. One policy mechanism to prevent such a response is for Title I only to include the ACRE program and not allow the producer the option of staying with the traditional (price-based) support approaches.

It is possible that today's political climate may increase the chances of integrating ACRE with crop insurance as many—including farmers and policymakers—are questioning the need, or even desirability, of maintaining a program that pays farmers irrespective of need. Indeed, the Iowa Farm Bureau has argued for a three-pronged approach to altering farm programs: (1) eliminate the DCP program, (2) use the funding for the DCP program to strengthen the crop insurance program, and (3) base ACRE payment calculations on county- rather than state-level yields and revenues (Pillar, 2010; Anderson, 2010).

Our analysis of establishing ACRE program payments on county rather than state level yields and prices suggests that the program would increase farmers' coverage of farm-level revenue risk. However, feasibility concerns arise when contemplating structuring the ACRE program on county- instead of state-level data. Currently, calculating ACRE payments based on state level yields and revenues already is a time consuming and relatively long process – whereby farmers receive payments well after the growing season has passed. These problems would only be exacerbated when using county level data since this information would be more costly and take longer to collect.

At the other extreme of aggregation, we found that, even if the ACRE payment was generated at the national level, the program still covered a significant portion of the farm-level revenue risk, and payments generated at the state level, as currently legislated, cover an even larger share of the farm-level risk.

When exploring how the SURE program interacts with a revenue assurance crop insurance program and *ad hoc* disaster assistance programs, we found that the interactions between these three programs can cause a variety of reactions on the part of producers – including increasing or decreasing coverage and increasing or decreasing the number of planted acres, at least in the case of a spring wheat farmer in South Dakota. These different outcomes are sensitive to assumptions regarding elasticity of land supply and actuarial fairness of the insurance premiums.

Regardless of the actual responses, perhaps most important is the fact that the programs do interact with each other in sometimes unpredicted ways. While the SURE is explicitly designed to take into account the crop insurance program, it is essentially a "shallow loss" program, and if farmers stack this program on top of a RA crop insurance program, it can alter the decisions that the farmer will make, including coverage levels adopted and the number of acres planted, thereby introducing potential deadweight losses. This suggests that even the careful integration of various programs can still have unintended consequences.

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Table 1. Federal Insurance premium per acre without and with integration with the ACRE revenue payment (2009 crop year)

Location	Crop	APH Yield	Full Insurance Premium (Base)[a]	Full Ins. Premium Integrated with National ACRE	*Percent Decrease Relative to Base*	Full Ins. Premium Integrated with State ACRE	*Percent Decrease Relative to Base*	Full Ins. Premium Integrated with County ACRE	*Percent Decrease Relative to Base*
McLean, IL	Corn	183	23.69	20.86	*12%*	14.89	*37%*	13.14	*45%*
	Soybeans	54	14.84	10.60	*29%*	9.95	*33%*	8.22	*45%*
Hamlin, SD	Corn	131	39.31	36.88	*6%*	29.22	*26%*	27.52	*30%*
	Soybeans	38	23.89	20.25	*15%*	19.01	*20%*	15.61	*35%*
	S. Wheat	52	21.48	17.64	*18%*	13.52	*37%*	13.12	*39%*
McLeod, MN	Corn	162	29.55	26.79	*9%*	21.96	*26%*	20.97	*29%*
	Soybeans	44	17.03	12.96	*24%*	10.88	*36%*	9.99	*41%*
	S. Wheat	50	20.56	16.83	*18%*	12.79	*38%*	12.12	*41%*

[a] Revenue assurance with base price option, 70% coverage, for basic units (source, RMA/USDA). These are the full premiums unsubsidized by the Federal government, i.e., they are (1-0.41)*(farmer paid premium).

Table 2. Per acre simulated gross farm returns, net insurance indemnities, ad hoc payments, and two types of SURE payments (Hyde County, SD spring wheat grower)

	Mean ($/acre)	Standard Deviation ($/acre)	90% Empirical C.I. ($/acre) Lower	Upper	Coeff. of Variation	(percent change)
I. SURE as actually implemented						
Market revenue	239.94	132.73	0.00	615.29	0.553	
RA Net indemnities	12.08	43.60	-8.39	149.79		
SURE payments	2.56	6.83	0.00	24.31		
Ad hoc payments	8.50	21.57	0.00	24.57		
Total revenue	269.93	100.70	152.41	615.73	0.373	-32.55%
II. Hypothetical SURE without integration with ad hoc disaster assistance						
Market revenue	239.94	132.73	0.00	615.29	0.553	
RA Net indemnities	12.08	43.60	-8.39	149.79		
HSURE payments	5.06	9.55	0.00	24.31		
Ad hoc payments	8.50	21.57	0.00	24.57		
Total revenue	272.44	99.55	152.41	615.73	0.365	-34.00%

Notes: Unlike this actual SURE program, this hypothetical SURE program (denoted as HSURE) does not includes *ad hoc* payments in the disaster calculation. We assume the Revenue Assurance insurance coverage rate is 70%. Total revenue includes direct payments. The total revenue value excludes all costs except for the farmer-paid insurance premiums. The county level SURE trigger is triggered by disaster declarations for corn, spring wheat, or soybeans in Hyde County. Simulations of disaster declarations in counties adjacent to Hyde are not conducted due to substantial non-reporting by NASS of yield data for those counties.

Table 3. Simulation results for the EU maximizing Hyde County, SD, Spring Wheat Farmer (farmer is moderately risk averse)[d]

	Insurance and Land Supply Scenario			
	(1) Actuarially fair Premium[b] / Land Supply is Inelastic[a]	(2) Actuarially Super Fair Premium[c] / Land Supply is Inelastic[a]	(3) Actuarially Fair Premium[b] / Land Supply is Elastic	
	EU maximizing values of the variables			
Risk Reduction Programs	Insurance coverage (θ)	Insurance coverage (θ)	Insurance coverage (θ)	Acres
a) No insurance	--	--	--	1.83
b) RA insurance	0.67	0.80	0.80	2.84
c) RA insurance and *ad hoc* payments	0.65	0.80	0.80	3.03
d) RA insurance and HSURE	0.75	0.80	0.80	3.12
e) RA ins, HSURE and *ad hoc*	0.75	0.80	0.80	2.94
f) RA ins, SURE and *ad hoc*	0.75	0.80	0.80	2.90

[a] Acreage is fixed at 1.827.
[b] The farmer's actuarially fair RA crop insurance premium is multiplied by 1/(1-0.59) before the government premium subsidy is applied to produce a premium that is actuarially fair on average after the federal premium subsidy is applied.
[c] The farmer's RA crop insurance premium is actuarially correct before the federal crop insurance premium subsidy is applied.
[d] The farmer has a risk premium of 20%.

**Figure 1. Graphical Depiction of Overlap between Two Support Programs
(Revenue density for a representative Hyde County, South Dakota corn farm, 2009 prices)**

Probability density

Revenue +
net indemnity pymt
(green line)

Revenue +
net indemnity pymt + ad hoc
pymt (blue line)

Revenue
(black line)

*Shaded area =
overlap effect*

Revenue per acre