Four Papers on the U.S. Federal Crop Insurance Program

The following four papers constitute the work of independent authors and are being made available by AGree to stimulate thinking and discussion about a significant public policy issue. They do not represent official AGree policy.

March 2016
This publication was commissioned by AGree to inform and stimulate dialogue about policy reform; it does not represent official AGree positions. The views expressed here are those of the individual authors.
Dear Colleagues,

As you know, AGree represents an unusually diverse group of leaders from across food and agriculture who have come together to drive positive change. Despite widely divergent views, our partners share a common vision of a healthy food and agriculture system and agree that it is key to the enduring wellbeing of our nation. Policies, government programs, and private sector actions are critical to its success and must be continuously reviewed if we are to create a 21st century food and agriculture system that improves the economy, human health, and the environment.

The agricultural producers responsible for the food on our tables are subject every day to the vagaries of weather and unpredictable market fluctuations. The federal risk management program – the Federal Crop Insurance Program – plays a crucial role; it ensures that agricultural producers can continue to provide safe, affordable food, even when confronted with factors out of their control.

We also recognize that federal crop insurance is a costly program that has been and will continue to be a political target. Those of us who want to see the program continue must also ensure that it can stand up to scrutiny. How can we create a durable risk management program that appropriately balances risk protection and costs to the taxpayer and appropriately considers the yield effects associated with different soil types and conservation practices?

With this goal in mind, AGree is committed to providing a venue for candid dialogue about ways to strengthen the Federal Crop Insurance Program. To date, conversations about the future of agricultural risk management policy have occurred largely behind closed doors. Our goal is to bring these discussions to light – and to include a broader array of voices in the conversation.

The four commissioned papers presented here explore federal crop insurance, including complex and controversial aspects of the program and creative ideas for change. The collection of views and analyses presented do not represent official AGree positions or the opinions of AGree’s Co-Chairs, Advisors, or partners.

We offer these papers to contribute to thoughtful dialogue. AGree is committed to developing policy and action recommendations for a stronger, more durable food and agriculture system.

Sincerely,

Dan Glickman
Kathleen Merrigan
Jim Moseley
Emmy Simmons
AGree Co-Chairs
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In addition, AGree is providing two working papers as a resource for those interested in learning more about topics discussed in this set of papers: Integrating High Resolution Soil Data into Federal Crop Insurance Rates: Actuarial, Policy, and Sustainability Implications by Joshua D. Woodard and Soil Data Not Considered in Cornerstone U.S. Agricultural Policy by Joshua D. Woodard and Leslie J. Verteramo Chiu. These working papers are available on the AGree website.
Soil, Conservation, and Federal Crop Insurance

Joshua D. Woodard*
Cornell University

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AGree’s work addresses four interconnected challenges facing the global food and agriculture system:

• Meet future demand for food;
• Conserve and enhance water, soil, and habitat;
• Improve nutrition and public health; and
• Strengthen farms and communities to improve livelihoods.

We have taken a deliberative, inclusive approach to develop a policy framework and ongoing, complementary initiatives to meet these challenges. To overcome traditional obstacles to change, we engage a broad array of stakeholders whose insights and commitment contribute to meaningful solutions. AGree’s work, building on our research to better understand problems and assess options, aims to stimulate creative ideas and encourage new perspectives while fostering the linkages key to catalyzing effective action.

This AGree Point of View paper was prepared by Joshua D. Woodard, assistant professor and the Zaitz Family Faculty Fellow of Agribusiness and Finance in the Dyson School of Applied Economics and Management at Cornell University. The paper draws on the authors’ research on and expertise in the Federal Crop Insurance Program (FCIP). Woodard examines the extent to which the FCIP’s current premium rating system captures the yield risk impacts of soil type, and explores policy implications and considerations.

This publication is intended to broaden discussion and complement AGree’s consensus recommendations on policies and actions focused on food and agriculture. While the concepts presented in this paper have greatly enriched the deliberations of the AGree Co-Chairs and Advisors, the perspectives and positions do not represent consensus among them.

We hope you find this paper a helpful resource and source of ideas.
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Soil, Conservation, and Federal Crop Insurance

The advent of “Big Data” in agriculture has led to an increased interest in large-scale empirical applications. One such unexplored area is in the potential applications of high resolution soil data for crop insurance and related policy designs. The Federal Crop Insurance Program (FCIP) now serves as the cornerstone agricultural policy in the United States (Woodard, 2013), with over $100 billion in liabilities annually. The program arguably has been quite successful in promoting risk management activities, reducing ad hoc disaster assistance and related moral hazard, and correcting market failures related to systemic risk and missing risk transfer markets for agricultural production. The program is priced, regulated, and administered by the Federal Government, and delivered by private companies.

Currently, soil data are not explicitly taken into account by the Government when estimating insurance premium rates or guarantees for the FCIP. This usually comes as a surprise to those outside of the agricultural insurance arena, given the obvious impact of soil on yields. From an actuarial and public policy perspective, premium rates should be calibrated to reflect expected risk and cost, and indeed Federal law mandates that the program should be delivered in a manner such that the expected indemnity to premium ratio (that is, the loss ratio) should approximate 1.0 in expectation. Thus, the Government should set premium rates in a manner which varies from region-to-region and farm-to-farm in an effort to mock what a privately priced market might price it. The extent to which current methods capture soil information appropriately is an important question and has a variety of economic implications on incentives.

Since 2009, the U.S. Department of Agriculture’s Risk Management Agency (RMA) began collecting field boundaries, or Common Land Units (or CLUs) associated with each policy (and insured unit), which—if matched appropriately with high resolution soil data from other sources and models—could be used to develop soil specific rates associated with the land in the policy. This information would allow analysts to link observed yield and insurance loss data back to the actual field characteristics. Yet, very little is known on how one might go about integrating soil data for the purposes of designing better insurance programs. The purpose of this article is to review some of the issues and considerations for incorporating these types of data, as well as recent research on the topic. Potential implications for conservation and sustainability are also discussed.

Guarantee Determination in the Federal Crop Insurance Program

Roughly speaking, crop insurance pays an indemnity when either the yield or revenue is below some baseline amount. How this baseline/expected yield is determined has a direct impact on the value of the insurance.

Soil, Yield Risk, and Insurance

Several studies have pointed out the importance of modeling and accounting for intra-county farm yield heterogeneity (e.g., Claassen and Just, 2011). Yet, surprisingly little work has been done to investigate the role of soil in the modeling of field specific yield distributions on a large scale, with very few exceptions (Woodard, 2014). Relatedly, there have been very few systematic assessments of using soil data in crop insurance rating models.

Some previous literature has investigated impacts of soil quality on conditional yield distribution estimation. For example, Woodard (2014) develops a conditional Weibull framework to jointly estimate impacts of soil quality, weather, and other factors on yield risk and expected yield, simultaneously, using a large farm level dataset. That study finds elastic responses of both expected yield and yield risk to soil quality. There are at least two direct impacts this would be expected to have on crop insurance design: guarantee determination (i.e., determination of baseline insured yield level), and intra-county rate differentiation.
Instead of relying on explicit field location and soil quality data, the FCIP relies on a measure of average historical producer yields as the basis for determining guarantees, called Actual Production History (APH). In essence, the APH is a simple average of between 4 and 10 years of yields; there are also some provisions related to various adjustments, for example, the Trend APH program adds a correction for trend to remove bias; and, a new program introduced in the last Farm Bill known as Yield Exclusion, which allows producers to drop certain poor yielding years, thus leading to bias in APH as a measure of expected yield.

Taken holistically, the APH measure:

a) does not take into account which fields are actually being planted/insured for any given policy in any given year; the yield data used to substantiate yield levels may include other fields which are not being planted in a given year, or may omit information for fields being planted, potentially leading to bias and inefficiency in pricing;
b) does not take into account soil data explicitly;
c) if Trend APH is not elected, will be a biased measure of expected yield due to trend;
d) does not adjust for which years of data are reported, and thus an inefficient estimator of expected yield; and
e) includes various capping, cupping, and yield exclusion features which can lead to bias.

A recent working paper by Woodard and Verteramo (2015) investigates the impact of soil heterogeneity within the county in determining guarantees, and find that arguably large improvements in actuarial performance could be obtained by incorporating those data. That study employs various indexes from nationwide SURRGO and VALU soil datasets, including the National Commodity Conservation Service, 2015); this is important as the data must be nationwide to be scalable in practice.

Additionally, when producers have less than 4 years of data for an insured unit, so called “Transitional” yields (or T-Yields) are plugged-in to get the number of records up to the minimum of 4. These T-Yields are published at the county level, are often not updated every year, and are another potential source of adverse selection and rate bias. Soil based yield and rating models thus could also be used for T-yield determination.

Rate Determination in the Federal Crop Insurance Program

Currently, RMA establishes premium rates at the county level, and then within the county there is a small correction for the level of the reported APH; higher APH farms within a county receive lower rates. At question is whether this biased and inefficient measure of expected yields (APH) captures all information relevant to soils, or at least approximately, particularly when a producer adds or removes a large amount of land from an insured unit. If not, then is the inefficiency large enough to be economically meaningful?

A recent working paper by Woodard (2015) sheds light on this issue by investigating the estimable magnitude of yield risk across soil types for intra-county yields, and how this translates into premium rate and expected loss impacts. Yield risk and insurance models are estimated from a large farm level yield dataset from Illinois with matched soil quality information. The study uses CLU field boundaries as the basis to approximate the distribution of soil quality and yield risk within a county. Soil quality data from the NRCS SURRGO dataset are then overlaid onto CLU level field boundaries to estimate soil quality and yield distributions for each field. Soil adjusted premium rates -- as well as the premium rate that RMA would generate under the current system -- are then estimated and compared for each CLU. Tests are then conducted to evaluate if the RMA’s current methods of incorporating soil information indirectly through the APH measure statistically under-differentiates relative to an explicit soil based rating.

The program has h have y been quite negative for the participating companies that constitute the delivery system. The actuarial validity of some recent changes, such as Yield Exclusion, have also been questioned. Many of the larger agribusiness players have even started to pull out of the market, potentially putting the delivery system at risk.

As it regards any effort towards integration of soil data into the current rating system, such changes should be considered in close concert with the existing Standard Reinsurance Agreement and future renegotiations. It should also be considered in light of related policies that interact with the crop insurance program, such as the shallow loss insurance programs and others in the recent Farm Bill (e.g., ARC, PLC, STAX, SCo). A unilateral or hastily implemented revision of the rating system by RMA alone on this issue may lead to less than optimal program outcomes. Such risk management programs will likely only become more important in coming decades as farmers are faced with increased risk from market volatility and climate change. Embracing technology advances in delivery is important, as is exploration of opportunities to continue privatizing certain functions that the Government is not well-suited to handle.

Rate Determination in the Federal Crop Insurance Program

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<th>Soil Conditioned Rate</th>
<th>RMA Rate = 0.0137 + Soil Conditioned Rate * 0.206</th>
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**Graph:**

- **X-axis:** Soil Conditioned Rate
- **Y-axis:** RMA Rate

**Equation:**

RMA Rate = 0.0137 + Soil Conditioned Rate * 0.206

**Note:**

Current, RMA Rate Determination in the Federal Crop Insurance Program

- **Estimation:**
  - **Regression Equation:** RMA Rate = 0.0137 + Soil Conditioned Rate * 0.206
  - **Graph:**
    - **X-axis:** Soil Conditioned Rate
    - **Y-axis:** RMA Rate
  - **Equation:**
    - RMA Rate = 0.0137 + Soil Conditioned Rate * 0.206
- **Comparisons:**
  - **RMA Rate versus explicit soil conditioned rates and actual RMA Rates, net of guarantee determination and Units in McLean, Illinois, for 85% Yield Protection Coverage. If RMA Rates embody all H approximation, then beta coefficient should be insignificantly different from 1.0 statistically significant.**
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  - **Beta coefficient should be insignificantly different from 1.0 statistically significant.**
- **Conclusion:**
  - The program has h have y been quite negative for the participating companies that constitute the delivery system. The actuarial validity of some recent changes, such as Yield Exclusion, have also been questioned. Many of the larger agribusiness players have even started to pull out of the market, potentially putting the delivery system at risk.
Instead of relying on explicit field location and soil quality data, the FCIP relies on a measure of average historical producer yields as the basis for determining guarantees, called Actual Production History (APH). In essence, the APH is a simple average of between 4 and 10 years of yields; there are also some provisions related to various adjustments, for example, the Trend APH program adds a correction for trend to remove bias; and, a new program introduced in the last Farm Bill known as Yield Exclusion, which allows producers to drop certain poor yielding years, thus leading to bias in APH as a measure of expected yield.

Rate Determination in the Federal Crop Insurance Program

Current research tends to indicate that the APH measure: a) does not take into account which fields are actually being planted/insured for any given policy in any given year; the yield data used to substantiate yield levels may include other fields which are not being planted in a given year, or may omit information for fields being planted, potentially leading to bias and inefficiency in pricing; b) does not take into account soil data explicitly; c) if Trend APH is not elected, will be a biased measure of expected yield due to trend; d) does not adjust for which years of data are reported, and thus is an inefficient estimator of expected yield; and e) includes various capping, cupping, and yield exclusion features which can lead to bias. A recent working paper by Woodard and Verteramo (2015) investigates the impact of soil heterogeneity within the county in determining guarantees, and finds that the APH measure statistically under-differentiates relative to an explicit soil based rating.

That study finds large deleterious impacts on rating efficiency from omitting consideration of soil data. Figure 1, for example, plots RMA rates versus explicit soil conditioned rates for all CLUs in McLean County, Illinois. If the current RMA rates adequately proxy for soil quality, then the slope between them should be equal to 1.0 (see Figure). However, the parameter is only 0.2, indicating the APH measure only picks up a small amount of the actual variation among soils in a county and how that flows through to affect premium rates. This is not surprising given that APH is known to be a fairly inefficient measure from a conceptual standpoint, as noted previously.

Policy Considerations

The Government’s track record in administering the FCIP has come under fire from time-to-time (see e.g., Government Accountability Office, 2007; Woodard et al., 2012a; Woodard et al., 2012b). The program has recently undergone a variety of changes which have created additional uncertainties; the vast majority of these changes have arguably been quite negative for the participating companies that constitute the delivery system. The actuarial validity of some recent changes, such as Yield Exclusion, have also been questioned. Many of the larger agribusiness players have even started to pull out of the market, potentially putting the delivery system at risk.

As it regards any effort towards integration of soil data into the current rating system, such changes should be considered in close concert with the existing Standard Reinsurance Agreement and future renegotiations. It should also be considered in light of related policies that interact with the crop insurance program, such as the shallow loss insurance programs and others in the recent Farm Bill (e.g., ARC, PLC, STAX, SCO). A unilateral or hastily implemented revision of the rating system by RMA alone on this issue may lead to less than optimal program outcomes. Such risk management programs will likely only become more important in coming decades as farmers are faced with increased risk from market volatility and climate change. Embracing technology advances in delivery is important, as is exploration of opportunities to continue privatizing certain functions that the Government is not well-suited to handle.
There could be a variety of conservation implications from adopting soil-based rating methodologies (see e.g., Woodard, 2015). For example, proponents of cover crops have argued that their use can be an effective way to reduce nutrient losses, yielding positive environmental benefits (e.g., to combat Gulf Hypoxia), but that the current crop insurance program disincentivizes their use. On the other hand, it is unknown whether in the short term if cover crops lead to increased risk, but clearly more research is needed here. Regardless, new approaches to integrate soil information explicitly into yield risk and insurance models is a necessary precursor for later incorporating models that quantify impacts from different soil sustainability practices, and resulting impacts on actuarially fair rates at the field level. That said, analysts should be cognizant that rates are not the only important determination; underwriting rules are also important to consider jointly.

It is also important to ask “why are these soil data not already used in the program?” The reasons are many, but could be due to a few factors. First, processing and working with such large datasets in these types of insurance contexts can be a difficult task, as a practical matter. The USDA-RMA, as the ultimate administrator and actuary of the program, also faces resource constraints, although the costs of implementing the technologies that would be needed have come down significantly in recent years. The second is that the producer level yield data needed with matched soil and production data are typically not shared by USDA to the research community, which hinders developments of redesigning the premium rating methodology to be built upon a soil-based rating framework. Retiring the current system and rebuilding from scratch is likely going to be in order at some point. Additionally, there are also several different crop insurance-like programs in the current Farm Bill that interact with the Federal Crop Insurance Program. Some of these are delivered by Approved Insurance Providers, and others by USDA. The merit of integrating these programs under a single delivery vehicle should be evaluated. Future research could also investigate the development of joint credibility models which take into account both soil data on the fields to be insured, as well as historical producer yields to capture any residual “management” effects. Further considerations for policy design which encourage the shifting of responsibility for rate-making and rule determination in more flexible and responsive frameworks away from USDA and towards the Approved Insurance Providers is also important to consider further.

Data Access

Producer level yield data needed with matched soil and production data are typically not shared by USDA to the research community. In order to scale up the analysis to the entire country for the purposes of operationalizing rating corrections that take into account soil quality explicitly, several government agencies would need to improve researcher access to data. Past attempts to obtain these data from the government have been unsuccessful. We urge the government to make these data available to researchers in a suitable form in order to foster an environment of progress on this issue. Future research related to topics such as those in the realm of “Big Data” applications will likely take on an increasingly larger role in shaping policy going forward.

These and other related data are potentially one of the largest untapped (or under-tapped) data resources for scaling soil economics research and bridging to policy solutions. In order to address privacy concerns, a strong case could be made that the government should participate with the academic and research sectors in developing and fostering secure data warehouses for integrating administrative data for analytical purposes. Such endeavors would require strong support and directives from leadership, as well as forethought on security and privacy issues, although many precedents exist; the main hurdle is likely not a technical one, however, nor a lack of motivation by the research community. More urgency on this issue by the USDA and related agencies is needed.

Future of Soil Based Rating Approaches

Crop insurance based programs have quickly become the single largest set of agricultural programs in the United States. There is a large literature on modeling crop yield distributions in the agricultural economics and actuarial literature, but much less that explicitly considers soil data. Several recent studies suggest that even in areas with relatively high quality soil and high homogeneity, such as Central Illinois, the current rating methods which use only APH as the basis for intracounty rate differentiation do not appear to fully capture observable heterogeneity in rates across soil quality. While the potential benefits of adopting soil-based rating approaches are difficult to deny, institutional and program rigidities may hamper adoption of modern analytical approaches; methods which have long been in place — such as the Actual Production History method of determining insurance guarantees — will not be easy to amend as a matter of culture. There will also be some costs involved, and the full benefits have not been calculated. Future applications in this area hold great promise, however, as the ability to condition rates on soil information would potentially lead to greater program efficiencies, more predictable underwriting returns, taxpayer savings, as well as potentially better environmental outcomes. Such innovations are also a necessary precursor to future program designs improvements, for example, to model and accommodate new or underutilized sustainability practices.

Future research should perhaps focus on the prospect of redesigning the premium rating methodology to be built upon a soil-based rating framework. Retiring the current system and rebuilding from scratch is likely going to be in order at some point. Additionally, there are also several different crop insurance-like programs in the current Farm Bill that interact with the Federal Crop Insurance Program. Some of these are delivered by Approved Insurance Providers, and others by USDA. The merit of integrating these programs under a single delivery vehicle should be evaluated. Future research could also investigate the development of joint credibility models which take into account both soil data on the fields to be insured, as well as historical producer yields to capture any residual “management” effects. Further considerations for policy design which encourage the shifting of responsibility for rate-making and rule determination in more flexible and responsive frameworks away from USDA and towards the Approved Insurance Providers is also important to consider further.

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About AGree

AGree seeks to drive positive change in the food and agriculture system by connecting and challenging leaders from diverse communities to catalyze action and elevate food and agriculture policy as a national priority. AGree also recognizes the interconnected nature of agriculture policy globally and seeks to break down barriers and work across issue areas.

AGree is supported by leading foundations that fund food and agriculture, international development, and health and wellbeing.

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Potential Conservation Implications of Federal Crop Insurance Actual Production History (APH) Procedures

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March 2016
While efforts have been made to ensure the accuracy of the material presented, this manuscript has been neither written by, nor approved by, the Risk Management Agency of the U.S. Department of Agriculture. It should not be considered authoritative nor relied upon by anyone making crop insurance sales or purchase decisions. Any opinions expressed are those of the authors and do not necessarily reflect the views of AGree, Mississippi State University, or the National Wildlife Federation.

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This AGree backgrounder was prepared by Barry Barnett, Professor in the Department of Agricultural Economics at Mississippi State University, and Ryan Stockwell, Senior Agriculture Program Manager for the National Wildlife Federation. The paper draws on the authors’ research and expertise in the Federal Crop Insurance Program. Barnett and Stockwell describe Actual Production History, a measure used to estimate a producer’s expected yield, and explore its purpose, structure, modifications (such as yield substitutions and exclusions), and potential conservation and environmental implications.

This publication is intended to broaden discussion and complement AGree’s consensus recommendations on policies and actions focused on food and agriculture. While the concepts presented in this paper have greatly enriched the deliberations of the AGree Co-Chairs and Advisors, the perspectives and positions do not represent consensus among them.

We hope you find this backgrounder a helpful resource and source of ideas.

Deborah M. Atwood
Executive Director
Introduction

As part of its efforts to drive positive change in food and agriculture, AGree – a multi-year collaborative initiative of leading foundations – has identified challenges and opportunities at the intersection of conservation and the U.S. Federal Crop insurance Program. AGree is particularly interested in ways that the crop insurance program might serve to either accelerate or impede conservation practice adoption among producers across the U.S.

Areas of opportunity and concern include those related to the crop insurance program’s Actual Production History (APH) procedures. This paper examines APH procedures in detail, including the ways APH is calculated, modified, and utilized, and the potential implications it might have for producers’ conservation decisions. A related AGree Point of View paper by Joshua Woodard, a professor at Cornell University, examines the extent to which APH captures the yield risk impacts of soil type.

Background

The U.S. Federal Crop Insurance Program is a public/private partnership administered by the Risk Management Agency (RMA) of the U.S. Department of Agriculture (USDA) on behalf of the wholly government owned Federal Crop Insurance Corporation (FCIC). Private insurance companies sell and service all federal crop insurance policies. RMA establishes the policy terms, determines premium rates (the cost of the insurance), and reimburses private insurers for their administrative and operating costs. Underwriting gains and losses are shared between the FCIC and the private insurers according to the terms of a negotiated Standard Reinsurance Agreement (SRA).

The most commonly used insurance products in the Federal Crop Insurance Program are Yield Protection (YP), Revenue Protection (RP), and Revenue Protection with Harvest Price Exclusion (RP-HPE). In 2014, 85% of U.S. corn acreage, 94% of cotton acreage, 87% of soybean acreage, and 84% of wheat acreage was insured using one of these three products. The RP product alone insured more than 70% of the planted acreage for each of these crops.¹

Measures of expected yield on the insured unit are important underwriting and actuarial components of YP, RP, and RP-HPE policies. This manuscript examines how expected yields are estimated and used for these federal crop insurance products and describes potential conservation implications.

Due to the diversity of farming practices and commodities produced in the United States, a large number of complex regulations exist regarding the calculation of federal crop insurance expected yields. This manuscript focuses only on the most commonly applied regulations and is intended to be illustrative rather than exhaustive. Those interested in more details regarding the regulations applicable to the calculation of federal crop insurance expected yields are referred to the Crop Insurance Handbook (2015).

Uses of Expected Yield Estimates

Expected yield estimates are used for two aspects of YP, RP, and RP-HPE policies. First, an expected yield estimate is required to establish both the liability and the trigger yield (or trigger revenue). Second, an expected yield estimate is required to establish the premium rate on the insured unit. The first of these estimates is known as the “approved yield” while the second is known as the “rate yield.” As will be described below, these two estimates do not necessarily take on the same value.

Liability and Trigger Yield (Trigger Revenue)

The estimate of approved yield affects both the liability and the trigger yield (or trigger revenue) for YP, RP, and RP-HPE policies. The liability is the maximum possible indemnity that can be paid on a federal crop insurance policy. For a YP policy, the trigger yield is the threshold for determining whether the policy will pay...
an indemnity. If the actual yield on the insured unit is greater than or equal to the trigger yield, no indemnity is paid. If the actual yield is less than the trigger yield, an indemnity is paid. Likewise, for RP and RP-HPE policies, the trigger revenue is the threshold for determining whether the policy will pay an indemnity conditional on the realization of actual revenue.

More specifically, assuming the policyholder has a 100% share in the crop, the YP liability per acre for insured unit $f$ is

1) $\text{Liability}_f = \text{Trigger Yield}_f \times \text{Projected Price}$

where

2) $\text{Trigger Yield}_f = \text{Coverage} \times \text{Approved Yield}_f$

In equation 2, $\text{Approved Yield}_f$ is a measure of the expected yield on the insured unit. Additional information on how this measure is calculated is provided in subsequent sections of this manuscript.

Coverage is generally available in 5 percent increments with $50% \leq \text{Coverage} \leq 85%$. $\text{Projected Price}$ is determined by pre-planting time prices on a harvest futures contract for the crop. For example, the $\text{Projected Price}$ for Illinois corn is the average of February daily closing prices on the Chicago Board of Trade December futures contract.

Indemnity per acre is calculated as

3) $\text{Indemnity}_f = \max (0, (\text{Trigger Yield}_f - \text{Yield to Count}_f)) \times \text{Projected Price}$

where $\text{Yield to Count}_f$ is the realized or appraised yield on the insured unit. Equation 3 makes it clear that an indemnity is paid only if $\text{Yield to Count}_f < \text{Trigger Yield}_f$ and, as indicated in equation 2, $\text{Trigger Yield}_f$ depends on $\text{Approved Yield}_f$ (the estimate of expected yield).

RP and RP-HPE are both revenue insurance products so any indemnity is triggered by a revenue shortfall rather than a yield shortfall. RP-HPE is a standard revenue insurance product whereas RP has an additional feature that increases the liability and trigger revenue if prices increase during the growing season.

For RP-HPE liability per acre is calculated as

4) $\text{Liability}_f = \text{Trigger Revenue}_f = \text{Coverage} \times \text{Approved Yield}_f \times \text{Projected Price}$

and for RP

5) $\text{Liability}_f = \text{Trigger Revenue}_f = \text{Coverage} \times \text{Approved Yield}_f \times \max (\text{Projected Price}, \text{Harvest Price})$

where $\text{Harvest Price}$ is a near harvest time average price on the harvest futures contract for the crop. For example, $\text{Harvest Price}$ for Illinois corn is the average of October daily closing prices on the December futures contract.

Indemnity per acre is calculated the same for both RP-HPE and RP as

6) $\text{Indemnity}_f = \max (0, (\text{Trigger Revenue}_f - (\text{Yield to Count}_f \times \text{Harvest Price})))$

where trigger revenue per acre is calculated as in equation 4 for RP-HPE and as in equation 5 for RP. Equation 6 makes it clear that for RP-HPE and RP an indemnity is paid only if $(\text{Yield to Count}_f \times \text{Harvest Price}) < \text{Trigger Revenue}_f$ and as indicated in equations 4 and 5, $\text{Trigger Revenue}_f$ depends on $\text{Approved Yield}_f$ (the estimate of expected yield).

**Premium Rate Determination**

The premium rate is the cost of the insurance per dollar of liability. Thus for example, a policy with a 5% premium rate would cost 5 cents per $1 of liability. The actuarial procedures used by RMA generally assume that units with higher expected yields are less risky and thus should have lower premium rates.

Equation 7 is a generalized version of the formula employed by RMA for calculating the unsubsidized base premium rate for 65% YP coverage on an optional unit. The formulas for RP-HPE and RP also subsume these calculations so while the focus here will be based on YP, relevant points would also apply to RP-HPE or RP.

7) $\text{Base Premium Rate} = ((\text{Reference Rate} \times (\text{Rate Yield}_f / \text{Reference Yield})^\text{Exponent}) + \text{Fixed Load})$
In this equation, $Rate_{Yield_f}$ is another estimate of the expected yield on the insured unit $f$. However, as will be discussed below, this estimate of expected yield it is not necessarily equal to $Approved_{Yield_f}$ in the equations above.

With the exception of $Rate_{Yield_f}$, all of the variables on the right hand side of equation 7 are for a specific combination of crop, county, type, and practice. Since $Reference_{Rate}$, $Reference_{Yield}$, $Exponent$, and $Fixed\ Load$ are the same for every policy with the same combination of crop, county, type, and practice, the base premium rate for 65% coverage on an optional unit varies only with the ratio of the $Rate_{Yield_f}$ to the $Reference_{Yield}$. In general, the higher the value of $Rate_{Yield_f}$ (the higher the expected yield on the insured unit), the lower the base premium rate.³

**Calculating the APH Yield**

The first step in calculating the expected yield on an insured unit is to calculate the APH (Actual Production History) yield. For major field crops, the APH yield is a simple rolling average of the most recent 10 years of producer reported actual yields.⁴ Table 1 contains an example where the APH yield for the 2014 crop year is 194 bushels per acre, the simple average of actual yields for the period 2004-2013. Likewise, the APH yield for the 2015 crop year is 200 bushels per acre, the simple average of actual yields for the period 2005-2014.

When crops are grown in rotation it will take more than 10 years to accumulate the 10 years of yield history used to establish an APH yield. For example, suppose an insured unit is planted in alternating years to corn and soybeans. In this case, twenty years of experience would be needed to generate 10 years of yield history for each crop.

If the grower does not have 10 years of actual yield records on the insured unit, an initial APH yield can be established with as few as 4 years of actual yields. In subsequent years, each additional year of yield experience is included in the calculation of the APH yield. Once 10 years of yield experience are available, the APH calculation transitions to a rolling average as described above.

**Table 1 | Calculation of APH Yield**

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Yield (bushels per acre)</th>
<th>Calculation of 2014 APH</th>
<th>Calculation of 2015 APH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>172</td>
<td>172</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>181</td>
<td>181</td>
<td>181</td>
</tr>
<tr>
<td>2006</td>
<td>176</td>
<td>176</td>
<td>176</td>
</tr>
<tr>
<td>2007</td>
<td>203</td>
<td>203</td>
<td>203</td>
</tr>
<tr>
<td>2008</td>
<td>210</td>
<td>210</td>
<td>210</td>
</tr>
<tr>
<td>2009</td>
<td>200</td>
<td>200</td>
<td>200</td>
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<tr>
<td>2010</td>
<td>213</td>
<td>213</td>
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<tr>
<td>2011</td>
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<tr>
<td>2013</td>
<td>221</td>
<td>221</td>
<td>221</td>
</tr>
<tr>
<td>2014</td>
<td>232</td>
<td>232</td>
<td></td>
</tr>
</tbody>
</table>

**Simple Average APH Yield**

| 194 | 200 |
If the grower does not have even 4 years of actual yield records for the insured unit, variable transitional yields (T-yields) are used to establish an APH yield. The RMA establishes T-yields which are crop- and county-specific. In some cases, T-yields also differ across different types and practices. If the policyholder has no actual yield records for the insured unit, the APH yield is established at 65% of the T-yield. If the policyholder has one year of actual yield records for the insured unit, the APH yield is the simple average of the one actual yield and three years of 80% of the T-yield. If the policyholder has two years of actual yield records for the insured unit, the APH yield is the simple average of the two years of actual yields and two years of 90% of the T-yield. If the policyholder has three years of actual yield records for the insured unit, the APH yield is the simple average of the three years of actual yields and one year of 100% of the T-yield. If the policyholder has four or more years of actual yield records for the insured unit, the APH yield is calculated as described above.

**Approved Yields and Rate Yields**

While the establishment of an expected yield on an insured unit begins with the calculation of the APH yield, there are various ways in which the APH yield can be modified. This section describes how those modifications impact the conversion of an APH yield into an approved yield or rate yield (where, hereafter the subscript is omitted to simplify the presentation). Some of these modifications have potential implications for the adoption of conservation practices such as reduced tillage, cover crops, and diverse crop rotations.

**Yield Substitutions**

APH yields are based on a relatively small sample of yield data. If a low-probability, extreme loss event occurs (e.g., a drought of a magnitude that would be expected to occur only once in 50 years) that event will be over-represented in a simple average APH yield based on 4 to 10 years of yield history. To mitigate the effect of extreme loss events, policyholders may elect to substitute 60 percent of the T-Yield for any actual yields in their APH yield histories that are less than 60 percent of the T-Yield as long as the yields being replaced were low due to an insurable cause of loss. This yield substitution impacts only the approved yield. The rate yield that is used in actuarial calculations is calculated without the yield substitution.

**Yield Floors**

Yield floors prevent the approved yield from falling below a specified percentage of the T-yield. To be eligible for a yield floor the policyholder must purchase a “buy-up” (not catastrophic) policy and must provide at least one year of actual yield records for the insured unit. For policyholders who provide 5 or more years of actual yield records, the yield floor prevents the approved yield from being less than 80% of the T-yield. For policyholders who provide 2-4 years of actual yield records, the yield floor prevents the approved yield from being less than 75% of the T-yield. For policyholders who provide only 1 year of actual yield records, the yield floor prevents the approved yield from being less than 70% of the T-yield. The yield floor impacts only the approved yield. The rate yield that is used in actuarial calculations is calculated without the yield floor.

**Yield Cups**

Yield cups are another mechanism designed to prevent low-probability, extreme loss events from having an inordinate impact on a policyholder’s approved yield. Yield cups prevent the approved yield on an insured unit from decreasing by more than 10 percent in successive years. When calculating an approved yield for year $t$, yield cups cannot be applied if yield substitutions have been used to calculate the approved yield in either year $t-1$ or year $t$. Yield cups also do not apply if the approved yield in year $t-1$ is a yield floor. Unlike yield substitutions or yield floors, cupped approved yields are also used as the rate yield in actuarial calculations. A 5% premium rate surcharge is applied when an approved yield is based on a yield cup.
Trend-Adjusted APH

For some crops and areas, policyholders also have the option of adjusting their APH yield to reflect increasing yield trends over time. Trend adjustments are made on each eligible yield within the APH yield history for the insured unit based on the county's historical yield trend. The approved yield is then calculated as a simple average of the trend-adjusted yields. Trend-adjusted APH is available only for buy-up coverage. Only policyholders who are able to provide at least 4 years of actual yield records for the insured unit receive the full trend adjustment. Policyholders who provide only 1 year of actual yield records receive 25% of any available trend adjustment. Policyholders who provide only 2 years of actual yield records receive 50% of any available trend adjustment. Trend-adjustment affects only the approved yield. It does not affect the rate yield. Additional information is available in the Trend-adjusted Actual Production History Standards Handbook (2015).

Yield Exclusions

The 2014 Farm Bill contained yet another provision to mitigate the impact on approved yields of extreme loss events. This amendment to §508(g)(4)(C) of the Federal Crop Insurance Act allows policyholders the option to exclude from the simple average APH calculation any actual yield for any crop year in which the per planted acre yield in the county is at least 50 percent below the simple average per planted acre yield for the county during the previous ten consecutive crop years. In addition, for any crop year that a county, crop, and practice combination satisfies the criterion of yield exclusion, policyholders in that county and in contiguous counties are eligible to exclude the year from their APH calculations if they are growing that crop using that practice. As with yield substitutions, yield floors, and trend-adjustment, yield exclusions will impact only the approved yield and not the rate yield.

Effective and Nominal Coverage Levels

The trend adjustment and yield exclusion have the same effect as increasing the coverage level selected by the policyholder. For example, suppose a trend adjustment and/or yield exclusion increases the simple average APH yield from 200 bushels per acre to 240 bushels per acre. If the policyholder selects a 75% coverage level, the trigger yield increases from 150 bushels per acre (200 bushels per acre × 75%) to 180 bushels per acre (240 bushels per acre × 75%). This implies an effective coverage of 90% (180 bushels per acre trigger yield / 200 bushels per acre simple average APH yield).

If an approved APH yield has been adjusted for trend adjustments and/or yield exclusions, the effective coverage level can be calculated as

\[
\text{Effective Coverage Level} = \text{Nominal Coverage Level} \times \frac{\text{Adjusted APH Yield}}{\text{Simple Average APH Yield}}
\]

For both trend adjustments and yield exclusions, the premium rate is based on the effective coverage level rather than the nominal coverage level.\(^6\)

Other APH Modifications

In addition to the above, there are some less frequently used APH modifications that have the potential to impact conservation outcomes. These are briefly described below. While it is not entirely clear from the Crop Insurance Handbook, it appears that these APH modifications affect only the approved yield.

Beginning Farmer

A beginning farmer is defined as someone who has not actively operated and managed a farm or ranch anywhere, with an insurable interest in any crop or livestock for more than 5 crop years. Beginning farmers are allowed to apply yield substitutions at 80% of the T-yield (rather than the standard 60%). For more information see the publication Beginning Farmer and Rancher Benefits for Federal Crop Insurance (2014).
**New Producer**

A new producer is defined as a person who has not been actively engaged in farming for a share of the production of the insured crop in the county for more than two crop years. New producers who have not produced the crop previously in the county (and thus, have no actual yield records) are assigned an approved yield equal to 100% of the T-yield. If the new producer has produced the crop for one or two crop years but does not have actual production records for those years, the approved yield is calculated at 65% of the T-yield. If the new producer has produced the crop for two years but is only able to provide actual yield records for the most recent crop year, the approved yield is calculated as a 4-year simple average of the one actual yield and three years of 80% of the T-Yield. If the new producer has produced the crop for one or two crop years and has actual production records for those years, the approved yield is calculated as a 4-year simple average where 100% of the T-yield is substituted for any of the 4 years for which an actual yield is not available.

**Added Land**

When a grower wants to insure acreage on which the grower has not previously produced the insured crop, type, and practice, the variable T-yield procedures described above generally apply to the added land. Exceptions may apply under certain circumstances. For example, it may be possible for the policyholder to receive a yield determined by the regional RMA office, in lieu of the variable T-Yield, the first time a new practice is used on an insured unit (e.g., when an irrigated practice is used for the first time). Also, under certain circumstances, a grower may qualify to use another producer's production history to establish an approved yield on added land.

**Prevented Planting**

If, in a given year, a prevented planting payment is received that exceeds 35% of the full prevented planting coverage for the insured crop, the year is excluded from APH calculations for subsequent years.

If a prevented planting payment is received that is less than 35% of the full prevented planting coverage, a yield is assigned that will be used for APH calculations in subsequent years. If the insured unit contained only prevented planting (no planted acreage), the yield assigned for APH calculations in subsequent years is 60% of the approved yield for the year in which prevented planting was claimed. If the insured unit contained both prevented planting and planted acreage, the yield assigned for APH calculation in subsequent years is a weighted average of 60% of the approved yield on the prevented planting acreage and the actual yield on the planted acreage.

**Potential Conservation Implications**

This section describes a number of potential conservation implications related to how expected yields are calculated and used in the Federal Crop Insurance Program. In addition, the section contains a discussion of potential conservation implications of the federal crop insurance premium subsidy structure.

**APH Yield Modifications**

Yield substitutions, yield floors, yield cups, and yield exclusions are all intended to prevent extreme loss events from being overrepresented in the calculation of approved yields. Interestingly, there is no mechanism for reducing the impact of unusually high yields on crop insurance approved yields.

Obviously, growers in higher risk areas are more likely to have opportunities to utilize one or more of these mechanisms. While further research is necessary, there are reasons to believe that areas with higher yield risk are also more likely to be characterized by fragile soils and extreme weather conditions – thus, implying greater susceptibility to wind-borne or water-borne soil erosion (Deal 2004, 2006). If this is correct, then these mechanisms for modifying APH yields provide incentives to produce in areas that are relatively more prone to soil erosion.
Some evidence of this is provided in the two appendix figures (from RMA's Actual Production History Commodity Maps) which show the number of years from 1995-2014 that a county would have qualified for yield exclusion. The first figure is for non-irrigated corn while the second is for non-irrigated cotton. For each of these crops, the figures clearly demonstrate that yield exclusions occur more often in marginal, high risk, production areas.

In addition to providing incentives for producing in risky areas, some of these mechanisms may also provide incentives for growers in any given area to use practices that may increase yields in ideal growing conditions but also increase the potential for yield losses in sub-optimal growing conditions. For example, in a drought year a grower who uses conventional tillage may experience a yield equal to 35% of the expected yield while a grower who uses reduced- or no-tillage may have a yield equal to 65% of the expected yield. The grower using conventional tillage can benefit by using some combination of yield substitutions, yield floors, yield cups, or yield exclusions to reduce the impact of the low yield on subsequent crop insurance approved yields. The grower who used reduced- or no-till to reduce his/her risk exposure is less likely to qualify for these mechanisms.

**Rating Assumption**

As described earlier the premium rating formula employed by RMA implicitly assumes that, for a given crop, county, type, and practice, a higher expected yield implies lower relative risk. Thus, units with higher (lower) expected yields are charged relatively lower (higher) premium rates. This rating assumption is based on research which suggests that yield variability tends to be independent of expected yield. Thus, an insured unit that has a yield variance of 80 bushels per acre when the expected yield is 100 bushels per acre is much riskier than an insured unit with a yield variance of 80 bushels per acre but an expected yield of 200 bushels per acre.

A potential concern with this rating assumption is that RMA only designates a limited number of practices. For many crops and counties, the only practices designated are irrigated and non-irrigated. Thus, the assumed relationship between expected yield and risk (reflected in the exponent in equation 7) may not be appropriate across a range of undesignated production practices. For example, for non-irrigated production the relationship between expected yield and risk may be different depending on whether a cover crop is used or whether the crop is produced using conventional tillage or some form of reduced or no tillage. It may even be that some conservation practices result in lower expected yields but also less yield variability (contrary to the implicit rating assumption). This suggests a need for data to support the development of additional crop insurance practice designations (including combinations of practices). This would allow RMA premium ratings to become more tailored to the combination of production practices employed on each insured unit.

Currently data on the risk associated with various production practices remains inadequate. However, there are indications that some conservation practices can significantly reduce yield risk. For example, in 2013 the North Central Region Sustainable Agriculture Research & Education Center and the Conservation Technology Information Center surveyed growers about cover crop usage. Results based on information provided by respondents from states hardest hit by the 2012 drought (Indiana, Illinois, Iowa, Kansas, Missouri, Nebraska, and South Dakota) indicated that those who used a cover crop following the 2011 crop year experienced less severe corn and soybean yield losses in 2012. More specifically, respondents in these states reported 2012 average corn yields on fields with cover crops that were 11% higher than average corn yields on fields without cover crops. Soybean yields on fields with cover crops were 14.3% higher than yields on fields without cover crops. The higher yields would have significantly reduced crop insurance claims on cover-cropped fields.

**Prevented Planting**

As described above, growers who take a full prevented planting payment due to an insurable cause of loss may ignore the prevented planting year in subsequent year APH calculations. Those who take a partial prevented planting payment may replace the prevented planting
year with 60% of the approved yield in the prevented planting year. In some regions (e.g., the northern Corn Belt), prevented planting claims are often caused by excess soil moisture. Practices that reduce soil organic matter and degrade soil structure make insured units more sensitive to excess moisture and thus more likely to receive a prevented planting payment. In contrast practices that improve soil health reduce the likelihood of receiving a prevented planting payment. Policy provisions require other producers in the area to experience prevented planting conditions in order for a grower to successfully file a prevented planting claim. While this helps to reduce fraud or abuse, existing crop insurance prevented planting provisions likely still create a disincentive for growers to adopt practices that may improve soil health and reduce the risk of prevented planting.

Consider an example of a grower who implements practices (e.g., cover crops or no-till) that improve soil structure and bulk density which improves water infiltration and the soil's ability to carry equipment in wet conditions. With regard to crop insurance prevented planting provisions, this grower may actually be disadvantaged relative to neighbors who do not use these practices. To see this suppose that, in a given year, the neighboring growers all take prevented planting. If they take a full prevented planting payment, the year is excluded from APH calculations for subsequent years. If they take a partial prevented planting payment (less than 35% of the full prevented planting coverage), the year is replaced in subsequent APH calculations with 60% of the grower’s approved yield in the prevented planting year. The grower who implemented soil improving practices was able to get the crop planted but, due to the sub-optimal growing conditions, experienced a yield loss. The prevented planting provisions make it likely that the growers who did not implement soil improving practices (and thus had a prevented planting claim) will see their APH yields decline less in subsequent years than the grower who, due to investments in improving soil health, was able to get the crop planted.

Structure of Premium Subsidies

The crop insurance feature that may have the most wide-ranging conservation/environmental implications is the premium subsidy structure. While this feature is unrelated to APH yield calculations or modifications, it is sufficiently important to warrant being mentioned in this document.

Crop insurance premium subsidies are stipulated as a percentage of the total premium. For example, a YP, RP, or RP-HPE policy at the basic or optional unit level with 65% coverage, has a 59% premium subsidy – that is, the grower pays only 41% of the total premium cost. The reference rate (see equation 7) is higher for more risky crops and regions. Thus, for example, the 2015 YP reference rate for non-irrigated corn insured at 65% coverage in DeKalb County, Illinois is 0.8% (or 80 cents premium per $100 of insurance liability). In contrast, the 2015 YP reference rate for non-irrigated cotton insured at 65% coverage in Fort Bend, Texas is 8.0% (or $8.00 premium per $100 of insurance liability). For simplicity, ignore the other variables in equation 7 that impact base premium rates and assume that a farm in each of these counties purchased an insurance policy with $500,000 of liability. The total premium for the Illinois corn farm would be $4,000. With a 59% premium subsidy, this grower would receive a premium subsidy of $2,360. For the same $500,000 of liability, the total premium for the Texas cotton farm would be $40,000. This grower would receive a premium subsidy of $23,600 – ten times more than the subsidy amount received by the Illinois corn grower.

Given this, it is hard to escape the conclusion that the crop insurance premium subsidy structure subsidizes higher yield risk production areas more than lower risk areas. If areas with higher yield risk are also likely to be areas with more fragile soils and/or more extreme weather conditions, then the crop insurance premium subsidy structure is likely disproportionately incentivizing production in areas with the greatest susceptibility to environmental problems such as wind-borne or water-borne soil erosion.
References


Endnotes

1 The percentage of insured acreage was determined by dividing RMA data on insured acres by National Agricultural Statistics Service data on planted acreage.

2 For some crops and counties the maximum Coverage is 75%.

3 Various factors are used to modify the formula in equation 7 for coverage levels other than 65%, for unit structures other than optional units, and for optional endorsements. These complicating factors, however, do not impact the role of in the actuarial procedures.

4 For certain insurable tree fruit species, APH yields are calculated as a 5-year simple rolling average.

5 Catastrophic policies offer yield insurance with a 50% coverage level. The liability and indemnity for catastrophic policies is calculated using 55% of the projected price. Catastrophic policies are provided to growers without any premium being charged. Growers who opt for a catastrophic policy rather than a “buy-up” YP, RP, or RP-HPE policy are required to pay a $300 administrative fee.

6 Yield substitutions, yield floors, and yield cups can also cause the effective coverage level to exceed the nominal coverage level. However, these mechanisms have been in place for many years whereas trend adjustment and yield exclusions are relatively new. For yield cups, a premium rate surcharge is applied. RMA assumes that the impact of yield substitutions and yield floors is already reflected in the loss experience data on which the in equation 7 is based. Trend adjustment and yield exclusions are not reflected in the loss experience data. Thus, for trend adjustment and yield exclusions RMA charges a premium rate that reflects the effective coverage level rather than the nominal coverage level.

7 It is important to note that many of these mechanisms are statutory.

8 A 962 acre corn farm with an approved yield of 200 bushels per acre and a projected price of $4.00 per bushel insured at 65% coverage would have an insurance policy with approximately $500,000 of liability.
About AGree

AGree seeks to drive positive change in the food and agriculture system by connecting and challenging leaders from diverse communities to catalyze action and elevate food and agriculture policy as a national priority. AGree also recognizes the interconnected nature of agriculture policy globally and seeks to break down barriers and work across issue areas.

AGree is supported by leading foundations that fund food and agriculture, international development, and health and wellbeing.

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Public and Private Roles in Agricultural Risk Transfer

By Barry Barnett, Keith Coble and Stephanie Mercier

March 2016
This publication was commissioned by AGree to inform and stimulate dialogue about policy reform; it does not represent official AGree positions. The views expressed here are those of the individual authors.
Foreword

AGree seeks to drive positive change in the food and agriculture system by connecting and challenging leaders from diverse communities to catalyze action and elevate food and agriculture policy as a national priority. Through its work, AGree will support policy innovation that addresses critical challenges facing the global food and agriculture system and overcomes barriers that have traditionally inhibited transformative change.

AGree developed the foundation for its work by identifying four broad challenges facing the global food and agriculture system:

• Meet future demand for food;
• Conserve and enhance water, soil, and habitat;
• Improve nutrition and public health; and
• Strengthen farms and communities to improve livelihoods.

AGree is taking a deliberative, inclusive approach to developing a policy framework to meet the challenges ahead. We are undertaking research to understand the problems and assess options and are being guided by the engagement of a broad array of stakeholders whose insights and ideas are contributing to meaningful solutions.

AGree also seeks to stimulate the development of creative ideas and encourage the examination of issues from new and unique perspectives while fostering linkages that catalyze and support action.

Public and Private Roles in Agricultural Risk Transfer, was written by Barry Barnett, Keith Coble, and Stephanie Mercier. It provides background information on the role that the U.S. government plays in agricultural risk management and how public risk management programs might be affected in an environment of reduced federal spending. The paper discusses two agricultural risk transfer programs that have received widespread attention in recent years, index products and whole farm insurance, as well as the potential for reorienting federal farm policy around a federally-provided, county-level, deep loss program.

This publication is the latest in a series intended to inform and broaden discussion and to complement AGree’s consensus recommendations on policies related to food and agriculture. While the concepts presented in this paper will enrich AGree’s discussions, the perspectives and positions do not represent the consensus of the AGree Co-Chairs and Advisors.

We hope you find this paper a helpful resource and will join the effort to transform federal food and agriculture policy to meet the challenges of the future.

Deborah Atwood
Executive Director
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Executive Summary

This paper provides background information on the role that the U.S. government plays in intervening in agricultural risk management, primarily through establishing programs that enable transferring aspects of agricultural risk from farmers to U.S. taxpayers or consumers when transfers of such risks by private sector mechanisms are deemed infeasible. The paper also looks at how public risk management programs might be affected in an environment of overall reduced federal spending.

Overview and Background of Current Agricultural Risk Protection System

Explicit federal intervention in agricultural risk began in the throes of the Great Depression in the 1930s, when the U.S. government took on the responsibility of helping to support the incomes of U.S. farmers, initially by seeking to prop up crop prices by reducing supply. The policy focus was on prices of the main food crops grown by farmers, primarily corn, wheat, and rice, as well as the non-food crops of tobacco and cotton. As reported in the 1935 Agricultural Census, about 60 percent of all farmers raised corn, while cotton, wheat, and rice were the most common crops produced in regions where corn was not widely grown. The range of crops covered by such programs has expanded since the original list to include soybeans and other oilseed crops, but price risks associated with fruits and vegetable crops remain largely outside this area of government intervention, as does most of the livestock sector.

The other major component of agricultural risk that has been subject to long-term U.S. government intervention since 1938, has been the risk generated by variability in crop yield. More than 80 percent of U.S. cropland is rain-fed (rather than irrigated) and thus yields are exposed to the vagaries of weather, both good and bad. Intervention in revenue variability is of much more recent vintage, since the mid-1990s, while the federal government has had little or no involvement in transferring risk resulting from input price variability.

There are a number of private mechanisms available to farmers that help them reduce risk faced within their own operations, by engaging in one or more of the following practices:

- **Share agreements for inputs** - This mechanism is typically used to reduce the risk associated with price variability of farmland rent by sharing costs and crop revenues between renters and landlords. Its use has declined somewhat in recent years, replaced by cash rent agreements.

- **Output contracts** - Allows farmers to establish prices or pricing mechanisms in advance for some or all of the output they produce. This practice is more common in the U.S. horticultural and livestock sectors than it is in U.S. row crop production.

- **Self-insurance (savings/borrowing)** - Farmers can use this approach to help them smooth consumption over and within years. Savings are accumulated in high revenue years and remain available to mitigate low revenue years.

- **Diversification** - Less than perfect correlation among investments or agricultural activities can reduce risk significantly. In past decades, this often took the form of raising both crops and livestock in the same operation, but more recently diversification has meant seeking income from off-farm employment or investments.
Overview of What Makes Agricultural Risk Transferable

Agricultural risks are transferred primarily through insurance and exchange-traded futures and options contracts. This section of the paper describes what characteristics are necessary for a risk to be transferable either through insurance or exchange market mechanisms. For insurance, these characteristics include: 1) does the insured product or service have a determinable and measurable loss; 2) can the policyholder engage in behavior which increases the probability of a loss (i.e., moral hazard); 3) does the insurance company have sufficient information to differentiate risks between potential policyholders; and 4) are the losses uncorrelated enough to allow an insurance company to benefit from risk pooling.

To the extent that agricultural perils violate insurability principles, it becomes more difficult and more expensive to offer agricultural insurance coverage on a private basis. Moral hazard and adverse selection occur due to a fundamental information asymmetry; a grower has better information than the insurer about production practices and risk exposure on the insured farm.

Agricultural producers have long had private sector price risk protection available to them through direct access to futures markets. While it is possible for producers to hedge directly, it is more common for producers to forward contract with local elevators and buyers who then aggregate the various lots of forward contracted commodity and hedge the total amount. However, federal commodity programs also provide price risk protection so it is possible that they “crowd out” farmers’ use of exchange-traded futures and options contracts and forward contracts derived from exchange-traded contracts. It is important to note, however, that traditional farm bill supports have provided a long-term (typically five years) window of price risk protection and at time provided support at higher levels than futures markets and crop insurance (which uses futures prices) would provide.

The U.S. Government’s Current Role in Transferring and Subsidizing Various Types of Agricultural Risk

Since the enactment of the original Agricultural Adjustment Act of 1933 (and subsequently the Agricultural Adjustment Act of 1938), federal commodity programs have focused primarily on protecting farmers against low prices. Initially, growers were provided with price supports for selected commodities that prevented domestic prices from falling below specified levels. The main mechanism for implementing these price supports was a short-term (less than a year) loan from the federal government with the crop serving as collateral. To be eligible for the price support program, growers were often required to forego producing on a portion of their cultivatable acres. In the early 1980s, persistent low prices led to a large accumulation of stocks of grains and oilseeds. At their peak in 1986, total ending stocks of corn were 4.9 billion bushels, nearly 60 percent of that year’s corn crop. Beginning in 1985 (for rice and cotton) and 1990 (for all other loan-eligible commodities), farmers were allowed the option to request cash payments equal to the gap between the loan rate and market price (the so-called loan deficiency payment (LDP)) in lieu of forfeiture of loan commodities.

This program change to discourage forfeiture marked the beginning of the shift from price support to income support for producers of key field crops, although the shift was not completed until the enactment of the Federal Agriculture Improvement and Reform Act of 1996 (FAIR Act), when set-aside requirements were dropped, and most federal payments were shifted into decoupled direct payments that did not vary with market prices. The marketing loan program was maintained at relatively low loan rates as a safety net against future low prices, but policymakers did not expect it to be used. After the Asian financial crisis of the late 1990s, which lowered export demand and commodity prices significantly, additional market-linked programs
were restored to the farm safety net mix, with the Countercyclical Payment Program (CCP) in the Farm Security and Rural Investment Act of 2002 and the Average Crop Revenue Election (ACRE) program in the Food, Conservation, and Energy Act of 2008.

The Agricultural Adjustment Act of 1938 also established the Federal Crop Insurance Program (FCIP) which authorized federal provision of yield insurance for selected commodities. While private sector insurers had successfully offered insurance against crop losses caused by hail or fire, all previous private sector efforts to offer multiple peril crop insurance had failed. In 1939, the first FCIP policies were sold to wheat growers. Coverage was later extended to cotton growers as well but the program’s actuarial performance proved disappointing. The Federal Crop Insurance Act of 1980 made several significant changes to the FCIP. Coverage was expanded into new crops and regions. Federal premium subsidies were introduced to encourage more participation in the FCIP. Also, for the first time, private sector insurance companies were allowed to sell and service FCIP policies.

Currently, FCIP policies are available for more than 100 different crops. Coverage is available for at least one crop in almost every U.S. county. In 2015, the FCIP had gross premium revenue of $9.7 billion on more than $102 billion of insurance protection in force, the latter down 17 percent from the peak liability in 2013.

Revenue policies are not available for most specialty crops, primarily due to the lack of publicly available prices generated by an open exchange or market for such crops.

In recent years, federal farm programs have also started moving toward payments triggered by revenue shortfalls. The 2008 farm bill allowed growers to choose between the price-triggered CCP program and the revenue-triggered ACRE program. A revenue-triggered standing disaster assistance program, known as the Supplemental Revenue Assistance (SURE) program, was also created by the 2008 farm bill. The SURE program expired in 2011. In February 2014, after a more than two-year legislative process, Congress passed the Agricultural Act of 2014. The commodity title of the new farm bill repealed the Direct Payment (DP), ACRE, and CCP programs, and replaced them by offering farmers a choice between two forms of commodity support, a price-based program similar to the CCP program (Price Loss Coverage (PLC)) but with higher program prices for all commodities, or a revenue-based program (Agricultural Risk Coverage (ARC)), providing payments for shallow losses as experienced at either the farm or county level. The county level ARC option would pay on a larger share of the gap between the county average revenue for a crop and the actual county revenue for a given year. The ARC program is designed to partially fill in the gap not addressed under a deductible for a revenue policy offered under the federal crop insurance program. The signup for the new programs in the 2014 farm bill was completed in 2015; in aggregate, 76 percent of all program crop acres were enrolled in the ARC-County program (nearly all corn and soybean acres, and the majority of wheat acres), 23 percent was enrolled in the PLC program (primarily rice and peanut acres), and only 1 percent was enrolled in the ARC-Individual program option.
Executive Summary

Innovative Designs

The paper also discusses two innovative designs for agricultural risk transfer programs that have received widespread attention in recent years, index products which transfer commodity-specific yield or revenue risks using an index that is correlated with losses experienced on the farm, and whole farm insurance, which would provide multiple commodity or “whole farm” revenue risk transfer.

Index insurance makes payments based on the realized value of an index rather than on the loss actually experienced by the individual policyholder. Such products, in the form of county-based group risk or group income protection, and broader index products for pasture and rangeland, are already available under the FCIP, but weather index products have received a lot of attention for their potential for insuring farmers in developing countries.

Multiple commodity or whole farm revenue insurance is increasingly mentioned in farm policy debates as an alternative to the current commodity-specific approach. The obvious motivation is that if the intent of a farm safety net is to protect farm household income then the focus should be on aggregate revenue for the entire portfolio of commodities produced. While whole farm designs are conceptually attractive and straightforward, they are operationally quite complex. Each farm’s portfolio of agricultural enterprises is unique so whole farm insurance designs require sophisticated portfolio modeling of the revenue risk for each policy sold.

In a World of Reduced Federal Spending

As efforts continue to cut federal spending to address the long-term budget deficit problem, farm and crop insurance programs will be part of that mix. Methods to achieve savings from these programs in the future could include:

• Eliminating one or more price- or revenue-triggered commodity programs;
Introduction

Production agriculture is fraught with risks. Weather events cause realized yields to differ from expected yields. Prices at harvest may be quite different than what was anticipated at planting time. The costs of inputs such as fuel or fertilizer can vary significantly from one year to the next or even change dramatically within the growing season. This unpredictability is problematic. Gross farm revenue (yield times price) or profit (gross farm revenue minus costs) can vary tremendously. When profit is unexpectedly low, farms have difficulty repaying long-term obligations such as loan payments for purchased land or equipment. In extreme cases or when unexpectedly poor outcomes occur repeatedly, the financial viability of the operation can be threatened.

Farmers use various methods to manage their exposure to risks. In general, these methods can be grouped into three categories: risk reduction; risk transfer; and risk retention. Examples of risk reduction would include diversification, income from off-farm employment, installation of irrigation equipment, or prophylactic pesticide usage. Risks can be transferred through mechanisms such as insurance, forward pricing, and share-renting. Since the Great Depression, the federal government has also provided various programs designed to offset farmers' financial losses, thus transferring some aspects of crop farmers' risk exposure to taxpayers or consumers. After risk reduction efforts have been employed, any residual risk that is not transferred is implicitly retained and typically managed using personal savings or access to credit to smooth household consumption over time.

This paper focuses primarily on mechanisms for transferring the risks faced by crop producers. We begin by briefly reviewing various private and public risk transfer tools currently used by crop farmers. We then explore the question of “What makes a risk transferrable?” Contrary to popular belief, not all risks are transferrable. For those risks that are transferrable, different risk transfer instruments may be needed for risks with different characteristics. The paper then

Concluding Remarks

Within the context of crop production, the term “risk” generally refers to variability in annual profit. This variability in net returns can occur due to variability in prices, yields, and/or input costs. Crop producers manage their risk exposure by investing in risk reduction efforts such as irrigation equipment and transferring risk through both private and public instruments. After risk reduction efforts have been employed, any remaining risk that is not transferred is implicitly retained within the farm business.

Traditionally, insurable risks have a number of specific characteristics that are not consistent with yield or revenue risks for most agricultural commodities. This lack of compatibility has led to a federal role in providing and subsidizing multiple peril crop yield and revenue insurance in the United States, but that role has become a costly one in recent years. Pressure to reduce federal spending is expected to lead to further cuts in available funds for farm and crop insurance programs in the future, and policymakers will be looking for approaches that will allow for reduced spending but still preserve the basic functioning of the farm safety net.

• Modifying the triggers which determine how payments are made under farm programs;
• Reducing spending by paring back on the share of the price or revenue gap or acreage on which payments are made;
• Reducing premium subsidies for crop insurance across the board;
• Reducing or ending subsidies for the price portion of revenue insurance policies;
• Reducing reimbursement for crop insurance companies; or
• Removing systemic risk from mix so private insurance could be facilitated, such as in a program in which the federal government covers ‘deep losses’.

Introduction
focuses on the major crop risk transfer programs provided or facilitated by the federal government. Finally we describe how policymakers could modify these programs in response to reduced federal funding availability.

Overview and Background of Current Agricultural Risk Protection System

Major Forms of Agricultural Risk

Price Risk

Crop producers consistently identify price risk as the type of risk that causes them the greatest concern. Due to changing supply and demand conditions, prices can vary significantly across years and even within a given production season. Beginning during the Great Depression, the U.S. government took on the responsibility of helping to support the incomes of U.S. farmers, initially by seeking to prop up crop prices by reducing supply in a harsh economic environment under which aggregate demand for a range of basic goods, including food and clothing, had fallen through the floor. The policy focus was on prices of the main food crops grown by farmers, primarily corn, wheat, and rice, as well as the non-food crops of tobacco and cotton. For corn, historically the largest U.S. crop in terms of both acreage and value, the annual coefficient of variation for nominal corn price received by farmers averaged 0.130 for the period between the passage of the Agricultural Adjustment Act of 1933 and the end of World War II. This is nearly identical to the 0.129 average annual coefficient of variation for the 66 years prior to the passage of the 1933 Act. In the post-war period, the average annual coefficient of price variation has been considerably higher at 0.369.

As reported in the 1935 Agricultural Census, about 60 percent of all farmers raised corn, while cotton, wheat, and rice were the most common crops produced in regions where corn was not widely grown. The farm safety net has been extended to cover more crops over time as the range of row crops grown by American farmers has increased. In particular, acreage of soybeans and other oilseed crops expanded beginning in the late 1940s, as it became more cost-effective to separate the oil and protein in oilseeds for use as animal feed and vegetable oil for human consumption. Soybeans were partially integrated into support programs when they were designated as a non-basic loan commodity in the Agriculture Act of 1949, but not fully integrated as a program crop until the Farm Security and Rural Investment Act of 2002 (2002 farm bill).

Because these crops can be readily stored and easily transported, the price for a given commodity tends to be consistent between regions under perfect information conditions, except for differences in transportation costs. This ‘law of one price’ has allowed federal policymakers to provide support for given commodities based on changes in a single estimated national price for those commodities. For the majority of federal commodity programs aimed at addressing price risk, the focus has been on mitigating the down-side impact of between-year price variability, which is consistent with planning horizons for farmers raising annual row crops.

Yield Risk

The other major component of agricultural risk that has been subject to U.S. government intervention has been the risk generated by variability in crop yield. More than 80 percent of U.S. cropland is rain-fed (rather than irrigated) and thus yields are exposed to the vagaries of weather, both good and bad. Unlike prices, yields can vary tremendously across different regions. While some weather perils (e.g., hail) cause only localized yield losses, other perils (e.g., droughts or floods) can cause widespread, systemic losses. It is particularly difficult to transfer yield risk through private sector mechanisms because yield losses are neither completely systemic nor completely localized (see later section titled “Overview of What Makes Agricultural Risks Transferable”).

When yields are measured at an aggregate level (e.g., county, state, or national), the variability is reduced because localized poor yields in some regions are often offset by localized good yields in other regions. The
higher the level of aggregation, the more that yield variability measures are biased downward. For example, Coble, Dismukes, and Thomas show that for major crops, the yield coefficient of variation at the farm level is twice as high as the yield coefficient of variation at the county level.8

The first federal program to address yield risk also had its origin in the set of policy responses to problems faced by the U.S. agricultural sector during the Great Depression, as Congress authorized the establishment of a crop insurance program in 1938. The Federal Crop Insurance Program (FCIP) was initially limited to insuring major crops grown in core production areas, and had low participation and bad loss history for several decades. The main features of the federal crop insurance system as it is known today, offering nationwide coverage to a broad range of crops, making it more affordable to farmers by subsidizing the premiums paid for coverage, and encouraging private sector delivery of the program, began in 1981. This program will be described in greater detail later.

Revenue Risk
While federal programs have historically focused on price risk and yield risk separately, farmers are really concerned about revenue risk – variability in the product of price and yield. Obviously, the magnitude of revenue risk depends on the magnitudes of price risk and yield risk but it also depends on the correlation (or covariance) between prices and yields. For example, in the Midwest, farm-level corn yields are generally negatively correlated with prices, because of the region’s dominant share of national production. If a Midwest farm experiences significant yield shortfalls it is likely that low yields have occurred throughout the region and, as a result, prices have increased. Similarly, unusually good yields tend to cause lower prices. This “natural hedge” reduces revenue variability for farms in the region. In contrast, there is very little relationship between yield and price for corn farmers in more marginal production regions. This implies that farms in more marginal areas will have greater revenue risk even if they have exactly the same magnitude of price and yield risk as farms in the Midwest. Likewise, U.S. producers of crops such as cotton, rice, and sugar have no natural hedge, largely because the United States accounts for only a relatively small portion of total world production of these crops, so yields on farms in the United States are largely uncorrelated with price.

The FCIP focused almost exclusively on covering yield risk at the individual farm level until the mid-1990s. At that time, both private crop insurance companies and outside consultants began to contemplate development of products that would not just insure a given crop yield level on a farm as determined by the farm’s historic production pattern, but guarantee a given revenue for that crop based on that farm’s demonstrated crop yields, prevailing market prices, and desired coverage levels. Adoption of this approach was in part an effort to take advantage of the natural hedge in major producing areas, which was expected to reduce the cost of managing risk.9 Unlike the federal price support programs described earlier that were designed to protect against price variability across production seasons, revenue insurance products were designed to mitigate within-year revenue variability. Initially offered on a pilot basis for a few Midwest states for corn and soybean production in the spring of 1996, revenue insurance policies accounted for more than 70 percent of the total FCIP protection in force for all crops (excluding forage policies) during the 2015 crop year.10 The revenue insurance percentage was even higher for major crops such as corn, soybeans, and wheat.

Input Cost Risk
Much less attention has been given to input price risk than to either output price risk or yield risk. This low policy priority is consistent with input prices having been relatively stable for long periods of time, but with occasional spikes. It is also important to recognize that in many cases the output price risk for grains and oilseeds is also input price risk for livestock production. While a broad array of inputs are used in agricultural production, most research on input cost risk has focused on land prices (cash rents), interest rates, and prices of diesel fuel, natural gas, and fertilizer.
Commodity programs and crop insurance have largely ignored input price risk. In part that has been a result of lesser demand for this type of protection.

Interest rates reflect underlying macroeconomic conditions. While interest rate spikes and other macroeconomic shocks had catastrophic effects on agriculture during the 1980s, these factors have had much less impact in the years since. Land prices and rents are significant input costs and are often affected by demand side shocks tied to the profitability of production agriculture. Thus, while periods of high output prices increase agricultural profitability in the short term, they also increase demand for land, driving up land prices and rents and eventually returning profitability to more typical levels. Similarly, government programs that increase agricultural profitability in the short-term will cause land prices and rents to increase, returning profitability to more typical levels over the long term. Input cost risk is exacerbated by the fact that the prices of many key production inputs are positively correlated. For example the prices of diesel fuel, anhydrous ammonia, and nitrogen fertilizer all tend to move together because of linkages to energy markets.

Commodity programs and crop insurance have largely ignored input price risk. In part that has been a result of lesser demand for this type of protection. In recent years, some proposals have been made to insure crop production based on costs incurred by farmers. However, data suitability as well as logistic and insurability issues have doomed these proposals. In principle, private-sector futures markets could be used for managing some input price risks. For example there are swap contracts or exchange-traded contracts to hedge interest rates and diesel prices. However it appears that agricultural producers seldom use these contacts. In part this may be due to the large contract size. The New York Mercantile Exchange (NYMEX) trades a heating oil contract, a product which is chemically similar to diesel fuel, but it is denominated in 42,000 gallon lots. According to the 2012 Census of Agriculture, the average farmer spends about $8,300 annually on gasoline, fuels, and oils, while a single heating oil futures contract sold on NYMEX in February 2016 cost nearly $45,000.11

Mechanisms for Reducing Agricultural Risks

Diversification

Diversification is a well-known means to reduce risk in both agricultural and non-agricultural contexts. Investing in various enterprises, (which have less than perfectly correlated returns), can reduce revenue risk significantly. In an agricultural context, this means producing crops for which prices and/or yields are not highly positively correlated. For example, producing corn and wheat or corn and cotton will likely achieve more diversification than producing corn and grain sorghum. Producing both crops and livestock is a longstanding diversification strategy in agriculture.12 However, the movement to larger and more vertically integrated livestock production systems for the sake of cost efficiency has reduced the opportunities for many farms to diversify across crops and livestock. It is also important to note that agricultural producers have the opportunity to diversify into non-agricultural investments and off-farm labor markets. These strategies are widely used, especially among smaller farms. In fact, U.S. Department of Agriculture (USDA) data indicate that off-farm income on average exceeded farm-generated net income for more than 90 percent of farm households in 2014.13

Share Agreement for Inputs

Share agreements can also be used to reduce risk. In agriculture, share agreements are typically established among two or more parties to jointly provide inputs for production. Rented farmland is the primary input for which share agreements are used. A typical share agreement has a landlord providing land and a tenant farmer providing labor, equipment and most other inputs. The parties also typically specify the split of
crop revenue each party will receive. Share-renting land reduces the tenant’s risk exposure compared to cash rental agreements which specify a fixed annual rental price regardless of realized crop revenue. In a year when crop revenue is below the expected level due to low yields and/or low prices, a share rental contract will cause the loss to be shared between the landlord and tenant while a cash rental arrangement will force the tenant to bear the full loss. In recent years there has been a trend toward greater use of cash rental agreements, although the percentage varies considerably by region. In recent studies, cash rental agreements accounted for 77 percent of rented land in Iowa in 2007 (up from 50 percent in 1982), but only 36 percent of rented land in Kansas in 2011.14,15 Ultimately it is likely that trends in the nature and prevalence of share rental agreements in agriculture will flow from changes in risk-return scenarios and the availability of other risk management tools.

**Output Contracts**

Output production contracts usually specify the quality and quantity of a particular commodity that is to be delivered. In most cases production contracts will also specify additional details such as production practices and exactly what inputs are to be used. In return, the contract specifies the compensation to be paid the producer.

Production contracts are quite common in certain sectors of the U.S. agricultural economy, but relatively rare in the production of field crops such as corn, wheat, and soybeans. In 2014, about 35 percent of overall U.S. agricultural production by value was produced under contract (both production and marketing).16 According to a 2011 ERS study, contracted production in the poultry and eggs, hog, sugar beet, tobacco, and peanut sectors accounted for two-thirds or more of total production. On the other end of the spectrum, the shares were 30 percent or lower for cattle, corn, wheat, and soybeans.17

Output marketing contracts differ from production contracts in that they typically do not include any specifications about the production process. Marketing contracts can take many forms. They are at times used by grain farmers to forward price a growing crop with a local elevator or other buyer. Typically these contracts establish a price (or a formula for determining a price at a later date) and include terms spelling out a given quality, quantity, and delivery period.

A basic “flat price” (or fixed price) marketing forward contract will typically state the quantity and quality of the product to be delivered for a predetermined price. Generally, the producer is required to deliver the quantity contracted so while forward contracting decreases price risk it can actually magnify the consequences of yield losses. If producers do not produce the full amount contracted, they must go into the market and purchase enough of the commodity to deliver on the contract. To make matters even worse, if a producer’s yield shortfall is due to a systemic event such as a drought, current spot market prices may actually be higher than the price specified in the forward contract. For this reason, producers rarely forward contract the full amount of their anticipated crop.18

Basis contracts are another common type of marketing contract. In this context, the term “basis” refers to the difference between a futures contract price and a local cash price. With basis contracts, the price received by the producer is typically calculated by applying a stipulated basis to the harvest time price of a particular futures contract. This assures the producer access to a market for his or her entire crop and protects against changes in any localized factors that might cause the actual basis to differ from the basis specified in the contract. However, producers remain exposed to global price changes as reflected in futures contract prices.

**Risk Retention**

Risks that are not transferred are implicitly retained and create variability in farm family income. A fundamental approach for managing this income variability is to use access to credit and savings to smooth household consumption across time.19 In many respects, savings and borrowing can be thought of as mirror images. Savings are accumulated in high revenue years and remain available to mitigate low revenue years. Borrowing that is used to fund consumption in low revenue years is
then repaid in high revenue years. It is important to note that the capacity of savings/borrowing strategies to reduce risk is constrained by the farm household’s capacity to save or borrow. For example, a string of poor revenue years can leave the household with no savings and no further access to credit.

Farm household savings are typically held in a financial investment that earns interest and is often fairly liquid. A 1999 USDA study found that non-farm assets were held in the following forms: retirement accounts (26 percent), checking, savings, and other liquid accounts (21 percent), financial assets, including stocks and mutual funds (22 percent) and all other assets, including non-farm vehicles and real estate (31 percent).20 As such, savings can help achieve diversification of the farm household’s portfolio into assets outside of agriculture.

Borrowing by a farm household for the purposes of smoothing consumption is conceptually quite different than borrowing undertaken by the farm business. Farm businesses borrow to obtain more access to productive assets (land, equipment, etc.) than would be possible using only business equity. If the real return on farm assets is above the interest rate, this leveraging will increase the rate at which business equity grows over time. However, this leveraging also increases risk exposure since loan payments are a fixed cost that must be repaid regardless of farm income.21

Overview of What Makes Agricultural Risks Transferable

Agricultural risks are transferred primarily through insurance and exchange-traded futures and options contracts. This section describes what characteristics are necessary for a risk to be transferable either through insurance or exchange market mechanisms.

**Insurability**

In developed countries, a number of insurance products are available that protect against various perils. For this reason, it is often incorrectly assumed that insurance can be offered against any peril. In this section we describe the characteristics that cause a peril to be considered “insurable.”22

**Determinable and Measurable Loss**

For the peril under consideration, key questions include the feasibility of measuring the magnitude of any loss and the ability to clearly determine that the peril caused the loss. If neither can be satisfactorily addressed, frequent disagreements between the insurer and the policyholder will lead to costly litigation regarding whether a payment is due and/or the magnitude of the payment. A first principle of insurance is that “one cannot insure what cannot be measured.”

**Accidental and Unintentional Loss**

In this area, the key question is, can the policyholder engage in actions, such as reduced effort or reduced investment in loss mitigation, that increase the probability of loss and/or the magnitude of loss? Behavioral changes that occur as a result of having purchased insurance are often called “moral hazard.” Fraud is an extreme example but moral hazard need not imply illegal or even unethical behavior. Insurers often try to control moral hazard by requiring that customers pay deductibles and/or co-payments. Insurers may also provide good experience discounts. In principle, the insurer could also try to directly monitor the policyholder’s behavior but this can become quite expensive and intrusive. Moral hazard can lead to payments exceeding premiums. Assuming that they have simply underestimated the risk, insurers will respond by increasing premium rates. Due to the higher premium cost, those not engaging in moral hazard will be more likely to cease purchasing the insurance in the next insurance cycle. This further increases payments relative to premiums. Over time, uncontrolled moral hazard will destroy an insurance market. In general, the greater
extent to which policyholders can affect loss outcomes by their business decisions, the more that insurers will be exposed to moral hazard. A second principle of insurance is that “You will go broke insuring against poor management.”

**Sufficient Information to Classify Risk**

Insurers attempt to classify potential policyholders according to their risk exposure. Those with higher (lower) risk exposure pay higher (lower) premium rates. “Adverse selection” can occur when insurers are unable to accurately classify potential policyholders. Those who have been misclassified to their benefit (charged premium rates that are too low) will be more likely to purchase insurance while those who have been misclassified to their detriment (charged premium rates that are too high) will be less likely to purchase insurance. The result will be higher than anticipated insurance payments. Again, if the insurer responds by simply increasing premium rates across the board, those who continue to purchase insurance will be those who are most misclassified to their benefit. As with moral hazard, unless the underlying problem is corrected, adverse selection can destroy an insurance market.

**Losses Sufficiently Uncorrelated to Facilitate Pooling**

Insurance operates based on diversification and pooling. By pooling a large number of policies with uncorrelated loss exposures the law of large numbers can provide a relatively accurate prediction of aggregate expected payments. Life insurance and automobile insurance are examples of insurance lines where payments should be largely uncorrelated across policies. One of the challenges with insuring against crop yield losses is that losses are often correlated across policies. With the possible exception of hail damage, crop perils tend to be spatially correlated so that if one farm is affected it is likely that many farms in the same region will also be affected. Furthermore, the correlation tends to increase with the severity of the loss event. The 2012 drought in the Midwestern United States is a prime example. At the same time, yield losses are not nearly as highly correlated across farms as say, price declines. Yield losses are examples of what Skees and Barnett call “in-between risks” – perils that exhibit enough correlation to make insurance provision challenging but are not sufficiently correlated to support markets for other risk transfer instruments such as futures contracts. When payments across policies are correlated, the law of large numbers breaks down and it becomes very difficult to predict aggregate expected payments. This characteristic increases the price of insurance coverage because the insurer must hold large reserves to cover potential payments and/or purchase reinsurance.

**Insurability of Agricultural Commodities**

The perils that affect agricultural crops violate all of these insurability principles to some degree. It is often not easy to determine whether a loss was caused exclusively by a particular peril or perils. It is also not always easy to determine the magnitude of the loss. An insurer cannot monitor a grower’s day to day production decisions to control for moral hazard. It is difficult for insurers to accurately classify different growers according to their risk exposure. Finally, losses tend to be spatially correlated so the insurer can experience years with extremely high payments. The insurability challenges with production livestock are even greater since the primary risks of concern are communicable diseases (either endemic or exotic) that, in some cases, also pose human health risks.

**Insurability and the Cost of Insurance**

To the extent that perils violate insurability principles, it becomes more difficult and more expensive to offer insurance coverage. If it is not easy to determine whether a loss was caused by an insured peril or measure the magnitude of the loss, excessive litigation is likely to occur. Moral hazard and adverse selection occur due to a fundamental information asymmetry; a grower has better information than the insurer about production practices and risk exposure on the insured farm. The insurer can attempt to address this information asymmetry through collecting extensive information and closely monitoring the grower’s production activities but this activity will be both very expensive and intrusive. An insurer can use international reinsurance markets to protect against the
possibility of large payments due to correlated losses (e.g., the 2012 Midwestern drought) but this again adds to the expense of offering insurance. In summary, it is possible to offer insurance against perils that violate some of these basic insurability conditions (e.g., perils that cause crop losses), but it is very expensive to do so. For this reason, it is extremely rare to find multiple peril crop insurance offered without either direct or indirect government premium subsidies. In contrast, products that protect only against crop losses caused by single perils such as hail (and sometimes fire) are widely available since this type of peril is consistent with basic insurability conditions.

Viable Exchange Traded Markets for Futures and Options Contracts

Agricultural producers have long had private sector price risk protection available to them through direct access to futures markets. While it is possible for producers to hedge directly, it is more common for producers to forward contract with local elevators and buyers who then aggregate the various lots of forward contracted commodity and hedge the total amount. Commodity futures are highly standardized forward contracts that are traded on an exchange. Payments for, and delivery of the product are due when the contracts mature. Since most traders eliminate their contracts by undertaking opposite trades before the contracts mature, few contracts actually result in delivery. Futures contracts typically trade for at least 15 months prior to expiration. Also, options on futures contracts are available which allow a hedger to purchase downside risk protection for a premium with a contract form that is similar to insurance.

To obtain the trade volume necessary to support an exchange-traded market, futures contracts must relate to a systemic risk. Historically, futures contracts have been based on prices of agricultural and nonagricultural commodities. These prices are highly spatially correlated so they tend to vary systemically. In recent years, contracts have been developed for other financial measures that tend to vary systemically such as interest rates or exchange rates. Other requirements for viable exchange traded contracts include: a homogeneous product to be traded, a sufficiently large cash market for the product, sufficient volatility in the price of the product, and a large number of potential buyers and sellers.

Federal commodity programs also provide price risk protection so it is possible that they “crowd out” farmers’ use of exchange-traded futures and options contracts and forward contracts derived from exchange-traded contracts. However, it is important to remember that exchange-traded instruments protect only against short term (e.g., within growing season) price variability. Commodity programs, on the other hand, can protect against inter-year price variability. Furthermore, the price guarantees offered by exchange-traded instruments are determined solely by market conditions. In extreme cases, the price guarantee offered by exchange-traded instruments may be extremely low (e.g., below the cost of production). In contrast, commodity programs typically offer long-term price guarantees at politically determined levels.

The U.S. Government’s Current Role in Transferring and Subsidizing Various Types of Agricultural Risk

Evolving Government Role in Addressing Price Risk

Since the enactment of the original Agricultural Adjustment Act of 1933 (and subsequently the Agricultural Adjustment Act of 1938), federal commodity programs have focused primarily on protecting farmers against low prices. Initially, growers were provided with price supports for selected commodities that prevented domestic prices from falling below specified levels. The main mechanism for implementing these price supports was a short-term (less than a year) loan from the federal government.
with the crop serving as collateral. The government established loan rates (price support levels) for each commodity. If current market prices were below the loan rate, the grower would receive a loan equal to the value of the grower’s production, priced at the loan rate for the commodity. If market prices subsequently increased to levels greater than the loan rate, the grower could sell the commodity and repay the loan. If market prices did not exceed the loan rate during the term of the loan, the grower could simply default on the loan and forfeit the commodity to the government—effectively, selling the commodity to the government at a price equal to the loan rate. Loan rates were initially based on the concept of “parity,” defined as the price that generates the same purchasing power from the sale of a given commodity as it had during the period of 1910-1914, but that approach was jettisoned in 1973 in favor of Congressionally determined rates.

To be eligible for the price support program, growers were often required to forego producing on a portion of their cultivatable acres. These so-called “set aside” requirements reduced supply and put upward pressure on commodity prices. Various soil conservation programs also took land out of production. With domestic price supports set at levels that generally exceeded world market prices, border controls were also required to prevent a flood of imported commodities entering the United States, which would further increase government held stocks. Nevertheless, the accumulation of government stocks continued to be a problem. Storing commodities was expensive and the very existence of large government stocks that could enter the market at any time put downward pressure on commodity prices (increasing the likelihood of commodity loan forfeitures and even greater government-held stocks). Set aside requirements were increased in an effort to push prices higher but as global production of agricultural commodities expanded rapidly (especially as the global economy recovered after World War II), changes in U.S. acreage had less and less impact on world market prices.

In the early 1980s, persistent low prices led to a large accumulation of stocks of grains and oilseeds. At their peak in 1986, total ending stocks of corn were 4.9 billion bushels, nearly 60 percent of that year’s corn crop. This phenomenon prompted the federal government to take a number of extraordinary policy steps. These steps included withholding large acreage from production in 1983 (under the Payment-In-Kind or PIK program) to reduce stocks, providing certificates giving farmers and others the ability to redeem commodity stocks as an alternative to cash payments, establishing a long-term land retirement program (the Conservation Reserve) in 1985 and allowing farmers to request cash payments equal to the gap between the loan rate and market price (the so-called loan deficiency payment (LDP)) in lieu of forfeiture of loan commodities in 1985 for cotton and rice and in 1990 for the other program crops.

This last program change to discourage forfeiture marked the beginning of the shift from price support to income support for producers of key field crops. Set aside requirements were initially maintained to put upward pressure on prices and reduce federal outlays. However, with growers making planting decisions based on government established prices (so-called “target prices”) rather than market prices, larger and larger set asides were required. U.S. farm policies were essentially giving away market share as global competitors stood ready to make up for reductions in U.S. production.

In the Federal Agricultural Improvement and Reform Act of 1996 (the FAIR Act), policymakers took a more significant step away from federal programs that triggered payments based on low prices. Since market prices were high by historical standards and were predicted to stay that way for the foreseeable future, federal payments under the traditional price-triggered programs were expected to be quite small. To keep from losing budget baseline for farm programs, most federal payments were shifted into decoupled direct payments that did not vary with market prices. The marketing loan program was maintained at relatively low loan rates as a safety net against future low prices, which were not expected to occur. The FAIR Act also ended set aside requirements and provided planting flexibility by eliminating most restrictions on what crops could be planted on acres eligible for direct payments.
The historically high prices of the mid 1990s were followed by extremely low prices for the period 1998-2001, after a financial crisis in Asia reduced export demand for agricultural commodities. In response, the 2002 farm bill introduced a new price-triggered federal farm program called the Countercyclical Payment (CCP) Program. As with the earlier deficiency payment program the CCP program was triggered by market price shortfalls relative to a target price. However, in contrast to earlier programs, the CCP program allowed for full planting flexibility. The payment would be based on market prices for the crop that had historically been produced on the acreage (the so-called “base acres”) regardless of what crop the grower was now producing. Thus, for example, in some areas of the southern United States, many growers responded to market price signals and chose to grow corn or soybeans instead of cotton or rice. However, these same growers were not eligible to receive CCP payments based on low price for corn or soybeans. Instead, they received CCP payments when price shortfalls occurred for cotton or rice – crops that the grower might no longer be producing. Thus, the program only provided price risk protection in a given crop year if growers actually chose to produce the crop for which they had base acres. The new PLC program is similar in structure to the now-repealed CCP program, except that the fixed program prices (now called reference prices rather than target prices) have been increased on average by 42 percent across all program crops to reflect the higher price/cost structure than was in place at the time the 2002 farm bill was enacted.

The Federal Crop Insurance Act of 1980 made several significant changes to the FCIP. Coverage was expanded into new crops and regions. Federal premium subsidies were introduced to encourage more participation in the FCIP.34 Also, for the first time, private sector insurance companies were allowed to sell and service FCIP policies. Eventually direct sales of FCIP policies by the federal government were eliminated and all FCIP policies are now sold and serviced through private insurance companies. Private companies enter into a Standard Reinsurance Agreement (SRA) with the federal government that specifies how both premium income and liability for payments will be shared.

Government Role in Yield Risk

The Agricultural Adjustment Act of 1938 also established the Federal Crop Insurance Program (FCIP) which authorized federal provision of yield insurance for selected commodities. While private sector insurers had successfully offered insurance against crop losses caused by hail or fire, all previous private sector efforts to offer multiple peril crop insurance had failed. Private insurers found it difficult to obtain the scale necessary to diversify their exposure to droughts and other regional natural disasters. Much has changed since 1938 and today some observers believe that with the immense capacity of global reinsurance markets, it may now be possible for private sector insurers to provide multiple peril crop insurance to U.S. producers.29,30 The size of the global reinsurance market in terms of gross annual premiums paid has roughly doubled in the last few decades, from $108 billion in 1993 to $197 billion in 2011.31,32

In 1939, the first FCIP policies were sold to wheat growers. Coverage was later extended to cotton growers as well but the early program’s actuarial performance proved disappointing. The program was terminated in 1943 but restarted in 1945. By 1979, federal crop insurance was available for 29 crops with coverage for at least one crop being offered in 1,526 counties, about half of all counties.33

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Figure 1 | Total Premiums, 1980-2015

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between the contracting parties, as well as other financial and compliance requirements. The federal government also reimburses insurance companies for administrative and operating expenses (A&O) associated with selling FCIP policies. Currently FCIP policies are available for more than 100 different crops. Coverage is available for at least one crop grown in almost every U.S. county. Figure 1 shows the growth in program premium since 1980. In 2015, the FCIP had gross premium revenue of $9.7 billion on more than $102 billion of insurance protection in force, the latter down 17 percent from its peak in 2013 due to lower crop prices.

This increase in premium is driven partly by increased acreage in the program as shown by Figure 2. Less than 30 million acres were insured in 1980. Over time, participation rates increased as did the number of crops insured and the counties where coverage was offered. Today almost 300 million acres are insured. In recent years, high prices of agricultural commodities have caused large increases in premium. High prices increase the value of the insurance protection in force, and hence, premium.

A loss ratio, the ratio of payments made to premiums collected, is typically used to measure the actuarial performance of insurance products. Figure 3 shows aggregate loss ratios for the FCIP since 1980. Note that the loss ratio exceeded the 1.0 breakeven level every year from 1980 through 1993. Further, it exceeded 1.5 in seven years. From 1994 until 2011 the loss ratio never reached 1.5. FCIP actuarial performance has been impacted by both adverse selection and moral hazard problems. The improved actuarial performance in recent years reflects generally good weather and various efforts that have been made to address these problems as well as improvements to premium rating procedures. In addition, increased premium subsidies since 2000 have masked adverse selection and moral hazard problems by “buying” producers into the FCIP. The loss ratio for the 2012 reinsurance year was 1.58, the highest level recorded since 1993, a year with historic and widespread Midwest flooding. In the three subsequent years, loss ratios were 1.02, 0.91, and 0.56, respectively.

**Government Role in Revenue Risk**

From the New Deal era until the late 1990s, federal roles in providing risk protection to agricultural producers were clearly segregated. Price risk protection was provided through federal farm programs administered by the agency that is currently known as the Farm Service Agency (FSA). Yield risk protection was provided primarily through the FCIP which was administered by a federal agency that is now known as the Risk Management Agency (RMA).
In 1996, this separation began to change as the first FCIP revenue insurance policies became available. Initially, federal premium subsidies only applied to yield insurance. Insured growers paid the full cost of “upgrading” to revenue insurance coverage. The Agricultural Risk Protection Act of 2000 (ARPA) increased the overall level of premium subsidies and extended the same percentage subsidy (which varies by coverage level and unit structure) to both yield insurance and revenue insurance policies. Currently, 90 percent of corn FCIP insurance protection in force is individual revenue insurance. The revenue insurance percentages for soybeans, wheat and cotton are 91 percent, 89 percent, and 78 percent, respectively.

In recent years, federal farm programs have also started moving toward payments triggered by revenue shortfalls. The Food, Conservation and Energy Act of 2008 (2008 farm bill) allowed growers to choose between the price-triggered CCP program and the revenue-triggered (at the state level) Average Crop Revenue Election (ACRE) program. A revenue-triggered standing disaster assistance program, known as the Supplemental Revenue Assistance (SURE) program, was also created by the 2008 farm bill. The SURE program expired in 2011.

In February 2014, after a more than two-year legislative process, Congress passed the Agricultural Act of 2014. The commodity title of the new farm bill repealed the Direct Payment (DP), ACRE, and CCP programs, and replaced them by offering farmers a choice between two forms of commodity support, a price-based program similar to the CCP program (Price Loss Coverage (PLC)) but with higher program prices for all commodities, or a revenue-based program (Agricultural Risk Coverage (ARC)), providing payments for shallow losses as experienced at either the farm or county level. The county level ARC option would pay on a larger share of the gap between the county revenue guarantee for a crop and the actual average county revenue for a given year. The ARC program is designed to partially fill in the gap not addressed under a deductible for a revenue policy offered under the federal crop insurance program. Farmers electing the PLC option are also eligible to purchase a separate shallow loss insurance policy (Supplemental Coverage Option (SCO)) that was available under the federal crop insurance program beginning in the 2015 crop year. In addition, after the U.S. government lost a dispute settlement case in the World Trade Organization over cotton support programs to the government of Brazil, upland cotton producers are no longer eligible for either the PLC or ARC option in the commodity title but instead have a separate shallow loss program called STAX, also to be offered under the federal crop insurance program.

The existence of revenue-triggered crop insurance and farm programs raises questions about potential redundancies in the benefits provided by these federal programs. Questions also arise about the need for two different USDA agencies – RMA and FSA – both of which will be operating revenue-triggered risk management programs under the 2014 farm bill.

**Federal Subsidy versus Federal Provision**

To date, federal agricultural risk transfer programs have involved the government in both providing risk transfer services and subsidizing the cost of the risk transfer. Federal commodity programs are provided solely by the federal government and are fully subsidized. Federal crop insurance is provided through a partnership between the federal government and private insurance companies and is heavily (though not fully) subsidized. In principle, however, one could imagine a policy structure where the federal government either provides or subsidizes risk transfer services, but not both. For example, the federal government could offer commodity programs where participating farmers pay the full expected cost of the program. Such programs would be provided by, but not subsidized by, the federal government. Alternatively, the federal government could provide vouchers to be applied toward the cost of crop insurance provided solely by private-sector insurers. In this case, the risk transfer would be subsidized by the federal government.
but provided solely by private-sector entities. This conceptual distinction between federal provision and federal subsidization can be useful as one examines current federal programs and considers alternative designs. Specifically, one should consider whether the risk transfer problem to be addressed is that: 1) the private-sector is not capable of providing the desired risk transfer; 2) farmers are unable to afford the cost of the desired risk transfer; or 3) both. The first problem suggests a possible role for federal provision (though not necessarily subsidization) of risk transfer mechanisms, the second suggests a possible role for federal subsidization (though not necessarily provision), while the third suggests that both federal provision and subsidization may be required.

The Federal Crop Insurance Corporation (FCIC) is the legal entity established to carry out the FCIP, while RMA is the federal agency that actually oversees the program’s day-to-day operations. Until the Federal Crop Insurance Act of 1980 was adopted, the private sector had no role in the federal crop insurance program, but their participation was sought because Congress thought they would be better positioned to market and deliver the program to a broader swath of the farming population than the federal employees who had previously been tasked with that responsibility.

Premium subsidies to make coverage more affordable to farmers were also introduced by the 1980 Act, when Congress authorized a subsidy of up to 30 percent of the total premium, although the subsidy was capped at the amount provided for 65/100 coverage. In an effort to further expand participation in the program, Congress raised premium subsidies under ARPA—in the current program environment, the federal government covers on average about 62 percent of the total premium for each policy sold, although the subsidy is realized as a transfer between federal accounts and never actually paid to farmers. The total cost of that subsidy has grown over the last decade by nearly 330 percent (from $1.7 billion in 2002 to a record $7.5 billion in 2011), attributed both to expansion in participation in terms of acres insured and to the higher prices for the crops insured. Figure 4 shows the amount of subsidy on a per acre basis. Prior to 1996 the subsidy remained below $5 per acre. Since then, subsidies climbed to a high of more than $28.00 per acre in 2011. Several factors drive this result – higher crop prices and yields and producers opting in to higher valued crop insurance coverage options. As crop prices began decreasing after 2011, the premium subsidy per acre decreased as well.

The federal government provides an additional indirect subsidy to producers by reimbursing crop insurance companies for expenses incurred in delivering the program, rather than requiring producers to absorb those costs through a ‘load’ layered on top of the policy premium, as is traditional for other lines of insurance. Since federal payments for A&O expense reimbursement are directly linked to total premium paid for coverage, program costs in this area have increased in recent years as well, despite steps taken to reduce these costs in recent negotiations between USDA and the crop insurance companies over the SRA that governs the financial relationship between the two sets of entities. Total A&O reimbursement increased by $370 between 2000 and 2008 (to a record $2 billion) due to higher commodity prices.

**Figure 4 | Subsidy Per Acre for Total Crop Insurance Program**

![Subsidy Per Acre for Total Crop Insurance Program](image-url)
Other government roles include underwriting a portion of the insurance portfolio held by the companies, the parameters of which are also established under the SRA mentioned above, providing regulatory oversight of the program, and setting rates and premiums for the insurance policies to be offered for sale. A board of private sector stakeholders and certain designated USDA officials is vested with the management of the FCIC, which provides oversight of the development and review of proposals for new crop insurance products, with the authority to reimburse product developers for their expenses.42

Artificial Supply and Demand Systems

Since the FAIR Act was enacted, the predominant support structure for U.S. commodities has shifted away from a supply control/price support approach to one in which the market is largely allowed to determine price and government payments are made to farmers to offset a portion of income shortfalls they experience, in addition to direct, decoupled payments made to farmers based on historical production patterns.43 The major exceptions to this approach are the price support system provided for U.S. sugar producers, and renewable fuel policy which affects supply and demand in the U.S. market for biofuel feedstocks, which are dominated by corn used to produce ethanol and soybean oil used to produce biodiesel.

The U.S. Sugar Program

Although U.S. sugar producers have benefited from federal intervention for as long as producers of other row crops, the policy structure generating that support began to diverge in the 1980s and 1990s. The ability of farmers to forfeit their crop pledged as collateral under the loan program when market price fell below the established loan rate was for many decades a staple feature of commodity programs. However, unlike other row crops, raw sugar beets and sugar cane are not storable commodities over the long-term, and thus have to be at least partially processed to reach that state and gain eligibility for loans.44 Those loans are taken out by processors, not sugar producers.

As described above, farm programs provided for most row crop producers underwent significant shifts during the 1980s and 1990s. Cumulatively, these steps had the effect of converting programs from focusing on supply control and support prices to providing income support while letting prices vary more-or-less according to supply and demand conditions.45 None of these changes to the core program structure were applied to the sugar program, due to the strong and unified preferences of sugar producer groups. In fact, since the 2002 farm bill, USDA has been required to operate the sugar program at ‘no net cost’ to the federal government, with the cost burden of the program transferred to consumers in the form of higher prices rather than through government payments.

Instead, the sugar program has retained its price support features, relying on limiting imports and domestic production in order to keep the U.S. sugar price high and avoid forfeitures to the federal government. With their ability to limit imports somewhat impaired by new rules barring prohibitive import restrictions under the Uruguay Round Agreement on Agriculture (which took effect in 1994) and later U.S. concessions on sugar market access in Free Trade Agreements (FTA’s) negotiated with sugar-producing countries, U.S. sugar interests initially undertook strict domestic supply control with its formal market allocation system in the 2002 farm bill, and then added a mechanism to take additional sugar off the domestic market in the 2008 farm bill by allowing USDA to sell excess sugar to biofuels producers at discounted prices to serve as a feedstock and keep it out of food use. World sugar prices were relatively high in first few years, so the rules for this new mechanism, called the Flexible Feedstock Program, were not completed until 2013.46 USDA expended $173 million under this program in late 2013 to take 440,000 tons of sugar off the U.S. market.47 Although U.S. producers of sugar beets and sugar cane do typically insure their crops (approximately 90 percent of harvested acres were insured for each type of sugar in 2015) against yield loss, the reduced price transmission from world market shocks and the lack of an open market published price (due to its perishability, nearly
all production is contracted), has precluded to date the development of revenue insurance coverage for these crops. All components of the U.S. sugar program were maintained in the 2014 farm bill.

Federal Biofuels Policy
The U.S. government has been intervening in energy markets for nearly one hundred years, although its role in encouraging the development of a renewable fuels sector is of more recent vintage. Historically, these interventions have been made through the U.S. Tax Code, starting with the Tariff Act of 1913 which allowed the oil and gas industry to take as tax deductions “a reasonable allowance for depletion” that was not available to other sectors of the economy. The initial intervention in biofuels also was engendered through the Tax Code, beginning in 1979 by providing a partial exemption from the federal excise tax for motor vehicle fuels for mixtures that included ethanol derived from renewable sources.48

This policy, which became known as the “blender’s credit,” helped get the industry off the ground in the 1980s, but the real growth in U.S. biofuels production came later, with two additional policy developments that were not explicitly tax-related.49 The first development was the decision by gasoline refiners to end their use of MTBE (a petroleum-based product) as an additive to improve the emission performance of gasoline used in areas with impaired air quality outside of the Midwest. Under the Clean Air Act, refiners had to use either MTBE or ethanol as an oxygenate in gasoline to meet those standards, but the use of MTBE was phased out because it led to problems in ground water quality when it leaked from car gas tanks or underground storage.

The second step was the establishment of a federal renewable fuel standard (RFS). The first RFS applied only to the use of ethanol, and the mandated annual use level under the Energy Policy Act was specified to begin at 4 billion gallons and ratchet up to 7.5 billion gallons by 2012. After the removal of MTBE from the fuel supply by the end of 2006, the U.S. ethanol industry blew through the mandated RFS levels fairly quickly, and within two years was back before Congress requesting higher levels. As part of the Energy Independence and Security Act of 2007 (EISA), Congress raised the overall RFS, starting with required use of 9 billion gallons in 2008 and expanding to 36 billion gallons by 2022. In recognition of the pressure that increased corn use for ethanol was putting on other sectors of U.S. agriculture, the revised RFS requirements allow only up to 15 billion gallons of ethanol produced from corn starch to count toward meeting the standard in any given year. With ethanol increasingly integrated into the motor vehicle fuel supply, demand for ethanol is now tightly linked with supply and demand conditions in U.S. oil and gasoline markets.

Due to concerns about declining gasoline consumption in the United States and the artificial constraint on biofuels use represented by the so-called blend wall, a rule change by the Environmental Protection Agency to reduce required use of biofuels for 2016 by more than 4 billion gallons was finalized in November 2015. This action has raised concerns about the stability of that source of demand for corn, and has drawn a lawsuit from key commodity and renewable energy stakeholder groups.

The U.S. biodiesel industry lagged behind corn-based ethanol, not receiving a blender’s credit for its use or being explicitly included in the RFS until the passage of EISA in 2007. U.S. production of biodiesel rose from 250 million gallons in 2006 to about 1.3 billion gallons in 2014.50 The share of total soybean acreage

Figure 5 | U.S. Ethanol Production vs. U.S. Corn Price, 1980-2015

![Figure 5](https://example.com/figure5.png)

Source: ERS/USDA, Renewable Fuels Association.

The U.S. Government’s Current Role in Transferring and Subsidizing Various Types of Agricultural Risk
used to produce soybeans that are crushed for oil used to produce this biodiesel has increased from 10 percent in 2007 to about 12 percent in 2015.51

These policy developments have had the effect of creating a new and sustained source of demand for U.S. corn over the last several years, with the share of total corn supply used for ethanol increasing from 7 percent (1.4 billion bushels) in 2001 to 40 percent (5 billion bushels) in 2011, thus increasing pressure on U.S. farmers to raise more corn.52 In response, U.S. corn planted area increased by more than 15 million acres over the last several years, drawing land from other crops and pastureland and contributing to an overall increase in crop prices, not just for corn but also for crops which compete with corn for cropland (Figure 5). Since the premium for crop insurance coverage is directly linked to the value of the crop insured, the federal cost of the program was driven higher by the emergence of greater corn demand for ethanol and biodiesel demand for soybeans, although they were certainly not the sole source of the increase. With three consecutive years of U.S. bumper crops, crop prices have fallen dramatically across the board since the 2013/14 crop year.

Innovative Designs

In this section we review two innovative designs for agricultural risk transfer programs that have received widespread attention. The first would transfer commodity-specific yield or revenue risks using an index that is correlated with losses experienced on the farm. The second would provide multiple commodity or “whole farm” revenue risk transfer. Small-scale examples of each of these innovative designs currently exist within the FCIP.

Index Designs

Index insurance makes payments based on the realized value of an index rather than on the loss actually experienced by the individual policyholder. An example is the Area Yield Protection (AYP) area yield insurance product offered in the FCIP. Payments under this program are triggered by shortfalls in county average yields rather than by yield shortfalls experienced on the insured farm.53 An area revenue insurance product called Area Revenue Protection (ARP) is also offered under the FCIP. This product triggers payments due to shortfalls in county average revenue (the product of county average yield and the average of daily closing futures prices over a specified period) relative to an established benchmark.54

In many low-income countries reliable aggregate yield data are not available, so it is not possible to offer area yield or revenue insurance. For this reason, much recent effort has focused on offering weather index insurance in low-income countries.55,56,57,58 Weather index insurance payments are based on realized values of a particular weather variable (relative to a benchmark) measured using a specified instrument (e.g., a particular weather station). For example, suppose the insurance is designed to protect against drought. The index is cumulative rainfall measured over a specified period of time at a particular weather station, and payment is made when measured rainfall falls below a specified percentage of that index.

While the most common examples are based on area yield, area revenue, or a weather measure (e.g., rainfall or ambient temperature), index insurance products can be created for any measurable natural phenomenon. For example, index insurance products have been developed, or are being developed, based on sea-surface temperatures, Normalized Difference Vegetative Index (NDVI) measures, flooding, earthquake measures, and measures of livestock mortality.59,60,61,62,63

Why Index Products?

Index products address many of the insurability challenges described earlier in this report. Payments are based solely on the realized value of the underlying index. There is no need for a loss adjuster to visit the farm to determine whether a reported farm level loss occurred due to a particular peril nor is there a need to measure the magnitude of the loss. There is no need to monitor for moral hazard behavior because individual policyholders cannot influence the realized value of the index.
value of the index. Similarly, there is little potential for adverse selection because the policyholder has no better information about the risk inherent in the underlying index than does the insurer. Finally, whereas spatially correlated losses are a problem for traditional insurance products, index products are especially designed to transfer correlated losses. In fact, if the peril is not spatially correlated, index products are not likely to provide adequate risk protection. Because they effectively address these insurability challenges, index products can be offered with much lower administrative and operational costs than can traditional, loss-based, multiple-peril, crop insurance products. A provision in the 2014 farm bill authorizes RMA to conduct two or more pilot programs examining the value of developing index-based weather insurance products for otherwise underserved commodities, including specialty crops and livestock.

**Basis Risk**

Since payments are based solely on the realized value of the underlying index, it is possible for a policyholder to experience a loss and receive no index insurance payment (or receive an inadequate payment). Conversely, it is possible for a policyholder to receive a payment that exceeds the actual loss (or receive a payment when no loss was incurred). The potential for index payments to be less than perfectly correlated with actual losses is typically called “basis risk.”

It is important to note that the existence of basis risk does not necessarily undermine the risk management benefits of index products. In fact, basis risk occurs with many other risk management tools (e.g., hedging price risk with futures or options contracts). The relevant question is the magnitude of the basis risk. If it is relatively small, index products can still provide effective risk management protection. But if basis risk is large, the risk management effectiveness of index products is severely compromised. In extreme cases, index products can actually increase rather than decrease the policyholder’s risk exposure.

There are two primary causes of basis risk in index products. First, a lack of spatial correlation in the peril or perils being indexed will cause index measurements taken at one location to be unrelated with losses that occur at another location. With weather index insurance this may occur if the insured farm is located too far from the weather station. But what is “too far” will depend on the spatial characteristics of the peril. For example, effective rainfall based index insurance would likely require a more dense network of weather stations than would temperature based index insurance.

A second cause of basis risk is variability in how realizations of the measured index translate into farm level losses. Consider, for example, area yield index insurance. Differences exist across farms in how highly correlated the farm’s yield is with the county yield. Farms located in areas that are typical of the county as a whole will likely find that area yield index insurance provides effective risk protection while farms located in areas that are not typical of the county as a whole (e.g., river bottoms) will likely find that area yield index insurance does not provide effective risk protection. For this reason, basis risk on area yield index products tends to be lower in more homogeneous production regions (e.g., the U.S. Midwest) than in more heterogeneous production regions (e.g., the U.S. Southeast).64,65

**Status of Index Products**

Due to the widespread availability of federally subsidized multiple peril crop insurance at the farm (and even sub-farm) level, very little index insurance is currently sold in the United States. Area-based AYP and ARP index insurance policies account for just over 2 percent of total FCIP insurance protection in force. The FCIP also includes rainfall and NDVI based index insurance policies for commodities where it is difficult to measure yield (pasture and rangeland) but these products account for only about 1 percent of total FCIP insurance protection in force. Some private sector companies also offer weather index insurance products targeted primarily to specialty crop growers in selected regions. Data on the size of this private market is not readily available but it is likely to be quite small.
India currently has the largest market for index insurance (both area yield and weather) in the world. In 2012, it was estimated that around 25 million Indian farms were covered by such products. This market size is due to government premium subsidies, and (in some Indian states) compulsory insurance purchasing requirements for those taking out agricultural production loans.

Pilot programs, mostly based on weather indexes, are underway in many other countries. However, it is still too early to assess the success of these programs.

It is important to note that indexes are also currently used to trigger U.S. federal commodity program payments. For example, the now-defunct CCP program made payments based on low prices. However, the payment is not based on the price the individual farmer actually received but rather on the Marketing Year Average Price calculated by USDA’s National Agricultural Statistics Service (NASS). Thus, for this program the marketing year average price served as the index. The now-defunct ACRE program made payments that are triggered in part by shortfalls in a state level revenue index for the targeted crop. The “shallow loss” concept adopted in the 2014 farm bill in the form of the Supplemental Coverage Option (SCO) and the Stacked Income Protection Program (STAX) for upland cotton are area revenue triggered index programs.

Alternative Data Sources for Index Products

In many lower income countries, weather stations are too sparse to facilitate the offer of index products. The same is true for some areas of the western United States. For this reason some have proposed offering index products based on data obtained from satellite platforms. For example, the FCIP offers pasture and rangeland index insurance (known as the “Rainfall Index” product) based on rainfall data collected from weather stations. But for some western regions of the United States, where weather stations are generally less dense, the FCIP pasture and rangeland index insurance is based on NDVI data collected from satellites. This product is known as the “Vegetative Index” product. An index insurance product based on NDVI is also currently being used to insure against drought risk for pastoralists in northern Kenya.

As mentioned above, satellite platforms can provide data for areas that are not well served by ground-based weather stations. In addition, the spatial uniformity of the data collection mechanism provides practical advantages. In some cases as much as 30 years of satellite based NDVI data are now available. However, longer series of data are generally only available at low resolutions. Current NDVI technologies can generate data with much higher resolutions (less than 250 square meters per pixel) but historical data are available only for a few years.

Satellite platforms can also be used to measure rainfall. While satellite measures of rainfall are improving, significant errors still occur when satellite measures are compared to weather station measures. In general, satellite measures of rainfall are more accurate in warm seasons than in cold seasons and more accurate in wetter regions than in drier regions. Evidence also suggests that satellite measures of rainfall are also generally less accurate over complex, varying terrains.

There are also a number of significant technical challenges with using satellite data to estimate crop health, such as imaging distorted by cloud cover or air pollution, and less precision at the field level. Also, since NDVI is simply measuring “greenness,” weather conditions and land use changes can become conflated. Unusual NDVI measures may simply reflect changes in the crops being planted in a region (due to a change in relative crop prices) rather than changes in crop health. For some crops, greenness may not be highly correlated with yield. For these reasons, satellite based NDVI measures have thus far only been used as indexes for products that protect against drought impacts on pasture and rangelands in normally arid regions.
Whole Farm Insurance

Multiple commodity or whole farm revenue insurance is increasingly mentioned in farm policy debates as an alternative to current commodity-specific approaches. The obvious motivation is that if the intent of a farm safety net is to protect farm household income then the focus should be on aggregate revenue for the entire portfolio of commodities produced. Groups such as the Union of Concerned Scientists have proposed that whole-farm insurance replace existing programs to become the main component of the federal farm safety net. While whole farm designs are conceptually attractive and straightforward, they are operationally quite complex. Each farm’s portfolio of agricultural enterprises is unique so whole farm insurance designs require sophisticated portfolio modeling of the revenue risk for each policy sold. Such models would require knowledge of farm-level yield distributions for each commodity produced, price distributions for each commodity and a full covariance matrix which specifies the relationships between each of these variables. In most cases, such detailed farm level data are simply not available. In fact, many farmers find it difficult, given year to year changes in land tenure arrangements and commodities produced, to provide the four to ten years of yield data required to purchase commodity-specific FCIP policies.

Despite these challenges, a policy incorporating whole farm insurance design has been offered since 1999 as part of the FCIP. Adjusted Gross Revenue (AGR) insurance was implemented as a means to provide insurance to producers of specialty crops that were currently uninsurable. It was not envisioned as a replacement for existing crop insurance products. AGR and a basic version called AGR-Lite use a farmer’s Schedule F form from the federal income tax return as a starting point for calculating expected and actual revenue. However, because most farms use cash accounting, the AGR program requires a number of adjustments to the Schedule F information. Additional adjustments are required if significant changes are made from one year to the next in the agricultural commodities produced on the farm. Participation in AGR and AGR-Lite has generally been quite low in the regions where it has been offered. In 2013, only 752 policies of this type were sold to farmers, representing less than 0.4 percent of all insurance protection in force under the program. The 2014 farm bill instructs the Federal Crop Insurance Corporation to conduct research and development into a whole farm revenue product designed to work for farmers with diversified crop and livestock operations, unless such a plan has been already approved for availability for farmers by the 2016 reinsurance year. The new Whole Farm Revenue Policy was available for sale in the 2015/16 crop year, and 1,090 policies were sold for a total liability of $1.13 billion.

A federal commodity program providing whole-farm revenue protection at the farm level would face many of the same challenges encountered by RMA when implementing AGR, although at a much greater scale. AGR expected revenue is based on farm income reported on Form 1040 Schedule F in previous years. Likewise, actual realized revenue is based on the Schedule F for the current year. However, a number of issues associated with Schedule F values must be addressed. For example, the Internal Revenue Service allows farmers to use cash accounting, which does not necessarily provide an accurate measure of actual farm revenue in a particular year. Thus, RMA must obtain additional information from AGR policyholders to convert cash accounting measures into estimated accrual accounting measures. Failure to make such conversions would allow policyholders to use flexible cash accounting to engage in moral hazard. It can be difficult to estimate expected farm revenue because farm expansion (or contraction) often occurs in discrete jumps such as when additional land is purchased or an enterprise is shut down. As a result, RMA created a lengthy set of rules to address such situations. A related issue that has proven difficult to address (especially for specialty crop producers) is defining which of the farmer’s activities qualify as agricultural production and which are value-added.
In a World of Reduced Federal Spending

In the 2014 farm bill, severe federal budget pressures forced farm groups to surrender one component of the farm safety net they have enjoyed in recent years—the direct payments totaling $5 billion annually that were dispensed to farmers regardless of market conditions. However, less than 20 percent of the savings from ending direct payments and two other income support programs are to be devoted to deficit reduction. The remainder is diverted to bolstering other components of the farm safety net, mainly to new or re-designed programs that are intended to compensate farmers either for shallow revenue losses or for losses suffered as a result of declining crop prices.

The Bipartisan Budget Act of 2015 (P.L. 114-74) established funding levels for the federal government for fiscal years 2016 and 2017, in the process reducing the impact of sequestration cuts for those two years but the caps from the Budget Control Act of 2010 take effect again in fiscal year 2018. This legislation gives the Agriculture Committees a bit of a hiatus. Beginning in the spring of 2017, as Congress and the Administration begin to set overall funding levels for fiscal year 2018, there may be renewed pressure to undertake additional budget reductions.

Reduced Farm Commodity Programs

The commodity title in the 2014 farm bill includes a combination of price- and/or revenue-linked programs to serve as the new farm safety net for row crops (in addition to crop insurance) that farmers will be required to choose between. There is significant regional disparity in the type of program preferred by farmers, with Midwest farmers (producing primarily corn, wheat, and soybeans) largely focused on addressing the ‘shallow loss’ revenue gap they see as persisting even with recent changes in revenue coverage under the FCIP, and Southern farmers (producing primarily rice and peanuts) preferring a program that triggers payments.
off of crop price reductions below an established level. Cotton producers are seeking a separate shallow loss program designed to fit within the crop insurance program, primarily to bring their support programs into compliance with a WTO panel decision in a case brought by the government of Brazil back in 2003.

If a future Congress faces pressure to reduce spending under these types of programs, they would have a limited set of choices. These choices would include:

- Eliminate one or more of the programs entirely,
- Modify the trigger that determines when payments are made, by lowering the reference price (for the price-triggered program) or the percentage of county (or farm-level) target revenue at which shallow loss payments begin,
- Pay a reduced percentage of the gap between the actual price or revenue and the reference price or revenue, or
- Make payments on a lower percentage of crop acreage.

Obviously, ending the price- or revenue-linked programs would eliminate that component of the farm safety net entirely, and leave the FCIP as the major remaining component. The second option would reduce the effectiveness of the program's protection by requiring a greater decline in price or revenue to occur before payments would be initiated.

The third and fourth options would leave the safety net’s structure largely intact but make it less costly in budgetary terms. Past legislation has utilized such an approach to control costs while minimizing program impairment, such as the reduction of acreage under the deficiency payment program for which payments would be made from 92 percent to 85 percent to cut costs as part of the 1993 Omnibus Budget Reconciliation Act (a pro-rata reduction that was retained for both direct and countercyclical payment programs through the 2008 farm bill), and the provision paying out only 60 percent of the gap between the program guarantee and total farm revenue under the SURE program established in the 2008 farm bill. If faced with the necessity of further funding reductions in a future farm bill, farm groups would almost certainly favor one of the latter two options, leaving the programs still able to respond to changing market conditions.

### Table 1 | Federal Crop Insurance Premium Subsidies in 2015

<table>
<thead>
<tr>
<th>Insurance Product</th>
<th>Net Acres</th>
<th>Total Premium</th>
<th>Premium Subsidy</th>
<th>Subsidy Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue Protection</td>
<td>196,472,388</td>
<td>$7,595,984,331</td>
<td>$4,747,907,500</td>
<td>62.5%</td>
</tr>
<tr>
<td>Revenue Protection w/ Harvest Price Exclusion</td>
<td>1,703,998</td>
<td>$40,686,531</td>
<td>$23,733,583</td>
<td>58.3%</td>
</tr>
<tr>
<td>Yield Protection</td>
<td>26,232,660</td>
<td>$455,335,878</td>
<td>$292,618,903</td>
<td>64.3%</td>
</tr>
<tr>
<td>Other</td>
<td>73,795,064</td>
<td>$1,622,401,328</td>
<td>$990,115,296</td>
<td>61.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>298,204,110</strong></td>
<td><strong>$9,714,408,068</strong></td>
<td><strong>$6,054,375,282</strong></td>
<td><strong>62.3%</strong></td>
</tr>
</tbody>
</table>

Source: Risk Management Agency Summary of Business Report
Potential Crop Insurance Subsidy Changes

Table 1 shows the total premium subsidy associated with crop insurance for 2015. More than $6 billion in premium subsidy was provided to reduce the producer paid premium on a total of $9.7 billion of total premium. Thus, producers paid roughly $3.7 billion of the total premium. The table also shows the breakout of subsidy for the three major row crop insurance products.

Major crops are primarily insured with revenue protection. As a result, $4.7 billion of the total premium subsidy are associated with this product. Note also that the final column shows the premium subsidy as a percentage of total premium. Across all products the subsidy percentage averages just over 62 percent.

Further insights into the subsidy structure can be gained from Table 2. This table summarizes the subsidy percentages for different insurance products and coverage levels. These subsidy percentages have been defined in statute, while the premiums to which subsidies are applied are established by the RMA. Catastrophic coverage is the lowest level of coverage, but it is the most highly subsidized. For individual yield or revenue insurance policies with basic or optional units, premiums are 100 percent subsidized for catastrophic

Table 2 | Subsidy Percentages for Various Insurance Products and Coverage Levels

<table>
<thead>
<tr>
<th>Product</th>
<th>Coverage Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAT 50% 55% 60% 65% 70% 75% 80%* 85%* 90%**</td>
</tr>
<tr>
<td><strong>Individual Yield and Revenue Insurance</strong></td>
<td></td>
</tr>
<tr>
<td>Basic and optional units premium subsidy percentage</td>
<td>100% 67% 64% 64% 59% 59% 55% 48% 38% NA</td>
</tr>
<tr>
<td>Enterprise unit premium subsidy percentage</td>
<td>NA 80% 80% 80% 80% 77% 68% 53% NA</td>
</tr>
<tr>
<td><strong>Area Yield and Revenue Insurance</strong></td>
<td></td>
</tr>
<tr>
<td>Yield insurance (AYP) premium subsidy percentage</td>
<td>100% NA NA NA NA 59% 59% 55% 55% 51%</td>
</tr>
<tr>
<td>Revenue insurance (ARP) premium subsidy percentage</td>
<td>NA NA NA NA NA 59% 55% 55% 49% 44%</td>
</tr>
</tbody>
</table>

Source: Risk Management Agency, * indicates coverage level not available for individual yield and revenue products for some crops/regions, ** indicates coverage level only available for area yield and revenue products.
coverage, although they are required to pay a $300 per policy administrative fee. The subsidy percentage then decreases to a low of 38 percent for the highest available coverage level (85 percent coverage). It is important to note that the table presents premium subsidy percentages rather than actual dollars of premium subsidy. Premium costs increase exponentially as coverage levels increase. Thus, as one moves from lower to higher coverage levels, the actual dollar amount of premium subsidy typically remains relatively constant though the premium subsidy percentage is decreasing. The next series is associated with enterprise units (encompassing all acres of a crop in a county farmed by an individual). Premium costs are lower for enterprise units than for basic or optional units. Thus, the higher premium subsidy percentage for enterprise units does not necessarily imply more premium subsidy dollars per acre. Finally, Table 2 shows the premium subsidy percentages associated with area insurance products. Area products are generally subsidized at lower rates than individual products. It is also important to note that the individual revenue insurance products which dominate participation have upside price protection which makes the premiums for these products higher. Thus, more premium subsidy per acre is provided for this product than for either the revenue protection with the harvest price exclusion or yield protection insurance products.

Ultimately, in a budget constrained environment there are various possible scenarios where subsidies are reduced. This set is not exhaustive but it reflects variants of scenarios proposed or of past subsidy structures.

Reduce Subsidy Percentages Across Coverage Levels

An obvious possibility is to modify the subsidy percentages provided for crop insurance coverage. However, this approach could take various forms. The 100 percent subsidy for catastrophic coverage was meant to entice producers into taking on at least minimal coverage that would protect against the most severe yield or revenue shortfalls. In recent years, participation has migrated to higher coverage levels so that much more subsidy is provided to those policies. Lowering the subsidy percentage on higher coverage levels would increase the marginal cost to farmers of moving to higher coverage levels and decrease the likelihood of buying up.

Enterprise units aggregate yields within the farms and lower premium cost and potentially reduce moral hazard problems. The rules for determining subsidy levels for enterprise and whole farm units were set in the 2008 farm bill and maintained in the 2014 farm bill. These subsidy percentages are the highest available and peak at 80 percent. It appears that a significant amount of participation has moved to enterprise units because of the significant premium reduction. Lowering these subsidy rates would, all else equal, shift participation back to the basic and optional units. However, given the strong shift to enterprise units, the current enterprise unit subsidy levels may have been in excess of what was needed to induce that shift in preference between basic/optional and enterprise coverage.

The subsidy percentages on area products are relatively lower than for the other products, combined with relatively lower premium rates and lower participation they represent a relatively small portion of total premium subsidy. Related to the area products are the proposed shallow loss commodity programs which function much like area revenue protection (ARP) insurance. There is the potential for overlap between insurance and the shallow loss commodity programs. Thus, there could be overlapping coverage and subsidy. For example, the House Agriculture Committee’s proposed Revenue Loss Coverage (RLC) is an area index based program that triggers payments whenever the county level realized revenue is less than 85 percent of the expected revenue. Payments are made for a layer of loss between 85 percent and 75 percent of expected area revenue. However, participating in the RLC would not preclude the purchase of 85 percent coverage crop insurance. If area revenue is highly correlated with farm revenue the federal RLC program and the FCIP could be providing overlapping coverage.
Reduce Subsidy on Revenue Products

Prior to the 1998 crop year, crop insurance subsidies were based only on yield insurance. This is important because per acre revenue insurance rates are generally significantly higher. The implication is that if the 55 percent subsidy on a 75 percent coverage yield insurance policy resulted in $10 per acre of subsidy then the subsidy on a 75 percent coverage revenue insurance policy would also be $10 per acre. So the percentage subsidy for the revenue insurance product would be lower than for the yield insurance product. Said differently, the producer would pay the full marginal cost of the additional protection provided by the price component of revenue insurance.

To date, no caps have been placed on the amount of crop insurance subsidies a farm may receive in a single year though various limitations have been proposed. This is in contrast to commodity programs where farmers are not charged any fees for program participation but payments under the programs are subject to both adjusted gross income tests and payment limits for amounts collected annually under individual programs. For example, the version of the current farm bill that passed in the Senate in 2012 but was never enacted included an adjusted gross income test of $750,000. A proposal to limit benefits under the FCIP was evaluated by the Government Accountability Office (GAO) in 2012 where an annual cap of $40,000 of subsidy was considered. The GAO report found that the $40,000 subsidy cap would have saved roughly $1 billion in 2011 and affected 3.9 percent of participants. Such a provision was included in the Senate version of the 2014 farm bill, but dropped in the conference committee process.

Reduce Company Reimbursement

Private companies selling crop insurance are reimbursed for delivery costs (sales, data processing, loss adjustment, etc.) through Administrative and Overhead (A&O) payments. These firms are also reinsured through the Standard Reinsurance Agreement (SRA) which defines how premiums and indemnities are allocated between the companies and the USDA. Thus, the SRA provides risk protection to the companies which are ultimately financially responsible for indemnities on the policies they sell.

Because the A&O reimbursement has historically been specified as a percentage of premium, recent trends toward higher coverage levels and generally high prices for many major crops have resulted in significant increases in the amount of A&O reimbursement. This growth is in spite of the fact that the delivery cost is believed to have largely remained unchanged. The most recent SRA caps the overall A&O subsidy that can be received. This is in response to the perceived windfalls of recent years. The current SRA also caps the maximum agent reimbursement rate. Because agents can typically write for multiple companies, it appears there has been significant bidding by crop insurance companies for agents in some regions of the country where the crop insurance business has been profitable in the past.

The SRA provides some asymmetric sharing of premiums and losses such that companies may achieve net positive returns from the SRA. However, this outcome will depend on allocation decisions the private companies are allowed to make within the SRA framework and of course the loss experience on the insured policies. In years of low losses it is likely that private insurance companies would obtain net gains from the SRA. In the major drought that occurred in 2012, the companies suffered a net underwriting loss of $1.3 billion. It is the intent of the SRA for the private insurance companies to not suffer the full brunt of major crop loss events, but that risk sharing between USDA and companies would expose the companies to some of the losses. In fact, companies tend to retain more risk than they are required to by the SRA and in some cases reinsure some of that risk privately in the global reinsurance market.

Options to reduce company reimbursement would most likely take the form of further reductions in the standard reimbursement percentages, harder caps on reimbursement, or changes in the SRA. It appears that the most recent SRA renegotiated in 2010 made some significant changes after a long period of good weather in major production regions resulted in strong returns to the companies. The results for 2012 will provide an interesting insight into the fairness of the current SRA. A provision of the 2014 farm bill’s crop insurance title
requires that any new renegotiations of the SRA be ‘budget-neutral’, so this avenue for further budgetary savings has been closed off for now.

A provision in the Budget Act of 2015 (passed in October 2015) imposed a restriction on the rate of return that crop insurance companies would be allowed to earn under the program. That provision was vigorously opposed by farm and crop insurance interest groups and their supporters on the House and Senate Agriculture Committees and reversed in an unrelated piece of legislation within a month.

**Removing Systemic Agricultural Risk to Facilitate Private Risk Provision**

The recent farm bill debate has made the terms ‘deep’ and ‘shallow’ loss common vernacular among those interested in the agricultural safety net. Deep losses refer to infrequent yield or revenue loss events that may have quite serious financial consequences. Conversely, the various shallow loss programs proposed in 2012 would protect against less serious but more frequent yield or revenue loss events.

A key to understanding the nature of agricultural risk is to consider the spatial correlation of agricultural yields, prices and revenues. Price risk is highly correlated or systemic across locations since a crop grown in one location is a perfect substitute to that grown in another region. Thus, prices tend to differ only by transportation costs and thus move up and down together. This implies that large price changes will occur for essentially all farmers of a given crop at the same time. This characteristic is essential to making commodity futures markets functional. Crop yields are also spatially correlated but less so. This is because the correlation tends to be driven by the systemic nature of weather across geographic regions. Under typical conditions, the weather in a county may be highly correlated with the weather in an adjacent county. However, this correlation tends to decrease with distance so that the correlation of yields in fields a few hundred miles apart may be essentially zero. In contrast, with systemic weather perils such as the 2012 drought, yield losses may be highly spatially correlated. Revenue correlation across farms tends to be somewhere between the level of price correlation and the level of yield correlation. So revenue triggered payments will be more highly correlated across farms than yield triggered payments.

The insurance principles discussed earlier point out that insurance works best when losses are uncorrelated across policies. However, as just described, agricultural revenue and yield risks tend to be spatially correlated which makes it difficult for private insurers to effectively diversify their risk exposure even with a large number of policyholders. This potential for spatially-correlated losses is one of the primary reasons why the federal government became involved in providing agricultural insurance.

One approach to increasing the private insurability of crop insurance would be to provide a federal stop loss mechanism. This is a well-known reinsurance technique which defines an extreme boundary beyond which all losses are covered by the reinsurer. Currently, the SRA for companies selling federal crop insurance policies provides a stop loss provision which completely compensates for losses when loss ratios exceed 500 percent. This provision removes some portion of the most extreme loss events from the company’s risk portfolio. These are the events most likely to bankrupt a private firm and are the most difficult to accurately price. Thus, it facilitates private reinsurance by reducing the risk and making private reinsurance easier to price with confidence.

An alternative approach would transfer deep losses experienced by agricultural producers directly to the federal government. While the focus of recent farm bill deliberations has been on layering an area based program on top of individual-triggered federal crop insurance, another approach would be to ‘wrap’ crop insurance around a deep loss area triggered commodity program. Several different variations to this approach could be designed.
Concluding Remarks

Within the context of crop production, the term “risk” generally refers to variability in annual profit. This variability can occur due to variability in prices, yields, and/or input costs. Crop producers manage their risk exposure by investing in risk reduction efforts such as diversification, share-renting, and transferring risk through both private and public instruments. After risk reduction efforts have been employed any remaining risk that is not transferred is implicitly retained within the farm business.

A common misconception is that any risk is transferrable. In reality, risks must have specific characteristics to be transferrable using either private or public instruments. Exchange-traded futures and options contracts can be used to transfer risks that are highly systemic. The risk must also affect a sufficiently large volume of cash market transactions to support active trading on the exchange. Price variability for major commodities is the primary example of such a risk. Public sector price triggered commodity programs also provide effective risk management for crop producers due to the systemic nature of price variability.

Traditionally insurable risks have a number of specific characteristics that are not consistent with yield or revenue risks for most agricultural commodities. For example, traditional insurance products (e.g., life insurance, automobile insurance, etc.) cover risks that are largely uncorrelated across policyholders while agricultural yield or revenue typically exhibits some degree of spatial correlation — and the scale of the spatial correlation typically increases with the magnitude of the loss event. Traditional insurance products also cover risks that are not highly susceptible to moral hazard and adverse selection problems whereas the information asymmetry inherent in crop production makes crop insurance susceptible to these problems. While it is sometimes possible to insure risks that are not fully consistent with traditional insurability conditions, doing so can be quite expensive. This realization has led to a federal role in providing and subsidizing multiple peril crop yield and revenue insurance in the United States.
In recent years, there has been significant interest in changing federal commodity programs from being price triggered to revenue triggered. Unless such programs are index based (e.g., area revenue triggered) rather than based on farm level revenues, they will be highly susceptible to moral hazard problems. However, index based programs leave growers exposed to basis risk (localized losses that are not reflected in the index). There is also an increasing interest in “whole farm” (multiple commodity) revenue insurance designs. While conceptually attractive, such designs are likely operationally infeasible. They are also likely to create economic disincentives for diversification leading to more specialized and risky farms. Again, index based whole farm revenue designs would address many of these problems but at the cost of leaving producers exposed to basis risk. It may also be possible to provide an index based, revenue triggered, commodity program that protects against deep losses and allow private insurers to sell policies that protect against the remaining residual risk, such as has been proposed by the Environmental Working Group or the American Farm Bureau Federation.

While all of these changes are possible, public policy tends to evolve incrementally so modest changes to existing programs are far more likely. For commodity programs, reductions in future federal funding availability could lead to marginal changes such as lowering price or revenue targets, compensating producers for a smaller percentage of any realized price or revenue shortfall, or making payments on a smaller percentage of planted acreage. For the federal crop insurance program, cost saving marginal changes could include across the board reductions in premium subsidy percentages or offering premium subsidies only on the yield risk portion of revenue insurance products. Alternatively, the A&O reimbursements paid to private insurance companies could be further reduced (they were reduced as recently as 2010) although it is unclear how much further these reimbursements could be reduced before private insurance companies would decide not to participate in the program. If faced with specific spending reductions, policymakers would be likely to make choices based on their determination of what cuts would do least harm to the functioning of the farm safety net.

Appendix

Reorienting Federal Farm Policy Around a County-level Deep Loss Program

The 2014 farm bill authorizes a variety of title 1 federal farm programs (delivered by the Farm Service Agency) and title 11 federal crop insurance products (delivered by the Risk Management Agency in partnership with private insurance companies). However, these federal efforts, designed to help agricultural producers manage risk, are incredibly complex and can potentially provide overlapping benefits. For example, it is conceivable that, in a given year, a program crop producer could receive payments from as many as four different federal programs/products (Price Loss Coverage, Marketing Loan Program, Yield or Revenue Protection, and the Supplemental Coverage Option). In addition, with Direct Payments gone, there is increased focus on the cost of the federal crop insurance program. Continuing budget pressure at the federal level means the pressure to reduce the costs of the crop insurance program is likely to increase.

As an alternative to the current confusing mix of federal programs/products and as a way to reduce the costs of the crop insurance program, this document explores the potential for reorienting federal farm policy around a federally-provided, county-level, deep loss program. The document describes such a program, compares it to the county-level, shallow loss programs authorized in the 2014 farm bill, explains how a deep loss program could be integrated with farm-level, multiple-peril crop insurance products, explores some potential implementation challenges, and identifies areas in need of further exploration.

What is a Deep Loss Program?

A deep loss program is one that protects against only extreme loss events. Using insurance terminology, it can be thought of as a program with a relatively large deductible – the farmer absorbs more common, less severe, losses while the program would provide risk protection for more rare and extreme losses.
In crop agriculture, deep losses in annual revenue are caused by extremely low realized prices and/or realized yields. Generally, deep losses are geographically widespread. Extremely low prices will affect most producers of a particular commodity. Extremely low yields can be caused by localized phenomena, such as a hail storm, but often the perils that cause extremely low yields are also widespread (drought or excessive rainfall).

**Why a County-level Deep Loss Program?**

Depending on how one defines “deep,” traditional farm-level Yield Protection or Revenue Protection crop insurance can be thought of as providing protection against deep losses. In most regions these products have a minimum 15 percent deductible (maximum 85 percent coverage level) meaning that the farmer must absorb the first 15 percent of loss relative to the expected yield or revenue.

Unfortunately, farm-level insurance products are both expensive to administer and susceptible to fraud and abuse. High levels of federal premium subsidies to farmers and administrative and operating expense reimbursements to insurance companies have been required to overcome these challenges. In addition, due to the widespread nature of deep losses, the federal government provides reinsurance to the insurance companies that sell Yield Protection and Revenue Protection policies.

A county-level deep loss program would trigger payments whenever county-level losses exceed the stated deductible. To simplify the presentation, this manuscript will assume that a deep loss program would be based on revenue (rather than yield) shortfalls though, in principle, it could be based on either.

Suppose a commodity has a county-level expected revenue (the product of the expected county yield and the expected price) of $1,000 per acre. If the deductible on a county-level deep loss program was set at 25 percent (75 percent coverage level), each participant in the county would receive a payment if the realized county revenue (the product of realized yield and realized price) for that year was less than $750 per acre. For example, if the realized county revenue was $500 per acre, every participant in that county would receive a payment of $250 per acre ($750 per acre - $500 per acre) on all enrolled acres of the commodity, regardless of the realized revenue per acre on the participant’s farm.

At first blush, the italicized statement at the end of the previous paragraph may seem strange. Shouldn't the payment reflect the loss experienced on the participant’s farm? But it is this characteristic that makes a county-level program unique. County-level programs are much less expensive to operate because there is no need to determine the expected revenue on a particular farm or the realized revenue on the farm. This characteristic also means that county-level programs are much less susceptible to fraud and abuse since the actions of a single farmer are unlikely to have more than a trivial impact on the realized county revenue.88

If the farmer’s realized revenue tends to be highly correlated with the county realized revenue, then county-level programs can provide effective risk protection. Notice that it doesn't matter whether the farmer’s expected revenue is higher or lower than that of the county. All that matters is that revenue realizations on the farm are correlated with those of the county. If this is not the case — if the farm revenue is not highly correlated with the county revenue — then a county-level program may not make a payment when the farmer experiences a loss (or may make a payment when the farmer does not experience a loss). This potential for a mismatch between farm and county outcomes is often called “basis risk.”

It is important to note that the existence of basis risk does not necessarily undermine the risk management benefits of county-level products. In fact, basis risk occurs with many other risk management tools (e.g., hedging price risk with futures or options contracts). The relevant question is the magnitude of the basis risk. If it is relatively small, county-level products can...
still provide effective risk management protection. But if basis risk is large, the risk management effectiveness of county-level products is severely compromised.

**Shallow Loss Versus Deep Loss Programs**

The 2014 farm bill authorizes a number of county-level, shallow loss, programs/products. The Agricultural Risk Coverage (ARC) program, authorized under title 1, makes payments whenever realized county-level revenue falls below 86 percent of the expected county revenue (i.e., the program has a 14 percent deductible). ARC is considered a shallow loss program because it only pays for a 10 percent layer of loss. No additional payment is made for losses that exceed 24 percent of expected county revenue.

ARC is a farm program delivered by the Farm Service Agency but the 2014 farm bill also authorized two county-level shallow loss federal crop insurance products. These are called the Stacked Income Protection Plan (STAX) and the Supplemental Coverage Option (SCO). STAX is only available for cotton production and offers a minimum 10 percent deductible (payments begin when realized county-level revenue falls below 90 percent of the expected county revenue). It is a shallow loss product because it covers a maximum 20 percent layer of loss (no additional payment is made for losses that exceed 30 percent of expected county revenue). The STAX layer of coverage is even less than 20 percent if the grower has an underlying Yield Protection or Revenue Protection policy with a coverage level that exceeds 70 percent. For example, if a grower has an underlying Revenue Protection policy with a 75 percent coverage level, the STAX layer of coverage is only 15 percent (90 percent – 75 percent).

SCO is available for all program crops and has a 14 percent deductible (86 percent coverage level). Growers must have an underlying Yield Protection or Revenue Protection policy to be eligible for SCO. The SCO layer of coverage extends from 86 percent of the expected county yield or revenue (depending on whether the grower’s underlying insurance policy is Yield Protection or Revenue Protection) to the coverage level on the underlying insurance policy. For example, if a grower has an underlying Revenue Protection policy with a 75 percent coverage level, the SCO layer of coverage will be 11 percent (86 percent – 75 percent).

Understanding these various shallow loss programs and how they interact with other federal farm programs and crop insurance products is quite challenging. This is compounded by the fact that each of these various shallow loss programs uses different methods for calculating expected county revenue and realized county revenue. A more fundamental problem with shallow loss programs is that, if, as suggested earlier, deeper losses tend to be more widespread, then basis risk should be a bigger problem with shallow loss programs than with deep loss programs.

**Wrapping Crop Insurance Around a County-level Deep Loss Program**

A much more straightforward approach to federal farm policy would be to have the federal government provide growers with a county-level deep loss program. A deep loss program might have a 30 percent deductible (70 percent coverage level) but the coverage layer would extend all the way to zero so that extreme loss events are covered. The deeper the loss (as measured by the shortfall in realized county-level revenue relative to the expected county revenue), the larger the payment made to growers. Crop insurers could then offer farm-level policies that protect against any losses for which an insured grower is not compensated by the federal deep loss program.

Consider an example of a county with expected revenue per acre for a particular commodity of $800 per acre. If the deep loss program had a 70 percent coverage level, growers of that commodity would receive payments whenever the realized county revenue was less than $560 per acre (800 percent × 70 percent). Suppose that due to a combination of lower than expected prices and yields, the realized county revenue per acre for the commodity was only $360 per acre. Each eligible grower of the
commodity in the county would receive a payment of $200 per acre ($560 - $360), regardless of the grower’s realized revenue per acre.

Suppose a grower of the commodity in this county has expected revenue of $1,000 per acre. This grower purchases a revenue insurance policy with a 70 percent coverage level, so the grower is protected against revenue realizations less than $700 per acre. Now suppose that due to the combination of low prices and low yields, the grower’s realized revenue was only $400 per acre. The grower would also receive the deep loss program payment of $200 per acre. The deep loss payment would count as revenue toward the insurance policy, so the insurer would pay the grower $100 per acre ($700 guarantee - $400 realized revenue - $200 deep loss payment). The combination of realized revenue, deep loss payment, and insurance payment equals $700 per acre which was the grower’s revenue guarantee under the insurance policy.

Now suppose that the grower’s revenue shortfall was due to a hail storm or some other localized phenomenon. The county realized revenue actually exceeded the guarantee of $560 per acre so the deep loss program made no payment. In this case, the insurance policy would pay the grower $300 per acre ($700 - $400) – the difference between the grower’s insurance guarantee and the realized revenue with no deep loss payment.

Now consider a scenario where the deep loss program makes a payment of $200 per acre while the grower’s realized revenue is $750 per acre – exceeding the insurance guarantee of $700 per acre. The deep loss payment is completely unrelated to the grower’s farm-level revenue, so the grower would end up with $950 per acre – the realized revenue of $750 per acre plus the deep loss payment of $200 per acre.

Finally, note that the grower might prefer an insurance policy with a smaller deductible. For example, suppose that the grower purchased a revenue insurance policy with an 85 percent coverage level. The grower’s revenue guarantee would be $850 per acre. Using the scenario where the deep loss program makes a $200 payment, the insurance payment would then be $250 per acre ($850 guarantee - $400 realized revenue - $200 deep loss payment). If the deep loss program makes no payment, the insurance payment would be $450 per acre ($850 guarantee - $400 realized revenue).

These examples demonstrate how an insurance policy could wrap around a federal deep loss program and protect growers against losses for which they are not compensated by the deep loss program. Obviously, the cost of the insurance policy would depend on the coverage level selected by the grower, the insurer’s underwriting assessment of the grower’s revenue risk, and the insurer’s assessment of the correlation between the grower’s realized revenue and the county realized revenue. The higher (lower) the correlation, the higher (lower) the likelihood that the deep loss program will compensate for a significant portion of any realized farm-level revenue shortfall, which reduces (increases) the amount that the insurer will be required to pay.

Since the federal deep loss program would protect against widespread deep losses, there should be no need for the federal government to provide reinsurance protection to insurers who sell the wrap-around insurance products. Whether the federal government would provide premium subsidies on wrap-around insurance products is a matter of policy preference. Regardless, providing a county-level deep loss program (around which an insurance product that protects against residual losses can be wrapped) would both clarify and simplify the federal role in providing risk management protection to growers of program crops. This is in contrast to the status quo in which growers of program crops must make participation decision from among a myriad of confusing federal programs/products that provide potentially overlapping risk protection.

**Implementation Challenges with a County-level Deep Loss Program**

While a county-level deep loss program would, at least conceptually, have many attractive features, a number of important implementation challenges would need to be addressed. The most fundamental of these are challenges related to the availability of county yield data. Historical
counties with higher revenue variability. The higher revenue variability may be due to the crop/region having greater price variability, greater yield variability, and/or a lower correlation between yield and price. Obviously this raises questions about the equity of federal benefits provided by such a program. Furthermore, if one believes that areas with higher yield variability are also likely to be areas that are more environmentally fragile, then such a design could create incentives that work at cross-purposes with federal conservation programs – since federal dollars would be transferred disproportionately to those producing crops in more environmentally fragile areas. In principle, to equalize the transfer of federal dollars across different crops/counties, different coverage levels would need to be offered for each crop/county combination – with higher (lower) risk crops/counties receiving lower (higher) coverage levels. However, such a design may not be politically feasible.

While these are important challenges that would need to be addressed with any county-level deep loss program, it is important to note that all of these challenges also exist with the county-level shallow loss programs authorized by the 2014 farm bill. In fact, because they make more frequent payments, shallow loss problems may have greater implementation challenges than would a deep loss program.

For counties where NASS does not provide county-level yield estimates, a deep loss program could be based on yield estimates from a neighboring county. Multi-county Crop Reporting District (CRD) yield estimates could also be used for each county in the CRD although CRD yield estimates would need to be adjusted for aggregation bias. For the STAX and SCO shallow loss programs, the Risk Management Agency has chosen to estimate county-level yields by aggregating the farm-level yield data provided by growers when they purchase Yield Protection (YP) or Revenue Protection (RP) insurance policies. Questions remain about how this will impact the performance of STAX and SCO in counties where YP and RP purchasing is limited. This is particularly true for STAX since STAX purchasers are not required to purchase an underlying YP or RP policy. While all of these data challenges would need to be addressed in a deep loss program, it is important to recognize that the current shallow loss programs face exactly the same challenges. In addition, all of the concerns about a deep loss program disproportionately transferring federal dollars to riskier production regions exist with the current shallow loss programs (and also with subsidized farm-level federal crop insurance products).
Finally, it is important to note that this discussion has focused on county-level deep loss programs as a possible replacement for federal programs targeted to growers of program crops. Data sufficient to support a deep loss program are unlikely to exist for crops that are not produced in large volume and in many counties. Thus, deep loss programs could not replace all of the various federal crop insurance products that currently insure well over 100 different commodities.

**Next Steps for Further Exploration**

Research is needed to better understand how the efficacy of a county-level deep loss program is impacted by differences in factors that are likely to vary across crops, regions, and farms. More specifically, better information is needed about how the basis risk inherent in a deep loss program varies with differences in the correlation between county yield and farm yield. Better information is also needed about how much, for a given coverage level, the dollars transferred varies with differences in county yield variability, price variability, and the correlation of county yield to price. Related to this is a need for better information about how anticipated federal costs would change with different levels of coverage in a deep loss program.

Given the data challenges described above, information is also needed about alternative sources of county yield data and the potential impact of basing a deep loss program on yields measured at a higher level of aggregation (e.g., a crop reporting district). Due to aggregation effects, yields measured at the crop reporting district level will generally exhibit lower variability than yields measured at the county level. For a given coverage level, this implies that payments will be reduced – relative to what they would be with a county-level program – if the deep loss program is based on crop reporting district yield data. To offset this effect, the coverage level might need to be higher if the deep loss program is based on crop reporting district yields – but how much higher would it need to be?

Finally, additional information is needed about the residual risk that private insurers would be assuming with policies that wrap around a deep loss program.

Before offering such wrap around policies, insurers will want to better understand how the statistical properties of the residual risk vary for different commodities produced in different regions. They will also want to understand the cross-commodity and spatial dimensions of this residual risk to ensure that their reserves and reinsurance coverage are sufficient to cover worst case scenarios.

**Conclusion**

The current mix of federal farm programs and federal crop insurance products is both confusing and potentially redundant. A county-level deep loss program could both clarify and simplify the federal role in providing risk management protection to U.S. crop producers.

The 2014 farm bill authorized several programs/products that focused on stacking county-level shallow loss protection on top of farm-level federal crop insurance. The approach described in this document would turn that upside down by having the federal government focus primarily on protecting growers against deep losses. Private insurers could offer crop insurance policies that would wrap-around the federal deep loss program to protect growers against residual losses. Such an approach would concentrate federal efforts on catastrophic and widespread losses that cause problems for private insurers. Residual losses that are not compensated by the deep loss program should generally be smaller and more idiosyncratic, making them easier for private insurers to handle.

A number of implementation challenges would need to be addressed before federal farm policy for program crops could be reoriented toward county-level deep loss programs. This document highlights some of the areas requiring further research. It is also important to realize that many of these same implementation challenges also exist with the current ARC, STAX, and SCO programs.

Finally, it is important to note that county-level deep loss programs are likely only feasible for crops (such as program crops) that are produced in large volume and in many counties. They cannot replace the many federal crop insurance products that currently provide insurance coverage for well over 100 different commodities.
The Farm Service Agency was known as the Agricultural Stabilization and Conservation Service prior to a legislatively mandated re-organization of the U.S. Department of Agriculture in 1994.


U.S. Congress. Section 11 of the Agricultural Adjustment Act of 1933, P.L. 73-10, enacted May 12, 1933.


Commodity prices can differ between regions due to quality differences, vertical integration, and the exercise of market power by oligopsonistic purchasers.


26 It is relatively easy to identify losses caused by hail, the grower cannot affect the likelihood or magnitude of loss, risk exposure is relatively uniform across growers of a particular crop in a given region, and losses are largely uncorrelated.


42 The Board consists of six private sector members (4 producers from different parts of the country, an expert in the crop insurance business and an expert in reinsurance) to be appointed by the Secretary of Agriculture, and three senior USDA officials.

43 The 2014 farm bill eliminated the Direct Payment Program.

44 Over the last three decades, about 54 percent of U.S. domestically produced sugar has been derived from sugar beets, and the remainder from sugar cane.


49 This tax credit is estimated by the U.S. Government Accountability Office to have cost $5.7 billion in foregone revenue in fiscal 2011, and was allowed by Congress to expire without renewal at the end of 2011.


52 The 2011 estimate by the USDA accounted for the bulk corn purchased by the ethanol industry for its use, but did not deduct out the byproducts left over after the starch is converted into ethanol. Those byproducts consist primarily of protein and roughage, and can be used as animal feed. The ethanol industry urged the USDA to take these deductions into account when calculating the share of the corn crop devoted to ethanol demand, but instead USDA has simply footnoted the matter in the relevant tables without changing the underlying data.


80 This reduction was made in Sections 1101 through 1104 of P.L. 103-66, the Omnibus Budget Reconciliation Act of 1993.


82 A catastrophic risk protection endorsement (or CAT coverage) kicks in only when losses exceed 50 percent of the policy’s APH, and pays on only 55 percent of the established price for the covered crop.

83 Basic units insure production separately by crop, county (or parish), and entity/share. Optional units are a further subdivision of basic units. Optional units allow the producer to insure production separately by farm serial numbers, or section/township/range.


86 The level of loss that would trigger a ‘shallow loss’ payment versus a ‘deep loss’ payment in various programs would be established legislatively, and would depend largely on estimated budgetary costs. Most existing proposals for shallow loss programs suggest a trigger of between 10 and 15 percent, whereas proposed triggers for deep loss programs are generally between 20 and 30 percent. Deep losses are sometimes called ‘catastrophic’ losses but this is a colloquial use of the term and should not be confused with catastrophic crop insurance policies that make payments when the farm-level yield is less than 50% of the expected yield.

87 The AFBF proposed to extend their deep loss program to mechanically harvested forage, grapes, potatoes, tomatoes, apples, and sweet corn.

88 The Federal Crop Insurance Program currently offers some county-level insurance products (Area Yield Protection and Area Revenue Protection) but these products have largely been crowded-out by highly subsidized farm-level insurance products. Prior to 2014, Area Yield Protection was known as the Group Risk Plan and Area Revenue Protection was known as Group Risk Income Protection.
About AGree

AGree seeks to drive positive change in the food and agriculture system by connecting and challenging leaders from diverse communities to catalyze action and elevate food and agriculture policy as a national priority. AGree also recognizes the interconnected nature of agriculture policy globally and seeks to break down barriers and work across issue areas.

AGree is a collaborative initiative of nine of the world’s leading foundations, including the Ford Foundation, Bill & Melinda Gates Foundation, The David and Lucile Packard Foundation, W.K. Kellogg Foundation, The McKnight Foundation, Robert Wood Johnson Foundation, Rockefeller Foundation, Surdna Foundation, and The Walton Family Foundation, and will be a major force for comprehensive and lasting change.

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Evaluating Private Sector Risk Management Tools

by Mike Boehlje and Steve Hofing
Centrec Consulting Group

June 2014
This publication was commissioned by AGree to inform and stimulate dialogue about policy reform; it does not represent official AGree positions. The views expressed here are those of the individual authors.
Foreword

AGree seeks to drive positive change in the food and agriculture system by connecting and challenging leaders from diverse communities to catalyze action and elevate food and agriculture policy as a national priority. Through its work, AGree will support policy innovation that addresses critical challenges facing the global food and agriculture system and overcomes barriers that have traditionally inhibited transformative change.

AGree developed the foundation for its work by identifying four broad challenges facing the global food and agriculture system:

- Meet future demand for food;
- Conserve and enhance water, soil, and habitat;
- Improve nutrition and public health; and
- Strengthen farms and communities to improve livelihoods.

AGree is taking a deliberative, inclusive approach to developing a policy framework to meet the challenges ahead. We are undertaking research to understand the problems and assess options and are being guided by the engagement of a broad array of stakeholders whose insights and ideas are contributing to meaningful solutions.

AGree also seeks to stimulate the development of creative ideas and encourage the examination of issues from new and unique perspectives while fostering linkages that catalyze and support action.

This paper, Evaluating Private Sector Risk Management Tools, was written by Mike Boehlje and Steve Hofing of Centrec Consulting Group, and is an analytic exercise designed to assess what private sector risk management tools might emerge or expand under a scenario in which the federal “safety net” no longer existed.

While the exercise required that the authors assume a “safety net-less” environment as an analytical device, AGree does not support elimination of the farm safety net programs and fully expects the continuation of necessary federal support for risk transfer and crop insurance. The analysis focused on four areas: 1) technology, 2) contracting and land rental agreements, including flex cash leases, 3) pricing instruments, including tools for margin management, and 4) income and cash flow assurance.

This publication is the latest in a series intended to inform and broaden discussion and to complement AGree’s consensus recommendations on policies related to food and agriculture. While the concepts presented in this paper will enrich AGree’s discussions, the perspectives and positions do not represent the consensus of the AGree Co-Chairs and Advisors.

We hope you find this paper a helpful resource and will join the effort to transform federal food and agriculture policy to meet the challenges of the future.

Deborah Atwood
Executive Director
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**Context**

AGree retained Centrec Consulting Group, LLC to assess what private sector risk management tools might emerge or expand in availability under a scenario in which the “safety net” provided by federal farm programs (specifically direct, countercyclical, and disaster payments as well as crop insurance subsidies) no longer existed. While the private sector tools analysis exercise required that consultants assume a “safety net-less” environment as an analytical device, AGree does not support elimination of the farm safety net programs and fully expects that federal support for risk transfer and insurance premium support will continue well into the future.

The analysis focused on four areas: 1) technology, 2) contracting and land rental agreements, including flex cash leases, 3) pricing instruments, including tools for margin management, and 4) income and cash flow assurance, particularly the concepts of debt service protection and farmer savings accounts.\(^1\)

**Methodology**

The three principal investigators in this project were Mr. Steven Hofing, Dr. Michael Boehlje, and Dr. Steven Sonka (managing director, senior associate, and founding partner emeritus of Centrec, respectively). The authors undertook three basic steps for each of the four categories:

1. Conduct a comprehensive review of academic and public literature regarding the status and potential for developments;
2. Interview key industry participants and other stakeholders regarding the potential for further development in a new risk environment without the safety net; and
3. Where appropriate, conduct more detailed modeling of the costs and benefits of certain alternatives, and attempt to illustrate the potential using various types of “example farms.”

A total of 48 individuals were interviewed during the course of the project, across a range of geographies and institutions, outlined in Table 1.

**Table 1 | Interviews Conducted**

<table>
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<th>Institution</th>
<th>Number</th>
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<tbody>
<tr>
<td>Farm Management Company</td>
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</tr>
<tr>
<td>University</td>
<td>5</td>
</tr>
<tr>
<td>Producer</td>
<td>9</td>
</tr>
<tr>
<td>Lending/Financial Services (^1)</td>
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<tr>
<td>Agribusiness (^2)</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
</tr>
</tbody>
</table>

\(^1\) Includes Farm Credit, PNC Bank, Wells Fargo, Rabo Agrifinance

\(^2\) Includes John Deere, Monsanto, CF Industries, Pioneer, Cargill, CGB

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\(\text{This analysis also originally proposed to investigate the development of a comprehensive private sector crop insurance industry. However, AGree commissioned Dr. Barry Barnett of Mississippi State University and Stephanie Mercier, former chief economist to the U.S. Senate Agriculture Committee, to undertake an in-depth analysis of this topic, “Public and Private Roles in Agricultural Risk Transfer.”}\)
Findings

The analysis resulted in several primary conclusions in each of the four risk management categories:

1. **Technology:** Advances have been significant in the last 20 years, and will continue to develop in the future. Value chain participants involved in this technology development (biotech, input suppliers, and service providers) will continue to provide products and services that will allow agricultural producers to mitigate production risk, especially as information and communication technologies achieve a broader level of usability. Providers of these products and services, however, believe that the market for these risk management tools will continue regardless of the presence or absence of a public safety net – their strategies are based almost entirely on product enhancement, not risk management specifically. The developments that are currently emerging have the potential to make access to certain technologies more available to smaller operations through the packaging and sale of services by input cooperatives and others.

2. **Contracting and Land Rental Arrangements:** Contracting arrangements that transfer risk among supply chain participants are widely used in livestock and non-“program” crops, especially fruits and vegetables. Similar arrangements could evolve in the commodity crop industry with a significant change in the risk environment, but it is not likely to happen until there has been a significant “shock” to the income potential of ag producers in those segments. Given the relatively strong financial performance of these sectors of production ag in the last five years, it would require a significant (and probably multi-year) downturn in cash flow for alternative contracting arrangements to become more popular in the program crops. The same conclusion applies to risk-shifting changes to land rental arrangements: moving to “flexible cash leases” that would allow the producer to transfer a portion of risk (and return) to the landlord would require significant income shock to the sector.

3. **Pricing Instruments:** While exchange traded contracts (futures and options) have been a core component of the risk management strategy for certain participants in the value chain, these tools have primarily been indirectly utilized by agricultural producers (few farmers and ranchers actually directly hedge, but instead use cash contracts provided by those buying their products). Despite many attempts at providing education and awareness about direct utilization of futures and options, only a small portion of farmers use these tools. However, grain firms have become increasingly more sophisticated in their development of contracts available to farmers that allow a significant amount of flexibility in risk management. Although these arrangements involve a commitment to deliver product and are somewhat expensive, they will continue to expand and will provide significant risk management enhancements for crop producers.

   Historically, there have been few risk management options available to farmers for managing the price risk of their input purchases (fertilizer, seed, chemicals, energy). That is just beginning to change, as several firms are piloting index contracts that allow producers to lock in a relationship between the price of the commodity produced and the cost of key inputs (primarily fertilizer). Growth of these types of tools would be accelerated by a dramatic change in the risk environment, such as the removal of the safety net.

4. **Farmer Savings Accounts and Debt Servicing Protection:** Farmer Savings Accounts have been implemented in several countries around the world (e.g., Australia and Canada) and have a fairly well documented set of risk management enhancements. While such programs could succeed in an environment without a public safety net, significant public sector support would be needed due to the required tax incentives. The pros, cons, and program features of an FSA program are summarized in the analysis. However, a potentially more applicable tool meriting further investigation is a Debt Servicing Protection product, which would provide coverage of a cash flow shortfall for a farm operation, generally tied to the debt service requirements of that farm, and for a limited period of time (1-3 years). A more detailed description of this potential product is included below.
Debt Servicing Protection: An Opportunity for Future Analysis

The authors identified Debt Servicing Protection as a concept deserving of a more detailed design and evaluation with key stakeholders (lenders, providers, producers) than those included in the original analysis. The impact that income volatility has on cash flow and debt servicing capacity is a critical risk that farmers and their lenders face.

One option that could enable farmers and their lenders to absorb this risk is a form of debt repayment insurance whereby scheduled principal and interest payments are made by a third party if annual earnings or cash income is unavailable to make that payment. A fee could be charged as part of the loan agreement and used by the lender to purchase a debt service repayment instrument from an insurance company. The prime objective would be buffering the firm from major income shocks, which coupled with tight credit or falling land values (limiting producers’ ability to access equity for a working capital cushion) is a significant risk for agricultural producers.

This instrument would be similar to the mortgage insurance arrangements used in the residential housing market, but the indemnity paid jointly to the farmer and lender would only comprise the annual debt service deficiency, and the loan agreement would remain in force and not be declared in default. It might have an index insurance feature as a component of its design, and would likely be administered by credit institutions financing agriculture.

Reducing debt default risk is critical for the capital markets to adequately fund the agricultural sector. If options to reduce variability in income and debt servicing capacity are not available or effective, and lenders cannot or do not develop instruments or arrangements to mitigate this risk, farmers will face severe capital constraints which would significantly impact productivity, investment behavior, asset values, and the overall financial health of individual farmers, the farming sector, and rural communities.

A further analysis of the key required elements of Debt Servicing Protection products should investigate the following questions:

1. What are the insurable events that will trigger an indemnity?
2. How are claims validated?
3. What pooling arrangements would diversify the risk of default?
4. How would a pool be risk rated and how would it be structured to mitigate the risk?
5. How would such a program be integrated with current insurance/assurance products such as weather insurance, crop insurance, casualty insurance, etc.?
6. What fee/price would the provider need/expect to offer such a product, and how would this be priced to the farmer?
7. How would such a program be implemented and delivered?

Key first questions in providing cash flow assurance/debt service protection are what events are the focus of the program, how will a loss/shortfall be measured and what would trigger an indemnity. Potential events of interest would be production shortfalls due to weather, disease, or other natural disaster events, or lower than anticipated product prices. Cash flow shortfalls can result from higher costs than anticipated, but more if not most of the events that impact costs are controllable. Consequently, the focus would likely be on gross revenue as the metric to trigger an indemnity similar to current RA crop insurance.
insurance products. In fact, this program might be structured as an expansion of current crop and livestock revenue protection/assurance programs offered in both the U.S. and Europe (particularly in the Netherlands for livestock). An alternative that is currently being introduced in Canada by a private sector firm is a multi-peril program that insures fertilizer, seed and chemical costs plus a specified amount of revenue per acre (see www.agrisolutions.ca).

Structured as a variation/expansion of current crop/livestock gross revenue insurance programs, procedures for validation of losses would be similar to those used in those programs. Likewise, pooling arrangements and risk rating experience and expertise of the current insurance industry combined with experience in writing catastrophic reinsurance for other industries and sectors would be leveraged for insights into risk assessment and pricing, deductibles, co-insurance, indemnity levels and other program parameters.

Analysis

The analysis provides a brief overview of the current risk environment, reviews the analysis scope and approach, and then assesses the potential for innovations in private sector risk management offerings categorized in four areas:

- Technology
- Contracting and Land Rental Arrangements
- Pricing Instruments
- Income/Cash Flow Assurances (Farmer Savings Accounts and Debt Servicing Protection)

As with all analyses commissioned by AGree, this represents only the opinions and conclusions of the analysts (in this case, Centrec Consulting Group, LLC) and should not be considered to represent the position or opinion of AGree.

Annex

Evaluating Private Sector Risk Management Tools
Risk Environment

Risk Environment Baseline (‘07-12)

- Dramatic increases in prices for core program crops
  - Corn
  - Soybeans
  - Wheat
  - Cattle
  - Hogs
- Significant increases in price volatility
  - Absolute terms
  - Daily changes
Risk Environment Baseline (‘07-12)

• Record net farm incomes
• Dramatic increases in land values
• Lagging, but major moves in input costs
  – Seed, fertilizer
  – Fuel
  – Land values
  – Feed for livestock
  – Machinery
  – Crop insurance
• One major exception – interest rates

Characterizing the Safety Net

• Includes
  – Commodity Programs (Direct Payments, Counter-cyclical payments, Loan Deficiency Payments, Marketing Loss Assistance)
  – Crop Insurance Premium Subsidies and Other Costs
  – Conservation Subsidies
  – Disaster Subsidies
The Safety Net Provides

- A modest revenue supplement for program crops
- The option of significant protection against yield and price variability
- The possibility of disaster assistance
- Impacts certain producers and regions differently
  - Geographic location of crops
  - Payment limitations

Absent The Safety Net

- Component of net income that had existed no longer exists
- Volatility of farm cash flows will increase due to exposure to downside risks from production and price volatility
- Increased volatility may cause impact on level and predictability of key capital asset values
- Potential impact on other participants in the supply chain may cause them to consider offering solutions to mitigate
  - Either for the returns involved or for stabilizing the income stream of their customers
- Lenders will be less willing to finance without alternative risk mitigation strategies
To Think of it Another Way

• The “risk environment” of the industry and participants in the supply chain will be changed by a withdrawal of the Safety Net

• This will give rise to one of several responses by participants:
  — Accepting the new risk environment because they believe it will provide appropriately higher returns and in some cases seeking risk management strategies to manage this risk
  — Determining the new risk environment to be unacceptable for effective management and therefore seek to transfer risks to others
  — Ignoring the new environment and accepting the consequences

Areas of Investigation
Supply Chain Based Analysis Focus

1. Potential for development of risk management tools that were already inherent in the strategies of key supply chain participants
   - Technology, Precision Ag, Analytics
2. Potential for development of risk sharing/risk transfer products triggered by the new risk environment
   - Contracting Arrangements Supplier>Farmer; Farmer>Processor
   - Land Rental Arrangements
3. Potential for tools designed to allow participants to better manage the new risk environment (specifically farmers and lenders)
   - Debt Service Protection
   - Farmer Savings Accounts

Led to this Categorization

• Technology
  – Production technology/practices that have the potential to reduce productivity/efficiency losses or failures

• Contracting and Land Rental Arrangements
  – Contracting arrangements that transfer some or all of net income risk (prices, costs, or quantities) from one party to another
  – Broader use of crop-share or flexible cash rental arrangements that share land rental costs between tenants and land owners
Categorization (cont’d)

• Pricing Instruments
  – Tradable pricing instruments for a broader set of agricultural products and inputs
  – “Indirect” participation tools that enable access to futures or options markets without exposure to margin calls

• Cash Flow Assurance
  – Debt service protection insurance that makes payments to service debt if cash income is unavailable to make a payment
  – Farmer savings accounts that allow the producer to accumulate a liquid pool of funds to access in periods of financial stress

Analysis Scope

• Emphasize the nexus of increased risk noted above and the prospects of a reduced public safety net
• Focus is the emergence of innovations in the private sector to mitigate/manage risk
• Crop insurance is not part of the analysis
• Understanding the impact at the firm level as well as the sector level
Analysis Approach

- Identify innovations
- Describe/design the alternatives
- Assess impacts/usefulness/applicability
  - Qualitatively and quantitatively
- Ground-truthing with industry stakeholders
  - Interviews
  - Forums (AAPEX and Chicago)
- Illustrate usefulness/applicability with farms
- Draw key insights/conclusions
- Identify next steps

Interviews – Summary Statistics

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<tr>
<th>Institution</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Management Company</td>
<td>4</td>
</tr>
<tr>
<td>University</td>
<td>5</td>
</tr>
<tr>
<td>Producer</td>
<td>9</td>
</tr>
<tr>
<td>Lending/Financial Services ¹</td>
<td>13</td>
</tr>
<tr>
<td>Agribusiness ²</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
</tr>
</tbody>
</table>

¹ Includes Farm Credit, PNC Bank, Wells Fargo, Rabo AgriFinance
² Includes John Deere, Monsanto, CF Industries, Pioneer, Cargill, CGB
Industry Reaction

- Input suppliers suggest the safety net restricts innovation in risk management products.
- Safety net changes will have disproportional impact (Midwest corn farmer vs. Southern rice farmer).
- Most producers not concerned about eliminating direct payments.
  More concerned about potential changes to crop insurance.
- Lenders find it hard to think about a future that doesn’t include subsidized crop insurance or a government safety net.

Example Farms – An Introduction
Example Farms

- Corn/soybean farm in Illinois
- Dryland wheat and cow/calf operation in South Dakota
- Hog farm in Iowa
- Corn, Soybean and Cotton farm in North Carolina
- Dairy farm in Wisconsin
- Processing vegetable farm in New York

USDA ERS Farm Typologies

<table>
<thead>
<tr>
<th>Farm Type</th>
<th>Typology (Gross Cash Farm Income)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retirement farms</td>
<td>Less than $350,000</td>
</tr>
<tr>
<td>Off-farm occupation farms</td>
<td>Less than $350,000</td>
</tr>
<tr>
<td>Low-sales farming occupation</td>
<td>Less than $150,000</td>
</tr>
<tr>
<td>Moderate-sales farming occupation</td>
<td>$150,000 - $349,999</td>
</tr>
<tr>
<td>Midsize family farm</td>
<td>$350,000 - $999,999</td>
</tr>
<tr>
<td>Large family farm</td>
<td>$1,000,000 - $4,999,999</td>
</tr>
<tr>
<td>Very large family farm</td>
<td>$5,000,000 or more</td>
</tr>
</tbody>
</table>
# USDA ERS Farm Typologies

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $10,000</td>
<td>59.6%</td>
<td>1.4%</td>
</tr>
<tr>
<td>$10,000 to $99,999</td>
<td>23.4%</td>
<td>6.8%</td>
</tr>
<tr>
<td>$100,000 to $249,999</td>
<td>6.7%</td>
<td>8.4%</td>
</tr>
<tr>
<td>$250,000 to $499,999 (Midsize family farm)</td>
<td>4.5%</td>
<td>12.8%</td>
</tr>
<tr>
<td>$500,000 to $999,999 (Midsize family farm)</td>
<td>3.5%</td>
<td>19.0%</td>
</tr>
<tr>
<td>$1,000,000 to $4,999,999 (Large family farm)</td>
<td>2.0%</td>
<td>31.6%</td>
</tr>
<tr>
<td>$5,000,000 or more (Very large family farm)</td>
<td>0.2%</td>
<td>20%</td>
</tr>
</tbody>
</table>

About 10% of farms are Midsize family farms or larger, accounting for about 83% of production.

<table>
<thead>
<tr>
<th>Corn/Soybean farm Illinois</th>
<th>Dryland wheat cow/calf operator South Dakota</th>
<th>Hog farm Iowa</th>
<th>Corn, Soybean and Cotton Farmer North Carolina</th>
<th>Dairy Farm Wisconsin</th>
<th>Vegetable grower New York</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 600 Acres</td>
<td>• 4,000 acres (2/4) fellow and 400 cows</td>
<td>• 1,500 acres and 300 cow breeding herd (6,000 market hogs/year)</td>
<td>• 2,500 acres</td>
<td>• 300 cows</td>
<td>• 500 acres (400 processing snap beans and 100 green peas)</td>
</tr>
<tr>
<td>• Gross Revenues: $665,000</td>
<td>• Gross revenues: $1,375,000</td>
<td>• Gross revenues: $1,700,000</td>
<td>• Milk Sales: $3,200,000</td>
<td>• Milk Sales: $495,000</td>
<td>• Seed, pesticides and harvesting activities paid for by processor</td>
</tr>
<tr>
<td>• 2013 fixed assets: $193,000</td>
<td>• 25% cash rent, cows remaining land</td>
<td>• 25% cash rent, 75% stock</td>
<td>• Fertilizer/seed partnership (50/50)</td>
<td>• 50% owned</td>
<td>• Vegetables sold to processor under contract</td>
</tr>
<tr>
<td>• 30% debt/asset ratio</td>
<td>• 20% debt/asset ratio</td>
<td>• 50% debt/asset ratio</td>
<td>• Son owns 500 acres, sells corn and feed to dairies</td>
<td>• 40% debt/asset ratio</td>
<td>• 45% debt/asset ratio</td>
</tr>
<tr>
<td>• Crop share lease</td>
<td>• Crop Insurance user: 40% coverage (revenue protection)</td>
<td>• Cotton marketed to gin, other commodities sold in the cash market</td>
<td>• Son purchases crop insurance: 75% coverage (revenue protection)</td>
<td>• Cotton marketed to gin, other commodities sold in the cash market</td>
<td></td>
</tr>
<tr>
<td>• Crop insurance user: 85% cover</td>
<td>• Not sophisticated marketer, wheat sold in</td>
<td>• Cotton marketed to gin,</td>
<td>• Has adopted variable rate</td>
<td>• Cotton marketed to gin, other commodities sold in the cash market</td>
<td></td>
</tr>
<tr>
<td>• Has auto steer equipment and</td>
<td>the cash market and calves sold with forward cash</td>
<td>other commodities sold in</td>
<td>rate applications</td>
<td>• Has adopted variable rate</td>
<td></td>
</tr>
<tr>
<td>• and yield monitors but not</td>
<td>pricing</td>
<td>the cash market</td>
<td>• Purchase inputs through</td>
<td>rate applications</td>
<td></td>
</tr>
<tr>
<td>• a heavy user of technology</td>
<td>• Inputs purchased from local coop</td>
<td>• Purchase inputs through</td>
<td>local dealer</td>
<td>• Purchase inputs through</td>
<td></td>
</tr>
<tr>
<td>• because of cost</td>
<td>• No till practices</td>
<td>local dealer</td>
<td>• 2 employees</td>
<td>local dealer</td>
<td></td>
</tr>
<tr>
<td>• Uses biotech seed</td>
<td>• Guidance system and yield</td>
<td>• 1 full time employee,</td>
<td>• Direct payments: $80,000</td>
<td>• Direct payments: $80,000</td>
<td></td>
</tr>
<tr>
<td>• Doesn’t market grain using</td>
<td>monitors, not heavy technology user</td>
<td>seasonal part time</td>
<td>payment limit</td>
<td>payment limit</td>
<td></td>
</tr>
<tr>
<td>• futures/options, sells to</td>
<td>• bringing son back to farm</td>
<td>employees</td>
<td>• MLC price support program</td>
<td>• No Direct Payments</td>
<td></td>
</tr>
<tr>
<td>• local elevator</td>
<td>• 1 employee</td>
<td>• Direct payments and C&amp;I</td>
<td>payments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Buys inputs from local coop</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Plans to buy out siblings at</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• some point in the future</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• No employee</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Has employees</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Spouse has full time job</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• off-farm</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Direct payments: $40,000</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• payment limitation</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• payment limitation</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• payment limitation</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• payment limitation</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• payment limitation</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• payment limitation</td>
<td>• Direct payments and C&amp;I payments: $80,000</td>
<td>• Direct payments and C&amp;I</td>
<td>• Direct payments and C&amp;I</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Risk Management Categories

- Technology (Manage)
- Contracting and Land Rental Arrangements (Transfer)
- Pricing Instruments (Manage)
- Income/Cash Flow Assurance (Transfer/Manage)
Technology

- Biology, engineering and management have transformed production agriculture
- Additional advances are likely -- those that “change the way farming is done” likely to have most profound effects on risk management
- Still at early stages with respect to potential advances associated with genetics and information and communications technology
Technology

Biotechnology

Information and communication technologies
  – Predicting events
  – Process control technology

Precision production practices

Performance guarantees

Biotechnology

Biology and effective application have had profound effects on crop and livestock production

Integrated disciplinary advances to fuel application
  – Genetics & Breeding
  – Nutrition
  – Health
Biotechnology

- Biotechnology focused on traits fueled efficiency growth in last 20 years
  - Non-normal nature of yields and practice timing
- Future advances
  - Identifying traits which reduce variability
  - Applied knowledge of genetics with specific field characteristics
  - Advances in agronomic practices

Information and Communication Technology (ICT)

Application of knowledge and information
Traditionally - tacit knowledge tied to the individual experience
ICT revolution of last 25 years provided access to explicit forms of knowledge
Explicit knowledge from ICT application needed to fulfill promise offered by genetics
Precision Production Practices

Introduced in 1990s with breakthroughs in sensors, automated controls and GPS

Initial focus on more precise input application
  – Reducing costs
  – Increase yields
  – Illustration shows effective alignment of application and need

Still a mismatch between the capability to identify need and the ability to apply inputs and measure output

Technology

• Biotechnology (stress tolerant seed/genetics)
• Information and communication technologies (ICT)
  – Integrating public and private data into decision process
  – Real time monitoring and measuring
  – Process control technology in livestock production, irrigation, and green houses
• Precision production and nutrient management practices
Technology

- Communication and analytic technologies continue to advance
  - Geographic dispersion of crop agriculture
  - Expanding scale of individual farm operations
- Information Communication Technology (ICT) advances
  - Machine and equipment devices and telematics
  - Auto steer guidance systems
  - More effective deployment of equipment assets given shifting weather and production settings

Technology

- Combined with information analytics (big data) these capabilities offer the potential to integrate:

  Genetics | Production | Transformation | Consumers

- Potential exists for evidence-based implementation and compliance with agricultural policy
Technology

- What are the implications of reducing or eliminating the safety net?
  - Elimination of the safety net will have little significant impact on development of additional tools
- Developments have had significant risk mitigation impact in the last 15 years in reducing production variation
- Developments currently underway will continue this trend
- This trend will continue regardless of change in policy

Optimizing Agronomic Decision Making

The next level is integration and the elevation of agronomic decision making.
Contracting and Land Rental

Contracting

In any supply chain, relationships between firms at each level of the chain:
• Are affected by their economic strengths and weakness
• Reflect their relative ability to accept risk as well as many other factors
• Evolve as circumstances change
Contracting

- Cooperatives a traditional response to the “hold-up” problem
  - Perishable crops and dairy vulnerable if output markets unavailable
  - Producers concerned about the availability and price of key inputs have instituted formal cooperatives (or more informal buying groups) to reduce costs and be more assured of supply
  - The Farm Credit System in capital markets

Contracting

- Fruit and vegetable producers historically operated without federal safety net
- Marketing cooperatives more common
- Other means of facilitating supply chain relationships
  - Negotiated prices (growers / processors)
  - Grower/shippers who procure from other growers
  - Contracts that act more like supply arrangements (don’t hold if extremes happen)
- Increased use of contracts in pork production
- “Barter” contracts in Brazil (fertilizer priced in bags of seed)
Contracting

- With reduced safety net, risk sharing capability could significantly drive contracting and vertical integration
- Would lead to more integrative vertical relationships
- Specific type of organizational arrangements will take several forms to share risk and reward

Land Rental Arrangements

<table>
<thead>
<tr>
<th>Acres Operated by Tenure in 2010, %</th>
<th>IL</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owned</td>
<td>41%</td>
<td>57%</td>
</tr>
<tr>
<td>Fixed cash rent agreement</td>
<td>35.5%</td>
<td>30%</td>
</tr>
<tr>
<td>Flexible cash rent agreement (est.)</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Share of crop or livestock production</td>
<td>18%</td>
<td>7%</td>
</tr>
<tr>
<td>For free</td>
<td>0.5%</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Assuming 12% of cash leases are flexible not fixed cash leases
Land Rental Arrangements

Issues
- Increasing use of cash rental arrangements
- Increasing cash rents $/acre
- Increased price volatility (inputs and outputs)
- Increasing burden of risk on the operator
- Managing downside risk

Influencers
- Risk preferences
- Operator and Land owner relationship
- Negotiation/Monitoring costs
- Land owner attributes

---

Land Rental Arrangements

<table>
<thead>
<tr>
<th>Cash Rent Lease</th>
<th>Crop-Share Lease</th>
<th>Flexible Cash Lease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed rent per acre</td>
<td>Operator and landlord share input costs</td>
<td>Hybrid of Cash Rent and Crop-Share Leases</td>
</tr>
<tr>
<td>Operator pays all production costs</td>
<td>Operator provides labor</td>
<td>Operator pays the landlord a base payment per acre plus a flex payment (based on yield and prices)</td>
</tr>
<tr>
<td>Operator receives government payments</td>
<td>Proceeds divided according to the lease agreement (25/75, 50/50)</td>
<td>Risk is transferred from operator to landlord</td>
</tr>
<tr>
<td>Operator carries price, yield, and input cost risk</td>
<td>Risk is shared</td>
<td></td>
</tr>
</tbody>
</table>

Source: USDA, National Agricultural Statistics Service
Flexible Cash Leases

Flexible (Flex) Lease Options

1. Base rent plus flex payment
2. % of gross revenue

- Base rent is % of market cash rent or average cash rent in the area
- Flex payment is typically a % of profit (Revenue – Costs)
- Flex leases based on percentage of gross revenue typically 30-40%
- Some arrangements include a maximum on total rent

Fred Farmer-A Case Study

- Cash Rent
  - Average Market Cash Rent: $300/acre
  - Base Cash Rent for Flex Payment: $275/acre
- Yields
  - Corn: 187 bu/acre
  - Soybeans: 54 bu/acre
- Prices
  - “High”
    - Corn - $6.22
    - Soybeans - $13.00
  - Long-run Average
    - Corn - $4.50
    - Soybeans - $12.50
Simulations

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Land Owner Income (Cash rent), $/acre</th>
<th>Probability of Tenant paying equal to or above Market Rent ($300/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flex Cash Lease* (“High” prices)</td>
<td>$351.41</td>
<td>96%</td>
</tr>
<tr>
<td>Flex Cash Lease (Long-run average prices)</td>
<td>$290.53</td>
<td>26%</td>
</tr>
<tr>
<td>Fixed Cash Rent</td>
<td>$300.00</td>
<td>100%</td>
</tr>
</tbody>
</table>

In a “high” price environment, there is 4% chance the tenant will pay below the market rent of $300/acre.

Using long-run average prices, there is a 74% chance the tenant will pay below the market rent of $300/acre.

*Flex cash lease is the Base +30% Profit flex payment

Flexible Cash Lease Results

Flexible cash leases are successful in transferring risk.

In good years (“high” prices)
  – Landowner rewarded with higher rents (a flex payment above base rent)
  – Tenant pays over the market rent

In average year (long-run average prices)
  – Landowner gets below the market rent
  – Tenant is protected from paying high market rents
Flexible Cash Leases-Risk Mitigation

- Risk transfer (tenant to land owner)
- Common transition from crop share to cash rent
- Most common in the Midwest as cash rents have increased amid a more competitive rental market
- Approx. 25% of operators have some form of flexible cash lease
- More common if farm management company negotiates
- Less common if direct negotiation

Land Rental Arrangements

- Flexible cash leases are successful in shifting risk from the tenant to landlord
- Flexible cash leases reduce the chances of losing land to aggressive rent bidder
- Expect modest growth in use
  - Slower growth if cash rental market becomes less aggressive
  - Slower growth if prices/incomes less volatile
- Increased use as an alternative/transition from share to cash rents
- Depending upon the structure, high prices could mean high flex payments if total rent is not capped at a maximum
Pricing Instruments – Analysis Scope

• Traditional tools for managing commodity price risk (futures, options, forwards)
• Emerging “indirect” tools offering access to more sophisticated price management tools coupled with delivery commitment
• Tools for managing input cost price risk
• Tools for managing margins
Volatility

- For grain operations, volatility has been significantly truncated to the downside by the availability of revenue-protection crop insurance products.
- Nonetheless, the result is much wider distributions in profit per acre among similar crop operations based on their price and cost risk management practices – the management of MARGIN.
- In a world without the safety net (specifically revenue-based crop insurance) the ability to effectively manage margin risk will become extremely important for producers.

Utilization (Pricing Output)

Despite extensive education efforts over the last 30 years (Extension, RMA), there has been limited increase in producers’ utilization of more sophisticated pricing risk management tools:

- Where there has been movement, it has been primarily with larger operations.
- Evidence that producers perceive these tools to be more associated with maximizing price rather than reducing risk.
- Perception that more sophisticated tools are too expensive (associated with producers’ tendency to have price expectations higher than the market’s and volatility expectations lower than the market’s).
Utilization (Pricing Output)

More sophisticated price management tools have come almost exclusively from the buyers of product (grain firms, coops)

- Hedge to Arrive (HTA)
- Min/Max Contracts
- Average Pricing Contracts
- Managed Pricing Contracts

Common characteristics

- Delivery commitment (therefore difficult to price “expected” production)
- Provide indirect access to futures and options, but without direct obligation for margin calls (actual contract wording may be different)
- Priced on a per bushel basis, so cost is easy to understand

While no comprehensive data is available, we believe that utilization of these types of contracts has grown significantly in the last 3-5 years

Price Management of Input Prices

Think of expenses in four categories:

- Commodity-related (e.g., feed, fuel)
- Supply chain-related (e.g., fertilizer, seed)
- Macroeconomic-related (e.g., labor, repairs, etc.)
- Rent (similar to supply chain related expenses, but unique in the potential long-term nature of certain leases arrangements).

During a given production year, only commodity-related expenses are volatile, once prepaids such as fertilizer are purchased.
Price Management of Input Prices

For livestock operations, 40-60% of expenses may be commodity-related and hence highly volatile (but pricing tools are available).

For crop operations, a much smaller % of expenses are commodity-related, or if they are, have very limited price management alternatives (e.g., fertilizer, chemicals).

Tools for Margin Management

Small, but growing number of suppliers utilizing fertilizer/corn price relationship to encourage dual commitments to lock margin

- This has to be done with two or more separate contracting decisions
- Does have the impact of at least a partial margin lock
- Delivery and purchase commitment required

Larger players experimenting with “index” contracts

- Producer can lock the relationship between commodity and fertilizer (with delivery/purchase commitment)
- Can price either “leg” at any time – price is set based on the original price relationship with the other product
Other Developments

New futures/options contracts
- Most have failed, primarily because of lack of sufficient volume
- Exchanges appear to have limited interest in additional ag-related contracts

Dodd-Frank (who would have thought)
- Intent to regulate swaps (focus on interest rates, credit default)
-Regs continue to be written/clarified
  - The contracts will have to be margined (at dramatically higher levels than exchange traded contracts)
  - Will require significant capital reserves
- Impact on ag sector not totally clear, but:
  - Likely to have significant impact on input side, especially fertilizer
  - Could choke interest in developing margin management tools

Implications of Safety Net Reduction

Managing prices paid and received is at the core of risk management perception and evaluation for many ag lenders
- Increased pressure from lenders to demonstrate the ability to effectively manage margins in the business, or credit access will be more difficult

Likely to accelerate development of additional indirect pricing instruments for both inputs and outputs
- More difficult to do this in areas without developed merchandising systems (southeast, for example) or specialty crops
- Adoption will continue to be the challenge, but pressure will be higher

Limited likelihood of additional exchange-traded contracts
Cash Shortfall Coverage Strategies

1. Unused or increased operating line of credit
2. Deferral of principal and/or interest payment
3. Refinance/restructure loan
4. Debt service insurance
   - Mutual/self-funded
   - Third party insurer
5. Savings accounts
   - Private/individual
   - Government incented
   - FCS funds held
Income/Cash Flow Assurance Programs

1. Debt Service Protection (DSP)
2. Farmer Savings Accounts (FSA)
3. Other
   – Surplus Funds/Cash Accounts (Funds Held i.e. FCS)
   – Self Insurance (replacement for federally funded crop insurance)

Debt Service Protection

Covers loan payments when income falls below a trigger level

Different from mortgage guarantee insurance
   – DSP allows the loan to remain “current”
   – DSP protects the borrower from default
   – Mortgage insurance compensates the lender for losses due to default
Features

Buffers borrower and lender from cash shortfalls in servicing principal and interest payments
Loan payments made by program if borrower unable to do so
The loan is not declared in default (commitments of both borrower and lender remain in place)
Lender initiates/certifies claim

Funding/Fees

Pool loans for protection and insure with an insurance provider
  – Fees charged for program administration and servicing as well as for cost of reinsurance
Public sector subsidy implemented through sharing the reinsurance cost
Specific Design Parameters

1. What are the insurable events that will trigger an indemnity?
   – Production shortfall
   – Low product prices
   – Natural disasters (fire, weather, etc.)
2. How are claims validated?
   – Documentation of event and shortfall
   – Specific lender certification
3. What pooling arrangements would diversify the risk of default and lower the cost of insurance/reinsurance?
4. What fee/price would need to be paid for a DSP feature of a loan?
   – Limit on indemnity
   – Deductible
   – Co-insurance
   – Collateral/security interest

Farmer Savings Accounts – Government Incented

Similar to private savings accounts

Save funds during high-income years to have a safety net in place for low-income years

Two important differences between private savings accounts and FSAs

   – Government incentivizes farmers to save in FSAs (tax incentives, matching deposits, or interest rate bonuses)
   – Possible government restrictions (maximum annual deposit, maximum balance, when withdrawals can be made)
Australia and Canada Experience

Larger, wealthier farmers utilized the program the most and have received most of the benefits

– Australia: farms with accounts tended to be larger, more profitable, and more liquid even without considering the accounts

– Canada: farms with revenues in excess of $100,000 received 80% of the program benefits, even though they only account for 31% of all farms

Farmer Savings Accounts

FSAs and private savings accounts may be close substitutes

– “New” savings may not occur since the funds farmers deposit in FSA accounts might otherwise be deposited in private savings accounts

Farmers may not be able to save enough to effectively self-insure

– An issue in consecutive poor years or in the program’s early years before farmers have saved adequate balances
## Impact Analysis

<table>
<thead>
<tr>
<th>Technology</th>
<th>Corn/Soybean farm Illinois</th>
<th>Dryland wheat cow/calf operator South Dakota</th>
<th>Hog farm Iowa</th>
<th>Corn, Soybean and Cotton Farmer North Carolina</th>
<th>Dairy Farm Wisconsin</th>
<th>Vegetable grower New York</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracting and Land Rental</td>
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<td></td>
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<tr>
<td>Pricing Instruments</td>
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<td></td>
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<tr>
<td>Cash Flow Assurance (DSP, FSA)</td>
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</tbody>
</table>
Insights and Conclusions

Removing the Safety Net (Industry)

• Will have disproportional impact by crop, geography and size

• Will result in a period of re-adjustment
  – Growing operations may have to hold off on expansion plans until environment stabilizes
  – Small farms that rely primarily on farm income will be vulnerable
  – Higher leveraged, faster growing farms will be more vulnerable

• Capital providers will increase their focus on risk management practices of all types
Removing the Safety Net (Firm Level)

- Revenue less predictable and more volatile
- Risk mitigation will become more important in technology adoption, but productivity/income enhancements will still be the prime drivers
- More coordination/contracts in the supply chain to share/transfer risk
- Increased risk may cause land values and cash rent to decrease
- Credit cost will increase and availability restricted (lenders will be more selective)
- More risk capital (equity) will be needed (without crop insurance, downside risk no longer truncated)

Private sector initiatives

- Product offerings
  - Who will offer, at what price and to what production group?
- Producer adoption
  - Who will adopt and how rapidly will they do so?
### Change in Risk Environment

<table>
<thead>
<tr>
<th>Technology</th>
<th>Currently</th>
<th>Small</th>
<th>Large</th>
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</thead>
<tbody>
<tr>
<td>Adoption</td>
<td>Increasing</td>
<td></td>
<td></td>
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<tr>
<td>Offerings</td>
<td>Increasing</td>
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</tr>
</tbody>
</table>

- Currently, the adoption of technology and number of product offerings is increasing
- Changes to the risk environment (small or large) will have little impact in the rate of adoption or number of product offerings

### Change in Risk Environment

<table>
<thead>
<tr>
<th>Contracting</th>
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<th>Large</th>
</tr>
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<tbody>
<tr>
<td>Adoption</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offerings</td>
<td>Low</td>
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</tbody>
</table>

- Currently, the adoption of contracting and number of product offerings is low for safety net crops
- A small change in the risk environment will have little impact in the rate of adoption and number of product offerings
- A large change in the risk environment will result in an increase in the rate of adoption of contracting and an increase in the number of product offerings
Currently, the rate of adoption of pricing instruments is increasing but from a low adoption base.

From a small to large change in the risk environment, there is a slight increase in the number of offerings – not many more instruments available.

A large change in the risk environment will result in an increase in the rate of adoption of pricing instruments.

Currently, there are no debt service products offered.

As the risk environment changes, the rate of adoption and the number of product offerings has the potential to increase.
Impediments/Incentives to Offerings/Adoption

With a reduced safety net:

• Technology
  – Adoption: little impact, technology will continue to develop
  – Offerings: little impact, technology will continue to develop

• Contracting
  – Adoption: will be a significant time lag; significant incentives/change in behavior at the farm level – maybe a crisis response
  – Offerings: buyers will offer if willingness to participate

• Pricing Instruments
  – Adoption: modest increase, farmers could move forward with more education
  – Offerings: products will need to be marketed; will offer if willingness to use

• Debt Service Protection
  – Adoption: research needed on willingness to pay
  – Offerings: research needed on feasibility/insurability
About AGree

AGree seeks to drive positive change in the food and agriculture system by connecting and challenging leaders from diverse communities to catalyze action and elevate food and agriculture policy as a national priority. AGree also recognizes the interconnected nature of agriculture policy globally and seeks to break down barriers and work across issue areas.

AGree is a collaborative initiative of nine of the world’s leading foundations, including the Ford Foundation, Bill & Melinda Gates Foundation, The David and Lucile Packard Foundation, W.K. Kellogg Foundation, The McKnight Foundation, Robert Wood Johnson Foundation, Rockefeller Foundation, Surdna Foundation, and The Walton Family Foundation, and will be a major force for comprehensive and lasting change.

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