AN ECONOMIC ANALYSIS OF U.S. FARM PROGRAMS INCLUDING SENATE AND HOUSE FARM BILLS ON REPRESENTATIVE FARMS

A Dissertation

by

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ABSTRACT

Agricultural policy continues to play a large role in risk reduction for agricultural producers in the United States. However, current budget deficits and growing national debt has many policy makers looking for ways to change the farm safety net. The interactions of current and new policy tools including crop insurance and representative farms were examined in a simulation model for four representative farms. Various outcomes were examined with attention primarily focused on (1) magnitude and frequency of farm program payments, (2) government costs and farmer return on insurance premiums paid, (3) coefficient of variation of farm revenue and probability of negative ending cash, and (4) Stochastic Efficiency with Respect to a Function (SERF) analysis.

Results indicated that Supplemental Coverage Option (SCO) and Stacked Income Protection Plan (STAX) programs provide high farmer returns and positive mean payments. However, SCO, STAX, and crop insurance provided lower levels of protection when both the base and harvest price decline by the same amount. Overall, the House farm bill was preferred by all four farms for every scenario. Additionally, the results for Alternative 4, which examined different insurance coverage levels, showed that it was possible for a representative farm to lower its insurance coverage and improve its financial position. The results indicate how farm programs cover various types of potential losses faced by producer which makes the results meaningful to both producers and policy makers alike.

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CHAPTER I

INTRODUCTION

Although there were certainly influential pieces of legislation passed earlier in United States history, much of the present farm policy was developed in the 1930s as part of the government's response to the Great Depression (Little et al. 1987). Action taken to bolster the agriculture sector of the economy was important since a much greater percentage of the United States' workforce, 21.5%, was involved in production agriculture at that time (Bowers, Rasmussen and Baker 1984), and rural incomes were 40% of urban incomes (Cain and Lovejoy 2004).

The rationale for government's involvement in production agriculture in the United States has changed considerably since the 1930s, as the structure and size of farms has evolved. Technological changes have been at the heart of farms becoming larger and more mechanized. The average farm size has increased from 146 acres in 1900 to 441 acres in 2000. During the same time period, the number of farms has decreased from 5.7 million to 2.1 million (Economic Report of the President 2006). Likewise, the farm programs used to implement evolving policy objectives have also changed. Most of these changes occurred incrementally with the passing of new farm policy legislation (farm bills) usually every four to six years.

All farm bills have their roots in the *Agricultural Adjustment Act of 1933* (Rasmussen 1983). During the 1930s, per capita farm household income was one-third of non-farm per capita income (Economic Report of the President 2006). The 1933 Act was implemented to raise farm income and decrease variability in year-to-year income due to volatile commodity prices (figure 1). These two policy goals, among many others, are still in place today even as the tools to address these goals have constantly evolved. Modern agricultural programs are still designed as a safety net to protect farmers from volatile production and prices. These programs have traditionally focused on providing either a price floor or supplemental income in times of low commodity prices.

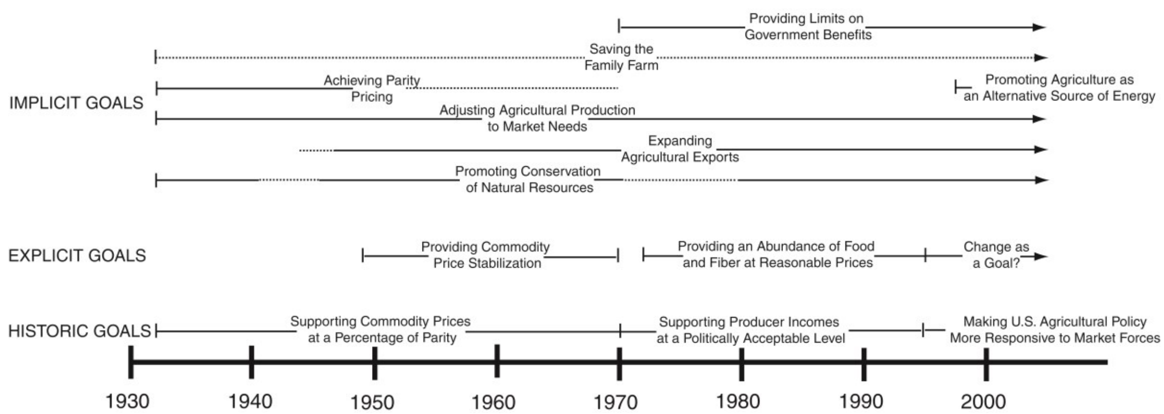

Figure 1. Agricultural policy goals: 1933-present.
Source: Doering and Outlaw, 2006.

Two policy tools first instituted in 1938 and 1973, respectively – a loan rate mechanism that protects commodity prices, and a target price system to raise farm income, are the tools that provide the support. In the 1990s, direct payments were instituted to add stability to farm incomes by providing a steady source of revenue (Outlaw et al. 2008). More recently, policy makers have considered insurance and revenue guarantee type programs as a means to provide a stronger safety net (Coble and Miller 2006).

The most recent agricultural legislation passed into law, the 2008 farm bill, retained the historical structure of the 2002 farm bill and includes loan rates, target prices, and direct payments. Also, two new policy tools were added to enhance the producer safety net. These significant changes to the safety net are the revenue guarantee program named Average Crop Revenue Election (ACRE) and the new permanent disaster program named Supplement Revenue Assistance (SURE). ACRE was designed to guarantee a level of revenue on a crop-by-crop basis. SURE was designed to be used with crop insurance and was generally considered to alleviate the need for ad hoc assistance in addition to existing safety net support. Both of these programs work much like revenue insurance products, but are meant to address different parts of the farm safety net. However, questions of potential redundancies (Coble and Dismukes 2008) and moral hazard behaviors (Smith and Watts 2009) have been raised. In other words, there may be situations where two or more policies overlap, leading to opportunities for producers to take undue advantage of the programs.

While neither ACRE nor SURE proved to be particularly popular, these programs signaled a shift in policy toward revenue-based programs as the main components of the noninsurance portion of the farm safety net. This trend of revenue coverage programs continued with the 2012 farm bill proposals from both the Senate and House. Both chambers of Congress include a revenue program as part of their legislation. While there currently is not a new farm bill, the trend appears to be toward insurance and revenue type programs being the main components of the farm safety net.

While it can be argued that recent agricultural programs have been successful in reducing producer's price and income risk, this has not come without a monetary cost. The United States' debt which stood at $11.8 trillion dollars at the end of fiscal year 2009 (United States Government Accountability Office 2010) and the projected annual budget deficits of over half a trillion dollars a year (Congressional Budget Office 2010), have many concerned about government spending. Thus, legislators are trying to reduce expenditures where they can, by not only reducing funding of farm programs, but also means testing of income and use of payment limits. If cuts are envisioned to the agricultural safety net, it would be helpful for decision makers to know which programs are most effective reducing farm income declines and if a set of programs addressed the same risks and/or if there is unneeded overlap. Therefore, redundant programs could be eliminated with minimal effect to the farm program safety net. The need for research in the area of farm program interaction, effectiveness, and necessity has been raised since the 2008 farm bill was passed (Harwood 2009).

Agricultural economists have long studied the effects of policies, the policy tools used to implement them and their impacts on various stakeholders. As with most policy tools, academemians have widely studied the new programs to find their effects on many different types of stakeholders. Many farm programs are analyzed as stand alone or in conjunction with crop insurance. Some have studied replacing current farm programs with revenue guarantee type programs, but no one has attempted to analyze the entire group of farm programs at one time including crop insurance.

Objectives of this Research

Alternative scenarios involving different combinations of government programs and varying levels and types of insurance result in different outcomes for individual farms will be analyzed. The benefits of the proposed 2012 farm bill from both the House and Senate will be examined in a simulation model. The objectives of this study are as follows:

- Quantify the economic outcomes for representative farms of alternative scenario combination of policy tools and insurance. Specific outcomes investigated include:
    - Average revenue for each representative farm
        - Proposed legislation will allow producers to make many decisions about what farm program in which to participate. These decisions could have meaningful effects on what is the optimal level and type of insurance that a producer should choose.
    - Relative reductions in risk for different mix of farm programs
        - One of the main reasons cited for the need of farm programs is reducing the volatility in revenues and income faced by producers. Obviously, farm programs and crop insurance is aimed at achieving this goal. However, which

combination works best to optimally reduce risk will be examined. Farms in different parts of the country growing different commodities may show that it will take many combinations of farm programs and insurance products to best meet the needs of the different risks faced across the country.

- Government cost
    - Budgetary concerns have policy makers searching for areas to reduce federal spending. Government costs will be reported for all farm programs evaluated under all alternatives analyzed.

CHAPTER II

LITERATURE REVIEW

The literature on farm programs goes back many years and covers a wide variety of sub topics. Flinchbaugh and Knutson (2004) organized farm programs into three eras; price support (1930s to 1960s), income support (1970s to 1995), and market-oriented (1996 to present). Although research has been conducted on farm programs and crop insurance in each of these eras, the last era is most relevant for this study. In particular, research that was done subsequent to legislation passed in 1996, 2002, and 2008 will be of specific interest.

History and Justification of Farm Programs

Several studies have looked at the justification for farm programs, their efficiency, and risk reducing ability. These studies are important since one of the key justifications of farm programs has been their ability to help stabilize farm incomes. Tweeten (1983) investigated what contributes to the instability in agriculture. He used United States Department of Agriculture data to investigate if variables such as farm programs added to the variance in farm incomes at the sector level. Tweeten reported that government payments helped to stabilize farm incomes and also concluded that a broad list of variables affect farm income, such as: trade, monetary, and fiscal policies should be considered when evaluating the instability in farm income at the sector level. In 1990, Turvey and Baker studied farm level decision making with regards to futures hedging. One of their findings is that farmers view farm programs as a substitute for hedging. This reinforces the idea that farm programs are effective at reducing risk in farm incomes. More recently, Moledina, Roe, and Shane (2004) suggested that the volatility faced by farmers is overstated and should not be used as a justification of farm programs, but not that programs didn't reduce risk. A stochastic simulation model using representative farms was used by Taylor and Koo (2006) to find which of the 2002 farm bill programs, including crop insurance, were of most importance to South Dakota producers based on average net farm income and variation in this measure. Antón and Giner (2005) used Monte-Carlo simulation and determined that in Europe, government policy interactions matter greatly when mixed with private risk reducing mechanisms such as insurance or hedging practices in finding the optimal trade-off between risk reduction and farmers' welfare. Pope and Keeney (2008) analyzed the efficiency of different farm program payments and how equitably they are distributed between large and small farms.

Crop Insurance

More specific research has been done on individual parts of the agricultural safety net, including crop insurance. The *Federal Agricultural Improvement and Reform Act of 1996* allowed some farmers to choose revenue insurance policies. Revenue policies insure individual crop's revenue (combination of price and yield) and not just crop yields. These policies have grown in variation and popularity since that time with now more than 50% of the U.S. program crop acres being covered by revenue coverage (Coble and Miller 2006). Subsequent research has addressed these revenue insurance products. Mahul and Wright (2003) investigated the design of optimal revenue products. In the policy arena, studies have looked at revenue coverage compared to traditional yield coverage products. Sherrick et al. (2004) researched the factors that are important to farmers' crop insurance decisions. In particular, the analysis reports that Midwestern farmers who are highly leveraged prefer revenue insurance to yield insurance. Vedenov and Power (2008) used Monte-Carlo simulations to compare revenue insurance versus yield insurance in combination with 2002 farm bill programs finding that government payments combined with yield coverage can provide more effective risk management than revenue insurance in production areas with low yield-price correlation.

ACRE and SURE

The 2008 farm bill introduced Average Crop Revenue Election (ACRE) and Supplemental Revenue Assistance (SURE) which have revenue components in them. Subsequently, this has been a rich area of research in agricultural economics, particularly expanding the previously mentioned studies conducted on crop insurance. Coble and Barnett (2008) also studied the issues surrounding moving to a revenue triggered commodity program with different combinations of insurance programs. Their research focused on the concept of wrapping insurance (deducting any payment from the government program from the insurance indemnity) within a revenue type of program in an attempt to account for redundancies in payments. Hong, Power, and Vedenov (2009) compared yield insurance to revenue insurance under the 2002 farm bill provisions and the ACRE program. The results showed that revenue insurance was more effective than yield coverage under both sets of farm bill provisions. Other works on ACRE include Woolverton and Young's (2009) study on Factor's Influencing ACRE Program Enrollment. Zulauf and Orden (2009) investigated ACRE and its World Trade

Organization implications. Cooper (2009) studied corn data for Barnes County, North Dakota, and Logan County, Illinois, under both a low and high price scenarios. His study found that ACRE payments lower a corn producer's coefficient of variation (measure of risk) of total revenue more than price-based support, although ACRE may not raise revenue as much.

Crop insurance and SURE have also been studied (Paulson and Babcock, 2008; Goodwin and Rejesus, 2008; Anderson, Barnett, and Coble (2009). Paulson and Babcock determined that Group Risk Income Protection (GRIP), which is a revenue insurance product, administered as a farm program eliminates the need for ad hoc disaster and is cost efficient. Goodwin and Rejesus showed an inverse relationship between disaster assistance and insurance purchases. Conversely, Anderson, Barnett, and Coble (2009) reported that SURE has little impact on producers' crop insurance decisions.

Revenue

Envisioning the 2012 farm bill debate, the momentum is arguably on the side of whole-farm revenue programs. Whether it is revamping the ACRE or SURE programs or a new revenue program to take the place of the existing price related programs, clearly there will be, at the very least, discussions of moving policy toward this direction. While interest in revenue programs appears to be nearing a peak, the concept has been studied for some time. In the early 1990s, Miranda and Glauber (1991) researched using a revenue based program to reduce the need for ad hoc disaster payments. They reported that a revenue based program would decrease the need for ad hoc disaster payments and reduce government outlays. In advance of the 1996 farm bill, Gray, Richardson, and McClaskey (1995) developed a simulation model and used representative farms to investigate the current program versus two alternative revenue assurance programs. Richardson, Smith, and Knutson (2001) simulated eight representative farms to analyze three different whole-farm revenue insurance policies versus only yield coverage products. The results show that 90% whole-farm revenue coverage was preferred to the alternatives based on five quantitative measures. Additional work that used simulation and representative farms to analyze the farm level effects of revenue based programs is Higgins, et al. (2007). Higgins used twelve representative farms located in ten different states and showed that a county-based revenue program with a 95% guarantee was preferred to 2002 farm bill provisions or the administration's 2002 proposal.

More recently, Coble and Cooper, two researchers respectively at Mississippi State University and USDA's Economic Research Service, are in the forefront of research on revenue based programs. In 2006, Coble reported on the pitfalls that might arise from replacing the current price-based commodity programs with revenue-based programs. Some of the potential challenges Coble and Miller (2006) reported include: limited data for implementation, accounting issues, World Trade Organization (WTO) implications, level of protection for dollars spent, and redistribution of program benefits. Cooper (2007) showed the cost of a revenue program at a national level was lower than the current set of farm programs. In particular, the probability of high payments was lower, leading to the conclusion that a revenue-based program would have greater budget certainty. Thomas, Coble, and Miller (2007) analyzed data for cotton and corn for counties throughout the major growing regions of the United States. The results of the Thomas, Coble, and Miller (2007) study indicated that a 95% county revenue based program would be less expensive than current programs assuming the elimination of crop insurance. Cooper (2008) researched a revenue-based alternative to the current counter-cyclical payment program using a stochastic model to compare payments under the two programs. The study indicated little difference in the two programs' risk reducing ability at the farm level.

Coble and Dismukes (2008) researched a revenue program at three different levels of aggregation (county, state, and national). Their study determined that more disaggregated revenue programs would cost the government more and direct more of the payments to riskier regions. They also found that revenue programs could be more efficient in reducing risk, as measured by percentage change in the coefficient of variation, than separate price and yield programs. However, when revenue programs are combined with other programs such as current marketing loan and crop insurance instruments, the risk reducing efficiency is lost.

Simulation and Representative Farms

Tyner and Tweeten (1968) were one of the first to use simulation to appraise farm programs at the sector level. They recommended using simulation because of its flexibility and predicted its increased application in evaluating farm programs. Tyner and Tweeten were prophetic as simulation models have been popular and widely accepted analytical tools used to investigate policy programs since their work. Many of the works already cited have used variations of this methodology. These works include: Miranda and Glauber, 1991; Gray, Richardson, and McClaskey, 1995; Richardson, Smith, and Knutson, 2001; Taylor and Koo, 2006; Antón and Giner, 2005; Coble and Barnett, 2008; Vedenov and Power, 2008; Paulson and Babcock, 2008; Hong, Power, and Vedenov, 2009; Cooper, 2009; and Anderson, Barnett, and Coble, 2009.

Additionally, simulation models need something to simulate, and a well-established practice is to simulate representative farms. Plaxico and Tweeten (1963) set the standard for what makes a representative farm useful in projection work. These attributes include: a consistent series that is maintained over time, definitions and assumptions must be reasonably uniform over the country, and resource situations must be constantly reviewed and output data revisited frequently to reflect changes in technology. Most of the previous referenced works have used representative farms in some form or fashion in their simulation models. What makes a representative farm varies from work to work. Taylor and Koo (2006) aggregated data from the North Dakota Farm and Ranch Business Management Association records into different sizes and regions in their research. Vedenov and Power (2008) and Hong, Power, and Vedenov (2009) used similar methods in their use of representative farms. Both works used National Agricultural Statistic Service (NASS) county yield data along with price information from the Chicago Board of Trade (CBOT) and crop insurance data from the Risk Management Association (RMA). Implicit assumptions about farm size and crop mix were made in each paper. Similarly, Coble and Barnett (2008) used NASS county yields and state and national prices along with RMA insurance information for each county to construct representative farms for each county with enough available data for cotton, corn, soybean, and wheat. Higgins, et al. (2007) used representative farms maintained by the Agricultural & Food Policy Center (AFPC) in their research. The AFPC builds and maintains these representative farms by ongoing producer panel meetings where information is collected on farm size, crop mix, prices, yields, and costs to create whole farm financial statements.

The aforementioned research on agricultural programs using simulation and representative farms has its positives and negatives, but clearly sets a standard for the additional research. The existing literature could be expanded to include analyzing all current farm programs including ACRE, SURE, crop insurance and the latest policy proposals included in submitted legislation for the 2012 farm bill. The objective of this research is to compare all farm programs at one time or in any combination that might be deemed worthy alternatives to help identify commodity and regional differences in representative farms economic conditions. Additionally, the representative farms used in this study have been modified to include units that serve as proxies for individual fields. This is a first of its kind attempt to help capture the truer interaction of risk faced by farmers with multiple fields and how this plays out with the interaction between farm programs and insurance. Many of the before mentioned studies have investigated parts of the farm safety net; however, none of the studies have researched all of the parts working together and none have included individual units on each representative farm.

CHAPTER III

METHODOLOGY AND MODEL

The stochastic simulation model used for this dissertation was constructed using SIMETAR©, a Microsoft Excel-based simulation and econometrics add-in (Richardson, Schumann, and Feldman 2004). The model incorporates price and yield risk into the simulated outcomes by using the multivariate empirical method described by Richardson, Klose, and Gray (2000). Provisions of current farm programs, proposed farm programs, and crop insurance were modeled and evaluated for representative farms. Descriptive characteristics (e.g., acres and crops), price, and cost data were used to construct representative farms in the major production areas of the United States. Using Agricultural and Food Policy Center (AFPC) data, representative farms were constructed of varying sizes located in different regions with crop rotations common to the corresponding regions. This diversity in representative farms allowed for analysis of farm level impacts on scale, region, crop mix, and varying levels of production and price risk. The creation of complete income statements, cash flow statements and balance sheets allow for evaluation of the economic impacts of alternative farm programs.

Stochastic Simulation

As stated previously, simulation has been a popular and well accepted method for evaluating farm programs. Richardson (2008) defined a simulation model as a model that mimics or represents an actual system using mathematical equations. Stochastic simulation is a form of simulation that takes into account risk. Risk in the context of a whole farm model is defined as a decision that is beyond the producer's control and often consists of yields and output prices. A stochastic model does not give point estimates, but rather a range or probability distribution of possible outcomes. The possible outcomes of Key Output Variables (KOVs) are dependent upon the distributions of the risky input variables. This type of modeling lends itself to the calculation of outcomes for alternative scenarios; where the outcomes of the scenarios are evaluated, not only for the highest average output, but also the probability of that outcome occurring. Alternative scenarios are defined and simulated by using a range of alternative input values in the model. For the present analysis of farm programs, the risky input stochastic variables are yield and price.

Thomas, Coble, and Miller (2007) state that there are two widely known farm simulation models, the FLIPSIM model developed by Richardson and Nixon (1981) and a nonparametric bootstrapping approach used by Miller, Barnett, and Coble (2003). Both consider crop yields and prices to be stochastic and neither approach makes assumptions about the form of the underlying price and yield data. However, the bootstrapping approach used by Miller, Barnett, and Coble (2003) to overcome lack of individual producer yields, can lead to a non-continuous cumulative distribution function (CDF). The model used in this dissertation will follow the methodology used in the FLIPSIM model. Additionally, the use of AFPC representative farm data allows the use of individual producer yields, thus negating the need to use bootstrapping to simulate crop yields.

Model Development

Richardson (2008) outlines an effective manner in which to build a useful simulation model. He indicates that the model should be built from the top down. Thus, the model should start by determining the KOVs which are most important and lend themselves to the decision making process. Determining the stochastic variables and model validation are also critical steps in model formation.

Key Output Variables (KOVs)

KOVs in the model are: a) farm revenue, b) cost of government programs, and c) the net present value (NPV) of the farming enterprise. Obviously, for a farm to remain viable, it must be profitable in the long run. Net cash farm income (NCFI) is an important variable to determine if farm programs help farms remain in business during times of low prices or yields. However, this is not the only goal of farm programs. One of the often-stated goals of farm programs is to serve as a safety net and stabilize farm income. In other words, to reduce the financial risk faced by farms. As stated previously, the literature commonly uses the coefficient of variation (CV) as a measure of risk or dispersion.

$$CV = (Standard\ deviation\ /\ mean) * 100$$

Comparing CV's on an economic measure from one scenario to another is a way to determine which scenario is less risky. One of the drawbacks of the CV, is if the mean is zero the CV is undefined. Furthermore, if the CV is close to zero, small changes in the mean can have large effects on the numerical value of the CV. This can lead to misleading results. To account for this fact, calculations of CVs will only be used on farm revenue, which is the first KOV in the model and cannot be zero. Revenue in the model is the sum of crop receipts, government programs, and crop insurance indemnities. The government programs evaluated in this analysis were taken from Senate Bill 3240, *Agriculture Reform, Food and Job Act of 2012*, and from House Resolution 6083, *Federal Agriculture and Risk Management Act*. The programs include:

- Direct Payments (DP) were first enacted in the 1996 farm bill under the Agricultural and Market Transition Payments. These payments are a simple income subsidy as these payments are made regardless of price, yield, or revenue consideration. Specifically the equation used to calculate DPs is:

  *DP Rate * Base Acres * Farm Program Yields * Payment Fraction*

- Agriculture Risk Coverage (ARC) Payments were proposed by the Senate in 2012. ARC is considered a shallow loss program as it has been proposed to cover revenue losses greater than eleven percent of calculated guaranteed revenue for farms. The calculated guaranteed revenue is based on a five year moving average of yields and national prices. If any of the previous five year moving average prices are lower than the reference price, (for rice $13/hundredweight (cwt) and peanuts $530/ton only) then the reference price is used in the calculation. The Senate proposed a County and Farm level version of ARC. The results discussed in the following chapter correspond to the county level option. The equations for county level option of ARC are:

*Benchmark Revenue = 5 year National Olympic Marketing year Price * 5 year Olympic County Yield*

*Actual Revenue = Actual County Yield * Max (first 5 months marketing year price OR Loan Rate)*

*Guarantee Revenue = Benchmark Revenue * 0.89*

*Max Payment = 0.10 * Benchmark Revenue*

ARC Payment per acre = Min (Max Payment OR Guarantee Revenue) – Actual Revenue

*Final ARC Payment = ARC Payment per acre * 0.80 planted acres (not to exceed $50,000)*

Cotton is not eligible for ARC

- Price Loss Coverage (PLC) payments are very similar to the Counter Cyclical Payments created in the 2002 farm bill and are meant to cover losses caused by decreases in commodity prices. The main changes in the House proposed PLC payments are that they are paid on planted versus base acres, and the reference prices have been increased to better reflect cost of production than the target prices used in the 2002 farm bill. The reference prices and equations for PLC payments are:

Reference Prices:

Wheat: $5.50/bushel (bu)

Sorghum: $3.95/bu

Corn: $3.70/bu

Soybeans: $8.40/bu

Rice: $14.00/cwt

Peanuts: $535/ton

Equations:

Effective Price = Max (Loan Rate OR First 5 month marketing year price)

Payment Rate = Reference Price – Effective Price

*PLC Payment = Payment Rate * Counter Cyclical Yield * 0.85 planted acres (not to exceed $125,000)*

Cotton is not eligible for PLC

- Supplemental Coverage Option (SCO) payments were proposed by both the House and Senate in 2012. The two versions of the program are very similar and are meant to serve as additional coverage to a farm's crop insurance purchase. SCO works very similar to the current Group Risk Insurance Plans (GRIP) and depends on yield or revenue losses at the county level and are not specific to a farm. The subsidy level for SCO is set at the 70% level. The specific equations for SCO are:

*Total Value of crop = Max (Base OR Harvest Insurance Price) * Producer's APH yield*

*Crop Value Insured = Total Value of Crop * Insurance Yield Election Percentage*

Value of SCO = Total Value of Crop – Crop Value Insured

Deductible = 0.25 for Senate or 0.10 for House

Percent SCO Coverage = (1 – Insurance election – Deductible)/(1 – Insurance election)

*Value of SCO after deductible = Value of SCO * Percent SCO Coverage*

*Actual Revenue as percent of Expected = (Actual County yield * Insurance Harvest Price)/County Average Yield * Max (Base Insurance Price OR Harvest Insurance Price)*

Percent of SCO Coverage Paid = ((.90 House OR 0.79 for Senate) – Actual/Expected) / (.90 OR 0.79) – Insurance election percentage

*SCO Payment = Percent of SCO Coverage Paid * Value of SCO after deductible * Planted Acres*

SCO is available for cotton only if cotton does not participate in STAX.

For this analysis, cotton is assumed to only participate in STAX.

- Stacked Income Protection Plan (STAX) was proposed by both the House and Senate to be used for cotton only. Thus, cotton would be excluded from the other programs that were proposed by the House and Senate in 2012. STAX works similar to SCO, but is subsidized at the 80% level. Specific equations for STAX payments are:

*Projected area revenue = Max (Base OR Reference Price (in House only)) * 5 year Olympic average of county yields*

*Area Harvest revenue = Insurance Harvest Price * 5 year Olympic average of county yields*

Final area revenue = Max (Projected OR Harvest revenue)

*Realized area revenue = Actual County yield * Insurance Harvest Price*

Revenue Shortfall = Final reference area revenue – Realized area revenue

*Max Indemnity = Final area revenue * STAX factor (.8 thru 1.2) * (.90 – Max (.70 OR Insurance election))*

*STAX Indemnity = 0.90 – (Realized Area Revenue/Final Area Revenue) * Final Area Revenue * STAX factor * Planted Acres*

- Crop Insurance policies are evaluated for each representative farm analyzed. Each farm is simulated with the common insurance type and insured level for its area, whether it is yield or revenue, optional or enterprise unit. Enterprise unit insurance treats all fields as an aggregate; thus, a loss must be incurred across all units before indemnities are paid. Optional unit insurance treats fields individually, so indemnities are paid on a unit basis.

Each component of revenue is reported for each scenario. The revenue equation used in the model is modified to take into account producers premiums paid for crop insurance, supplemental coverage option, and STAX programs. Thus, the numbers calculated in revenue are reported as net of producer premiums paid. Gross indemnities and premium costs are also reported.

To calculate whole farm revenue and NCFI, financial statements are constructed. Income statements, cash flow, and balance sheets, are calculated for each of the representative farms. Financial statements are simulated using Generally Accepted Accounting Principles (GAAP) and contain full tax and machinery depreciation calculations and schedules.

A business may not be profitable in the short run, but turn profitable in the long run. Economic theory of the firm will be addressed later in the chapter. However, if the business cannot meet its cash obligations it will not survive. Thus, cash flow is critical to a farm's survival. To examine the risk reducing elements of the farm programs, the probability of positive annual cash flows will be examined using procedures suggested by Richardson and Mapp (1976).

Stochastic Variables

The financial statements were created by multiple equations that make up costs and revenues. Price and production make up market revenues, which are inherently risky. Government programs and crop insurance are both in place to deal with shortfalls in production, price, or the combination (revenue). Thus, prices and yields are stochastic in the model to capture when government support and crop insurance indemnities are triggered. The model uses stochastic prices in many different equations. Crop insurance futures prices, crop prices, and commodity programs all use prices that are stochastic. Therefore, the model includes many stochastic variables, but the basis for all the stochastic variables was the calculation of stochastic national prices and farmer yields.

Each stochastic variable has its own probability distribution. Using the appropriate distribution for each random variable is vital to building an accurate forecast for each stochastic variable and representative farm. However, it is not always possible to know the shape of the distribution for random variable particularly when there are too few observations to estimate parameters for a continuous distribution. The generally accepted approach is to use a non-parametric empirical distribution that allows the shape of the distribution to be defined by the data. This model specifically uses the applied approach outlined by Richardson, Klose, and Gray (2000) and used extensively in Allison (2010). This method incorporates intra- and inter-temporal correlation and allows for control of heteroscedasticity over time. Yields and prices are forecasted from historical data using this multivariate empirical distribution method. Stochastic variables are validated to ensure that the simulated variables are not statistically different from their historical data.

Model Verification and Validation

Verification is the mechanical part of testing the model. It involves checking all equations for accuracy and use of appropriate variables (Richardson 2008). All equations used in the model were checked and validated by hand for correctness and accuracy. Linkages between all equations were checked to make sure they are in the right order and include the correct variables.

Validation of the model involved making sure the model accurately forecasts the system being analyzed, results conform to theoretical expectations, and expectations of experts (Richardson 2008). All equations in the financial statements were checked deterministically to make sure they were mathematically correct. Results were checked against *a priori* expectations and reviewed by policy experts for theoretical soundness. Additionally, all simulated variables were checked and validated to make sure they replicated the correlation relationship represented by the underlying correlation matrix. To test the correlation for a multivariate probability distribution, the historical correlation matrix used to simulate the multivariate distribution is tested against the simulated variables to determine if their correlation coefficients are statistically equal using a Student's t-test.

Scenarios

Scenario analysis refers to simulating alternative strategies to calculate a unique set of KOVs associated with changes to control variables. For this research, the scenarios consist of alternative combinations of farm programs. By choosing different farm programs or combination of farm programs between scenarios, one can compare the effect of the chosen farm programs on the representative farm's economic viability. The model utilizes the SCENARIO function in SIMETAR© to program alternatives. A table of alternative combinations of farm programs was created to use in the SCENARIO function. The model evaluates 29 different scenarios representing possible policy tool combinations (described previously) for each representative farm evaluated assuming a specific set of mean baseline prices. The Senate farm bill was represented by scenario 22 with scenario 26 representing the House farm bill. The 29 scenarios are addressed in detail in Appendix A. Additionally, two separate low price alternatives and a low yield alternative were evaluated for each of the 29 scenarios. Four representative farms are evaluated in the scenario analysis for these alternatives. An insurance alternative was analyzed for TXCB8000 only. The baseline prices and all alternatives are addressed in greater detail in the assumption section.

Model Assumptions and Baseline Prices

The model has assumptions that are not included as part of the scenarios. These assumptions are necessary for the model to run and make meaningful assertions about the policy implications.

The study period for this analysis spans from 2009 to 2018. The years of history are included to calibrate each representative farm to make sure that the data collected from producers is correct and valid. Additionally, the years of history allow for calibration of the model to make sure that it accurately represents the actual conditions for each representative farm. Many of the output are reported for 2016. This year was chosen as it allows time for the proposed farm bill programs that take effect in 2013 to be fully realized.

Each representative farm starts the analysis period with twenty percent intermediate- and long-term debt. This assumption is made to eliminate the differences in financial conditions that might be caused by differing levels of beginning debt. The length of intermediate and fixed loans associated with each representative farm was established by the participating producers in the update meetings.

Planting patterns and land tenure arrangements are assumed to be fixed in the projected years. If a farm has a set planting rotation, that rotation is assumed to continue throughout the planning horizon. The amount of land owned and rented is held constant, as well as share rent percentages and cash rental rates. These assumptions help to take out the financial changes that may occur due to changes in cropping decisions from year to year.

Payment limits have become an important part of farm programs. The payment limits proposed by the Senate in 2012 were far more restrictive than what producers had seen in the previous two farm bills. Thus, payment limits for each representative farm are assumed to be binding at two limits. This means that the representative farms are assumed to have the ability to have two limits, one for the producer and one for their spouse. Additionally, the farms are assumed to not be able to collect payments beyond the two limits for any year.

Means testing has been another area of growing debate. First introduced in the 2002 farm bill, eligibility requirements required to receive farm program payments have been tied to a three year moving average of Adjusted Gross Income (AGI). These means tests have proved to only affect a small amount, only 0.6%, of operations (Qui and Goodwin, 2011) even as the maximum AGI level allowed was lowered in the 2008 farm bill. Faced with this data and the fact that there was not a consensus level set during the 2012 farm bill debate, it is assumed that AGI means testing is nonbinding. It should be noted that this area merits future research.

Baseline Prices and Alternatives

The mean annual prices 2013 – 2018 used in the stochastic simulation come from the Food and Agricultural Policy Research Institute's (FAPRI) 2012 January Baseline (Westhoff and Brown 2012). These baseline prices serve as only one potential path into the future, and a different set of baseline prices would result in different impacts of farm programs on the economic viability of the representative farms. Thus, two low price alternatives were analyzed along with the FAPRI 2012 January Baseline. The low price alternatives were constructed by decreasing all commodity prices by twenty-five percent in 2016. The first low price alternative assumed that the entire reduction in price occurred before the base insurance was set. Therefore, both the base insurance price and the harvest insurance price were subject to the twenty-five percent reduction. The second low price alternative assumed that the entire reduction in price occurred after the insurance base price was established. These two low price alternatives were created to evaluate how farm programs perform in reducing the economic risk faced by farmers.

Two non-price related alternatives were also analyzed. A low yield alternative was evaluated to show how the different farm programs mitigated a yield loss. This alternative analyzed all four of the representative farms assuming each suffered a 25% yield reduction for all crops across all units in 2016. Since the level of insurance election directly affects the potential SCO payments (see previous described equations in KOV section), a fourth alternative analyzed the relationship between the level of crop insurance election and SCO payments. TXCB8000 was simulated with enterprise unit crop insurance at a 65% level of revenue coverage and at a 75% level of revenue coverage to evaluate if farmers could benefit from lower crop insurance coverage with the addition of SCO.

Representative Farms

The stochastic simulation model used data from four AFPC representative farms. A subset of four farms was chosen from the 64 crop farms maintained by the AFPC. The location of the farms allowed for analysis of farm level impacts on scale, region, crop mix, and varying levels of production and price risk. Appendix B shows the location of the representative farms used in this analysis. The four representative farms are:

- IAG3400 is a 3,400 acre feedgrain farm located in Webster County, Iowa that grows corn and soybeans. It represents production in the heart of the Corn Belt.
- ARSR3240 represents the heart of the rice production in Arkansas County, Arkansas. The farm produces rice, wheat, and both full-season and double crop soybeans on its 3,240 acres of cropland.

- KSCW2000 is a 2,000 acre Sumner County, Kansas farm that produces wheat, corn, sorghum, and soybeans.
- TXCB8000 was chosen to represent a large dry land farming operation producing cotton. TXCB8000 grows both grain sorghum and cotton on its 8,000 acres.

Greater details specific to the four representative farms can be found in Appendix C.

AFPC representative farms were chosen because they contain the three attributes that Plaxico and Tweeten (1963) cited as necessary for a representative farm to contain to accurately evaluate farm programs: consistent series that is maintained over time, definitions and assumptions must be reasonably uniform over the country, and resource situations must be constantly reviewed and output data revisited frequently to reflect changes in technology. Specifically:

- The AFPC builds their one of a kind data base of representative farms through on going producer cooperation. Data is obtained through face-to-face meetings with small groups of producers (four to six). Many of the representative farms have been in existence for over 25 years with many of the same producers still serving on the farm panel. The AFPC team collects the information in the same fashion during every farm visit. This leads to a consistent series of relevant data.
- Definitions and key assumptions are applied equally to every farm regardless of size or location. For example, the definition of budgeted yield is applied the same for each farm. Additionally, assumptions such as planting rotations staying the same in projected years are applied to all farms. However, it

should be noted, that using actual producers in a selected area allows for the farms to mimic real life conditions very accurately. Thus, each farm is greatly customized leading to a rather small set of assumptions that are applied to all farms.

- Farm meetings are scheduled every two to three years to update the farms. Costs and prices are adjusted annually based on projections from FAPRI. Furthermore, if a large change in a specific farm area is noted, AFPC personnel contact the representative farm panel producers to make needed adjustments to the farm data. The output from the farm is not allowed to be used until the producers of each farm approve its accuracy.

Data Collected

Typical data collected for each representative farm includes:

- Size of the typical operation (number of acres, etc.)
- Land tenure (acres owned, cash rented, and crop share rented)
- Scope of enterprises (crops grown)
- USDA farm program Base Acres and Farm Program Yield information
- Last two years of prices received for crops and breakdown of portion received from market and in the form of LDP's
- Ten years of production history (FCIC Forms)
- Overhead costs: accounting/legal, telephone/utilities, property taxes, fuel, machinery repairs, and supplies.
- Costs of production for each crop (dollars per acre, where applicable)

- Seed and technology cost
- Fertilizer cost
- Herbicide cost
- Insecticide and fungicide cost
- Custom application/scouting costs
- Custom harvesting
- Irrigation cost
- Tractor fuel
- The types of machinery and equipment the representative farm requires. A roster of tractors, combines, planters, tillage equipment, sprayers, and other equipment, is assembled by the panel.

Each representative farm is categorized by which commodity makes up the majority of its receipts. For specific information on each farms planted acres, crop mix, etcetera, please see Appendix D.

Representative Farm Units

This dissertation is unique as it includes individual units for each representative farm. Some representative farms are built as if all planted acres of all crops are one large field. Additionally, crop mix can be an assumption based on the researchers needs. This is the case for much of the research reviewed earlier. In reality, most farms are made up of more than one field and in some cases numerous parcels. These fields face different yield risks due to microclimates and differences in soil types.

The AFPC representative farms provide data on actual crop mixes and planting patterns, which makes them superior at replicating actual conditions. AFPC representative farms use actual producer yield history to quantify yield variability for each crop. While this process is a close approximation of replicating real world conditions in a representative farm structure, it still treats all crops as if they were grown in one field. The model used for this research attempts to improve upon the AFPC representative farm by including individual units which act as multiple fields.

Multiple units are accomplished in this model by applying a set of assumptions and using a bootstrapping method to construct yields for each additional unit. Each representative farm in this model is assumed to have four units. The number of units was chosen to be large enough to investigate questions between whole farm and unit coverage with crop insurance. The planted acreage on each unit is determined by taking the planted acres on the entire farm and dividing by four. Thus, all units on each farm are uniform in acres. This is not likely the case in reality, but no clear method for splitting acreage into multiple units is present. To arrive at yields for each unit, each farm's yields were calculated by applying a bootstrapping method in SIMETAR©. Then the multivariate empirical methodology described previously was used to obtain yields for each unit while maintaining the correlation between crops within and across units. This process means that each unit on a farm will face the same distribution since the bootstrapped yields came from the same set of historical data, but each unit will see different yields in the projected years. While this process could be improved by having actual producer's historical individual yields for an individual field, it does solve the problem of all acres being treated as one field for evaluation of crop insurance products.

Economic Theory of the Firm

Economic theory of the firm is important to this research because it sets the framework for farm decision-making. It is assumed that producers are rational individuals, meaning they prefer more to less. In this case, producers prefer more income to less and are profit maximizers. Economic theory for the firm suggests that the firm will maximize profits by choosing the optimal level of output. The equation reads:

$$Profit\ (q) = Revenue\ (q) - Cost\ (q)$$

To find the optimal level of quantity (q), the firm must find the incremental point of output that leaves profit unchanged. More explicitly, the firm must find the point where the additional revenue brought in from selling another unit of output is completely offset by the additional costs of producing that unit of output. Mathematically, this is accomplished by finding where the slopes of the revenue and cost curves are equal. At this point, marginal revenue will equal marginal costs and the distance between total revenue and total costs will be greatest.

$$MR\ (q) = MC\ (q)$$

This equation can be expanded further. Agriculture has long been stated as an example of perfect competition. The reason is that one producer's output has no effect on the price received for the output. Thus, in perfect competition the producer is a price taker. This results in the firm's revenue curve being a straight line at the prevailing output price as revenue increases at the same amount with each additional output. This results in the following equation:

$$P = MR = MC\ (q)$$

It is important to delineate between the short-run and long-run for firms' decisions. The short run is defined as the time period when capacity is fixed. In this dissertation the representative farms are assumed to not grow (add acres), so the short run is the assumed time frame.

It is clear that if a firm loses money in the long run, that firm will go out of business and exit the industry. However, in the short run, a firm will continue to produce if it can cover its variable costs. The theory is that if a firm can cover its variable costs and have any amount to put toward fixed costs, this is better than shutting down and losing all fixed costs. Thus, the firm will produce in the short-run if marginal revenue is above average variable costs. This results in the firm's supply curve being the marginal cost curve above the average variable cost curve.

Ranking Risky Alternatives

As stated previously, if producers are rational, they will choose the alternative farm program that yields the highest NCFI and NPV. However, this assumes risk neutrality on the part of the producer. Risk neutrality simply states that an individual makes decisions on alternative choices based solely on the highest expected payout without any consideration for risk. However, most individuals are considered to be risk averse. Simply stated, most individuals would rather have a certain payout than one that has the same expected, but risky payout.

The model will include risk and probabilistic outcomes. Therefore, ranking risky alternatives is important. Von Neumann and Morgenstern (1944) first proposed ranking risky alternatives which involve the concept that individuals wish to maximize expected utility. For this analysis, it is assumed that producers would choose the highest expected return at the lowest level of risk and assumes risk aversion which is consistent with the economic literature as started by Arrow (1971).

One way to rank risky alternatives is stochastic efficiency with respect to a function (SERF) discussed in Hardaker et al. (2004). SERF has many advantages over other methods of ranking risky alternatives. For example, under subjective expected utility hypothesis, the underlying utility function of the decision-making individual must be known (Anderson, Dillon, Hardaker 1977). However, accurately eliciting a decision maker's utility function has proved difficult and led to mixed results (King and Robison 1984). First order and second order stochastic dominance are useful methods of ranking risky alternatives and overcome the need to obtain a utility function. However, in empirical work these two methods often yield results without much meaning (Schumann et al. 2004). Stochastic dominance with respect to a function (SDRF) was introduced by Meyer (1977). SDRF ranks risky alternatives for decision makers whose utility is defined by a lower absolute risk aversion coefficient (LRAC) and an upper absolute risk aversion coefficient (URAC). SDRF is limited in that if the RACs are set too far apart, the method will not produce consistent rankings. Additionally, it can only compare two risky alternatives instead of ranking all alternatives simultaneously (Allison 2010).

SERF overcomes many of the previous listed methods limitations. SERF finds utility efficient alternatives for ranges of risk attitudes. SERF then partitions alternatives in terms of certainty equivalents as a selected measure of risk aversion is varied over a defined range. Thus, SERF does not attempt to define a single risk aversion level, but takes risk aversion levels as given and yields rankings based on types of decision makers within ranges of risk aversion (Schumann et al. 2004). Additionally, SERF can rank many risky alternatives at the same time.

Due to its many robust attributes in ranking risky alternatives, SERF was used in this analysis. As is common in the literature and previously cited, decision makers are assumed to be risk averse. The commonly used negative exponential utility function was used in this analysis with a minimum RAC of zero and maximum RAC of four divided by each farms' net worth.

CHAPTER IV

RESULTS AND ANALYSIS

The analysis was conducted for each representative farm under the FAPRI 2012 January Baseline price path and for the two low price alternatives. Additionally, a low yield alternative and an insurance alternative were run under the Baseline price assumption. This section will compare not only means, minimums, and maximums, but will also use bar, CDF, and SERF charts to explain what the risk results mean and how they affect the representative farms' preference for the different programs.

Each farm was simulated for 29 scenarios assuming three different price alternatives. The financial outlook for the Baseline price alternative is positive based on the simulation results. All four farms are profitable given the relatively high projected commodity prices in the Baseline price alternative, particularly for corn and soybeans. Additionally, these representative farms are relatively large in terms of acreage. Thus, the differences in farm programs discussed for the farms should be tempered, as farm programs are a relatively small part of the farm's total revenue particularly for IAG3400 and TXCB8000. However, the results show trends, and the financial effects of the programs on smaller or less profitable farms would likely be magnified.

The results are presented for the individual farm programs in terms of magnitude and frequency of payments for each farm. The individual program's ability to reduce income risk and their costs are presented as well. The cost of SCO, STAX, and crop insurance was reported as the government's portion of the insurance premium. Lastly, a SERF analysis of the NPV of each program is presented to project the preference of each representative farm for the program alternatives. These types of results also are reported for head-to-head comparison of the proposed Senate and House farm bills. All scenarios evaluated assumed the annual prices forecasted in the FAPRI 2012 January Baseline were used as the means for their respective stochastic prices.

Results for the FAPRI 2012 Baseline

Magnitude and Frequency of Payments

Among the farm programs simulated, the highest mean payments in 2016 for ARSR3240 and TXCB8000 were the direct payments. This is not surprising as both of these farms grow rice and cotton which have relatively high direct payment rates. SCO House payments were relatively large across all four farms. The SCO House payments were greatest among the six alternative farm programs for IAG3400 and KSCW2000, second highest for ARSR3240, and third behind STAX for TXCB8000. These results can be explained by the relatively small loss threshold that SCO House has as the county must only realize a 10% loss for a payment to occur. This is also reflected in the relatively high frequency of payments for the SCO House (44% – 88%), which is highest of all the programs with the exception of the direct payments, which are paid at a 100% frequency (table 1). Additionally, the maximum payments for SCO House are higher than the other programs (excluding STAX) for all four farms, due to the uncapped nature of crop insurance payments. The ARC also has a relatively high frequency of paying (45% – 79%), but the size of ARC payments are limited by ARC's overall payment limit of $100,000 (assumed) and a payment band of 10%.

Crop insurance payments had relatively high maximum payments, but the lowest frequency of having a positive payment (5% – 28%) (table 1). This is explained, in part, by the type of insurance on each farm. The ARSR3240 carries yield coverage only at 65%, so the farm must sustain a greater than 35% yield loss to collect, which only occurs on wheat and soybeans because rice is irrigated and doesn't exhibit this amount of yield variability. The other three farms carry revenue coverage at the 70% coverage level with the enterprise unit option. The farms must suffer at least a 30% revenue loss across all of their planted acres for each crop. In general, a large loss is required for an insurance payment, which explains the low frequency but relatively high maximum payments when the large loss occurs.

Government Cost and Farmer Returns

Both the Senate and House version of the farm bills were scored by the Congressional Budget Office (CBO) to save the government money. A large part of the money saved in both farm bills came as the result of the proposed elimination of DPs. This is reflected in the results as each program's mean values cost the government less than DPs with the exception of SCO House for IAG3400 and KSCW2000 (table 1). However, the government exposure is actually increased as maximum PLC payments exceed DPs for all four farms. Maximum ARC payments exceed DPs for IAG3400 and KSCW2000. However, these high payment levels occur at a low frequency.

Table 1. Baseline Results of Individual Farm Programs for Each Representative Farm.

Variable		Farm			
		IAG3400	ARSR3240	KSCW2000	TXCB8000
Crop Receipts	Mean	$ 2,548,766	$ 1,967,416	$ 553,967	$ 3,459,707
	Min	$ 1,330,653	$ 884,128	$ 302,886	$ 1,478,139
	Max	$ 4,547,625	$ 3,623,516	$ 934,544	$ 6,304,632
DP	Mean	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	Min	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	Max	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	% time paid	100%	100%	100%	100%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 68,797	$ 146,603	$ 25,099	$ 159,332
ARC	Mean	$ 33,183	$ 34,339	$ 9,897	$ 37,920
	Min	$ -	$ -	$ -	$ -
	Max	$ 100,000	$ 100,000	$ 39,488	$ 100,000
	% time paid	45%	66%	79%	45%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 33,183	$ 34,339	$ 9,897	$ 37,920
SCO Senate	Mean	$ 23,169	$ 11,282	$ 11,222	$ 39,548
	Min	$ (30,531)	$ (44,025)	$ (7,465)	$ (33,275)
	Max	$ 382,016	$ 376,880	$ 69,063	$ 363,417
	% time paid	34%	24%	79%	37%
	Farmer Return	140%	45%	246%	298%
	Govt Cost	$ 38,580	$ 58,624	$ 10,631	$ 30,934
PLC	Mean	$ 6,183	$ 40,614	$ 6,632	$ 23,197
	Min	$ -	$ -	$ -	$ -
	Max	$ 154,075	$ 250,000	$ 51,604	$ 250,000
	% time paid	12%	52%	39%	24%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 6,183	$ 40,614	$ 6,632	$ 23,197
SCO House	Mean	$ 112,413	$ 51,490	$ 32,864	$ 99,116
	Min	$ (65,500)	$ (69,581)	$ (15,752)	$ (73,944)
	Max	$ 848,923	$ 768,703	$ 163,576	$ 807,594
	% time paid	60%	44%	88%	44%
	Farmer Return	306%	115%	325%	336%
	Govt Cost	$ 85,734	$ 104,686	$ 23,625	$ 68,743
Insurance	Mean	$ (1,137)	$ (6,660)	$ (6,521)	$ (16,693)
	Min	$ (11,445)	$ (36,153)	$ (17,270)	$ (87,315)
	Max	$ 598,718	$ 137,129	$ 82,383	$ 666,167
	% time paid	5%	28%	8%	13%
	Farmer Return	-21%	-31%	-67%	-35%
	Govt Cost	$ 21,447	$ 30,740	$ 38,667	$ 189,641
STAX Senate	Mean	NA	NA	NA	$ 137,346
	Min	NA	NA	NA	$ (48,848)
	Max	NA	NA	NA	$ 862,310
	% time paid	NA	NA	NA	49%
	Farmer Return	NA	NA	NA	298%
	Govt Cost	NA	NA	NA	$ 111,374
STAX House	Mean	NA	NA	NA	$ 139,589
	Min	NA	NA	NA	$ (48,848)
	Max	NA	NA	NA	$ 862,310
	% time paid	NA	NA	NA	50%
	Farmer Return	NA	NA	NA	499%
	Govt Cost	NA	NA	NA	$ 111,957

On average, ARSR3240 would lose the most payments if DPs ($146,603) are eliminated and replaced with some combination of ARC and SCO Senate ($45,621) or PLC and SCO House ($92,104). IAG3400 has the most to gain in mean payments from PLC and SCO House replacing DPs ($68,797 versus $118,596). TXCB8000 also can gain, on average, from replacing DP ($159,332) with PLC and SCO House when STAX House is included ($261,902) (table 1).

The farmer's return on premiums paid was calculated for both versions of SCO and STAX programs and crop insurance. This percentage represents the average return for the farm based on the premiums paid and program payments received (table 1). Because SCO, STAX, and crop insurance are subsidized at 70% for SCO, 80% for STAX, and levels above 50% for crop insurance, it was expected that the percentage return would be positive. However, crop insurance had negative average returns for all four farms (table 1). STAX and SCO had positive returns ranging from a low of 45% for SCO Senate for ARSR3240 to a high of 499% return for STAX House for TXCB8000. These results indicate that the assumed premiums are low for the proposed programs.

Risk Reducing Properties

The ability of each individual program to reduce whole farm financial risk was measured using the CV for revenue. Additionally, the probability of running a cash flow deficit in 2016 was also reported. ARC had the lowest CV for revenue for IAG3400 (table 2). This means ARC had the lowest dispersion of revenue in relation to mean levels. For TXCB8000, the lowest CV for revenue was DP and the highest CV was for STAX House (table 2). SCO House had the highest CV for revenue for the other three farms. The SCO program has the highest maximum payments, but there are a few cases where SCO did not pay because the county did not have a loss, but the farm did experience a loss. In these cases, the farm's divergences from the means are greater than if it was not in SCO because the farm must still pay the premiums without receiving any indemnities. The DP scenario had the lowest chance of a cash flow deficit in 2016 for three of the four farms (table 2). Crop insurance had the lowest probability of experiencing a cash flow deficit in 2016 for TXCB8000 (table 2).

Table 2. Baseline Results for Individual Farm Program's Risk Reducing Properties for Each Representative Farm.

Variable	**Farm**			
CV	**IAG3400**	**ARSR3240**	**KSCW2000**	**TXCB8000**
No Programs	24.09	27.38	23.95	24.82
DP	23.46	25.48	22.91	23.73
ARC	22.91	25.57	22.89	24.31
PLC	23.74	25.29	22.47	24.09
SCO House	25.22	27.92	24.78	24.79
INS	24.10	27.22	23.82	24.13
STAX Senate	NA	NA	NA	24.50
STAX House	NA	NA	NA	24.82
Prob Neg End Cash				
No Programs	0.86%	24.80%	42.04%	71.56%
DP	0.38%	6.76%	29.99%	31.38%
ARC	0.66%	19.25%	38.45%	71.04%
PLC	0.64%	17.15%	40.67%	70.08%
SCO House	0.65%	20.10%	33.19%	69.76%
INS	0.86%	25.68%	45.22%	1.56%
STAX Senate	NA	NA	NA	69.79%
STAX House	NA	NA	NA	69.39%

Risk Ranking Preference

Figures 2 - 5 show the SERF results for ranking the risky NPV distributions. The DP was the preferred farm program for three of the four representative farms with TXCB8000 being the exception. The ranking of crop insurance across the farms showed a regional difference. Crop insurance was least preferred by both IAG3400 and KSCW2000. However, TXCB8000 preferred crop insurance first and ARSR3240 second among the farm programs.

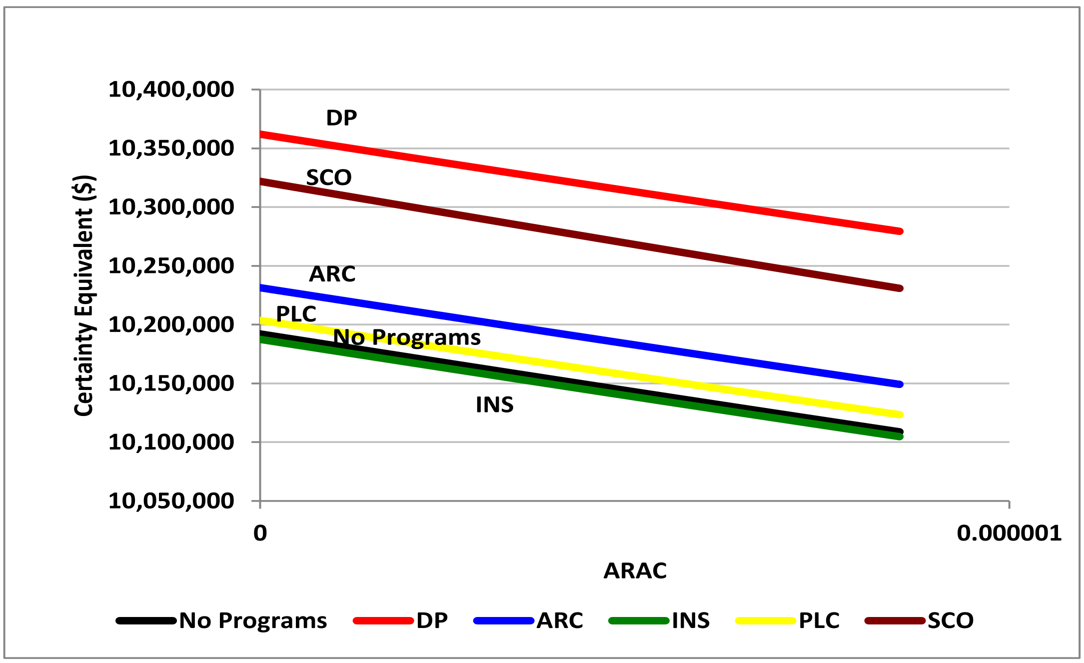

Figure 2. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for IAG3400 (for the Baseline).

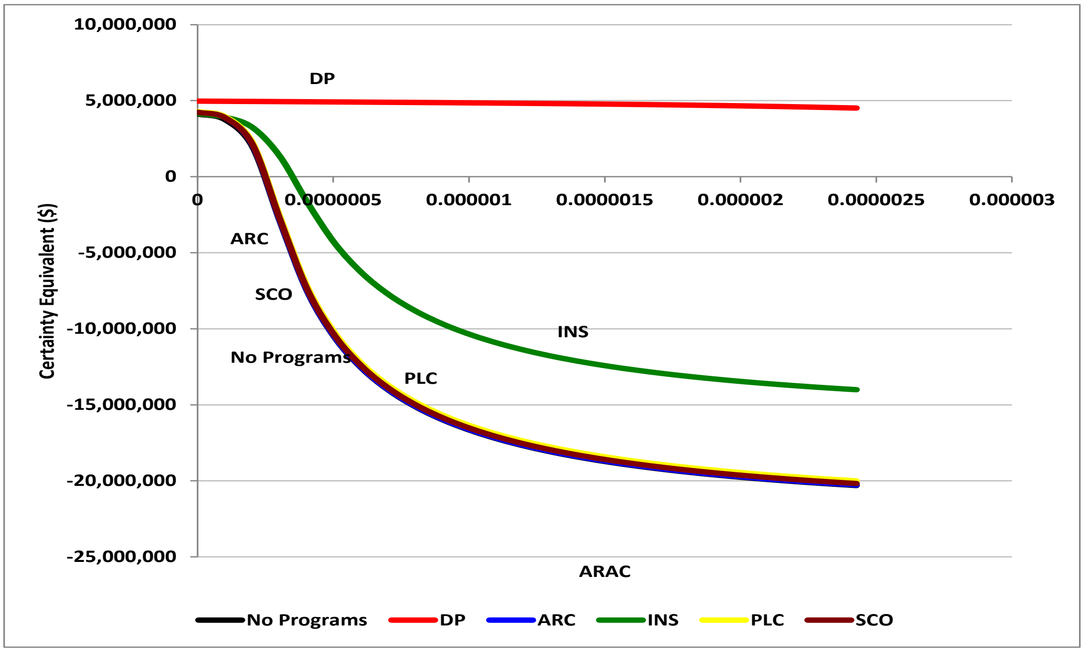

Figure 3. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for ARSR3240 (for the Baseline).

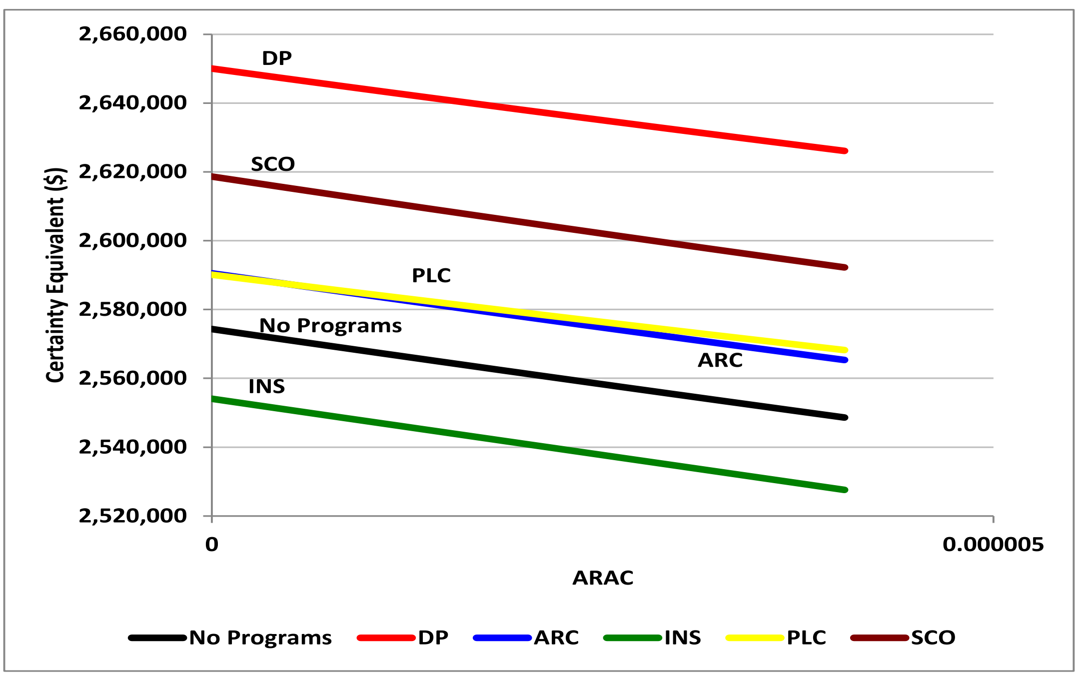

Figure 4. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for KSCW2000 (for the Baseline).

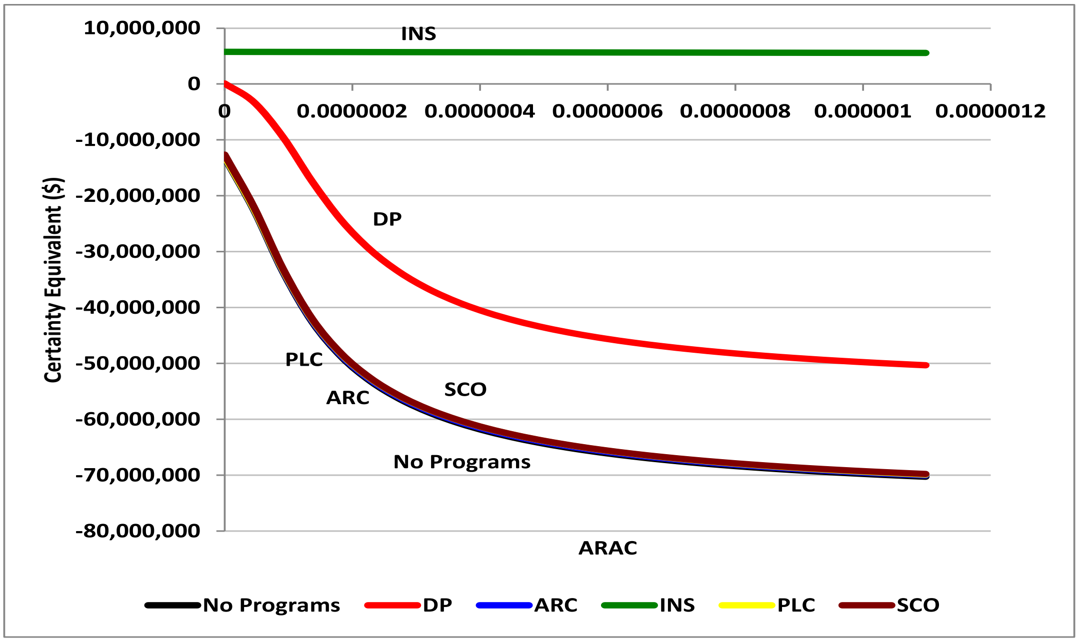

Figure 5. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for the Baseline).

Risk preferences showed that No Program was a less preferred option than the farm program options, so all risk averse individuals value farm programs. Specifically, IAG3400 prefers DP to all other farm programs across all levels of risk aversion (figure 2). SCO is the second ranked program followed by ARC, PLC, No Programs, and lastly crop insurance. These results run somewhat contrary to the general notion that DPs are not the preferred farm program safety net in the heart of the Corn Belt, in part, because they are relatively small in relation to total revenue. As mentioned, IAG3400 is a large and profitable farm, so on average, DPs are only 2.7% of crop receipts. The other average farm program payments are also less than 5% of crop receipts. While SCO and crop insurance have the potential for much higher payouts than DPs, the SCO and crop insurance had a negative payout 40% to 95% of the time (table 1). These numbers help explain why DP was the most preferred program for IAG3400.

The ARSR3240 preferred DP first with crop insurance a close second. The rest of the programs were preferred as follows: SCO, ARC, PLC, and No Programs (figure 3). The KSCW2000's most preferred program was DP with crop insurance least preferred (figure 4). Crop insurance was the most preferred program for TXCB8000 followed by DP (figure 5). The remaining programs were very close in preference for all ranges of risk aversion for TXCB8000.

Senate and House Results

Each representative farm was simulated under the provisions of Senate and House farm bills (the details of each bill can be found in Appendix E). The Senate farm bill provisions consist of a combination of ARC, SCO Senate, and crop insurance while the House farm bill includes PLC, SCO House, and crop insurance. The two SCO programs essentially work the same, but the House version has a wider pay band.

All four farms had higher mean NCFI under the House farm bill (table 3). On average, the ARC payments exceeded the PLC payments on every farm except ARSR3240 (table 3). Also, ARC was more likely to generate a payment than PLC on each farm. The reason the House farm bill resulted in greater mean NCFIs was because the larger SCO House had larger SCO payments than the Senate payments. The larger SCO House payments were more than enough to make up for the difference between ARC and PLC for IAG3400, KSCW2000, and TXCB8000 (table 3).

The House farm bill is projected to cost more for each farm. Government costs for SCO House are greater than for the SCO Senate due to the larger payment band in the House version. Each farm gets more coverage from the SCO House resulting in higher premiums. Because both versions of SCO are subsidized at the 70% level, the government cost is greater for House SCO. On the three farms where mean ARC payments were greater than PLC payments, the difference in government cost between the SCO programs is large enough to result in the House farm bill costing more (table 1). Additionally, the government has greater exposure under the House farm bill because maximum PLC payments are larger than maximum ARC payments.

The probability of each farm having a cash flow deficit in 2016 is reported in table 3. All four farms had lower probabilities of cash flow deficits under the House farm bill. IAG3400 had less than a 1% chance of a cash flow deficit under each of the farm bills so the difference between the two versions of the farm bill was small. The differences in probability of cash flow deficits in 2016 between the Senate and House farm bills were 3.3%, 6.0%, and 0.7% for ARSR3240, KSCW2000, and TXCB8000, respectively (table 3).

Table 3. Baseline Results of Senate and House Farm Bills for Each Representative Farm.

Variable		Farm							
		IAG3400 Senate	IAG3400 House	ARSR3240 Senate	ARSR3240 House	KSCW2000 Senate	KSCW2000 House	TXCB8000 Senate	TXCB8000 House
Crop Receipts	Mean	$ 2,548,766	$ 2,548,766	$ 1,967,416	$ 1,967,416	$ 553,967	$ 553,967	$ 3,459,707	$ 3,459,707
	Min	$ 1,330,653	$ 1,330,653	$ 884,128	$ 884,128	$ 302,886	$ 302,886	$ 1,478,139	$ 1,478,139
	Max	$ 4,547,625	$ 4,547,625	$ 3,623,516	$ 3,623,516	$ 934,544	$ 934,544	$ 6,304,632	$ 6,304,632
	CV	23.37	24.97	25.63	25.78	23.21	23.36	23.54	23.35
NCFI	Mean	$ 1,242,864	$ 1,305,107	$ 588,447	$ 638,813	$ 228,780	$ 247,181	$ 1,614,326	$ 1,661,412
	Min	$ 47,469	$ 23,813	$ (1,242,377)	$ (1,223,682)	$ (12,160)	$ 1,877	$ (347,187)	$ (51,435)
	Max	$ 3,152,245	$ 3,419,228	$ 2,235,794	$ 2,533,295	$ 609,460	$ 663,402	$ 5,186,483	$ 5,341,856
	% time paid	NA	NA	NA	NA	NA	NA	NA	NA
	Farmer Return	NA	NA	NA	NA	NA	NA	NA	NA
	Govt Cost	NA	NA	NA	NA	NA	NA	NA	NA
ARC or PLC	Mean	$ 33,183	$ 6,183	$ 34,339	$ 40,614	$ 9,897	$ 6,632	$ 37,920	$ 23,197
	Min	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Max	$ 100,000	$ 154,075	$ 100,000	$ 250,000	$ 39,488	$ 51,604	$ 100,000	$ 250,000
	% time paid	45%	12%	66%	52%	79%	39%	45%	24%
	Farmer Return	NA	NA	NA	NA	NA	NA	NA	NA
	Govt Cost	$ 33,183	$ 6,183	$ 34,339	$ 40,614	$ 9,897	$ 6,632	$ 37,920	$ 23,197
SCO	Mean	$ 23,169	$ 112,413	$ 11,282	$ 51,490	$ 11,222	$ 32,864	$ 39,548	$ 99,116
	Min	$ (30,531)	$ (65,500)	$ (44,025)	$ (69,581)	$ (7,465)	$ (15,752)	$ (33,275)	$ (73,944)
	Max	$ 382,016	$ 848,923	$ 376,880	$ 768,703	$ 69,063	$ 163,576	$ 363,417	$ 807,594
	% time paid	34%	60%	24%	44%	79%	88%	37%	44%
	Farmer Return	140%	306%	45%	115%	246%	325%	298%	336%
	Govt Cost	$ 38,580	$ 85,734	$ 58,624	$ 104,686	$ 10,631	$ 23,625	$ 30,934	$ 68,743
Insurance	Mean	$ (1,137)	$ (1,137)	$ (6,660)	$ (6,660)	$ (6,521)	$ (6,521)	$ (16,693)	$ (16,693)
	Min	$ (11,445)	$ (11,445)	$ (36,153)	$ (36,153)	$ (17,270)	$ (17,270)	$ (87,315)	$ (87,315)
	Max	$ 598,718	$ 598,718	$ 137,129	$ 137,129	$ 82,383	$ 82,383	$ 666,167	$ 666,167
	% time paid	5%	5%	28%	28%	8%	8%	13%	13%
	Farmer Return	-21%	-21%	-31%	-31%	-67%	-67%	-35%	-35%
	Govt Cost	$ 21,447	$ 21,447	$ 30,740	$ 30,740	$ 38,667	$ 38,667	$ 189,641	$ 189,641
STAX	Mean	NA	NA	NA	NA	NA	NA	$ 137,346	$ 139,589
	Min	NA	NA	NA	NA	NA	NA	$ (48,848)	$ (48,848)
	Max	NA	NA	NA	NA	NA	NA	$ 862,310	$ 862,310
	% time paid	NA	NA	NA	NA	NA	NA	49%	50%
	Farmer Return	NA	NA	NA	NA	NA	NA	493%	499%
	Govt Cost	NA	NA	NA	NA	NA	NA	$ 111,374	$ 111,957
Prob Neg End Cash		0.64%	0.30%	17.84%	14.52%	38.19%	32.12%	1.06%	0.33%

The results of SERF analysis show that all four farms prefer the House farm bill to the Senate farm bill, across all levels of risk aversion. The difference in the certainty equivalence (CE) (preference) between the two bills narrows as an individual becomes more risk averse for IAG3400 (figure 6). The opposite is the case for KSCW2000 and TXCB8000 where greater levels of risk aversion lead to slightly stronger preferences (large CE differences) for the House farm bill (figures 7 & 8). The preference level between the two bills remains relatively constant for ARSR3240 over-all risk aversion levels (figure 9).

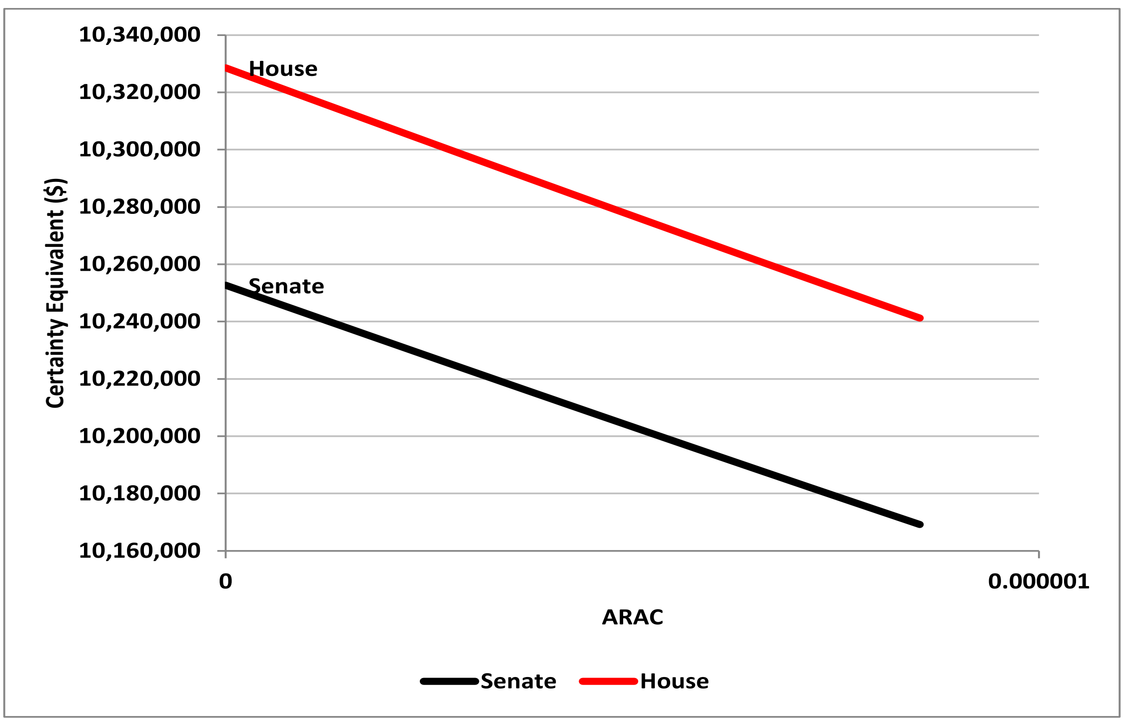

Figure 6. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for IAG3400 (for the House and Senate under the baseline).

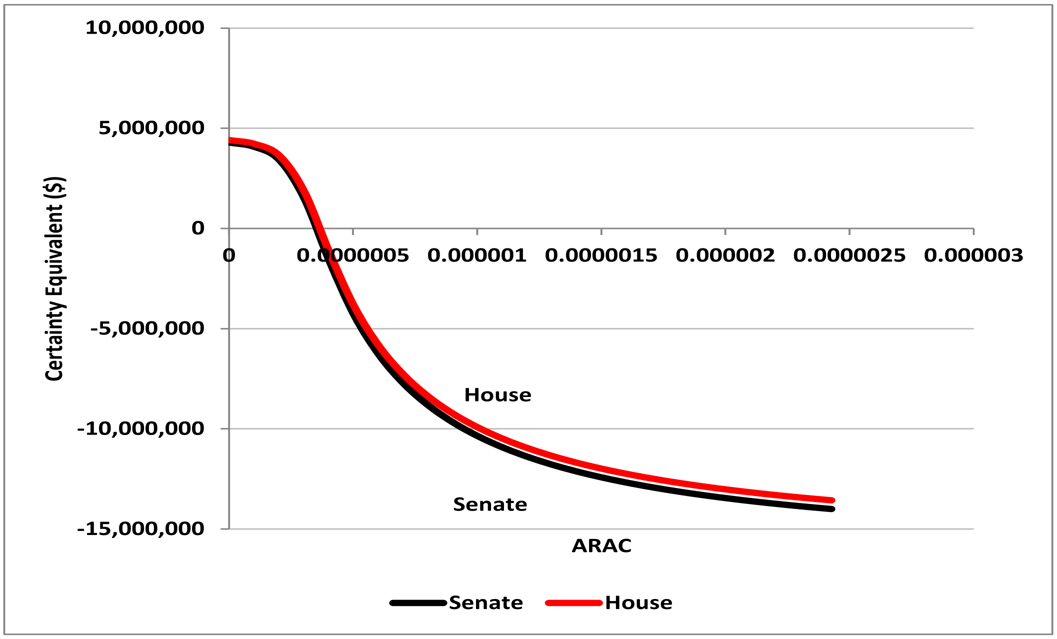

Figure 7. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for ARSR3240 (for the House and Senate under the baseline).

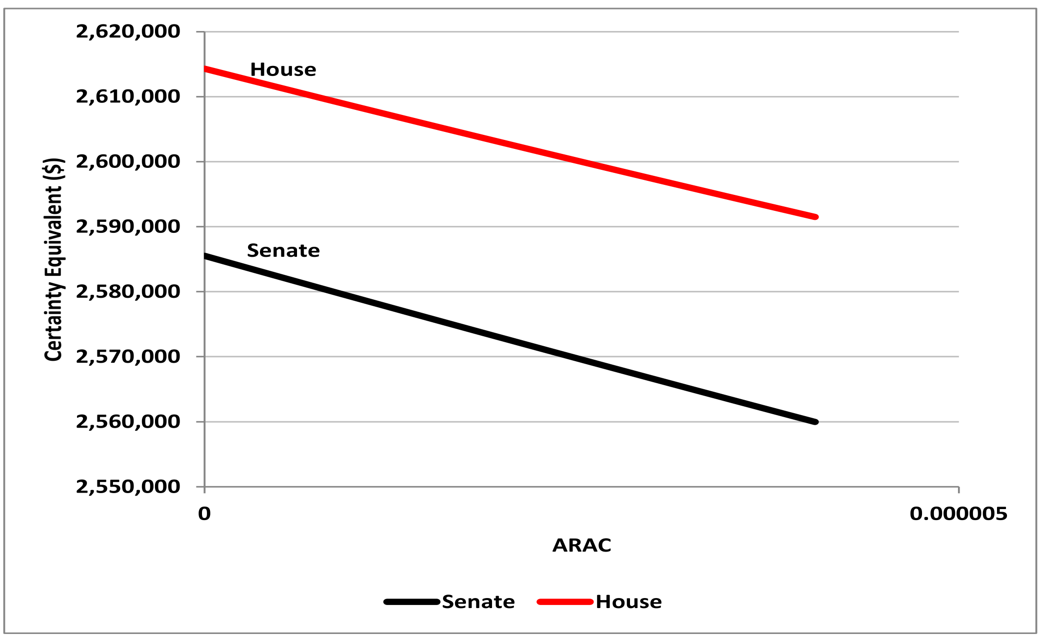

Figure 8. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for KSCW2000 (for the House and Senate under the baseline).

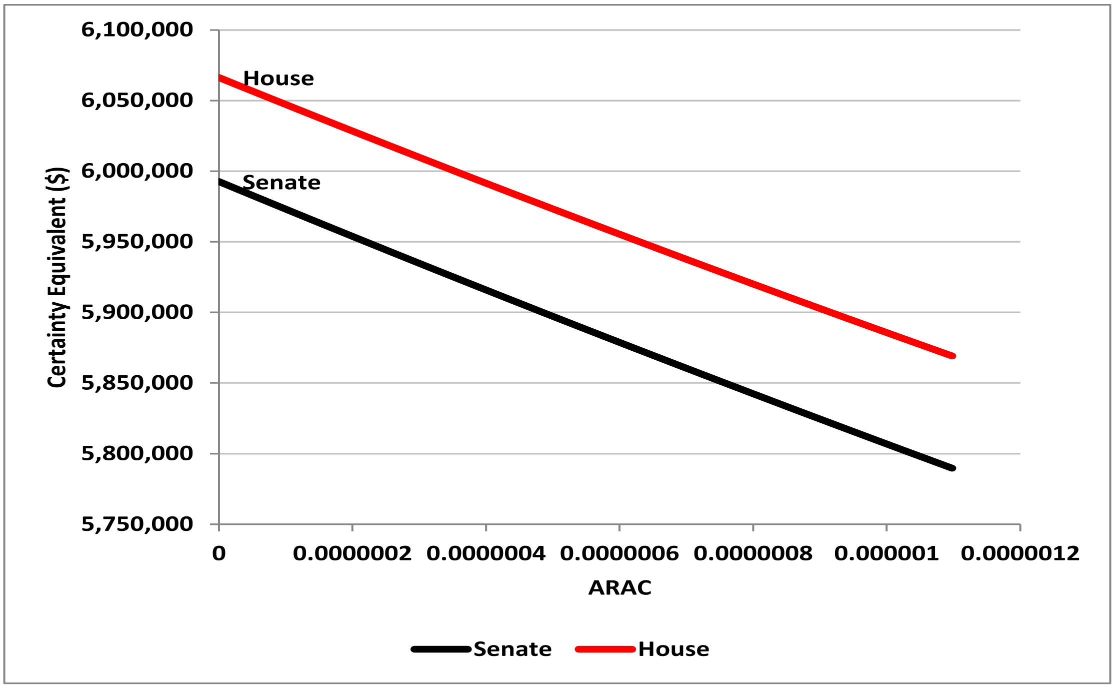

Figure 9. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for the House and Senate under the baseline).

Results for Alternative 1: Low Price 1

All scenarios reported in this section were simulated assuming a 25% reduction in the annual mean commodity prices in the FAPRI 2012 January Baseline in 2016. The 25% drop was assumed to apply for both the base insurance price and the harvest insurance price.

Magnitude and Frequency of Payments

The results show how each program responds to the price decrease when compared to the unchanged Baseline results reported previously. DPs were unchanged versus FAPRI 2012 January baseline. This revealed one of the arguments against DPs. Namely, they do not adjust to changing market conditions. The ARC payment frequency and size increased for all four farms compared to the Baseline price alternative (table 4). Interestingly, the mean ARC payment was still less than the DP and PLC payment for all farms except IAG3400. In both the Senate and House versions of SCO, the mean and maximum payments decreased while the percentage of time positive payments were made remained almost the same, because both insurance prices, base and harvest, fell by the same amount. The consequence was a lower level of protection, but near the same probability of incurring a loss. A similar result was observed in the case for crop insurance. Government costs for crop insurance and SCO fell as the amount of exposure the government had was reduced by the lower prices. PLC saw large increases in mean payments and frequency of payments compared to the unchanged price baseline. Across all four farms, the average frequency of PLC payments increased 37.5%.

Results of specific farm programs for low price Alternative 1 highlight a few commodity specific points. Excluding DPs, the mean payments for PLC are highest for all farms excluding IAG3400 (table 4). For the corn and soybean producing IAG3400, PLC has the fourth highest mean payments behind SCO House, ARC, and DP. The highest mean payments for ARSR3240 were DP with PLC coming in second. The ARSR3240 rice producing farm had the largest difference ($62,651) between DP ($146,603) and its next highest farm program, PLC ($83,952); however, the maximum payouts of both SCO programs and PLC were higher than the fixed DP. DP and PLC are nearly identical for KSCW2000 at $25,099 and $25,003 respectively. For TXCB8000, the combination of PLC for sorghum and STAX House for cotton results in the highest mean payments.

Due to the assumption that the price decrease affected both the base and harvest insurance prices equally, crop insurance payments had similar chances of paying as the Baseline. The price decline results in less total dollar value being insured. Thus, premiums were lower and so were the maximum payouts.

Table 4. Alternative 1 Results of Individual Farm Programs for Each Representative Farm.

Variable		Farm			
		IAG3400	ARSR3240	KSCW2000	TXCB8000
Crop Receipts	Mean	$ 1,905,916	$ 1,474,474	$ 416,405	$ 2,594,334
	Min	$ 993,701	$ 657,819	$ 227,956	$ 1,103,986
	Max	$ 3,404,374	$ 2,918,270	$ 701,986	$ 4,726,825
DP	Mean	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	Min	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	Max	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	% time paid	100%	100%	100%	100%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 68,797	$ 146,603	$ 25,099	$ 159,332
ARC	Mean	$ 72,463	$ 73,380	$ 17,372	$ 50,860
	Min	$ -	$ -	$ -	$ -
	Max	$ 100,000	$ 100,000	$ 39,488	$ 100,000
	% time paid	80%	91%	95%	60%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 72,463	$ 73,380	$ 17,372	$ 50,860
SCO Senate	Mean	$ 17,377	$ 8,173	$ 8,372	$ 29,661
	Min	$ (22,898)	$ (40,992)	$ (5,599)	$ (24,956)
	Max	$ 286,512	$ 249,310	$ 48,862	$ 272,563
	% time paid	34%	25%	79%	37%
	Farmer Return	140%	43%	245%	298%
	Govt Cost	$ 28,935	$ 43,903	$ 7,970	$ 23,201
PLC	Mean	$ 62,309	$ 83,952	$ 25,003	$ 95,985
	Min	$ -	$ -	$ -	$ -
	Max	$ 250,000	$ 250,000	$ 80,229	$ 250,000
	% time paid	49%	86%	79%	63%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 62,309	$ 83,952	$ 25,003	$ 95,985
SCO House	Mean	$ 84,310	$ 38,775	$ 24,597	$ 74,337
	Min	$ (49,125)	$ (56,267)	$ (11,830)	$ (55,458)
	Max	$ 636,693	$ 524,144	$ 120,889	$ 605,695
	% time paid	60%	45%	89%	44%
	Farmer Return	306%	115%	324%	336%
	Govt Cost	$ 64,300	$ 78,398	$ 17,712	$ 51,557
Insurance	Mean	$ (853)	$ (4,954)	$ (4,886)	$ (12,519)
	Min	$ (8,584)	$ (29,343)	$ (12,858)	$ (65,486)
	Max	$ 449,038	$ 114,461	$ 61,926	$ 499,626
	% time paid	5%	27%	8%	13%
	Farmer Return	-21%	-31%	-67%	-35%
	Govt Cost	$ 16,086	$ 23,010	$ 29,010	$ 142,231
STAX Senate	Mean	NA	NA	NA	$ 103,010
	Min	NA	NA	NA	$ (36,636)
	Max	NA	NA	NA	$ 646,733
	% time paid	NA	NA	NA	49%
	Farmer Return	NA	NA	NA	493%
	Govt Cost	NA	NA	NA	$ 83,530
STAX House	Mean	NA	NA	NA	$ 113,893
	Min	NA	NA	NA	$ (36,636)
	Max	NA	NA	NA	$ 646,733
	% time paid	NA	NA	NA	54%
	Farmer Return	NA	NA	NA	521%
	Govt Cost	NA	NA	NA	$ 87,517

Government Cost and Farmer Returns

The government cost increased for ARC and PLC in Alternative 1 compared to the Baseline (tables 1 & 4). Payments for ARC increased more than 130% for each farm. Average PLC payments increased by more than 200% for ARSR3240, the smallest increase. The largest increase in PLC payments of approximately 10 times occurred for IAG3400. The increase in government costs for ARC and PLC was somewhat offset by both SCO programs and crop insurance premiums which declined by roughly 25%. Consequently, the government share of the premium subsidy declined by 25%. The farmer's return on premiums paid for both SCO and crop insurance were virtually the same as the Baseline. The results showed that the price decline described in this alternative would result in no greater return on premiums paid for farmers in addition to lower maximum potential payouts. Both House and Senate STAX programs for TXCB8000 had lower government costs than the Baseline but higher farmer returns.

Risk Reducing Properties

For three of the four farms, PLC had the lowest CV for revenue and SCO had the highest table 5). The highest CV for revenue on the TXCB8000 farm was STAX House. PLC is designed specifically to deal with price declines such as the one assumed in this alternative and reduced the low end revenue risk for all the farms which resulted in the relatively low CVs. SCO had the highest maximum payments and had either the lowest or second lowest minimum payment for each farm. The results show that SCO actually increased the dispersion in farm revenue compared to no programs. For IAG3400, PLC had the lowest probability of having a cash flow deficit in 2016 at 3.4%. Crop insurance had the highest probability at 13.9% followed by the next highest, SCO, at just over 10% (table 5). DP had the lowest probability of a cash flow deficit in 2016 for ARSR3240 at 26.2%. PLC was next lowest at 45.8% while crop insurance was the highest at 60.4%. For KSCW2000, DP had the lowest probability of a cash flow deficit at 71.5% followed closely by SCO at 73.2%. Crop insurance had the highest chance of a cash flow deficit at 82.3% (table 5) for KSCW2000. Crop insurance had the lowest chance of a cash flow deficit for TXCB8000 at 16.5%. The next lowest was DP at 43.9% for TXCB8000 (table 5).

Table 5. Alternative 1 Results for Individual Farm Program's Risk Reducing Properties for Each Representative Farm.

Variable	Farm			
CV	**IAG3400**	**ARSR3240**	**KSCW2000**	**TXCB8000**
No Programs	24.15	26.98	23.90	24.86
DP	23.31	24.54	22.54	23.42
ARC	22.00	23.88	21.85	24.01
PLC	20.66	23.57	18.78	22.19
SCO House	25.29	27.57	24.70	24.81
INS	24.17	26.79	23.77	24.16
STAX Senate	NA	NA	NA	24.53
STAX House	NA	NA	NA	24.86
Prob Neg End Cash				
No Programs	13.82%	59.88%	79.99%	78.41%
DP	6.85%	26.24%	71.48%	43.87%
ARC	6.87%	48.51%	76.94%	77.00%
PLC	3.43%	45.76%	77.59%	75.32%
SCO House	10.31%	53.03%	73.17%	76.26%
INS	13.97%	60.44%	82.34%	16.47%
STAX Senate	NA	NA	NA	76.26%
STAX House	NA	NA	NA	76.26%

Risk Ranking Preference

The SERF analysis results were similar for IAG3400 and KSCW2000 (figures 10 & 12). Both farms preferred DP first with SCO second. Crop insurance is least preferred by both farms, and ranked even below the No Programs option. ARC was third most preferred for IAG3400, followed closely by PLC. KSCW2000 preferred PLC third most with ARC fourth most preferred across all levels of risk aversion.

ARSR3240 preferred DP over the other farm programs (figure 11). The second most preferred was crop insurance. PLC was third most preferred which was followed by ARC, SCO, and No Program option. For a risk averse decision maker on ARSR3240, the

difference between having no program, SCO, or ARC was very small. For TXCB8000, crop insurance was most preferred over all levels of risk aversion by a wide margin (figure 13). For TXCB8000, DP was second most preferred; STAX was third most preferred, ranking just above all the remaining program options.

Senate and House Results

All four farms had higher mean and maximum NCFI under the House farm bill (table 6). All minimum NCFIs were higher than under the Senate farm bill. Each farm had a probability of having a cash flow deficit in 2016 that was four to five percent lower under the House farm bill versus the Senate farm bill.

The greater level of protection provided by the House farm bill represented by the lower probabilities of cash flow deficits and higher minimum NCFI numbers came with a greater government cost for the House farm bill. For each farm, the sum of PLC payments and the government's share of premiums were higher than ARC payments and SCO Senate government costs. Furthermore, the maximum payments for PLC are greater than ARC, indicating a greater potential government cost under the House farm bill.

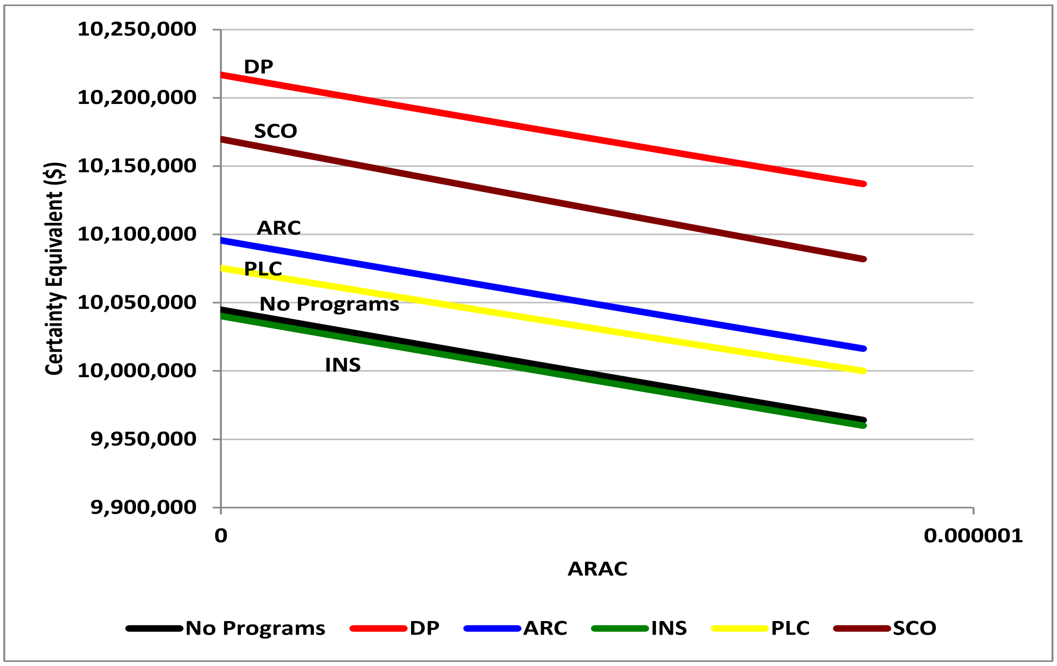

Figure 10. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for IAG3400 (for Alternative 1).

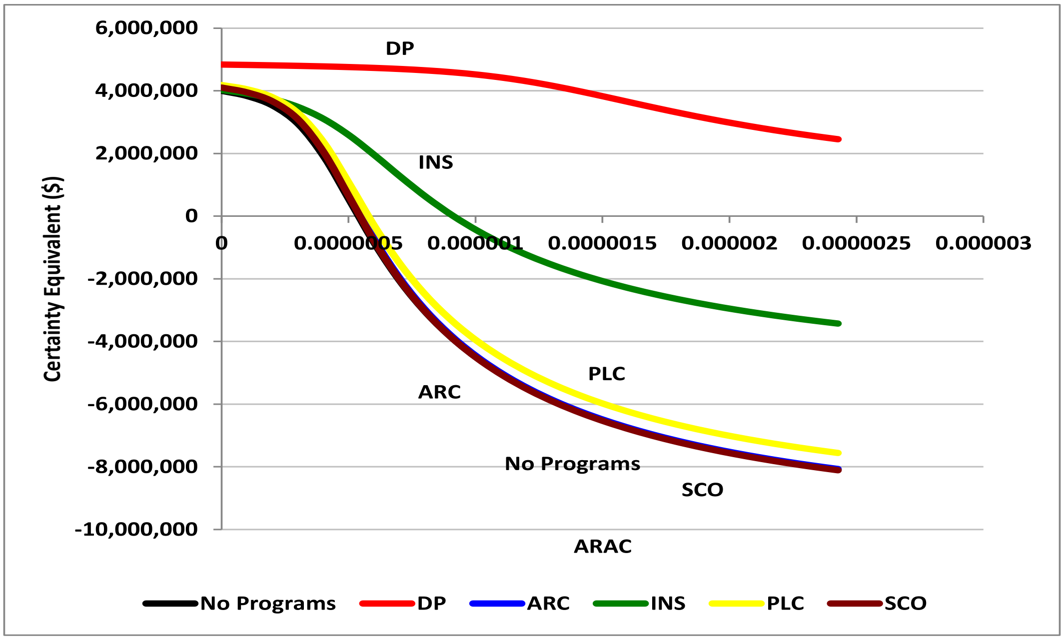

Figure 11. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for ARSR3240 (for Alternative 1).

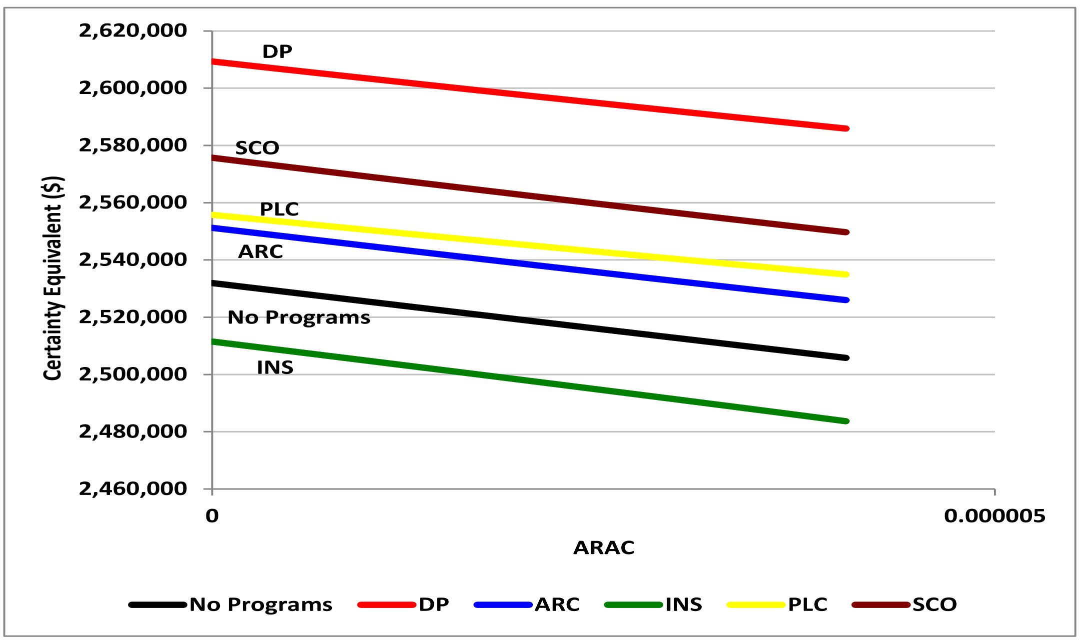

Figure 12. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for KSCW2000 (for Alternative 1).

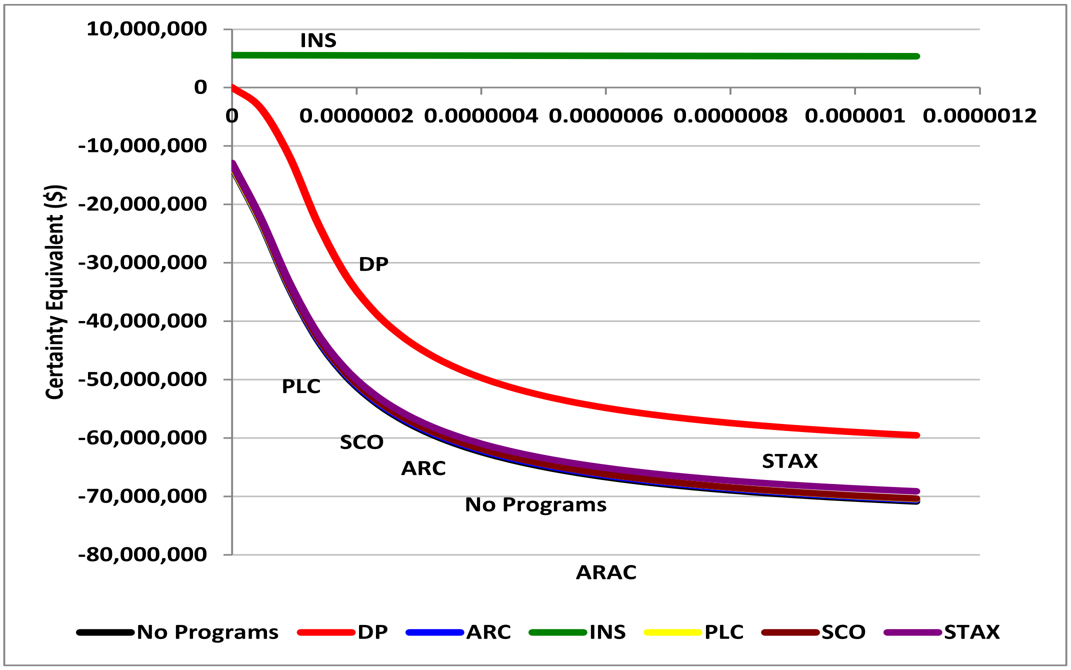

Figure 13. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for Alternative 1).

Table 6. Alternative 1 Results of Senate and House Farm Bills for Each Representative Farm.

Variable		Farm							
		IAG3400 Senate	IAG3400 House	ARSR3240 Senate	ARSR3240 House	KSCW2000 Senate	KSCW2000 House	TXCB8000 Senate	TXCB8000 House
Crop Receipts	Mean	$ 1,905,916	$ 1,905,916	$ 1,474,474	$ 1,474,474	$ 416,405	$ 416,405	$ 2,594,334	$ 2,594,334
	Min	$ 993,701	$ 993,701	$ 657,819	$ 657,819	$ 227,956	$ 227,956	$ 1,103,986	$ 1,103,986
	Max	$ 3,404,374	$ 3,404,374	$ 2,918,270	$ 2,918,270	$ 701,986	$ 701,986	$ 4,726,825	$ 4,726,825
	CV	22.45	22.09	23.85	24.13	22.15	19.84	23.30	21.20
NCFI	Mean	$ 633,860	$ 690,639	$ 135,436	$ 180,045	$ 97,599	$ 121,479	$ 721,996	$ 822,679
	Min	$ (265,041)	$ (117,179)	$ (902,227)	$ (746,762)	$ (85,690)	$ (43,787)	$ (743,102)	$ (437,447)
	Max	$ 2,015,975	$ 2,218,926	$ 1,458,169	$ 1,681,442	$ 376,805	$ 413,752	$ 3,394,820	$ 3,486,350
	% time paid	NA	NA	NA	NA	NA	NA	NA	NA
	Farmer Return	NA	NA	NA	NA	NA	NA	NA	NA
	Govt Cost	NA	NA	NA	NA	NA	NA	NA	NA
ARC or PLC	Mean	$ 72,463	$ 62,309	$ 73,380	$ 83,952	$ 17,372	$ 25,003	$ 50,860	$ 95,985
	Min	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Max	$ 100,000	$ 250,000	$ 100,000	$ 250,000	$ 39,488	$ 80,229	$ 100,000	$ 250,000
	% time paid	80%	49%	91%	86%	95%	79%	60%	63%
	Farmer Return	NA	NA	NA	NA	NA	NA	NA	NA
	Govt Cost	$ 72,463	$ 62,309	$ 73,380	$ 83,952	$ 17,372	$ 25,003	$ 50,860	$ 95,985
SCO	Mean	$ 17,377	$ 84,310	$ 8,173	$ 38,775	$ 8,372	$ 24,597	$ 29,661	$ 74,337
	Min	$ (22,898)	$ (49,125)	$ (40,992)	$ (56,267)	$ (5,599)	$ (11,830)	$ (24,956)	$ (55,458)
	Max	$ 286,512	$ 636,693	$ 249,310	$ 524,144	$ 48,862	$ 120,889	$ 272,563	$ 605,695
	% time paid	34%	60%	25%	45%	79%	89%	37%	44%
	Farmer Return	140%	306%	43%	115%	245%	324%	298%	336%
	Govt Cost	$ 28,935	$ 64,300	$ 43,903	$ 78,398	$ 7,970	$ 17,712	$ 23,201	$ 51,557
Insurance	Mean	$ (853)	$ (853)	$ (4,954)	$ (4,954)	$ (4,886)	$ (4,886)	$ (12,519)	$ (12,519)
	Min	$ (8,584)	$ (8,584)	$ (29,343)	$ (29,343)	$ (12,858)	$ (12,858)	$ (65,486)	$ (65,486)
	Max	$ 449,038	$ 449,038	$ 114,461	$ 114,461	$ 61,926	$ 61,926	$ 499,626	$ 499,626
	% time paid	5%	5%	27%	27%	8%	8%	13%	13%
	Farmer Return	-21%	-21%	-31%	-31%	-67%	-67%	-35%	-35%
	Govt Cost	$ 16,086	$ 16,086	$ 23,010	$ 23,010	$ 29,010	$ 29,010	$ 142,231	$ 142,231
STAX	Mean	NA	NA	NA	NA	NA	NA	$ 103,010	$ 113,893
	Min	NA	NA	NA	NA	NA	NA	$ (36,636)	$ (36,636)
	Max	NA	NA	NA	NA	NA	NA	$ 646,733	$ 646,733
	% time paid	NA	NA	NA	NA	NA	NA	49%	54%
	Farmer Return	NA	NA	NA	NA	NA	NA	493%	521%
	Govt Cost	NA	NA	NA	NA	NA	NA	$ 83,530	$ 87,517
Prob Neg End Cash		6.11%	2.59%	46.82%	41.71%	77.32%	71.89%	8.96%	4.26%

A SERF analysis showed all four farms prefer the House Bill for the Alternative 1 low price simulation (figures 14 -17). The preference for each farm held across all levels of risk aversion. KSCW2000 and TXCB8000 showed a slightly increasing preference for the House farm bill at higher levels of risk aversion. ARSR3240 showed a strong increase in preference for the House farm bill at higher levels of risk aversion. This is shown by increasing risk premiums at higher ARAC values.

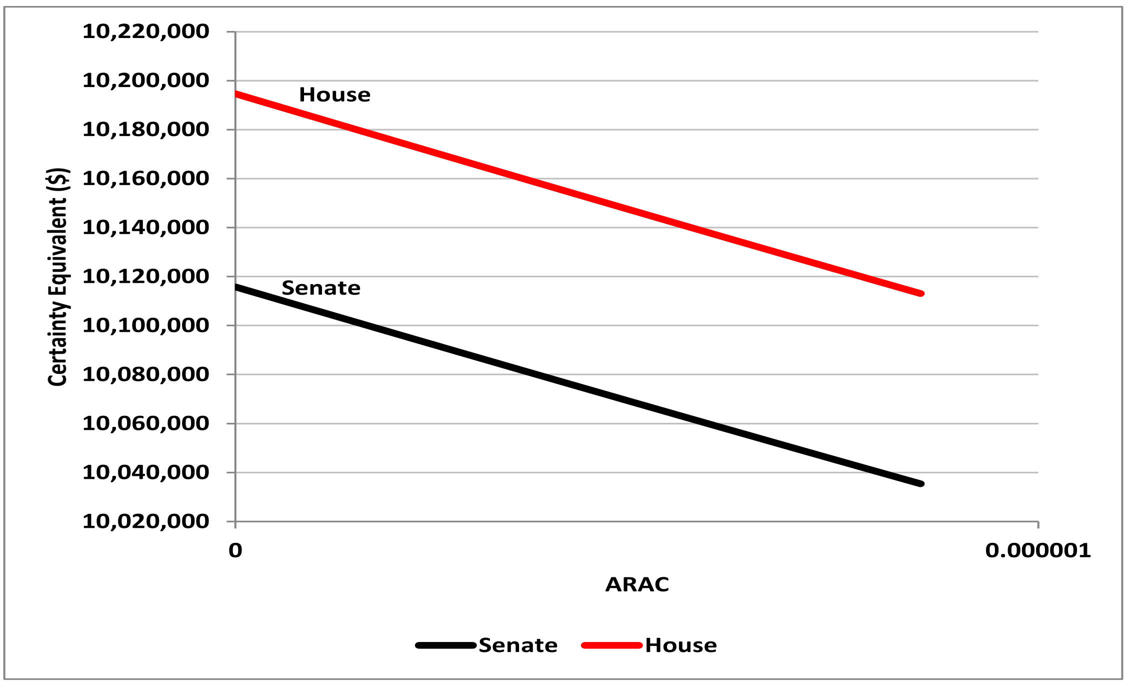

Figure 14. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for IAG3400 (for the House and Senate under Alternative 1).

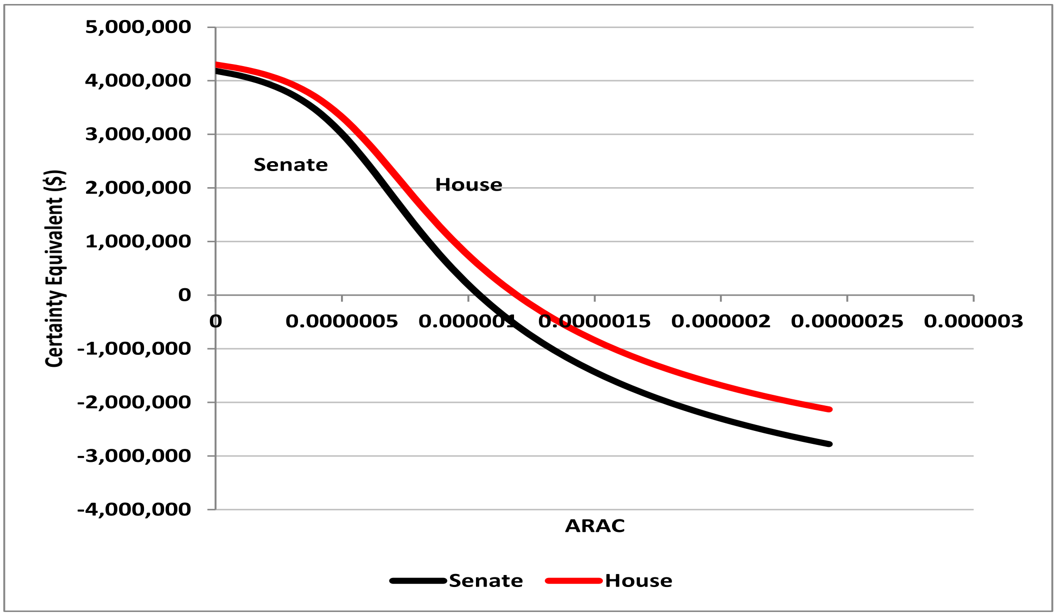

Figure 15. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for ARSR3240 (for the House and Senate under Alternative 1).

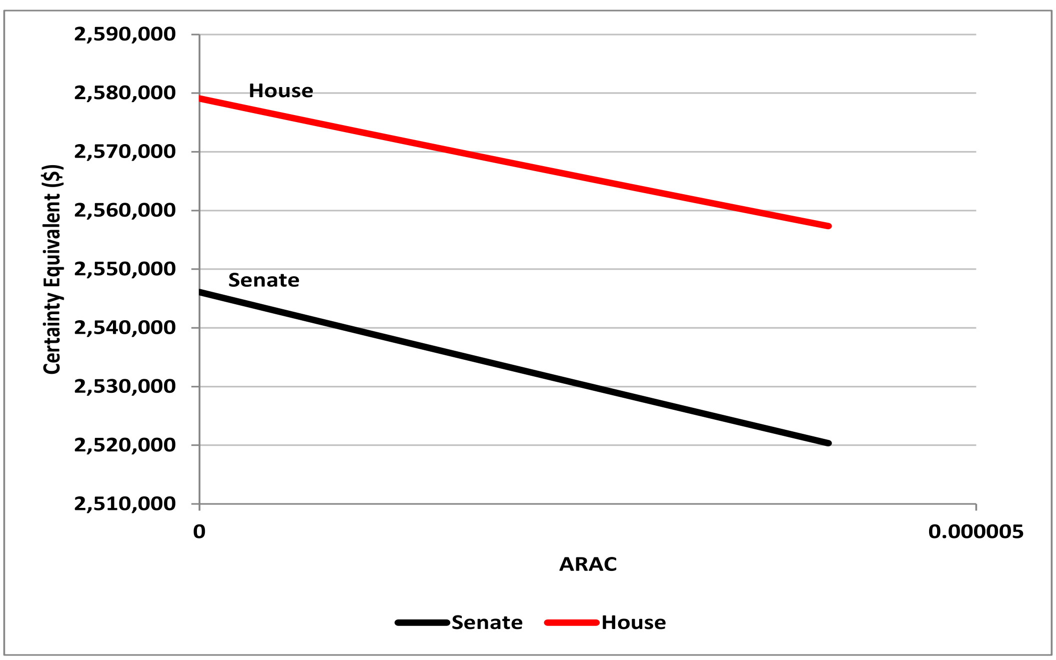

Figure 16. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for KSCW2000 (for the House and Senate under Alternative 1).

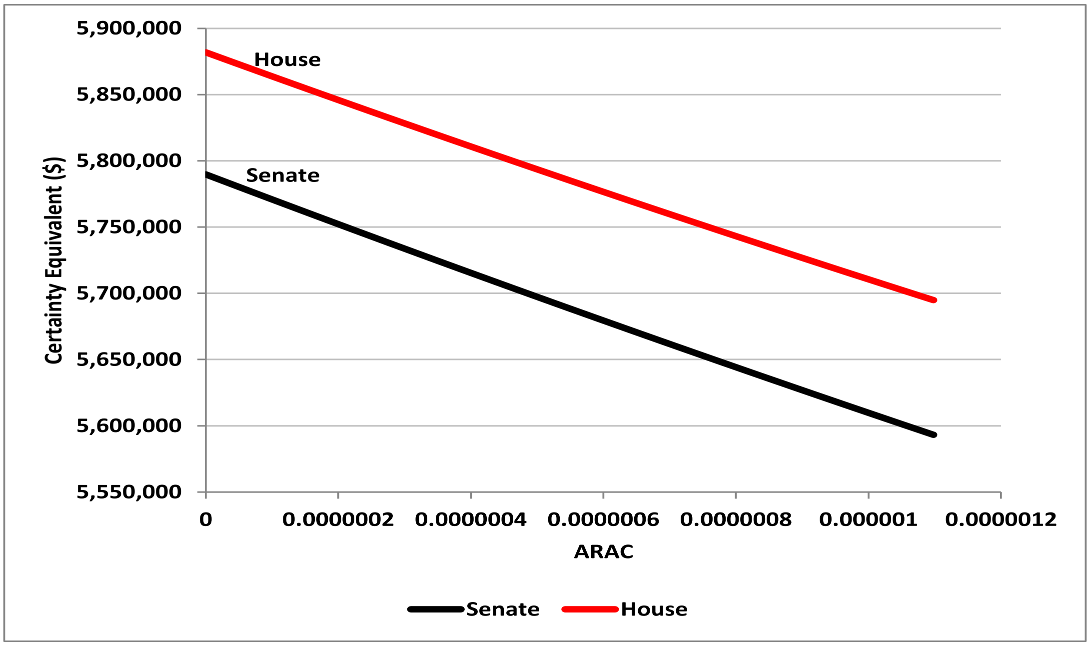

Figure 17. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for the House and Senate under Alternative 1).

Results for Alternative 2: Low Price 2

All scenarios reported in this section were simulated assuming a 25% reduction in the annual mean commodity prices in the FAPRI 2012 January Baseline in 2016. However, in contrast to Alternative 1, this price decline alternative represented a drop in price after the planting of crops. Thus, the 25% drop was assumed to apply to only the harvest insurance price and not the base price. Alternative 2 produced results that were significantly different for all of the insurance based programs compared to Alternative 1.

Magnitude and Frequency of Payments

The results when compared to the Alternative 1 price decline show that the timing of the price declines made a big difference in how each program responded. The ARC and PLC payment frequency and size remained the same for all four farms compared to the Alternative 1 price decline. This is explained by the equations for ARC and PLC detailed in the methodology section. Both programs use the first five month national marketing year price to establish payments. For ARC, the first five month price is used to establish actual revenue, and for PLC this price is used to compare against the assigned commodity reference price.

In both the Senate and House versions of SCO, crop insurance, and STAX, the mean and maximum payments, as well as the percentage of time positive payments were simulated, increased compared to the Alternative 1 price decline (tables 4 & 7). The exception was crop insurance for ARSR3240 (which only takes yield coverage insurance). The increase in the effectiveness of these programs comes from two areas. These programs are insurance based and cover against price declines that occur within the growing year. Each program used the harvest insurance price to calculate actual revenue. Therefore, when only the harvest price falls, actual revenue is more likely to be less than guaranteed revenue for these programs. Secondly, with the base price not experiencing a decline, the amount of coverage or guarantee is increased compared to the Alternative 1 price decline.

Results of specific farm programs for low price Alternative 2 showed the increased payments for SCO and crop insurance (table 7). Compared to Alternative 1 where payments for PLC were highest for all farms excluding IAG3400, Alternative 2 resulted in SCO House having the highest mean payments for all farms excluding TXCB8000 which received the largest payments from STAX House. The frequency of positive payments made for both SCO programs was large particularly for IAG3400, ARSR3240, and KSCW2000. For these three farms, SCO Senate had an 86% to 98% probability of positive payments. For SCO House, the probability ranged from 97% to 99%.

Under Alternative 2, crop insurance had lower mean payments than SCO House and SCO Senate for all farms (excluding TXCB8000) (table 7). However, crop insurance had higher maximum payments for all but the ARSR3240 farm. The result points out the differences between SCO and crop insurance. First, both versions of SCO take much smaller losses to trigger a payment versus the relatively large losses that must occur to trigger a positive crop insurance payment. Second, the smaller maximum payment potential for SCO points to the relatively narrow band of coverage that SCO provides.

Table 7. Alternative 2 Results of Individual Farm Programs for Each Representative Farm.

Variable		Farm			
		IAG3400	ARSR3240	KSCW2000	TXCB8000
Crop Receipts	Mean	$ 1,905,916	$ 1,474,474	$ 416,405	$ 2,594,334
	Min	$ 993,701	$ 657,819	$ 227,956	$ 1,103,986
	Max	$ 3,404,374	$ 2,918,270	$ 701,986	$ 4,726,825
DP	Mean	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	Min	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	Max	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	% time paid	100%	100%	100%	100%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 68,797	$ 146,603	$ 25,099	$ 159,332
ARC	Mean	$ 72,463	$ 73,380	$ 17,372	$ 50,860
	Min	$ -	$ -	$ -	$ -
	Max	$ 100,000	$ 100,000	$ 39,488	$ 100,000
	% time paid	80%	91%	95%	60%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 72,463	$ 73,380	$ 17,372	$ 50,860
SCO Senate	Mean	$ 142,570	$ 109,867	$ 25,745	$ 61,058
	Min	$ (20,391)	$ (33,402)	$ (4,240)	$ (33,275)
	Max	$ 437,856	$ 512,250	$ 78,575	$ 363,417
	% time paid	91%	86%	98%	54%
	Farmer Return	895%	438%	594%	475%
	Govt Cost	$ 37,168	$ 58,537	$ 10,109	$ 30,012
PLC	Mean	$ 62,309	$ 83,952	$ 25,003	$ 95,985
	Min	$ -	$ -	$ -	$ -
	Max	$ 250,000	$ 250,000	$ 80,229	$ 250,000
	% time paid	49%	86%	79%	63%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 62,309	$ 83,952	$ 25,003	$ 95,985
SCO House	Mean	$ 364,463	$ 258,857	$ 65,838	$ 149,985
	Min	$ (39,930)	$ (38,771)	$ (8,420)	$ (73,944)
	Max	$ 973,012	$ 930,365	$ 174,611	$ 807,594
	% time paid	97%	98%	99%	61%
	Farmer Return	1030%	578%	684%	525%
	Govt Cost	$ 82,595	$ 104,531	$ 22,464	$ 66,694
Insurance	Mean	$ 70,471	$ (6,606)	$ 13,433	$ 64,417
	Min	$ (8,967)	$ (39,125)	$ (13,355)	$ (82,389)
	Max	$ 1,042,497	$ 152,615	$ 178,718	$ 976,859
	% time paid	50%	27%	60%	36%
	Farmer Return	1314%	-31%	139%	136%
	Govt Cost	$ 21,447	$ 30,680	$ 38,680	$ 189,641
STAX Senate	Mean	NA	NA	NA	$ 189,199
	Min	NA	NA	NA	$ (45,606)
	Max	NA	NA	NA	$ 862,310
	% time paid	NA	NA	NA	64%
	Farmer Return	NA	NA	NA	712%
	Govt Cost	NA	NA	NA	$ 106,270
STAX House	Mean	NA	NA	NA	$ 193,410
	Min	NA	NA	NA	$ (45,606)
	Max	NA	NA	NA	$ 862,310
	% time paid	NA	NA	NA	66%
	Farmer Return	NA	NA	NA	720%
	Govt Cost	NA	NA	NA	$ 107,467

Government Cost and Farmer Returns

The government cost remained the same for ARC and PLC compared to the Alternative 1 price decline (tables 4 & 7). However, government cost increased considerably from the Baseline (tables 1 & 7). Unlike Alternative 1, where ARC and PLC cost increases were somewhat offset by declines in both SCO programs and crop insurance premiums, Alternative 2 results have SCO and crop insurance costs that are very similar to those of the Baseline. Alternative 2 had the highest government cost across all farm programs compared to the Baseline and Alternative 1 (tables 1, 4, & 7).

The farmer's return on premiums paid under Alternative 2 for both SCO and crop insurance were also the highest compared to the Baseline and low price Alternative 1 (tables 1, 4, & 7). The farmer's return for IAG3400 is the largest of all farms with returns of 895%, 1,030%, and 1,314% for SCO Senate, SCO House, and crop insurance, respectively. Farmer returns ranged from 438% to 594% for SCO Senate and 525% to 684% for SCO House.

Crop insurance returns for the other three farms were significantly lower than for IAG3400 (table 7). ARSR3240 had a -31% return because the farm is assumed to carry yield insurance. TXCB8000 and KSCW2000 had farmer returns of 136% and 139%, respectively. Both STAX programs for TXCB8000 had similar government costs to the Baseline but significantly higher farmer returns.

Risk Reducing Properties

As was the case with Alternative 1, PLC had the lowest CV for revenue and SCO had the highest CV for revenue across all four farms (tables 5 & 8). PLC is designed specifically to deal with price declines such as the one assumed in this alternative and reduces the low end revenue risk for all the farms which results in the relatively low CV. SCO had the highest or second highest maximum payments and had either the lowest or second lowest minimum payment for each farm. The results show that SCO actually increases the dispersion in farm revenue compared to the no programs option. For IAG3400, SCO had the lowest probability of having a cash flow deficit in 2016 at 2.8%. This number represents a 7.5% decline in the probability of a cash flow deficit for SCO compared to Alternative 1. The SCO 2.8% probability is slightly lower than PLC (3.4%), which was second lowest. Crop insurance had the highest probability of a cash flow deficit at 11.2% (table 8).

As was the case with Alternative 1, DP had the lowest probability of a cash flow deficit in 2016 for ARSR3240 at 26.3% (table 8). SCO was second lowest at 35.8% followed by PLC at 45.8%. For KSCW2000, SCO had the lowest probability of a cash flow deficit at 60.9% followed by DP at 71.7%. Crop insurance had the highest chance of a cash flow deficit at 78.4%. Crop insurance had the lowest chance of a cash flow deficit for TXCB8000 at 12.5%; the next lowest was DP at 44.6%.

Table 8. Alternative 2 Results for Individual Farm Program's Risk Reducing Properties for Each Representative Farm.

Variable	Farm			
CV	**IAG3400**	**ARSR3240**	**KSCW2000**	**TXCB8000**
No Programs	24.15	26.98	23.90	24.86
DP	23.31	24.54	22.54	23.42
ARC	22.00	23.88	21.85	24.01
PLC	20.66	23.57	18.78	22.19
SCO House	24.95	27.84	24.73	24.59
INS	24.25	26.75	23.76	22.67
STAX Senate	NA	NA	NA	24.46
STAX House	NA	NA	NA	24.86
Prob Neg End Cash				
No Programs	13.82%	59.89%	80.01%	78.41%
DP	6.85%	26.25%	71.67%	44.64%
ARC	6.87%	48.53%	76.99%	77.01%
PLC	3.43%	45.77%	77.61%	75.32%
SCO House	2.84%	35.76%	60.86%	75.67%
INS	11.16%	60.61%	78.41%	12.51%
STAX Senate	NA	NA	NA	75.34%
STAX House	NA	NA	NA	75.34%

Risk Ranking Preference

The SERF analysis results for IAG3400 show that SCO was most preferred and DP was second most preferred across all levels of risk aversion (figure 18). These two programs were clearly the most preferred and had risk premiums greater than $120,000 over the next ranked program, ARC. Compared to Alternative 1, crop insurance was preferred over the no programs option which was the least preferred (figures 10 & 18). KSCW2000 preferred DP first with SCO the second most preferred followed by PLC, ARC, no programs, and crop insurance (figure 20). ARSR3240 preferred DP across all levels of risk aversion (figure 19). For individuals who were almost risk neutral, crop insurance was preferred less than all options except no programs. However, for slight risk averse individuals and all higher levels of risk aversion, crop insurance was a clear second choice for ARSR3240. For TXCB8000, crop insurance was most preferred over all levels of risk aversion followed by DP (figure 21). All other programs were ranked very close together and similar in preference across all ARAC values.

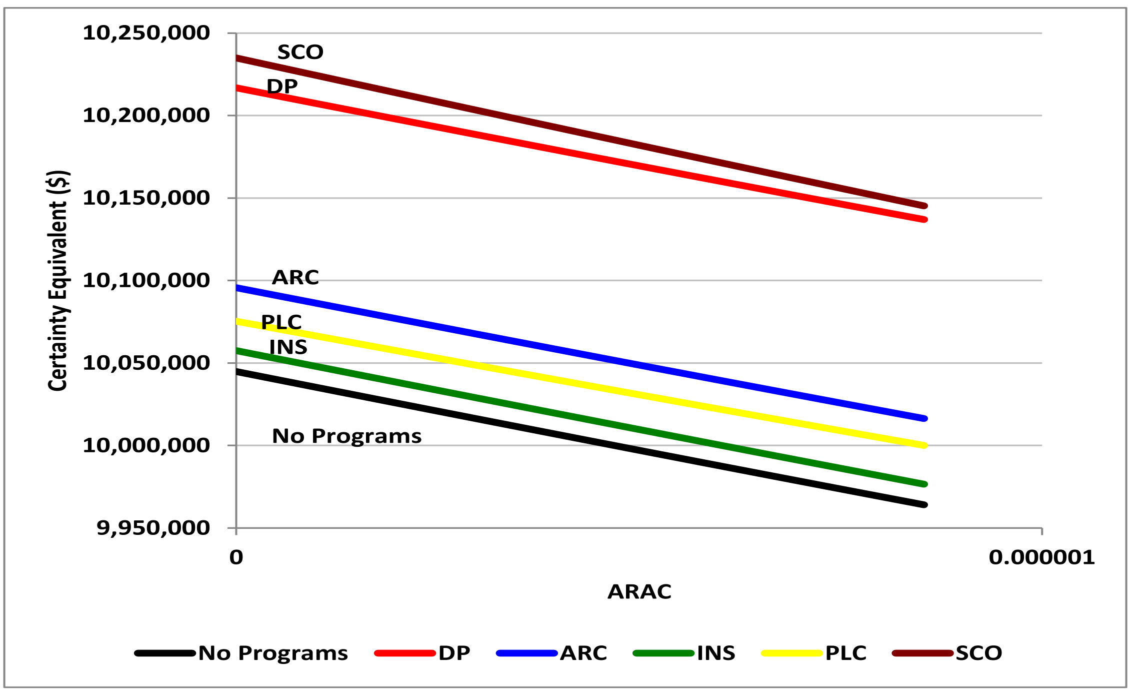

Figure 18. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for IAG3400 (for Alternative 2).

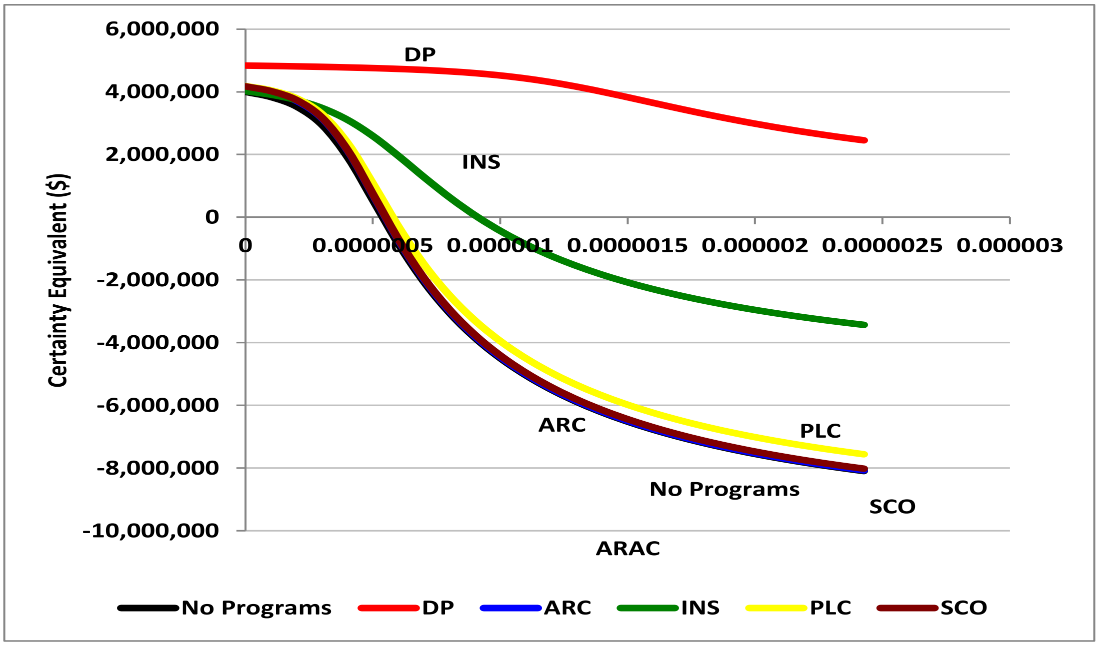

Figure 19. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for ARSR3240 (for Alternative 2).

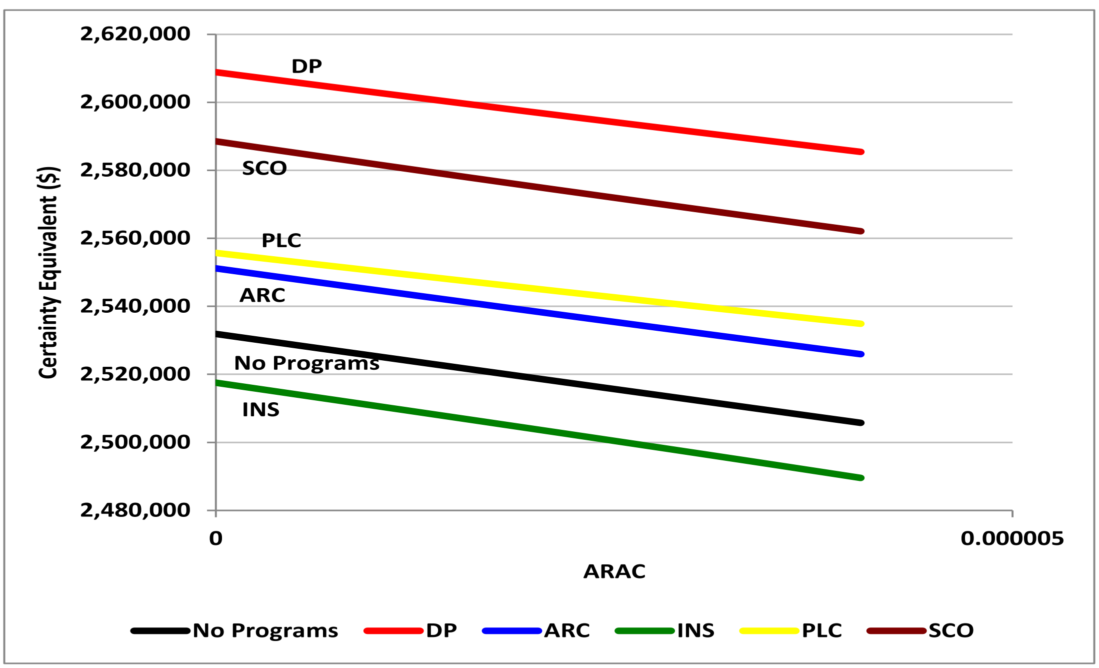

Figure 20. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for KSCW2000 (for Alternative 2).

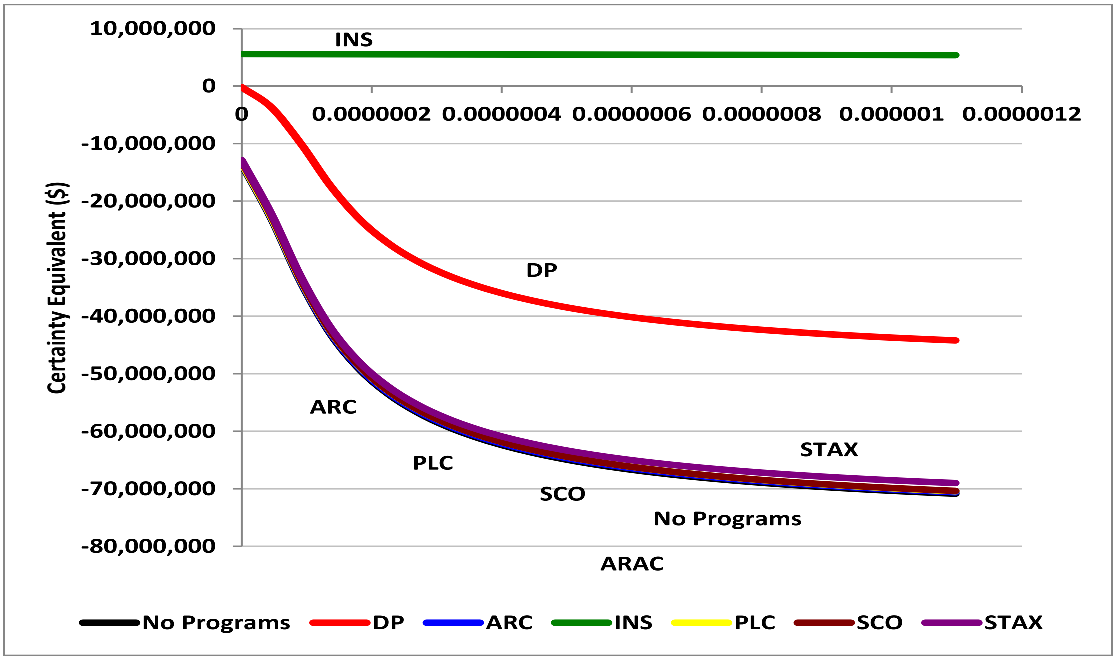

Figure 21. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for Alternative 2).

Senate and House Results

All four farms had higher mean and maximum NCFI under the House farm bill (table 9). All minimum NCFI for the House farm bill were higher than under the Senate farm bill. The difference in mean NCFI for IAG3400 is $211,739 ($1,042,042 versus $830,303). For ARSR3240 the House mean NCFI was $398,328 compared to $235,330 for the Senate. NCFI was $180,918 for the House and $133,169 for the Senate for KSCW2000. For TXCB8000, the difference in NCFI was $138,263 between the two versions of the farm bill.

Each farm had a lower probability of having a cash flow deficit in 2016 under the House farm bill versus the Senate farm bill (table 8). Unlike the Alternative 1 low price scenario where all farms had about a 4% to 5% lower probability of a cash flow deficit, Alternative 2 had a greater variation in results. IAG3400 reported a 1.6% lower probability of a cash flow deficit for the House versus the Senate (table 8). The House had a 26.6% probability of a cash flow deficit compared to 37.6% for the Senate. KSCW2000 had the largest difference between the probability of a cash flow deficit for the House and Senate at 15 percentage points (65.2% versus 50.2%). TXCB8000 had a 1.4% probability of a cash flow deficit for the House compared to 4.5% for the Senate.

This greater level of protection came with a greater government cost for the House version. For each farm, the combination of PLC payments and the government share of SCO House premiums were higher than ARC payments and SCO Senate government costs (table 7). Furthermore, the maximum payments for PLC are greater than ARC, indicating a greater potential government cost under the House farm bill.

Table 9. Alternative 2 Results of Senate and House Farm Bills for Each Representative Farm.

Variable		Farm							
		IAG3400 Senate	**IAG3400 House**	**ARSR3240 Senate**	**ARSR3240 House**	**KSCW2000 Senate**	**KSCW2000 House**	**TXCB8000 Senate**	**TXCB8000 House**
Crop Receipts	Mean	$ 1,905,916	$ 1,905,916	$ 1,474,474	$ 1,474,474	$ 416,405	$ 416,405	$ 2,594,334	$ 2,594,334
	Min	$ 993,701	$ 993,701	$ 657,819	$ 657,819	$ 227,956	$ 227,956	$ 1,103,986	$ 1,103,986
	Max	$ 3,404,374	$ 3,404,374	$ 2,918,270	$ 2,918,270	$ 701,986	$ 701,986	$ 4,726,825	$ 4,726,825
	CV	23.05	22.79	24.34	24.78	22.51	20.80	22.57	20.74
NCFI	Mean	$ 830,303	$ 1,042,042	$ 235,330	$ 398,328	$ 133,169	$ 180,918	$ 916,365	$ 1,054,628
	Min	$ (120,060)	$ (43,622)	$ (814,274)	$ (597,761)	$ (57,946)	$ (23,007)	$ (549,213)	$ (368,880)
	Max	$ 2,668,789	$ 3,192,431	$ 1,821,472	$ 2,216,286	$ 468,932	$ 559,111	$ 3,599,498	$ 3,700,966
	% time paid	NA	NA	NA	NA	NA	NA	NA	NA
	Farmer Return	NA	NA	NA	NA	NA	NA	NA	NA
	Govt Cost	NA	NA	NA	NA	NA	NA	NA	NA
ARC or PLC	Mean	$ 72,463	$ 62,309	$ 73,380	$ 83,952	$ 17,372	$ 25,003	$ 50,860	$ 95,985
	Min	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Max	$ 100,000	$ 250,000	$ 100,000	$ 250,000	$ 39,488	$ 80,229	$ 100,000	$ 250,000
	% time paid	80%	49%	91%	86%	95%	79%	60%	63%
	Farmer Return	NA	NA	NA	NA	NA	NA	NA	NA
	Govt Cost	$ 72,463	$ 62,309	$ 73,380	$ 83,952	$ 17,372	$ 25,003	$ 50,860	$ 95,985
SCO	Mean	$ 142,570	$ 364,463	$ 109,867	$ 258,857	$ 25,745	$ 65,838	$ 61,058	$ 149,985
	Min	$ (20,391)	$ (39,930)	$ (33,402)	$ (38,771)	$ (4,240)	$ (8,420)	$ (33,275)	$ (73,944)
	Max	$ 437,856	$ 973,012	$ 512,250	$ 930,365	$ 78,575	$ 174,611	$ 363,417	$ 807,594
	% time paid	91%	97%	86%	98%	98%	99%	54%	61%
	Farmer Return	895%	1030%	438%	578%	594%	684%	475%	525%
	Govt Cost	$ 37,168	$ 82,595	$ 58,537	$ 104,531	$ 10,109	$ 22,464	$ 30,012	$ 66,694
Insurance	Mean	$ 70,471	$ 70,471	$ (6,606)	$ (6,606)	$ 13,433	$ 13,433	$ 64,417	$ 64,417
	Min	$ (8,967)	$ (8,967)	$ (39,125)	$ (39,125)	$ (13,355)	$ (13,355)	$ (82,389)	$ (82,389)
	Max	$ 1,042,497	$ 1,042,497	$ 152,615	$ 152,615	$ 178,718	$ 178,718	$ 976,859	$ 976,859
	% time paid	50%	50%	27%	27%	60%	60%	36%	36%
	Farmer Return	1314%	1314%	-31%	-31%	139%	139%	136%	136%
	Govt Cost	$ 21,447	$ 21,447	$ 30,680	$ 30,680	$ 38,680	$ 38,680	$ 189,641	$ 189,641
STAX	Mean	NA	NA	NA	NA	NA	NA	$ 189,199	$ 193,410
	Min	NA	NA	NA	NA	NA	NA	$ (45,606)	$ (45,606)
	Max	NA	NA	NA	NA	NA	NA	$ 862,310	$ 862,310
	% time paid	NA	NA	NA	NA	NA	NA	64%	66%
	Farmer Return	NA	NA	NA	NA	NA	NA	712%	720%
	Govt Cost	NA	NA	NA	NA	NA	NA	$ 106,270	$ 107,467
Prob Neg End Cash		1.87%	0.29%	37.59%	26.57%	65.16%	50.19%	4.56%	1.42%

A SERF analysis showed all four farms prefer the House Bill for the Alternative 2 low price simulation (figures 22 – 25). The preference for each farm held across all levels of risk aversion. IAG3400 risk premiums declined at higher ARAC values which revealed a slight reduction in preference for the House farm bill for more risk averse producers. KSCW2000 and TXCB8000 showed a slightly increasing preference for the House farm bill at higher levels of risk aversion. ARSR3240 showed a strong increase in preference for the House farm bill at higher levels of risk aversion. This is shown by increasing risk premiums at higher ARAC values.

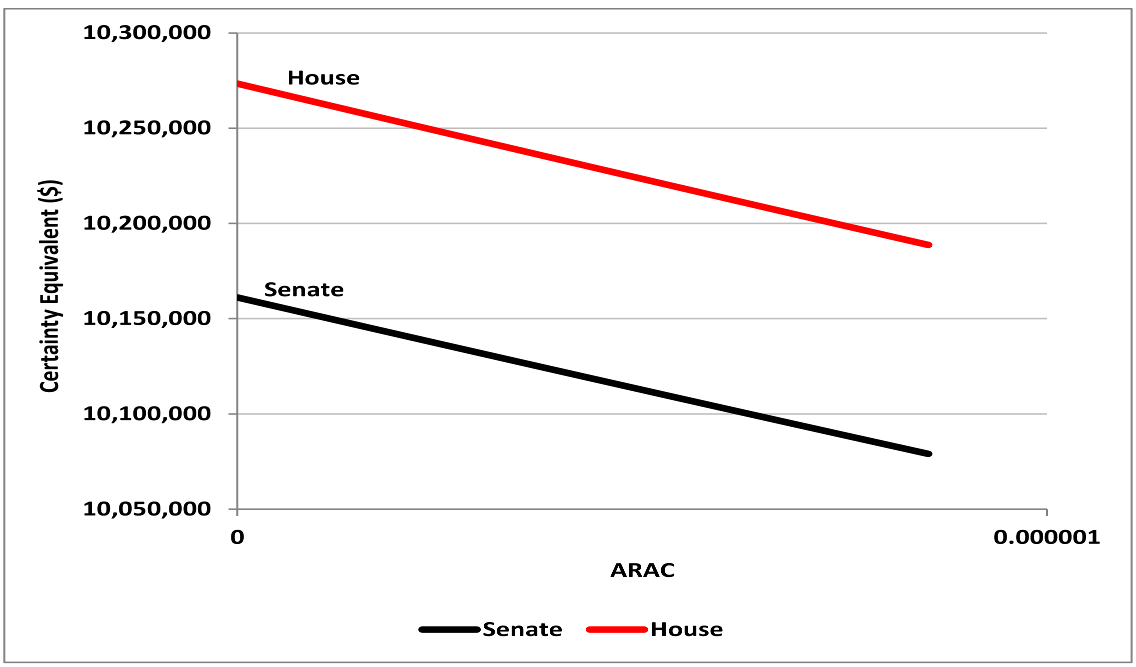

Figure 22. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for IAG3400 (for the House and Senate under Alternative 2).

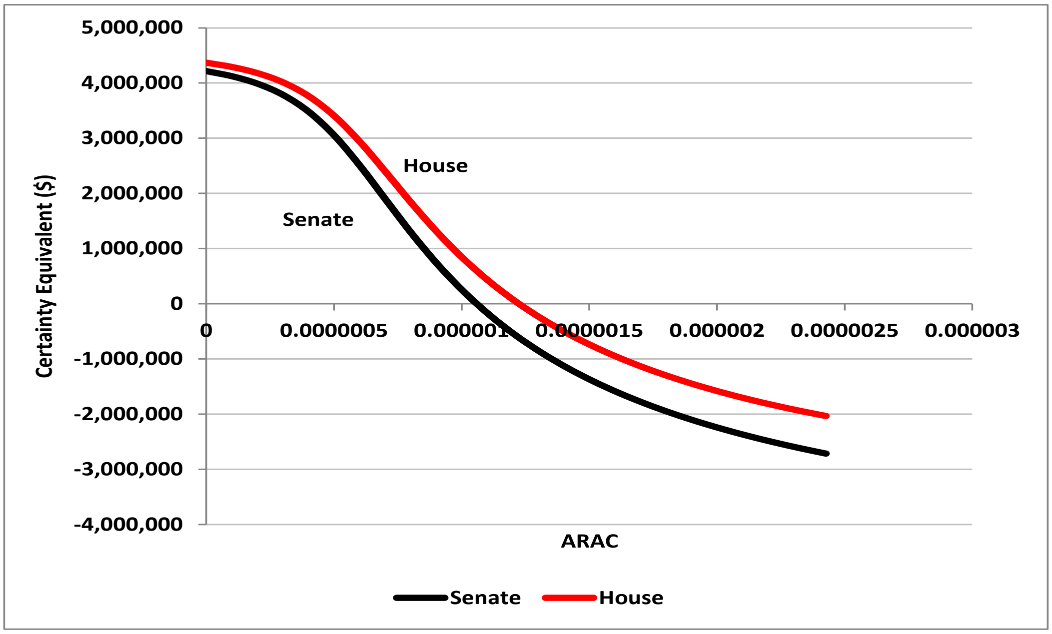

Figure 23. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for ARSR3240 (for the House and Senate under Alternative 2).

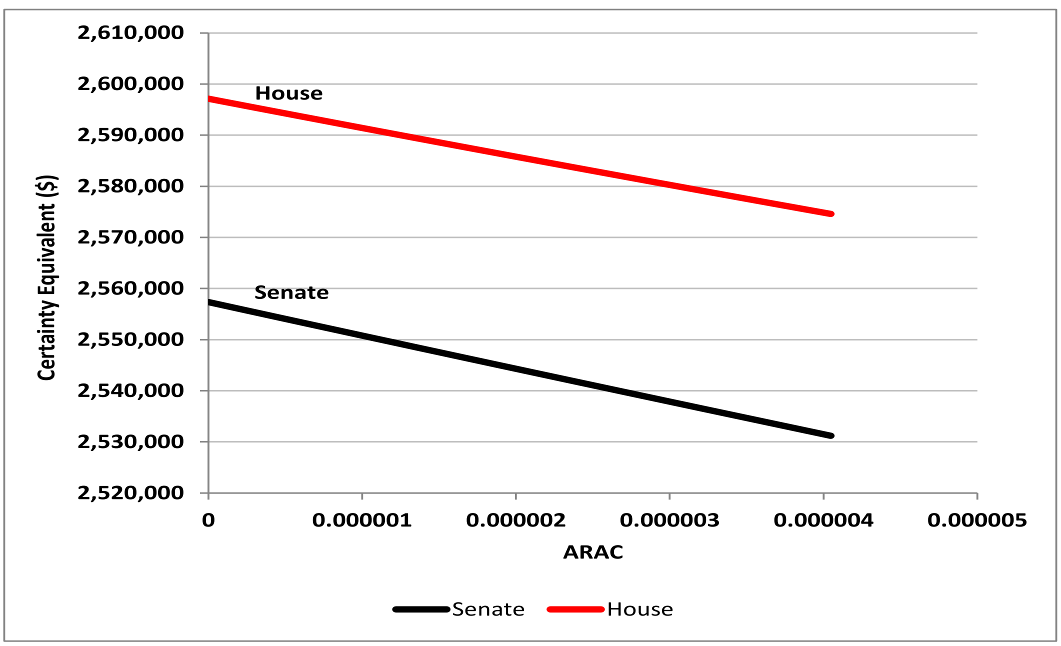

Figure 24. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for KSCW2000 (for the House and Senate under Alternative 2).

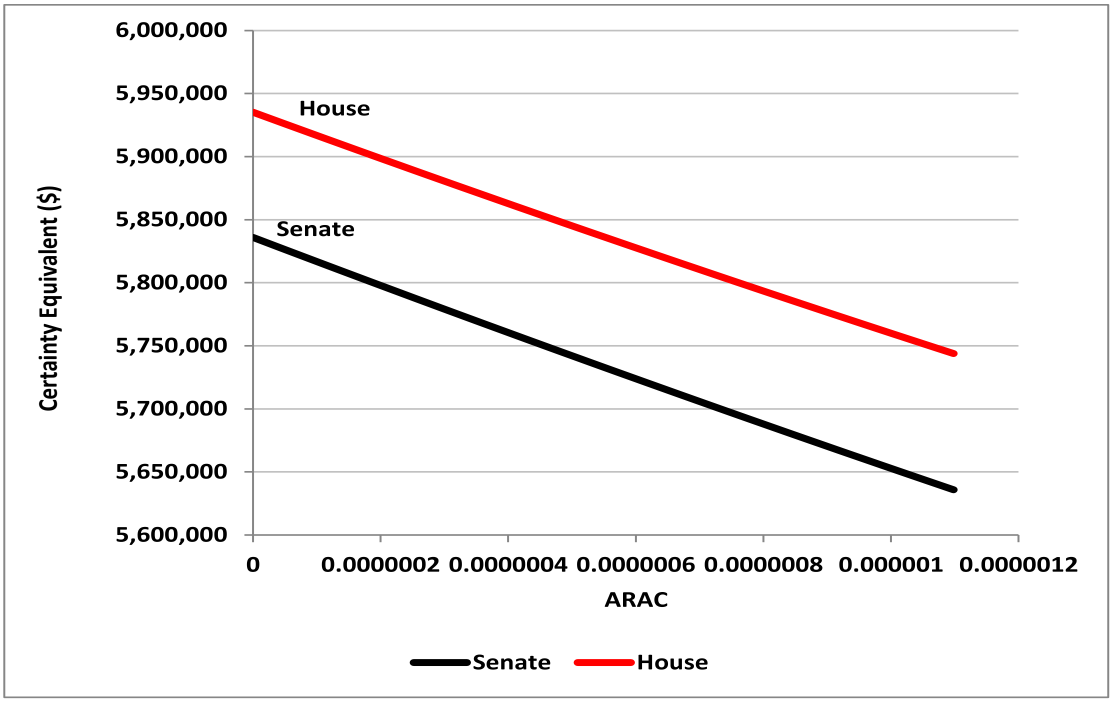

Figure 25. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for the House and Senate under Alternative 2).

Results for Alternative 3: Low Yield

The alternative assumed annual prices forecasted in the FAPRI 2012 January Baseline were used as the mean for their stochastic crop prices, but each of the farm's crop yields were reduced by 25% in 2016. The county yields for each farm were also reduced by 25% in 2016.

Magnitude and Frequency of Payments

Among the farm programs simulated, the highest mean payments in 2016 for IAG3400, ARSR3240, and KSCW2000 were for the SCO House (table 10). Because the county was assumed to have the same loss as the farms and SCO pays on county losses, the SCO House pays at a higher rate than it did under the Baseline. If the county was assumed not to have a loss, but the farm did incur a loss, then the results for SCO would mirror those of the Baseline. SCO House had the highest frequency of payments (62% – 100%) of all the programs with the exception of the direct payments which are all paid at a 100% frequency (table 10). The same rationale to explain the SCO program's relatively high mean payments and high frequency of positive payments used in Alternative 2 applies to the Low Yield Alternative as well. The results can be explained by the SCO program's relatively small loss threshold (10% loss at the county level for a payment to occur). Additionally, the maximum payments for SCO House are higher than the other programs for ARSR3240 and second highest for the other three farms. The uncapped nature of SCO gives it a large range of potential payments.

The highest mean payments for TXCB8000 were STAX House, followed by STAX Senate, and DP (table 10). TXCB8000 plants 35% (2,800 acres) of its cropland to cotton. STAX payments are greater than the payments that the farm received for its grain sorghum which is planted on 5,200 acres.

The ARC program also has a relatively high frequency of positive payments (66% – 97%), but the size of ARC payments are limited by ARC's overall payment limit of $100,000 (assumed) which constrained payments for three of the farms; and a payment band of 10%. Even so, ARC payments rank third for IAG3400, fourth for both ARSR3240 and KSCW2000, and seventh for TXCB8000 (table 10).

The DP program ranked relatively high in mean payment; second for ARSR3240, and third for both KSCW2000 and TXCB8000 (table 10). For the IAG3400 farm, DP had next to the lowest average payment.

Both PLC and crop insurance payments had relatively low mean payments compared to the other programs. PLC ranked last in mean payments for every farm except ARSR3240, which had crop insurance last (table 10). Because there was an assumed yield loss with no price loss, it is not surprising that PLC generally had the lowest frequency of payments among the six programs evaluated for each farm.

Crop insurance had high maximum payments, the highest of all programs for all farms except ARSR3240 (table 10). However, the minimum payment for crop insurance is the lowest of all programs evaluated. This is explained, in part, by the level of coverage on each farm. The ARSR3240 carries yield coverage only at the 65% level; the other three farms carry revenue coverage at the 70% coverage level with the enterprise unit option. Thus, a 25% drop in yields does not cause crop insurance to pay an indemnity. By comparison, the 25% loss does put SCO House and both STAX programs with their 10% loss thresholds into the situation of paying indemnities.

Government Cost and Farmer Returns

The government cost increased for ARC with the other programs' costs remaining almost unchanged compared to the Baseline (tables 1 & 10). Payments for ARC more than doubled for IAG3400, ARSR3240, and KSCW2000 and increased by approximately 47% for TXCB8000. The expected cost for PLC remained the same because no price decline was assumed. SCO, STAX, and crop insurance all use either county or farm historical yields and the base insurance price to set the amount of coverage a farm receives and the resulting premium costs. Because the yield drop during the crop year did not affect premium calculations, the premiums charged to the farmers were calculated to be the same as under the Baseline.

The farmer's return on premiums paid for SCO, STAX, and crop insurance were significantly higher than they were under the Baseline (tables 1 & 10). The results show larger mean and maximum payments for all three of these programs. With premiums very similar to those in the Baseline, the results were a greater return on the farmer's share of their premiums.

Table 10. Alternative 3 Results of Individual Farm Programs for Each Representative Farm.

Variable		Farm			
		IAG3400	ARSR3240	KSCW2000	TXCB8000
Crop Receipts	Mean	$ 1,911,575	$ 1,471,507	$ 415,475	$ 2,594,780
	Min	$ 997,990	$ 655,045	$ 227,164	$ 1,108,604
	Max	$ 3,410,719	$ 2,914,932	$ 700,908	$ 4,728,474
DP	Mean	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	Min	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	Max	$ 68,797	$ 146,603	$ 25,099	$ 159,332
	% time paid	100%	100%	100%	100%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 68,797	$ 146,603	$ 25,099	$ 159,332
ARC	Mean	$ 79,748	$ 81,095	$ 19,588	$ 55,577
	Min	$ -	$ -	$ -	$ -
	Max	$ 100,000	$ 100,000	$ 39,488	$ 100,000
	% time paid	86%	94%	97%	66%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 79,748	$ 81,095	$ 19,588	$ 55,577
SCO Senate	Mean	$ 164,608	$ 128,485	$ 29,777	$ 64,822
	Min	$ (22,274)	$ (17,583)	$ (4,786)	$ (33,275)
	Max	$ 437,856	$ 512,250	$ 79,656	$ 363,417
	% time paid	97%	98%	99%	57%
	Farmer Return	996%	512%	654%	489%
	Govt Cost	$ 38,580	$ 58,537	$ 10,627	$ 30,934
PLC	Mean	$ 6,183	$ 34,740	$ 6,632	$ 23,197
	Min	$ -	$ -	$ -	$ -
	Max	$ 154,075	$ 250,000	$ 51,604	$ 250,000
	% time paid	12%	51%	39%	24%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 6,183	$ 34,740	$ 6,632	$ 23,197
SCO House	Mean	$ 430,286	$ 308,935	$ 75,632	$ 157,386
	Min	$ 96,683	$ 64,584	$ (6,566)	$ (73,944)
	Max	$ 973,012	$ 930,365	$ 177,013	$ 807,594
	% time paid	100%	100%	100%	62%
	Farmer Return	1171%	690%	747%	534%
	Govt Cost	$ 85,734	$ 104,531	$ 23,615	$ 68,743
Insurance	Mean	$ 73,220	$ 29,377	$ 14,410	$ 67,831
	Min	$ (8,967)	$ (33,442)	$ (13,355)	$ (79,325)
	Max	$ 1,042,497	$ 314,041	$ 178,718	$ 976,859
	% time paid	53%	66%	63%	38%
	Farmer Return	1366%	138%	149%	143%
	Govt Cost	$ 21,447	$ 30,680	$ 38,680	$ 189,641
STAX Senate	Mean	NA	NA	NA	$ 204,451
	Min	NA	NA	NA	$ (48,848)
	Max	NA	NA	NA	$ 862,310
	% time paid	NA	NA	NA	68%
	Farmer Return	NA	NA	NA	734%
	Govt Cost	NA	NA	NA	$ 111,374
STAX House	Mean	NA	NA	NA	$ 207,258
	Min	NA	NA	NA	$ (48,848)
	Max	NA	NA	NA	$ 862,310
	% time paid	NA	NA	NA	69%
	Farmer Return	NA	NA	NA	740%
	Govt Cost	NA	NA	NA	$ 111,957

Risk Reducing Properties

ARC had the lowest CV for revenue for IAG3400, ARSR3240, and KSCW2000 (table 11). The properties of the ARC make it pay on relatively small losses, but ARC's small pay band and payment limit contain the maximum payments. Thus, ARC performed well in lowering the CV for revenue. SCO had the highest CV for revenue across the three farms without cotton. SCO increases the dispersion in farm revenue compared to other programs as measured by the CV for revenue.

For IAG3400, SCO had the lowest probability of having a cash flow deficit in 2016 at 1.8% (table 11). The ARC program's 5.8% probability is second lowest, and PLC had the highest probability of a cash flow deficit at 10.3% for IAG3400. As was the case with Alternative 1 and Alternative 2, the Alternative 3's DP had the lowest probability of a cash flow deficit in 2016 for ARSR3240 at 25.3% and SCO was second lowest at 31.4% followed by ARC 44.9% (table 11). For KSCW2000, SCO had the lowest probability of a cash flow deficit at 57.5% followed by DP at 71.7%, and PLC had the highest chance of a cash flow deficit at 79.6% (table 11). Crop insurance had the lowest chance of a cash flow deficit for TXCB8000 at 10.5% for TXCB8000 (table 11). The next lowest probability of cash flow deficit in 2016 was DP at 42.7% for TXCB8000.

Table 11. Alternative 3 Results for Individual Farm Program's Risk Reducing Properties for Each Representative Farm.

Variable	Farm			
CV	**IAG3400**	**ARSR3240**	**KSCW2000**	**TXCB8000**
No Programs	24.09	27.02	23.95	24.82
DP	23.26	24.57	22.58	23.39
ARC	22.03	24.04	21.77	23.91
PLC	23.63	24.79	22.01	23.87
SCO House	24.25	27.26	24.59	24.56
INS	24.10	26.44	23.69	22.55
STAX Senate	NA	NA	NA	24.36
STAX House	NA	NA	NA	24.82
Prob Neg End Cash				
No Programs	12.29%	59.21%	80.18%	77.24%
DP	5.80%	25.29%	71.73%	42.74%
ARC	5.78%	44.94%	76.60%	76.62%
PLC	10.30%	51.88%	79.61%	76.43%
SCO House	1.82%	31.37%	57.47%	75.29%
INS	9.38%	53.69%	78.46%	10.45%
STAX Senate	NA	NA	NA	74.65%
STAX House	NA	NA	NA	74.52%

Risk Ranking Preference

The SERF analysis results for IAG3400 show that SCO was most preferred and DP second most preferred across all levels of risk aversion (figure 26). These results were very similar to the results for Alternative 2 (figure 18). The difference in rankings compared to Alternative 2 was risk neutral to slightly risk averse individuals preferred crop insurance to PLC. However, as the ARAC values increased, PLC was preferred over crop insurance.

As was the case with both low price alternatives, the no programs option was least preferred. DP was most preferred for all levels of risk aversion for ARSR3240 (figures 11, 19, 27). Crop insurance was second most preferred for all but the least risk averse producers. PLC was third most preferred with the remaining programs very close together in risk ranking preference.

KSCW2000 preferred DP first with SCO the second most preferred (figure 28). ARC and PLC were very similarly ranked in the SERF analysis. ARC is slightly preferred to PLC for all but the most risk averse individuals. Crop insurance was least preferred with a negative risk premium in relation to no programs.

For TXCB8000, crop insurance was most preferred by a wide margin over all other programs (figure 29). DP was second most preferred with the remaining programs falling very close together across all ARAC values.

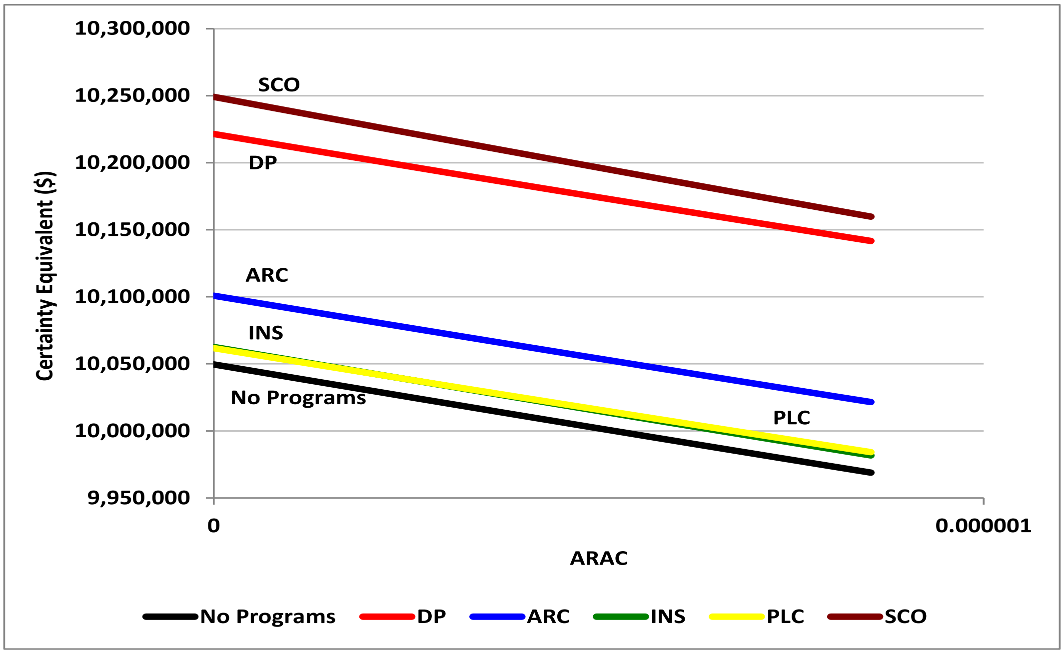

Figure 26. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for IAG3400 (for Alternative 3).

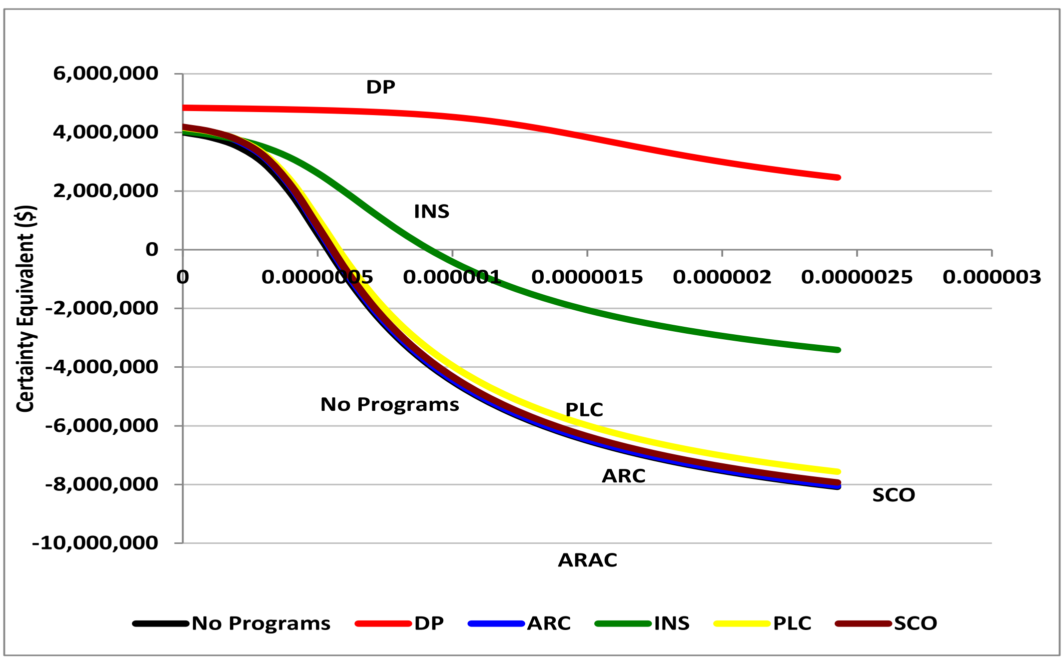

Figure 27. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for ARSR3240 (for Alternative 3).

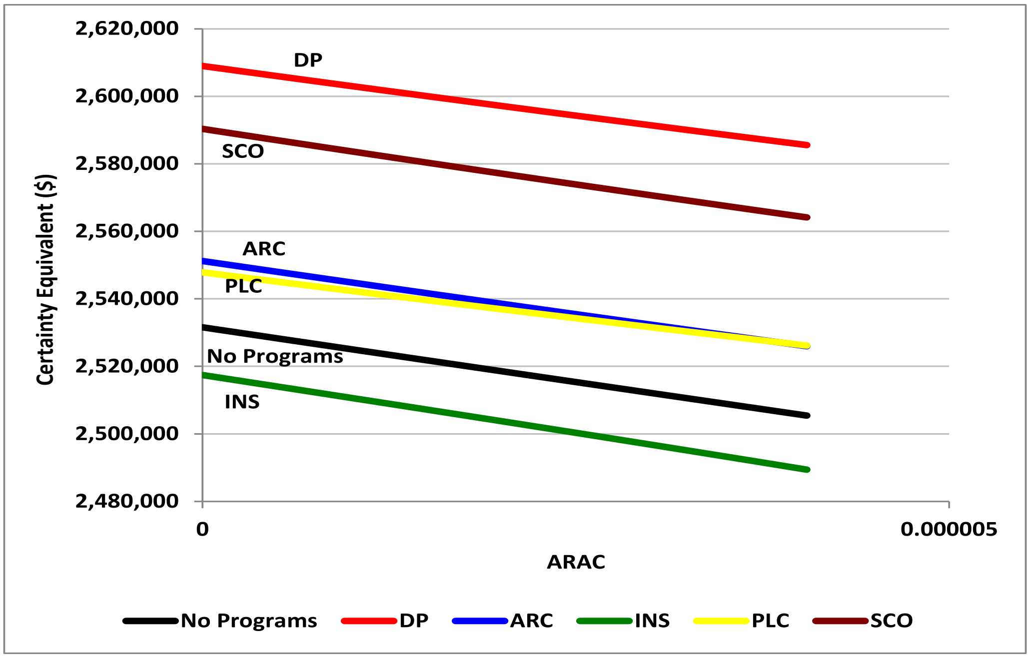

Figure 28. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for KSCW2000 (for Alternative 3).

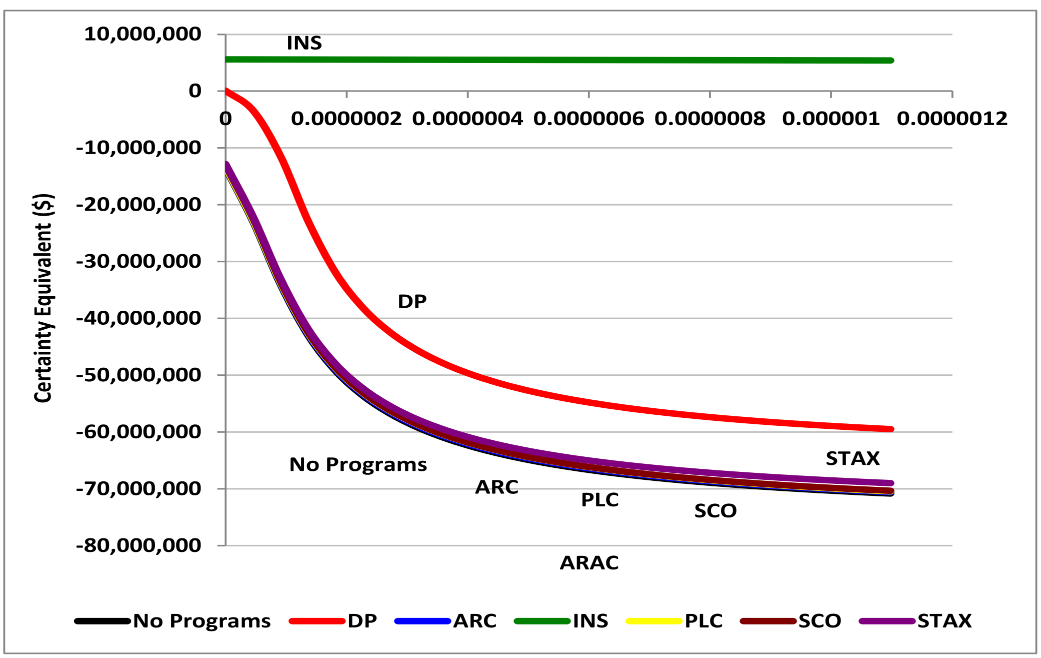

Figure 29. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for Alternative 3).

Senate and House Results

For Alternative 3, all four farms had higher mean and maximum NCFI under the House farm bill (table 12). Additionally, all minimum NCFI for the House farm bill were higher than under the Senate farm bill. The difference in mean NCFI for IAG3400 is $192,114 ($1,073,425 versus $881,311). For ARSR3240 the House NCFI was $448,996 compared to $311,464 for the Senate. NCFI was $172,388 for the House and $139,464 for the Senate for KSCW2000. For TXCB8000, the difference in NCFI was $62,990 between the two versions of the farm bill.

Each farm had a lower probability of having a cash flow deficit in 2016 under the House farm bill versus the Senate farm bill. IAG3400 and TXCB8000 had relatively low probabilities of cash flow under both House and Senate versions of the farm bill. IAG3400 reported a 0.96 lower probability of a cash flow deficit for the House versus the Senate (1.6% versus 0.64%). TXCB8000 had a 2.9% probability of a cash flow deficit for the House compared to 2.1% for the Senate. The largest difference in the probability of cash flow deficits was for ARSR3240; the House bill had a 33% chance of a cash flow deficit compared to 23% for the Senate bill. KSCW2000 had a 9% difference between the probability of a cash flow deficit between the House and Senate (63% versus 54%).

The greater level of protection for NCFI came with greater government costs for the House version. For each farm the combination of PLC payments and the government's share of SCO House premiums were higher than ARC payments and SCO

Senate government costs table 12). Furthermore, the maximum payments for PLC are greater than ARC, indicating a greater potential government cost under the House bill.

A SERF analysis showed all four farms prefer the House bill for Alternative 3, low yield simulation (figures 30 – 33). The preference for each farm held across all levels of risk aversion. The risk premiums between the House and Senate farm bills for Alternative 3 were similar to those in Alternative 1 (figures 14 – 17 & 30 – 33). The risk premiums for Alternative 2 were higher than both Alternative 1 and 3, showed the largest difference in preference between the House and Senate farm bills (figures 14 – 17, 22 – 25, & 30 – 33).

The House farm bill was criticized in some circles for not providing enough protection against yield losses. The results of this alternative refute that criticism. The House farm bill contained higher mean, maximum, and minimum NCFI. Furthermore, all four farms had low probabilities of having a cash flow deficit in 2016 under the House farm bill, and all four farms preferred the House farm bill to the Senate farm bill based on the SERF analysis. The SCO program was the key program that made the House farm bill preferred to the Senate plan. If for any reason SCO House was changed to be less effective or premium costs increased for it, then this analysis would need to be revisited.

Table 12. Alternative 3 Results of Senate and House Farm Bills for Each Representative Farm.

Variable		Farm							
		IAG3400 Senate	IAG3400 House	ARSR3240 Senate	ARSR3240 House	KSCW2000 Senate	KSCW2000 House	TXCB8000 Senate	TXCB8000 House
Crop Receipts	Mean	$ 1,911,575	$ 1,911,575	$ 1,471,507	$ 1,471,507	$ 415,475	$ 415,475	$ 2,594,780	$ 2,594,780
	Min	$ 997,990	$ 997,990	$ 655,045	$ 655,045	$ 227,164	$ 227,164	$ 1,108,604	$ 1,108,604
	Max	$ 3,410,719	$ 3,410,719	$ 2,914,932	$ 2,914,932	$ 700,908	$ 700,908	$ 4,728,474	$ 4,728,474
	CV	22.79	24.31	24.19	25.11	22.22	23.15	22.26	22.15
NCFI	Mean	$ 881,311	$ 1,073,425	$ 311,464	$ 448,996	$ 139,464	$ 172,388	$ 996,335	$ 1,059,325
	Min	$ (40,165)	$ 19,677	$ (792,404)	$ (577,972)	$ (54,939)	$ (38,363)	$ (472,612)	$ (303,627)
	Max	$ 2,687,358	$ 3,211,000	$ 1,847,351	$ 2,242,165	$ 490,955	$ 586,327	$ 3,705,299	$ 3,860,673
	% time paid	NA	NA	NA	NA	NA	NA	NA	NA
	Farmer Return	NA	NA	NA	NA	NA	NA	NA	NA
	Govt Cost	NA	NA	NA	NA	NA	NA	NA	NA
ARC or PLC	Mean	$ 79,748	$ 6,183	$ 81,095	$ 34,740	$ 19,588	$ 6,632	$ 55,577	$ 23,197
	Min	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Max	$ 100,000	$ 154,075	$ 100,000	$ 250,000	$ 39,488	$ 51,604	$ 100,000	$ 250,000
	% time paid	86%	12%	94%	51%	97%	39%	66%	24%
	Farmer Return	NA	NA	NA	NA	NA	NA	NA	NA
	Govt Cost	$ 79,748	$ 6,183	$ 81,095	$ 34,740	$ 19,588	$ 6,632	$ 55,577	$ 23,197
SCO	Mean	$ 164,608	$ 430,286	$ 128,485	$ 308,935	$ 29,777	$ 75,632	$ 64,822	$ 157,386
	Min	$ (22,274)	$ 96,683	$ (17,583)	$ 64,584	$ (4,786)	$ (6,566)	$ (33,275)	$ (73,944)
	Max	$ 437,856	$ 973,012	$ 512,250	$ 930,365	$ 79,656	$ 177,013	$ 363,417	$ 807,594
	% time paid	97%	100%	98%	100%	99%	100%	57%	62%
	Farmer Return	996%	1171%	512%	690%	654%	747%	489%	534%
	Govt Cost	$ 38,580	$ 85,734	$ 58,537	$ 104,531	$ 10,627	$ 23,615	$ 30,934	$ 68,743
Insurance	Mean	$ 73,220	$ 73,220	$ 29,377	$ 29,377	$ 14,410	$ 14,410	$ 67,831	$ 67,831
	Min	$ (8,967)	$ (8,967)	$ (33,442)	$ (33,442)	$ (13,355)	$ (13,355)	$ (79,325)	$ (79,325)
	Max	$ 1,042,497	$ 1,042,497	$ 314,041	$ 314,041	$ 178,718	$ 178,718	$ 976,859	$ 976,859
	% time paid	53%	53%	66%	66%	63%	63%	38%	38%
	Farmer Return	1366%	1366%	138%	138%	149%	149%	143%	143%
	Govt Cost	$ 21,447	$ 21,447	$ 30,680	$ 30,680	$ 38,680	$ 38,680	$ 189,641	$ 189,641
STAX	Mean	NA	NA	NA	NA	NA	NA	$ 204,451	$ 207,258
	Min	NA	NA	NA	NA	NA	NA	$ (48,848)	$ (48,848)
	Max	NA	NA	NA	NA	NA	NA	$ 862,310	$ 862,310
	% time paid	NA	NA	NA	NA	NA	NA	68%	69%
	Farmer Return	NA	NA	NA	NA	NA	NA	734%	740%
	Govt Cost	NA	NA	NA	NA	NA	NA	$ 111,374	$ 111,957
Prob Neg End Cash		1.58%	0.64%	32.51%	22.93%	62.79%	54.35%	2.91%	2.13%

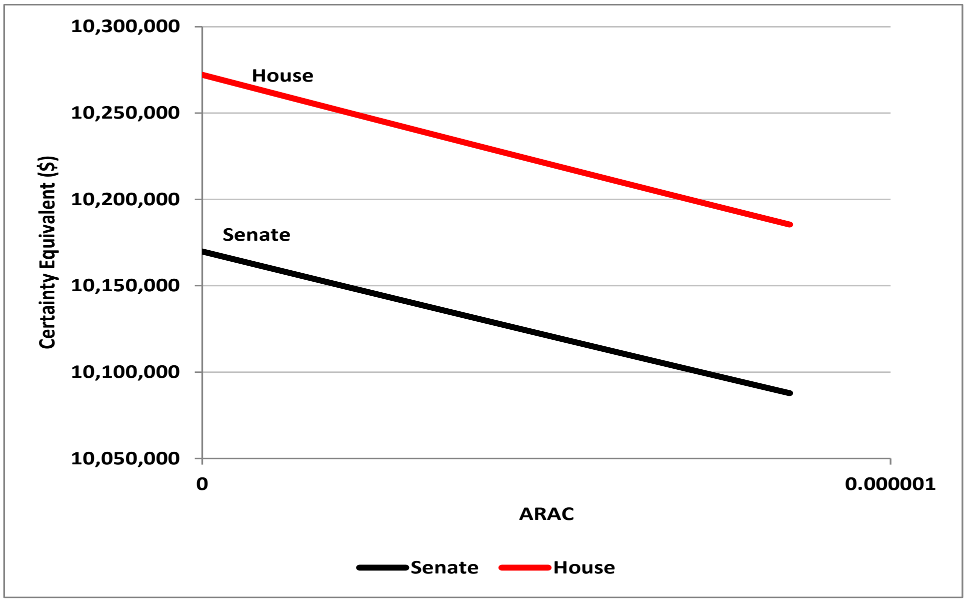

Figure 30. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for IAG3400 (for the House and Senate under Alternative 3).

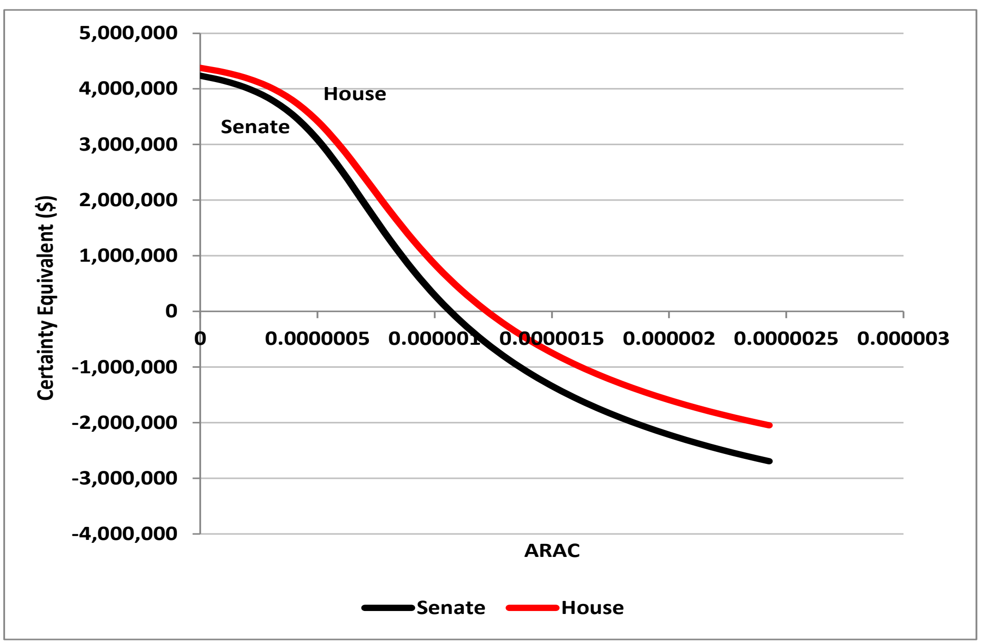

Figure 31. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for ARSR3240 (for the House and Senate under Alternative 3).

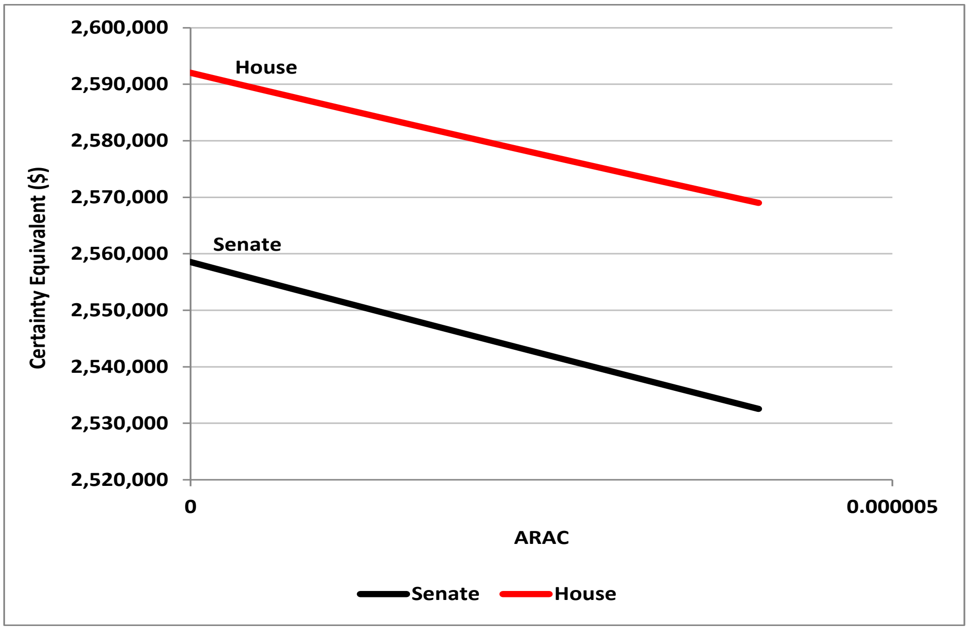

Figure 32. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for KSCW2000 (for the House and Senate under Alternative 3).

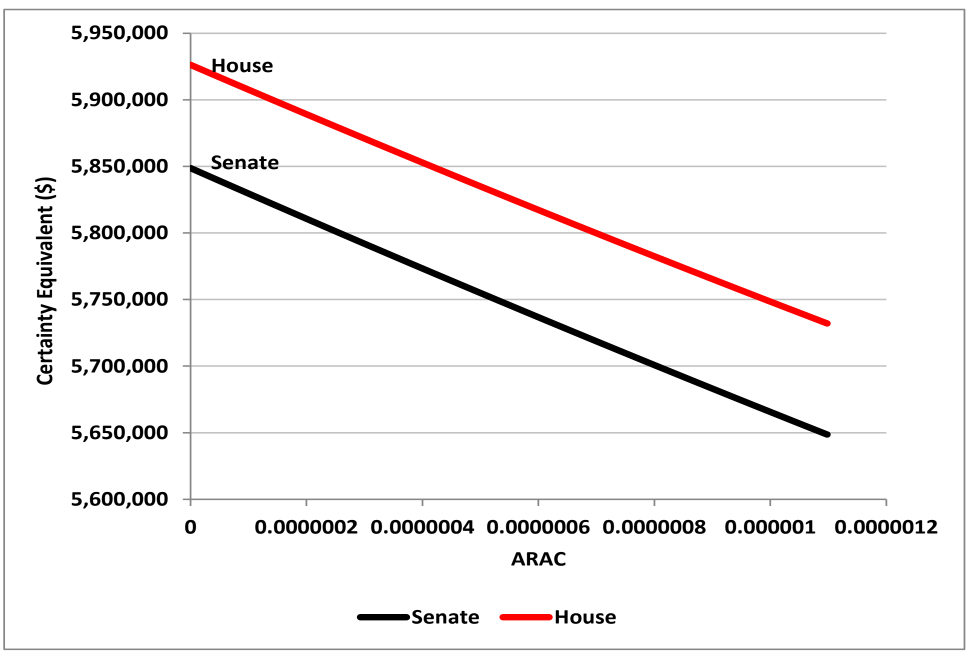

Figure 33. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for the House and Senate under Alternative 3).

Results for Alternative 4: Differing Insurance Levels

The alternative assumed annual prices forecasted in the FAPRI 2012 January Baseline were used as the mean for their stochastic crop prices. TXCB8000 was the only farm used in this Alternative. It was chosen because of its location in the Coastal Bend of Texas. The dry land farming in this region of Texas is characterized by large variability in harvested yields. The question this alternative intended to give incite to was; could a farm with large yield variability benefit from reducing its crop insurance election to take advantage of greater SCO coverage? The SCO coverage level for the House farm bill starts at 90% and goes down to the farm's insurance election level. For example, if a farm had chosen a 65% level of crop insurance coverage, SCO House would have a band of coverage from 90% down to 65%, or a 25% payment band. The 25% payment band is the maximum for SCO House. The SCO Senate payment band is equal to 79% minus the farm's crop insurance election level. The maximum payment band for SCO Senate is 14%. For this alternative, TXCB8000 was assumed to carry revenue coverage insurance with the enterprise unit option. The farm was simulated assuming a 65% farm election level and a 75% farm election level. The government premium subsidy level was assumed to be 80% for 65% coverage and 77% for 75% coverage level.

Alternative 4 Results

TXCB8000 had higher mean NCFI with the 65% farm level crop insurance coverage level under both the House and Senate farm bills (table 13). Furthermore, the 65% coverage level had higher maximum and minimum NCFI compared to the 75%

coverage level. ARC and PLC payments were unaffected by the change in insurance coverage level. The differences in NCFI between the 65% and 75% coverage level are a result of changes in SCO, STAX, and crop insurance premiums and indemnities.

Both SCO House and SCO Senate have higher mean payments under the 65% coverage level option (table 13). The percentage of time payments were positive was very similar between the two election levels. However, both versions of SCO at the 65% level have a greater spread of possible payments with lower minimums and higher maximums compared to the 75% level. Returns, though positive, are slightly lower under the 65% coverage level. Farmer returns are 278% and 318% for the Senate bill versus 317% and 354% for the House.

The STAX results mirror those of SCO (table 13). STAX had higher mean payments with lower minimums and higher maximums under the 65% level of crop insurance. The percentage of time payments were positive was just 1% lower under the 65% coverage level. Farmer returns were 27% lower under the 65% coverage level versus the 75% level.

Crop insurance payment results were identical between the House and Senate farm bills for the two coverage levels simulated. Mean crop insurance payments (indemnities net of premiums paid) were approximately $1,000 higher under the 65% level of coverage (table 13). The 75% coverage level has twice the percentage of positive payment and greater farmer returns. The 75% coverage level also has higher maximums and lower minimums.

Government costs were lower under the 65% election level for both the Senate and House farm bills (table 13). The combined cost for the Senate of SCO, STAX, and crop insurance was $297,157 for the 65% level and $368,737 for the 75% level. For the House, government costs were $349,297 for the 65% level versus $406,983 for the 75% level. In both the Senate and House cases, the savings from the reduced crop insurance costs offsets increases in the costs of SCO and STAX.

The probabilities of having a cash flow deficit were low and very similar across both levels of insurance coverage (table 13). For the Senate the probability of a cash flow deficit was 1.1% for the 65% option and 1.0% for the 75% coverage level. For the House farm bill, the probabilities were 0.4% versus 0.35% for the 65% and 75% coverage levels, respectively.

A SERF analysis was performed for both levels of crop insurance election (figures 34 & 35). The results show a difference between the Senate and House farm bills. Under the Senate farm bill, the 75% coverage level is preferred to the 65% coverage level for all levels of risk aversion (figure 34). More risk averse individuals had a greater preference for the 75% level of coverage under the Senate farm bill. This was shown by the increased risk premiums for higher levels of corresponding risk aversion.

Table 13. Alternative 4 Results of Senate and House Farm Bills for TXCB8000 at 75% and 65% crop insurance coverage levels.

		75%	65%	75%	65%
		TXCB8000 Senate	**TXCB8000 Senate**	**TXCB8000 House**	**TXCB8000 House**
Crop Receipts	Mean	$ 3,459,707	$ 3,459,707	$ 3,459,707	$ 3,459,707
	Min	$ 1,478,139	$ 1,478,139	$ 1,478,139	$ 1,478,139
	Max	$ 6,304,632	$ 6,304,632	$ 6,304,632	$ 6,304,632
	CV	23.19	23.72	22.95	23.66
NCFI	Mean	$ 1,560,552	$ 1,613,143	$ 1,607,215	$ 1,676,635
	Min	$ (390,250)	$ (335,086)	$ (155,757)	$ (10,543)
	Max	$ 4,822,201	$ 5,224,902	$ 4,977,575	$ 5,473,139
	% time paid	NA	NA	NA	NA
	Farmer Return	NA	NA	NA	NA
	Govt Cost	NA	NA	NA	NA
ARC or PLC	Mean	$ 37,920	$ 37,920	$ 23,197	$ 23,197
	Min	$ -	$ -	$ -	$ -
	Max	$ 100,000	$ 100,000	$ 250,000	$ 250,000
	% time paid	45%	45%	24%	24%
	Farmer Return	NA	NA	NA	NA
	Govt Cost	$ 37,920	$ 37,920	$ 23,197	$ 23,197
SCO	Mean	$ 18,682	$ 41,012	$ 78,249	$ 116,985
	Min	$ (14,789)	$ (36,972)	$ (55,458)	$ (92,430)
	Max	$ 161,519	$ 403,797	$ 605,695	$ 1,009,492
	% time paid	37%	37%	45%	44%
	Farmer Return	317%	278%	354%	318%
	Govt Cost	$ 13,749	$ 34,372	$ 51,557	$ 85,929
Insurance	Mean	$ (20,542)	$ (19,462)	$ (20,542)	$ (19,462)
	Min	$ (125,308)	$ (69,501)	$ (125,308)	$ (69,501)
	Max	$ 770,440	$ 545,880	$ 770,440	$ 545,880
	% time paid	16%	8%	16%	8%
	Farmer Return	-25%	-51%	-25%	-51%
	Govt Cost	$ 271,458	$ 151,411	$ 271,458	$ 151,411
STAX	Mean	$ 108,552	$ 137,346	$ 110,371	$ 139,589
	Min	$ (36,636)	$ (48,848)	$ (36,636)	$ (48,848)
	Max	$ 646,733	$ 862,310	$ 646,733	$ 862,310
	% time paid	50%	49%	51%	50%
	Farmer Return	520%	493%	526%	499%
	Govt Cost	$ 83,530	$ 111,374	$ 83,968	$ 111,957
Prob Neg End Cash		1.04%	1.09%	0.35%	0.44%

The SERF analysis for the House farm bill had opposite results as the 65% level of crop insurance coverage was preferred across all levels of risk aversion (figure 35). The more risk averse a producer is then the difference between the two levels of insurance coverage becomes smaller and the choice is less obvious. This is shown by the deceasing amount of risk premiums between the 65% coverage option and the 75% coverage option as the ARACs go from risk neutral to very risk averse.

These results are mixed in terms of a clear answer to the question posed: could a farm with large yield variability benefit from reducing its farm level crop insurance election to take advantage of greater SCO coverage? The analysis showed changes in NCFI that come from changes in SCO, STAX, and crop insurance. These programs have many interactions and show that the answer to the posed question will likely vary from farm to farm. However, the SERF analysis did show that the result of a farm benefitting from lowering its level of crop insurance and being better off is possible.

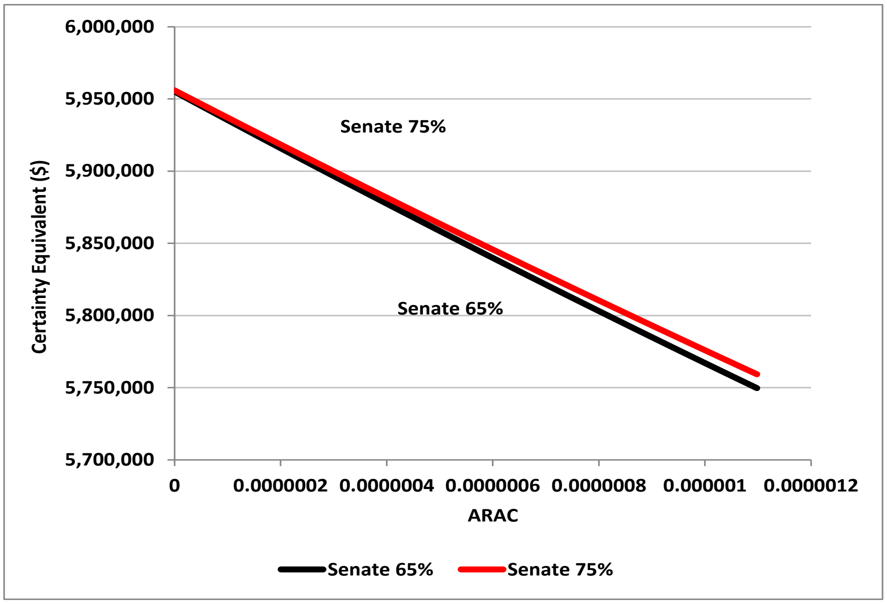

Figure 34. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for Senate under Alternative 4).

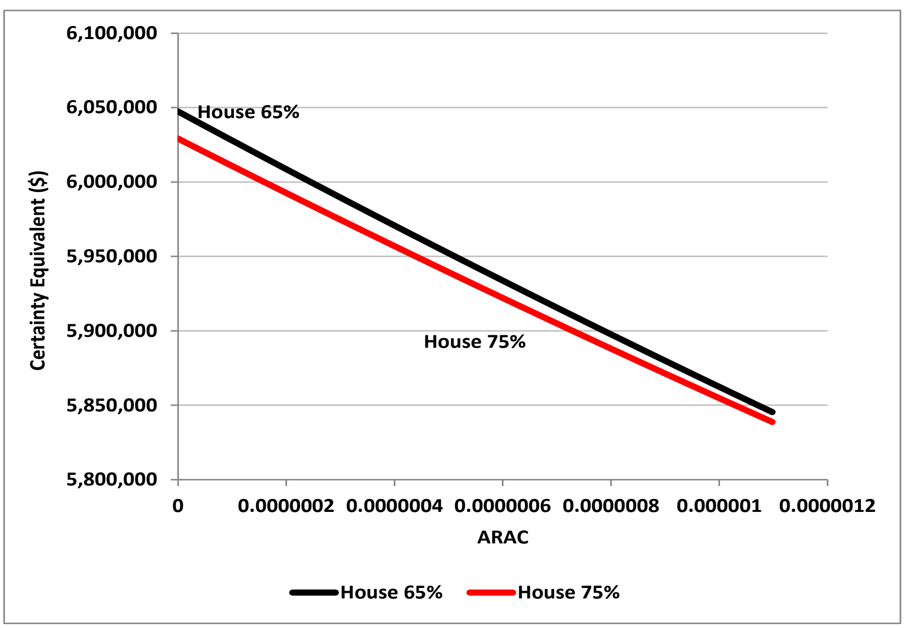

Figure 35. Stochastic efficiency with respect to a function (SERF) under a negative exponential utility function for NPV for TXCB8000 (for House under Alternative 4).

CHAPTER V

SUMMARY AND CONCLUSIONS

Given the increasing complexity and interaction of farm programs, producers and policy makers need information to help them in deciding which farm programs give the most protection for the least cost. The objectives of this study were to quantify the economic outcomes for representative farms of alternative scenario combination of policy tools and insurance. Specific farm programs analyzed were: DP, ARC, PLC, SCO Senate, SCO House, Crop Insurance, STAX Senate, and STAX House.

The stochastic simulation model used for this dissertation incorporated price and yield risk into the simulated outcomes by using the multivariate empirical method. Provisions for farm programs were modeled and evaluated for four AFPC representative farms (IAG3400, ARSR3240, KSCW2000, and TXCB8000). The simulation of complete financial statements allowed for evaluation of the economic impacts of alternative farm programs.

Results

A stochastic simulation model was developed to evaluate the economic viability of representative farms under alternative farm programs. The model was designed to provide probabilistic outcomes for numerous financial measures, as well as, government cost. The model was used to analyze 29 combinations of farm programs under Baseline prices, two separate low price scenarios, and a low yield scenario. Additionally, a scenario using different levels of crop insurance for the TXCB8000 farm was simulated to address optimal levels of crop insurance in conjunction with proposed Senate and

House farm bill legislation. Economic outcomes for representative farms were presented in terms of magnitude and frequency of payments. Government costs were reported along with the risk reducing properties of individual programs and combinations of programs. SERF analysis results were reported for all farm bill options using the simulated NPVs for each farm to give a utility ranking of risky program options.

The highest mean payments for ARSR3240 and TXCB8000 under Baseline prices were for the DP program. SCO House had the highest mean payments for IAG3400 and KSCW2000. On average, government cost was reduced by the proposed farm bills relative to DP. However, the potential government outlay was increased as maximum payouts were greater than the fixed DP. The results for a SERF analysis of the Baseline price alternative showed that DP was the preferred farm program on three of the four farms by risk averse farmers. Additionally, crop insurance was highly preferred by the two Southern farms, ranking first for TXCB8000 and second for ARSR3240. The second choice for both IAG3400 and KSCW2000 was SCO. The House farm bill was preferred by all four farms over the Senate farm bill under the Baseline price alternative.

For Alternative 1, all commodity prices as well as both the base and harvest time crop insurance prices were reduced by 25% in 2016. The Alternative 1 price decline results showed that PLC performed well in reducing the probability of cash flow deficits. The price decline had a negative effect on the risk reducing capabilities of SCO and crop insurance. DP was the most preferred program by three of the four farms in the SERF analysis with TXCB8000 preferring crop insurance. The second most preferred farm program was SCO for both IAG3400 and KSCW2000. ARSR3240 preferred crop insurance second to DP. All four farms preferred the House farm bill with PLC and House SCO compared to the Senate farm bill with ARC and SCO.

Alternative 2 involved a 25% price decline in 2016 for all commodities, but unlike Alternative 1, the decline only applied to the harvest crop insurance price and not the base crop insurance price. SERF results showed SCO was preferred by IAG3400 and second most preferred for KSCW2000 under Alternative 2. These results showed the regional commodity difference as ARSR3240 and TXCB8000 preferred DP and crop insurance over PLC, SCO, and ARC. All four farms preferred the House farm bill over the Senate bill.

For Alternative 3, the farm and county yields were reduced by 25% in 2016. The results showed how each farm program dealt with a yield decline at both the farm and county level. SCO House had the highest mean payments for three of the four farms. SCO House also had the highest frequency of payments of any program excluding DP. PLC ranked last in mean payments for three of the four farms. SCO House had the lowest probability of having a cash flow deficit for IAG3400 and KSCW2000. The SERF analysis results showed SCO was most preferred by IAG3400. DP was most preferred by ARSR3240 and KSCW2000 with crop insurance second most preferred for ARSR3240 and SCO second more preferred for KSCW2000. Crop insurance was most preferred by a wide margin for TXCB8000.

Alternative 4 compared two crop insurance coverage levels, 65% and 75%, for TXCB8000 with baseline prices to examine if the farm would benefit from reducing its insurance coverage level in the presence of SCO and STAX. The results showed higher mean NCFI at the 65% insurance coverage level for both the Senate and House farm bills. The SERF analysis results indicated that under the Senate farm bill, the 75% level of insurance coverage was preferred. However, the lower (65%) level of coverage was preferred under the House farm bill with PLC and SCO having the wider pay band.

Conclusions and Further Research

The results for the Baseline highlight three points that have been posited about the Senate and House farm bills and the elimination of DP. The first point is the importance of DP, particularly to Southern crops. The Baseline results showed, on average, DP provided the highest payments for both TXCB8000 and ARSR3240. Additionally, ARSR3240 is projected, on average, to lose the most when DP is eliminated. DP had the lowest percent probability of having a cash flow deficit for three of the four farms.

The second point is government costs were projected to be lower with the elimination of DP, particularly for the Senate farm bill. However, the exposure to the government is greatly increased for all farms as maximum payments for ARC and PLC exceed DP for each farm.

The last point is that the new programs (ARC and SCO) benefit the Corn Belt more than the Southern crops. On average, IAG3400 received larger payments (mostly SCO) under the House farm bill than it received from DP. In the Senate farm bill, average payments from ARC and SCO are 82% of DP. Thus, IAG3400 was projected to be either better off under the House or slightly worse off under the Senate while gaining in the form of higher maximum payments compared to DP from both farm bills.

ARC performed as expected. ARC was promoted as a solution to shallow losses, meaning losses that are relatively small, but frequent. In the Baseline results, ARC paid frequently (45% - 79%), but its payments were relatively small. Under no alternative analyzed did ARC have the highest mean payments or the highest maximum payments. On the opposite end of the spectrum was crop insurance. Crop insurance had the lowest frequency of positive payments, but also consistently had one of the largest maximum payments. It pays for deeper losses which occurred less often.

The farmer returns for SCO and STAX were very high. Under the Baseline prices, Senate returns from SCO average from 45% to 298%. The return was even higher under SCO House with returns ranging from 115% to 336% across all four farms. STAX had similar farmer returns at 298% and 499% for the Senate and House farm bills respectively. It was posited that farmer returns would be positive due to the high level of government subsidy on premiums. Producers were assumed to only pay 30% of the premium cost for SCO and only 20% of the premium cost for STAX. The outsized returns point out a real concern that the assumed premiums charged were not high enough given the potential payout.

The large subsidies for SCO and its interaction with the crop insurance election decision, called for an investigation of the optimal level of insurance choice for a farm. The results for Alternative 4 showed that TXCB8000 was better off lowering its level of crop insurance from 75% to 65% under the House farm bill. Moving from the 75%

insurance coverage level to the 65% coverage level resulted in higher premiums for SCO and STAX and higher payouts for these programs along with lower crop insurance premiums and indemnities. These complex interactions of changing premiums and payments resulted in higher NCFI and NPV for TXCB8000 for the 65% insurance coverage level. In the SERF analysis, the increase in NPV resulted in the 65% insurance coverage level being preferred over the 75% insurance coverage level. Thus, on a farm by farm basis, producers might benefit from lower levels of crop insurance coverage if they currently select the enterprise unit option. Further research is needed to analyze a greater number and variety of farms to see if these results are repeated elsewhere.

A criticism of the House farm bill was that it only protected one side of the revenue equation and that was price with its PLC. However, the results of Alternative 3 showed that the House farm bill had higher minimum, mean, and maximum NCFI for each farm than the Senate farm bill. Furthermore, each farm had slightly lower probabilities of having a cash flow deficit in 2016 under the House farm bill when yields declined. Lastly, all four farms preferred the House farm bill over the Senate farm bill in the SERF analysis for Alternative 3. It should be noted, that most of the protection in the House farm bill (particularly for the low yield alternative) comes from SCO. If the SCO House provisions were changed in a meaningful way such as smaller payment band, higher premiums, or a lower government subsidy, then the ability of the House farm bill to cover a yield loss would be hindered. Additionally, further research is needed to examine how the programs and farm bills perform when the farm has a yield loss, but the county does not.

Perhaps the most meaningful results were that SCO, STAX, and crop insurance added no extra protection from the Alternative 1 price decline compared to the Baseline. The price decline in Alternative 1 affected both the base insurance price and the harvest insurance price equally with an assumed 25% drop. Due to the nature of these programs, they resulted in a drop in the overall amount of protection but not a greater frequency of payments. These programs all paid more frequently and had larger payments than under the Alternative 2 price decline which only affected the crop insurance harvest price. These results bring into focus the fact that it is not only the size of the price decline, but also the timing of the price decline that matters in farm programs. Additional research would be useful in examining how the duration of price declines affect the payouts of farm programs.

This study analyzed the many facets of farm programs, their costs, and effectiveness. In addition to the research topics covered, there are topics that deserve further examination. They are farm program payment limits and means testing along with payment redundancy. These topics have been the subject of past research, but need to be updated in the context of proposed changes in the farm program provisions. Given the federal government's budget situation and the relatively robust reported farm NCFI numbers, these topics are likely to be heavily debated in the future. Add to the equation new farm programs such as the ones analyzed in this study, and these topics are available for future research.

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APPENDIX A

Details of the 29 Scenarios Simulated for Each Alternative

1. No programs – No farm program tools or crop insurance was included in this scenario. It relied only upon crop receipts, and all other scenarios were built upon this one.
2. DP only – Direct Payments were the only farm program tool included in this scenario.
3. DP and ARC -- Included Direct Payments and the Senate Agriculture Risk Coverage program.
4. DP, ARC, and SCO – Included Direct Payments, the Senate ARC Program, and the Senate Supplemental Coverage Option.
5. DP, ARC, SCO, and INS –Included all of the programs included in scenario four plus Crop Insurance.
6. ARC only – Included only the Senate ARC.
7. ARC and SCO – Included Senate ARC and SCO only.
8. ARC, SCO, and INS – Included Senate ARC, SCO, and Crop Insurance.
9. INS only – Included only crop insurance.
10. DP and PLC – Included Direct Payments and House Price Loss Coverage.
11. DP, PLC, and SCO – Included Direct Payments, House PLC, and SCO.
12. DP, PLC, SCO, and INS – Includes all of scenario eleven plus crop insurance.
13. PLC only – Included Price Loss Coverage only.
14. PLC and SCO – Included House PLC and SCO.

15. PLC, SCO, and INS – Included House PLC, SCO, and added crop insurance.
16. SCO only – Included the House version of the SCO program only.
17. SCO and INS – Included SCO and crop insurance.
18. ARC and INS – Included ARC and crop insurance only.
19. PLC and INS – Included PLC and crop insurance only.
20. PLC, ARC, and INS – Included House PLC, Senate ARC, and crop insurance.
21. DP, ARC, SCO, INS, and STAX – Built upon scenario 5 with the addition of the Senate version of the Stacked Income Protection Plan.
22. ARC, SCO, INS, and STAX – Included Senate ARC and SCO plus crop insurance and STAX.
23. STAX only – Included the Senate version of STAX only.
24. INS and STAX – Included only crop insurance and Senate version of STAX.
25. DP, PLC, SCO, INS, and STAX -- Built upon scenario 12 with the addition of the House version of the Stacked Income Protection Plan.
26. PLC, SCO, INS, and STAX – Included House version of PLC, SCO, and STAX plus crop insurance.
27. SCO, INS, and STAX – Included House version of SCO and STAX plus crop insurance.
28. STAX only – Included the House version of STAX only.
29. INS and STAX – Included the House version of STAX plus crop insurance.

APPENDIX B

Locations of Representative Farms

Figure 36. Locations of Representative Farms

APPENDIX C

2011 CHARACTERISTICS OF REPRESENTATIVE FARMS

IAG3400 This 3,400-acre, large-sized grain farm is located in northwestern Iowa (Webster County). It plants 2,040 acres of corn and 1,360 acres of soybeans each year, realizing 74% of receipts from corn production.

ARSR3240 ARSR3240 is a 3,240-acre, large-sized Arkansas (Arkansas County) rice farm that harvests 1,620 acres of rice, 1,620 acres of soybeans, and 324 acres of wheat (planted before soybeans) each year. Sixty-seven percent of this farm's 2011 receipts came from rice sales.

KSCW2000 South central Kansas (Sumner County) is home to this 2,000-acre, moderate-sized grain farm. KSCW2000 plants 1,200 acres of winter wheat, 400 acres of soybeans, 200 acres of sorghum, and 200 acres of corn each year. For 2011, 55% of gross receipts came from wheat.

TXCB8000 Nueces County, Texas is home to this 8,000-acre farm. Annually, 2,800 acres are planted to cotton and 5,200 acres to sorghum.

APPENDIX D

Table 14. Characteristics of Represenative Farms.

	IAG3400	KSCW2000	ARSR3240	TXCB8000
County	Webster	Sumner	Arkansas	Nueces
Total Cropland	3,400.00	2,000.00	3,240.00	8,000.00
Acres Owned	850.00	700.00	648.00	320.00
Acres Leased	2,550.00	1,300.00	2,592.00	7,680.00
Assets ($1000)				
Total	8,990.00	2,142.00	4,746.00	4,515.00
Real Estate	5,899.00	1,570.00	2,039.00	662.00
Machinery	1,738.00	372.00	2,431.00	2,449.00
Other & Livestock	1,354.00	200.00	276.00	1,404.00
Debt/Asset Ratios				
Total	0.15	0.11	0.26	0.30
Intermediate	0.31	0.08	0.39	0.50
Long Run	0.14	0.14	0.14	0.16
2011 Gross Receipts ($1,000)				
Total	2,891.30	638.80	2,112.50	4,341.10
Corn	2,133.70	99.00	0.00	0.00
	0.74	0.16	0.00	0.00
Wheat	0.00	347.90	121.70	0.00
	0.00	0.55	0.06	0.00
Soybeans	757.60	116.40	582.70	0.00
	0.26	0.18	0.28	0.00
Grain Sorghum	0.00	75.50	0.00	1,462.30
	0.00	0.12	0.00	0.34
Rice	0.00	0.00	1,408.10	0.00
	0.00	0.00	0.67	0.00
Cotton	0.00	0.00	0.00	2,878.80
	0.00	0.00	0.00	0.66
2011 Planted Acres				
Total	3,400.00	2,000.00	3,564.00	8,000.00
Corn	2,040.00	200.00	0.00	0.00
	0.60	0.10	0.00	0.00
Wheat	0.00	1,200.00	324.00	0.00
	0.00	0.60	0.09	0.00
Soybeans	1,360.00	400.00	1,620.00	0.00
	0.40	0.20	0.46	0.00
Grain Sorghum	0.00	200.00	0.00	5,200.00
	0.00	0.10	0.00	0.65
Rice	0.00	0.00	1,620.00	0.00
	0.00	0.00	0.46	0.00
Cotton	0.00	0.00	0.00	2,800.00
	0.00	0.00	0.00	0.35

APPENDIX E

Details of the Senate farm bill can be found at: http://www.ag.senate.gov/issues/farm-bill

Details of the House farm bill can be found at: http://agriculture.house.gov/farmbill