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Information and Opportunistic Behavior in Federal Crop Insurance Programs

By

Walters, C.G., Shumway, C.R., Chouinard, H.H., and Wandschneider, P.R.

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Cory G. Walters

C. Richard Shumway

Hayley H. Chouinard

Philip R. Wandschneider

Corresponding Author:
Cory G. Walters
School of Economic Sciences
Washington State University
P.O. Box 646210
Pullman, WA, 99164-6210
walters@wsu.edu

Cory G. Walters is a graduate research assistant, C. Richard Shumway is a professor, Hayley H. Chouinard is an assistant professor, and Philip R. Wandschneider is a professor in the School of Economic Sciences at Washington State University.

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Information and Opportunistic Behavior in Federal Crop Insurance Programs

Abstract

Opportunistic behavior in crop insurance can arise due to asymmetric information between producers and the Federal Crop Insurance Corporation. Producers who insure fields using transitional yields based on county average yields or who select options such as buy-up coverage or revenue insurance may increase their return from crop insurance. Using field-level crop insurance contract data for several crops in five growing regions, we find evidence that producers can profit from using buy-up coverage, revenue insurance, and transitional yields and that the level of producer opportunism is crop but not necessarily land-quality specific and is greater due to premium subsidization.

Keywords: opportunistic behavior, crop insurance, buy-up, revenue, transitional yields

JEL Code: Q18

Information and Opportunistic Behavior in Federal Crop Insurance Programs

Production of agricultural commodities involves many types of risk. Agricultural producers may purchase crop insurance in order to reduce yield and/or revenue risk. Prior to 1994, the crop insurance program experienced very low participation as the program offered insurance for a relatively small number of products and coverage levels, and offered little premium subsidization. Through the Agricultural Reform Act of 1994 and the Agricultural Risk Protection Act (ARPA) of 2000, Congress attempted to entice producer participation in crop insurance by increasing premium subsidies. Policymakers argued that the increased participation due to premium subsidies would eliminate *ad hoc* disaster payments or emergency aid (Ker 2001). Participation in crop insurance has increased. In 1998 more than 180 million acres of farmland was insured under the program, more than three times the acreage insured in 1988 (USDA-RMA Bulletin). The participation incentives created from the higher subsidy levels, however, may also increase the likelihood of opportunistic behavior. Producer opportunism results in larger indemnities being paid to producers, which in turn increases taxpayer outlays. Reducing producer opportunistic behavior creates a more efficient risk management program that limits the ability of producers to extract profits from participating.

Asymmetric information between producers and the Federal Crop Insurance Corporation (FCIC) may allow producers to engage in opportunistic behavior.[1] Producer insurance decisions such as buy-up coverage and revenue insurance can potentially increase producer return from crop insurance when producers have a better understanding of crop yield risk on their farms than

[1] Asymmetric information exists when one party in a transaction has more (or better) information than the other party.

the FCIC.[2] Producers without proven yields, who insure fields by using the prescribed alternative, transitional yields (T-yields) based on the county average yield, can potentially increase their indemnity when their expected yield falls sufficiently below the county average yield. In this article we examine whether evidence of producer opportunism exists in field-level crop insurance data from the use of buy-up coverage, revenue insurance, and T-yields.

Asymmetric information can result in producer opportunism through both adverse selection and moral hazard. Adverse selection occurs when "hidden information" exists and moral hazard occurs if producers take "hidden action" (Arrow 1985). Generally, we label opportunistic behavior as adverse selection if the producer uses asymmetric information to their advantage in making the insurance decision and moral hazard if the producer changes behavior because they have insurance. It is often difficult to distinguish empirically between adverse selection and moral hazard (Quiggin, Karagiannis, and Stanton 1993), and we do not specifically identify type of asymmetric information. Instead, we examine whether evidence exists that asymmetric information increases producers' return from crop insurance.

Several authors address the impact of asymmetric information on the use of crop insurance. Roberts, Key, and O'Donoghue (2006) find evidence of moral hazard in yields of insured wheat and soybean farms in Texas. Smith and Goodwin (1996) show that adopters of crop insurance exhibit moral hazard behavior by using fewer inputs than non-adopters. Their findings counter those of Horowitz and Lichtenberg (1993), who conclude that crop insurance participants use higher rates of inputs than non-participants, suggesting that both fertilizer and pesticides may be risk-increasing inputs. Makki and Somwaru (2001) suggest adverse selection exists in both coverage-level and insurance type decisions. High-risk producers more often

[2] Buy-up coverage refers to any coverage level above 50 percent.

select revenue insurance contracts and higher coverage levels. Skees and Reed (1986) also identify adverse selection due to asymmetric information in the relationship between the producer's choice of coverage level and expected yields, and in the bias introduced in coverage protection when trends are not used to establish expected yields. Just, Calvin, and Quiggin (1999) find that the subsidy benefits of crop insurance outweigh its risk-aversion incentive largely due to adverse selection.

Our study of producer opportunism in crop insurance adds to the previous literature in three important ways: we address the impact of using T-yields on producer opportunism; we analyze effects from the subsidy on producer opportunism; and we use more detailed, field-level crop insurance and performance data to analyze these effects as well as the impact of purchasing buy-up coverage or revenue insurance. This type of data has only been used previously by Roberts, Key, and O'Donoghue (2006).

Field-level data allows us to better estimate the extent of producer opportunistic behavior specific to crop insurance contract decisions. A unit represents a parcel of land insured independently of other parcels (Edwards, 2003a). Producers can insure a crop by the unit (typically a field) or the entire farm. Heterogeneous farms, i.e., farms that include field units with different average yields, provide better opportunities for opportunistic behavior from the use of buy-up coverage, revenue insurance, and T-yields. In our study, we use unit insurance information whereas other studies have generally used either farm or county-level data.

Since asymmetric information may enable producers to increase their returns, the results from this study could have important implications for policy makers. A positive relationship between the use of buy-up coverage, revenue insurance, or T-yields and return from crop insurance demonstrates the value to producers of using this asymmetric information. If such opportunistic behavior occurs, some relatively simple re-designing of crop insurance programs could reduce the farmer's ability to use buy-up coverage, revenue insurance, or T-yields to generate extraordinary indemnity payments.

This article proceeds as follows. We first outline how a producer can manipulate the yield guarantee, or the minimum yield that results in an indemnity payment, to allow for producer opportunism possibilities. We then present hypotheses relating producer insurance decisions to opportunistic behavior. A description of our model, data, and analysis follows. We present and interpret findings in the results section. Conclusions and a discussion of implications occur in the final section.

Insurance Characteristics

In this section we outline both the details of crop insurance and how the yield guarantee decisions may allow for producer opportunism. Two primary types of insurance exist – yield and revenue. Yield insurance insures only against low yield. Revenue insurance insures against the combination of yield and price. At the beginning of each crop year, the producer can change insurance type. Return per acre from crop insurance depends on the difference between what a producer receives as an indemnity and pays for the insurance: $R_{hj} = I_{hj} - W_{hj}$, where R_{hj} represents the return, I_{hj} represents the indemnity, and W_{hj} represents the crop insurance premium for field *h* and crop *j*.

An indemnity payment for yield insurance, also known as multiple peril crop insurance (MPCI), occurs if the yield guarantee, YG_{hj}, is greater than actual production, AP_{hj}. When this happens, the FCIC calculates the indemnity as $I_{hj} = [YG_{hj} - AP_{hj}] \times PE_j$, where PE_j represents the price election set by the government.

An indemnity payment for revenue insurance, specifically crop revenue coverage, occurs if the revenue guarantee is greater than actual producer revenue. When this happens, the indemnity equals $I_{hj} = [YG_{hj} * \max(BP_j, HP_j)] - [AP_{hj} * HP_j]$, where BP_j and HP_j represents the base and harvest price, respectively.[3] The base price represents the average daily settlement price of a futures contract during a month prior to planting. Harvest price equals the average daily settlement prices of a futures contract during a month when the crop matures. The choice of insurance type may lead to opportunistic behavior if the producer's information allows him/her to predict indemnity payments on the insured field more accurately than the FCIC so that his/her expected profit is increased along with reducing risk.

The yield guarantee for computing indemnity with either type of insurance represents a percentage of a producer's actual production history, APH_{hj}. Establishing APH_{hj} yield requires a minimum of four and a maximum of 10 consecutive years of verifiable yield records for the crop on the insured field. The FCIC calculates the yield guarantee for yield and revenue insurance as $YG_{hj} = CL_j \times APH_{hj}$, where CL_j represents coverage level. The revenue guarantee (RG_{hj}) is calculated as $RG_{hj} = YG_{hj} * \max(BP_j, HP_j)$. The producer selects a coverage level specific to each crop. Coverage levels typically range between 50 to 85 percent in 5 percent increments. Producers can adjust coverage levels at the beginning of each crop year.

The transitional yield (T-yield) option permits producers to enroll fields in the crop insurance program that have not previously or have only seldom been in production for a

[3] An indemnity for income protection, another form of revenue insurance, is calculated using only the base price, $I_{hj} = [YG_{hj} * BP_j] - [AP_{hj} * HP_j]$. For revenue assurance with the harvest price option, the indemnity is calculated the same as crop revenue coverage; without the harvest price option, the indemnity is calculated the same as income protection. Even when the indemnity is calculated the same, revenue assurance and crop revenue coverage differ in the futures month used to calculate the harvest price. Income protection and revenue assurance can also differ in applicable crops, coverage levels, and unit types. Not all coverage levels and unit types are available for each revenue insurance type (Edwards, 2003b).

particular crop. T-yields are based on the 10-year county average yield. Without an established actual production history, T-yields create the potential for producer opportunism when their expected yield falls sufficiently below the county average yield. If the producer cannot provide the minimum of four years of actual yields for a field, a T-yield must be substituted for each missing year. Depending on the number of T-yields a producer includes or the type of T-yield, the FCIC discounts the county average yield as much as 35 percent in determining the producer production history. If the farmer's expected yield on the field is sufficiently below the county average yield, the use of T-yields can be due to producer opportunism.

Insurance Decisions and Opportunistic Behavior

In our examination of producer opportunism in crop insurance, we examine three specific hypotheses. We use these hypotheses to determine (1) whether the use of buy-up coverage, revenue insurance, or T-yields signals producer opportunism through financial indicators; (2) whether the presence of a subsidy affects the amount of producer opportunism; and (3) whether producer opportunism from the use of buy-up coverage, revenue insurance, or T-yields is greater in regions with greater within-county land heterogeneity. The specific hypotheses that we test and their justification follow.

Hypothesis 1. Return per acre increases with the use of buy-up coverage, revenue insurance, and T-yields. We assess impacts on both producer return and social return, where we label producer return as the indemnity less producer premium and social return as the indemnity less total premium (including the federal subsidy).[4] We hypothesize that the use of buy-up coverage, revenue insurance, and T-yield increases both measures of return. Impacts on producer return directly relate to measuring private producer opportunism while impacts on

[4] The amount of producer premium is specific to each crop insurance contract.

social return allow the measurement of social consequences. Further, we examine whether the use of additional T-yields has a greater impact on producer return and provides evidence of greater producer opportunism.

Producers can select a unique coverage level for each crop based on perceived production risk and the cost of insurance for that coverage level. Selecting a higher coverage level increases the yield guarantee and increases the probability of receiving an indemnity. Since producers likely have a better idea of production risks associated with a crop grown on a particular field than the FCIC, opportunistic behavior may come from the higher yield guarantee. Opportunistic behavior can occur when high risk producers expect a positive return from selecting high coverage levels, even though higher coverage levels result in higher premium costs. More generally, we expect that a larger percentage of producers would select buy-up coverage levels in regions with higher crop production variability than in regions with lower variability.

Producers can also select insurance type, i.e., yield or revenue, for each crop. Without opportunism, producers select insurance type based upon perceived production risk, price risk, and the cost of the insurance type. Revenue insurance has higher premium costs than MPCI since revenue insurance protects against a price decrease following planting in addition to low yield whereas MPCI only insures against low yield. Opportunism with revenue insurance can occur if producers have more accurate information than the FCIC about the likelihood they will incur a yield loss and they also want to insure against a price drop.

A producer most likely knows, or has a good idea of, the expected yield for each field s/he farms. If the producer has been producing the insured crop on a field and has verifiable yield records, s/he must provide the yields from the field. However, if the producer did not keep good records or *claims failure to keep good records*, s/he must employ T-yields to obtain insurance. Those with expected yields sufficiently below the county average may not only transfer risk but also increase expected profit from the field by purchasing insurance.

Depending on the number of verifiable yield records and other circumstances, a producer may use one, two, three or four T-yields or special T-yields when purchasing crop insurance.[5] Special T-yields permit a producer to use 100 percent (or in some cases 110 percent) of the county average yield when computing his/her T-yield. Special T-yields are required if the producer has never participated in the crop insurance program or uses a new practice, type, or variety on additional land that has no production history in that crop. The more transitional yields a producer includes in the APH, the less information s/he provides about true expected yields. Thus, the amount of asymmetric information between the producer and the government increases. The government takes this information into account by discounting county average yield more heavily when using a larger number of T-yields to compute APH.[6]

Hypothesis 2. Subsidization of crop insurance promotes producer opportunism. The government provides premium subsidies to reduce the cost of crop insurance and entice more producers to participate in the program. Thus, subsidization may increase number of producers engaging in opportunistic behavior and the amount of total indemnities paid due to this opportunistic behavior. We expect that subsidizing crop insurance increases the extent of producer opportunism because it increases the opportunities for, and the returns to, opportunism.

Hypothesis 3. Producer opportunism due to the use of buy-up coverage, revenue insurance, and T-yields is greater in regions with greater within-county land resource heterogeneity. Soil and climate characteristics vary between geographic locations. We examine

[5] We analyze the six most widely used T-yield options. Although not analyzed in this paper, the RMA offers other T-yield options such as personal transitional yield and T-yield for added insurable acreage by practice, type, or variety.

[6] The following percentages are used to determine APH when using T-yields: 100 percent of the county average for one T-yield, 90 percent for two T-yields, 80 percent for three T-yields, and 65 percent for four T-yields.

whether evidence of producer opportunism from the use of buy-up coverage, revenue insurance, and T-yields increases for regions with greater within-county land resource heterogeneity.

Each county has a unique set of agro-climatic characteristics. Land quality represents a particularly important determinant of land use and yields (Hardie and Parks 1997). The FCIC calculates T-yields based on the county average yield. Regions with highly variable land resources may have greater variability of within county yields. The county average yield may not represent the average yield on many fields in such counties. Producers often have more information about expected yields on fields without verifiable yield records than does the FCIC, which must rely on the county average yield. Since producers also have private information about fields with verifiable yield records, they can use this information in deciding the optimal level of buy-up coverage and insurance type. These information asymmetries between producers and the FCIC may allow producers to profit in the use of buy-up coverage, revenue insurance, and particularly in the use of T-yields, in counties with more heterogeneous within-county resources than in counties with more homogeneous within-county resources. The use of T-yields in locations with heterogeneous within-county resources could provide a yield guarantee well above the field's actual production ability and thereby inflate the yield guarantee to unachievable levels.

Model, Data, and Analysis

We now present the empirical model in which we identify variables, regions, crops, and data used in the analysis and outline the analytical procedures. We expect return (both social return and producer return) to depend on county weather characteristics, growing degree days, county, year, crop, field practice (whether the land was in summer fallow the previous year), insurance decisions (coverage level and insurance type), and number of T-yields used to create the APH. Growing degree days represents the only continuous variable. We include a dummy variable for each county, year, crop, practice, coverage level, insurance type, and T-yields. Each T-yield dummy variable represents one of the six possible ways to use T-yields. The number of dummy variables for county, insurance type, and crop depend on the region. We specify all equations in per-acre terms. Table 1 defines the variables used.

To test our hypotheses, we estimate the following equation for each region:

(1) $Y = D_{CY}\alpha + D_{YR}\delta + X\beta + TY\gamma + \varepsilon$

where Y represents the magnitude of return (either social return or producer return) at the field-level; D_{CY} corresponds a matrix of county dummy variables used to capture unobserved heterogeneity in agricultural production; D_{YR} refers to a matrix of year dummy variables; X represents a matrix comprised of a vector of ones, growing degree days, and dummy variables for coverage level, insurance type, crop, and field practice; TY is a matrix of T-yield dummy variables ; α and δ are, respectively, estimated county and year fixed-effects parameters; β and γ are estimated parameters; and ε represents the error term.

The data include observations of crop insurance contract information and corresponding performance records for all insured fields by the FCIC for each of eight years – 1995 through 2002. The data set includes all the information that the FCIC has for each crop insurance contract: indemnity amount, premium paid by producer, amount of subsidy, crop type, number of acres, field practice, coverage level, insurance type, year, county location of field, and type of APH (actual and/or T-yields).

We analyze five different growing regions, two with relatively homogenous within-county land resources (Iowa and Western Nebraska) and three with more heterogeneous land resources (Oklahoma, North-Central Montana, and Eastern Washington). The five growing regions produce some of the same crops, but the crop mix differs by area. To document some of the differences in degree of heterogeneity, one could consider soil organic matter. Soil organic matter represents an important indicator of soil quality and thus land resources (Pulleman et. al. 2000). Regions such as Oklahoma and North-Central Montana generally have lower amounts of soil organic matter and vary much more across relatively small areas such as counties than regions such as Iowa and Western Nebraska. Eastern Washington has areas with high soil organic matter like Iowa and Western Nebraska but also exhibits high variability within counties like Oklahoma and North-Central Montana.

We analyze the returns to four insurance types: one yield insurance (MPCI) and three types of revenue insurance - crop revenue coverage (crop rev coverage), revenue assurance, and income protection. Each crop and region has a different set of available revenue insurance options. We study the effects of the most popular revenue insurance product, crop rev coverage, for each of five major regions. In addition to crop rev coverage, we analyzed revenue assurance in Oklahoma and Iowa, and income protection in Iowa.[7] Not analyzed in this paper, but available to producers during the study period, is hail insurance.

Buy-up coverage, revenue insurance, and T-yields can potentially vary by crop type and field practice. Thus, we differentiate these variables by several crop types: wheat, spring wheat, winter wheat, corn for grain (hereafter referred to as corn), soybeans, and “other crops.”

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[7] Income protection and revenue assurance are available for many crops in the “other” category, however these revenue options were seldom selected by producers. We report parameter estimates for the primary options selected.

We differentiate by two field practices: summer fallow and continuously cropped.[8] By aggregating all classes of wheat, the three major crops represent the highest-value insured crops grown in the U.S. The "other crops" category represents other insured crops grown in the specific region.[9]

The constant in the estimated equations represents a producer who grew wheat (soybeans in Iowa) on a continuously-cropped, non-irrigated field in a specific county, who provided all actual yields for the field's APH in year 2002, and purchased catastrophic coverage or MPCI insurance with a 50 percent coverage level. Thus, we can directly interpret the effect of buy-up coverage, revenue insurance, and T-yields on the dependent variable by their estimated coefficients.[10]

We use STATA 8.0 to perform the estimation. Since all models show evidence of heteroskedasticity, we use White's variance estimator to obtain robust standard errors. Producers often operate multiple fields. Therefore, we do not assume independent and identically distributed (IID) sampling error across fields for a single producer. We do assume IID sampling error between producers. To account for this sampling error structure, we use a robust cluster estimator (we cluster on producer) which adjusts the variance for within-cluster correlation (Wooldridge 2002).

[8] In regions such as Oklahoma and Nebraska, the RMA does not differentiate between winter or spring wheat varieties like they do in regions such as Montana and Washington. Therefore, the crop type "wheat" includes all types of wheat. The RMA makes no distinction in field practice in Oklahoma or Iowa but they do in Montana and Nebraska. Except for Washington, where we only analyze observations where the RMA did not identify field practice, we differentiate between crop types and field practice where the RMA does.

[9] There are a large number of other potentially insurable crops in each region (e.g., cotton, sorghum, oats, dry beans, sunflowers, and dry peas), but many had low numbers of observations. We focused on crops with a sufficiently large number of observations.

[10] Catastrophic coverage insures for a 50 percent coverage level and 55 percent of the price election set by the government. MPCI insurance with 50 percent coverage level insures with either 95 or 100 percent of the price election.

Serious multicollinearity often occurs when dummy variables are used to represent a large number of independent variables. Using the variance inflation factor (VIF), we checked for the presence of multicollinearity in the independent variables. The VIF measures how inflated the variance of the estimated regression coefficients are when compared to independent variables not linearly related (Kutner et. al. 2005). A VIF value of 10 or more indicates that multicollinearity may influence the estimates. We dropped the corn new producer T-yield dummy variable from the analysis due to a VIF of 229.

A positive and significant relationship between a coverage level, insurance type, or T-yield and the dependent variable suggests that producer opportunism exists. An insignificant or a significantly negative relationship indicates a lack of producer opportunism. We assess marginal impacts on producer opportunism from using more T-yields and using special T-yields by measuring their differential effects on estimated producer return.

To test whether subsidization of crop insurance promotes producer opportunism, we determine whether buy-up coverage, revenue insurance, or T-yield parameter estimates are significantly greater when the dependent variable is producer return (including the subsidy) than when accounting for the full cost of insurance (social return, not including the subsidy). By comparing results between the social return and producer return equations we calculate the amount of producer opportunism, if any, contributed by the subsidy. We implement this test by selecting each buy-up coverage level, revenue insurance, or T-yield variable for which the estimated parameter supported the hypothesis that producer return increases with the use of buy-up coverage, revenue insurance, or T-yields (i.e., where producer opportunism was found). For each selected variable, we conduct the test by computing the difference in its parameter estimates between the two models: $\Delta\gamma = \hat{\gamma}_p - \hat{\gamma}_s$, where $\hat{\gamma}_p$ represents the estimated coefficient with producer return as the dependent variable, and $\hat{\gamma}_S$ represents the estimated coefficient on the same variable with social return as the dependent variable. We compute a Wald test to determine whether a significant difference exists. We calculate this test because, if the subsidy had not been available, the producer would have had to pay the total premium to get crop insurance and would have received the social return. This would result in an estimated social producer opportunism effect of $\hat{\gamma}_s$. However, with the subsidy, the producer only paid the producer premium which resulted in the estimated private producer opportunism effect of $\hat{\gamma}_p$. A significant positive difference between $\hat{\gamma}_p$ and $\hat{\gamma}_s$ indicates that the subsidy increased producer opportunism.

To permit an examination of the effects of heterogeneity of land resources, our data sample is limited to non-irrigated agricultural production. We supplement the field-level crop insurance contract data with county-level annual growing degree-day data (Schlenker and Roberts 2006). Along with county fixed effects, growing degree-day data act as control variables for heterogeneity between counties that could come from differences in weather and land quality.

Support for greater producer opportunism in regions with greater within-county land resource heterogeneity occurs if the average of all significant buy-up coverage, revenue insurance or T-yield parameter estimates is greater for regions with greater within-county land resource heterogeneity than for regions with less within-county land resource heterogeneity. We compare evidence by conducting the tests for three crops to the extent relevant in five regions.

Results

We present the results for selection of buy-up coverage (55 percent - 85 percent Coverage level variables) and revenue insurance (crop rev coverage, income protection, and revenue assurance variables) using social return as the dependent variable in Table 2. We found six significantly positive parameter estimates on buy-up coverage for wheat in OK, one for summer-fallow wheat in Western NE, two for summer-fallow winter wheat and one each for continuously-cropped winter and spring wheat in North-Central MT, three for corn in OK, and five for corn in Western NE.[11] For other crops, we identified one significantly positive parameter for cotton in OK, one for both summer-fallow and continuously-cropped barley in MT, one for barley in WA, two for millet in NE, and one for canola in IA. We found two significantly positive parameter estimates on revenue insurance variables for wheat in OK, one each for both summer-fallow and continuously-cropped winter wheat and summer-fallow spring wheat in MT, one for spring wheat in WA, one each for corn in NE and IA, and one for soybeans in IA.

Based on social return, evidence of producer opportunism from the selection of buy-up coverage occurs in two of the three major crops (none in soybeans), in all four other crops, and in all five growing regions. Even without the subsidy, there is evidence of producer opportunism from selection of revenue insurance in all three major crops and in all five regions.

Table 3 contains results for selection of buy-up coverage and revenue insurance with producer return as the dependent variable. Producer return and social return provided similar results, with a few additional positive and significant parameters when examining producer return. Both producer return and social return provided evidence of producer opportunism from the selection of buy-up coverage. With the exception of soybeans, both producer return and social return showed evidence of producer opportunism from insurance type.

[11] Hereafter we refer to the regions only by their state abbreviation.

As evident from table 3, the value to the producer of producer opportunism varied widely, ranging from $1 to $61 dollars per acre for buy-up coverage and from $1 to $17 for revenue insurance. For example, corn in OK provided producers an average return of $61 more per acre if the producer selected a 65 percent coverage level rather than a 50 percent coverage level. The average difference was only $1 per acre greater for the same coverage level for NE millet producers. Growing corn in IA or wheat in WA provided no evidence of an increase in return from buy-up coverage. One possible explanation for this difference in producer opportunism could be that in OK there exists more opportunity to gain by choice of coverage level because favorable growing conditions don't always exist. Having higher coverage levels of crop insurance in OK results in additional profit for the producer because the additional expected benefit outweighs the additional insurance cost.

We present the results for the impacts of T-yields on social return in Table 4. We found four significantly positive parameter estimates on T-yield variables for wheat in OK, one for summer-fallow wheat in NE, four for summer-fallow and three for continuously-cropped winter wheat and two for summer-fallow spring wheat in MT, one for winter wheat in WA, one each for corn in NE and IA, and two for soybeans in IA. Three significantly positive parameter estimates apply to T-yields in "other crops", two for cotton in OK and one for canola in IA. Thus, we found evidence of producer opportunism on social return in the use of T-yields for all three major crops – wheat, corn, and soybeans, as well as for cotton in OK and canola in IA. All five regions provided evidence of producer opportunism from the use of T-yields in at least one crop.

Table 5 contains results for T-yields with producer return as the dependent variable. Nearly all significant parameters for social return were also significant for producer return. Several additional parameters were positive and significant for producer return. Whether measured in a social sense or a private sense, these results provide considerable evidence that producers exercise opportunistic behavior in the use of T-yields when securing crop insurance. The value of this producer opportunism ranges between $1 and $9 per acre. These findings support the idea that potential exists for producers in each region to profit by using T-yields to participate in the federal crop insurance program or by selecting buy-up coverage or revenue insurance. They lend support to the findings previously noted by Roberts, Key, and O'Donoghue (2006), Makki and Somwaru (2001), Just, Calvin, and Quiggin (1999), Smith and Goodwin (1996), and Skees and Reed (1986) that producers participate in crop insurance partly because of adverse selection and moral hazard possibilities.

We found no consistent evidence supporting the idea that producer return increases with the use of additional T-yields. For most commodities and regions, there were not a sufficient number of significant parameters on T-yields to draw a conclusion or else the evidence was ambiguous. Thus, the county average yield discounts used to create the field's yield guarantee when more than one T-yield is used do not appear to be out of balance with the undiscounted county average when only one T-yield is used.

To test whether the subsidization of crop insurance promotes producer opportunism, we computed Wald test statistics on the difference in relevant parameter estimates in equation (1) for the two dependent variables – social return and producer return. Support for the hypothesis was provided by a significant positive difference in the coefficient value due to subsidization when we found evidence of private producer opportunism. We report the test statistics for buy-up coverage and revenue insurance in table 6. In dollars per acre, the values in the table represent the difference in parameter estimates when producer return and social return are the dependent variables. We found a significant positive difference in 89 percent of the parameter estimate pairs where we identified producer opportunism for buy-up coverage and in 90 percent of the parameter estimate pairs for revenue insurance. Only 4 percent of buy-up coverage and revenue insurance would be consistent with the converse hypothesis that the subsidy reduces the amount of producer opportunism. Table 7 contains the test statistics for subsidization of crop insurance promoting producer opportunism using T-yields. The Wald statistics indicate a significant positive difference in 52 percent of the parameter estimate pairs where we found producer opportunism. Eleven percent of parameter pairs would have been consistent with the converse hypothesis. Thus, strong evidence suggests that the subsidy increases producer opportunism for buy-up coverage and revenue insurance selection but only modest evidence that the subsidy increases producer opportunism when using T-yields.

The value of producer opportunism due to the subsidy for buy-up coverage ranges from \$0.47 to \$11 per acre. For revenue insurance and T-yields the value of producer opportunism ranges from \$1 to \$2 and from \$0.07 to \$3 per acre, respectively. The differences in subsidy effect on producer opportunism between buy-up coverage, revenue insurance and T-yields may be because the subsidy amount for buy-up coverage changes dramatically between coverage levels but much less for revenue insurance and T-yields.

We also examine whether private producer opportunism due to the use of buy-up coverage, revenue insurance, and T-yields increases in regions with greater within-county land resource heterogeneity. We determine whether the more heterogeneous within-county land resource regions have a higher expected producer return than regions with more homogeneous within-county land resources from selection or use of these options. OK, MT, and WA have greater land heterogeneity than IA and NE. Results reported in tables 3 and 5 provide the parameters used to test this hypothesis. We examine both the percent of parameters on buy-up coverage, revenue insurance, and T-yields that are significantly positive and their average values. Across all crops, we found 33 percent of the estimated parameters on buy-up coverage significantly positive with an average estimated producer opportunism of $12.43 in the more heterogeneous regions. These figures compare to 30 percent of parameters with average opportunism of $17 in the more homogeneous regions. For revenue insurance, 70 percent of the parameters in the heterogeneous regions were significantly positive with average estimated producer opportunism of $7 compared to 38 percent and $5 in the homogenous regions. For T-yields, 27 percent of the parameters in the heterogeneous regions were significantly positive with average estimated producer opportunism of $3 per acre compared to 19 percent and $2 in the homogeneous regions.

For all options, the percent of significant positive parameters was larger in the more heterogeneous regions than in the more homogeneous regions. Also, for revenue insurance and T-yields, the average estimated producer opportunism was greater in the heterogeneous regions than in the homogeneous regions. However, most differences were not very large. So, while evidence generally supports this hypothesis, results do not provide conclusive support.

Conclusions

We have analyzed an important unintended outcome of the federal crop insurance program, producer opportunism. We examined whether evidence of producer opportunism exists in field-level crop insurance contract data for several crops in five different regions from the use of buy-up coverage, revenue insurance, and transitional yields (T-yields). Reducing producer opportunism creates a more efficient risk management program that limits the ability of producers to extract profits from participating. Our results are important to policy makers because they identify the characteristics of insurance that lead to producer opportunism.

For buy-up coverage, we found evidence of producer opportunism in wheat and corn in all five regions. Estimated opportunism effects from buy-up coverage ranged from trivial to very large in size, $1 to $61 per acre. For buy-up coverage, evidence did not support the hypothesis that more heterogeneous land quality increased producer opportunism. This result suggests that an increase in relative producer premium for higher coverage levels is recommended, regardless of land quality, to decrease the amount of producer opportunism. Increasing producer premium can be accomplished by either reducing the subsidy or increasing total insurance cost.

For insurance type, we found evidence of producer opportunism in wheat, corn, and soybeans and in all five regions. Estimated opportunism effects from insurance type were more moderate in size, from $1 to $17 per acre. This result indicates that premium structure for insurance type does not fully incorporate necessary information needed to offset opportunistic behavior. We also found greater evidence of producer opportunism in more heterogeneous land quality regions. Revenue insurance may warrant an increase in relative premiums, with a larger increase in premiums for producers in heterogeneous regions.

For T-yields, all three primary crops as well as all five regions showed evidence of producer opportunism. In many cases, the estimated effects were small, in the $1 to $9 per acre range. Further, while we found no consistent evidence that using more T-yields resulted in greater producer opportunism, evidence of producer opportunism was greater in the more heterogeneous regions. To address the effect of land quality on establishing APH the RMA has done the right thing by starting to assign a specific T-yield to areas within a county that have similar land quality.

In general our findings provide support for the hypotheses tested in this study. However, some caution is warranted in interpreting the results. It is possible that some of the evidence of producer opportunism could stem from differences in producer ability. For example, low producer ability can lead to expected yields lower than the county average just as poorer agro-climatic conditions can. If the ability of producers is inversely correlation with use of T-yields, our estimates of producer opportunism in using T-yields would be biased upward. It is also possible that fields that receive frequent indemnity payments are receiving larger expected returns from crop insurance than fields that seldom receive an indemnity. If this is true then increased premium amounts should focus on fields with frequent indemnities.

With such caveats, our results provide four important implications relevant to policymakers. First, we have documented that buy-up coverage, revenue insurance, and the use of T-yields can potentially increase expected income of producers. Second, evidence suggests that producer opportunism exists in all three major crops but the amount of producer opportunism varies between crops. Third, evidence suggests that the subsidization of crop insurance increases the level of producer opportunism possibilities, especially for buy-up coverage and revenue insurance. Fourth, evidence suggests that producer opportunism possibilities from exercising these options in regions with relatively homogeneous soils provide similar results when compared to regions with more heterogeneous soils. Each of these findings implies that crop insurance may be prone to producer opportunism issues. Information from this study provides the FCIC evidence that crop insurance contracts warrant redesign considerations to remove the opportunistic possibilities.

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Table 1. Variable Description

Variable Name	Variable Definition
Producer Return	(indemnity – producer premium)/ acres insured
Social Return	(indemnity – total premium)/ acres insured
Growing Degree Days	county average number of growing degree days above 20 degrees Celsius.
County	A matrix of dummy variables for each county.
Year	A matrix of dummy variables for each year: 1995 to 2002.
Crop	Dummy variables specific for each crop.
Coverage level	A matrix of dummy variables for each coverage level; between 50% and 85% in 5% increments.
Insurance Type	A matrix of dummy variables for producer selection of: multiple peril crop insurance, crop revenue coverage, revenue assurance, or income protection.
MPCI	Multiple Peril Crop Insurance
Crop Rev Coverage	Crop Revenue Coverage Insurance
Field Practice	A dummy variable if field was cropped the previous year, 0 otherwise.
T-yields	A matrix of dummy variables where column "t" =1 if "t" number of T-yields were used, t = 1, 2, 3, 4, 0 otherwise.
New Producer	A dummy variable if the producer is a new producer.
New practice, type, or variety	A dummy variable if the producer used a new practice, type, or variety on additional land that has no production history in the crop.
OK	Oklahoma
MT	North-Central Montana
WA	Eastern Washington
NE	Western Nebraska
IA	Iowa

Table 2. Buy-up Coverage and Revenue Insurance Parameter Estimates with Social Return as the Dependent Variable [a]

Crop	Coverage Level or Revenue Insurance	Region						
		OK	North-Central MT		Eastern WA	Western NE		IA
			Summer fallow	Continuously cropped		Summer fallow	Continuously cropped	
Wheat (Soybeans in Iowa)	55% Coverage	0.36	—		—	[b]	-4.41	0.41
	60% Coverage	3.83*	—		—	-2.96	-0.78	-0.72
	65% Coverage	1.77*	—		—	-0.55	-1.51	-2.04
	70% Coverage	2.66*	—		—	2.41*	-1.85	-2.15
	75% Coverage	3.89*	—		—	2.85	-2.24	-2.83
	80% Coverage	7.12*	—		—	-0.37	-1.43	-4.02
	85% Coverage	7.14*	—		—	16.88	4.20	-3.64
	Crop Rev Coverage	1.89*	—		—	1.82	-0.69	1.08
	Income Protection	—	—		—	—	—	2.35*
	Revenue Assurance	4.55*	—		—	—	—	-1.20
Winter Wheat	55% Coverage	—	-0.61	[b]	-0.27	—		—
	60% Coverage	—	-10.28	[b]	-1.25	—		—
	65% Coverage	—	-1.20	-3.48	-1.24	—		—
	70% Coverage	—	-1.27	-2.59	-1.48	—		—
	75% Coverage	—	5.47*	2.69	-1.56	—		—
	80% Coverage	—	18.83*	15.27*	-2.36	—		—
	85% Coverage	—	15.75	2.79	-0.79	—		—
	Crop Rev Coverage	—	15.40*	7.88*	0.40	—		—
Spring Wheat	55% Coverage	—	-3.03	-0.99	-0.58	—		—
	60% Coverage	—	-2.96	-1.74	-2.05	—		—
	65% Coverage	—	-0.62	0.79	-1.41	—		—
	70% Coverage	—	0.46	1.89*	-1.40	—		—
	75% Coverage	—	0.71	0.96	-0.86	—		—
	80% Coverage	—	3.77	-10.97	-3.28	—		—
	85% Coverage	—	15.22	[b]	-2.05	—		—
	Crop Rev Coverage	—	5.85*	0.47	3.67*	—		—
Corn	55% Coverage	[b]	—		—	9.87		-0.92
	60% Coverage	-4.45	—		—	9.39		-1.39
	65% Coverage	55.43*	—		—	5.04*		-3.32
	70% Coverage	17.80*	—		—	22.15*		-4.67
	75% Coverage	44.21*	—		—	23.52*		-6.29
	80% Coverage	[b]	—		—	36.10*		-9.54
	85% Coverage	[b]	—		—	40.06*		-7.95
	Crop Rev Coverage	-2.73	—		—	9.50*		[b]
	Income Protection	—	—		—	—		3.74*
	Revenue Assurance	[b]	—		—	—		-1.89
Other	55% Coverage	-2.78	11.44*	9.97	-0.54	-4.93		1.24*
	60% Coverage	1.28	-4.53	1.53	-1.57	4.70		[b]
	65% Coverage	6.63*	-0.74	-0.85	-0.84	0.41		-0.66
	70% Coverage	-13.37	-0.42	-0.01	-0.14	6.37*		-2.62
	75% Coverage	-10.91	-0.14	-3.60	-0.48	13.21*		-2.49
	80% Coverage	—	-5.26	-19.10	3.18*	—		—
	85% Coverage	—	[b]	23.93*	2.20	—		—
	Crop Rev Coverage	-6.59	—	—	—	—		—
	Income Protection	—	—	—	—	—		[b]
	Revenue Assurance	[b]	—	—	—	—		—
No. of Observ.		90869	55286		44921	47444		186654

Note: * implies parameter is significant at the 0.05 level.
[a] Units are in dollars per acre.
[b] Variable was available to producers but dropped due to lack of observations fitting the variables criteria.

Table 3. Buy-up Coverage and Revenue Insurance Parameter Estimates with Producer Return as the Dependent Variable [a]

Crop	Coverage Level or Revenue Insurance	Region						
		OK	North-Central MT		Eastern WA	Western NE		IA
			Summer fallow	Continuously cropped		Summer fallow	Continuously cropped	
Wheat (Soybeans in Iowa)	55% Coverage	0.77	—		—	b	-4.32	0.41
	60% Coverage	4.45*	—		—	-3.07	-0.17	-0.67
	65% Coverage	2.46*	—		—	0.05	-0.84	-1.17
	70% Coverage	4.33*	—		—	4.18*	-0.44	-0.84
	75% Coverage	5.65*	—		—	5.77*	-0.05	-0.80
	80% Coverage	9.21*	—		—	2.28	1.35	-1.23
	85% Coverage	6.92*	—		—	25.25*	8.84	-0.55
	Crop Rev Coverage	2.81*	—		—	2.90*	-0.18	0.28
	Income Protection	—	—		—	—	—	1.51
	Revenue Assurance	5.51*	—		—	—	—	-0.73
Winter Wheat	55% Coverage	—	-0.09	b	-0.31	—		—
	60% Coverage	—	-10.05	b	-0.98	—		—
	65% Coverage	—	-0.16	-2.36	-0.89	—		—
	70% Coverage	—	0.35	-0.78	-0.95	—		—
	75% Coverage	—	7.01*	5.54*	-1.00	—		—
	80% Coverage	—	22.45*	18.87*	-0.93	—		—
	85% Coverage	—	20.82	9.66*	0.82	—		—
	Crop Rev Coverage	—	16.74*	9.30*	1.45*	—		—
Spring Wheat	55% Coverage	—	-3.39	-1.03	-0.64	—		—
	60% Coverage	—	-2.49	-1.28	-2.07	—		—
	65% Coverage	—	0.27	1.86*	-1.08	—		—
	70% Coverage	—	1.62*	3.40*	-0.71	—		—
	75% Coverage	—	2.13*	2.62*	-0.18	—		—
	80% Coverage	—	6.44*	-7.13	-1.14	—		—
	85% Coverage	—	17.32	b	0.32	—		—
	Crop Rev Coverage	—	6.80*	1.60	5.20*	—		—
Corn	55% Coverage	b	—		—	10.88		-1.17
	60% Coverage	2.72	—		—	10.95		-1.11
	65% Coverage	61.04*	—		—	5.88*		-2.32
	70% Coverage	25.64*	—		—	24.63*		-3.06
	75% Coverage	55.11*	—		—	27.92*		-3.40
	80% Coverage	b	—		—	44.11*		-4.63
	85% Coverage	b	—		—	48.48*		-2.78
	Crop Rev Coverage	-1.95	—		—	10.82*		b
	Income Protection	—	—		—	—		1.99*
	Revenue Assurance	b	—		—	—		-0.69
Other	55% Coverage	-1.78	11.24*	10.00	-0.82	-4.05		0.94*
	60% Coverage	3.34	-4.67	2.05	-1.52	4.95*		b
	65% Coverage	8.34*	0.12	0.10	-0.60	0.87*		0.62
	70% Coverage	-7.69	0.82	1.49	0.31	7.51*		-1.81
	75% Coverage	0.33	1.35	-2.30	0.18	17.45*		-0.75
	80% Coverage	—	-1.72	-14.15	3.92*	—		—
	85% Coverage	—	b	27.70*	3.26*	—		—
	Crop Rev Coverage	-2.53	—	—	—	—		—
	Income Protection	—	—	—	—	—		b
	Revenue Assurance	b	—	—	—	—		—

Note: * implies parameter is significant at the 0.05 level.
[a] Units are in dollars per acre.
[b] Variable was available to producers but dropped due to lack of observations fitting the variables criteria.

Table 4. T-yield Parameter Estimates with Social Return as the Dependent Variable [a]

Crop	Number of or type of T-yield(s)	Region: OK	North-Central MT: Summer fallow	North-Central MT: Continuously cropped	Eastern WA	Western NE: Summer fallow	Western NE: Continuously cropped	IA
Wheat (Soybeans in Iowa)	4 T-Yields	-1.08	—		—	0.29	-2.10	-0.36
	3 T-Yields	-1.64	—		—	-0.10	-3.67	-0.73
	2 T-Yields	0.50*	—		—	-1.69	-3.13	-0.26
	1 T-Yield	1.09*	—		—	-0.76	-3.36	0.29
	New Producer	5.47*	—		—	2.27*	-1.80	1.54*
	New practice, type, or variety	1.89*	—		—	-1.09	-2.97	1.15*
Winter Wheat	4 T-Yields	—	1.26*	1.12	-0.48	—		—
	3 T-Yields	—	1.26*	3.08*	0.14	—		—
	2 T-Yields	—	1.34	1.44	0.34	—		—
	1 T-Yield	—	1.38*	-0.74	0.55	—		—
	New Producer	—	2.61	4.00*	3.78*	—		—
	New practice, type, or variety	—	5.46*	5.22*	-0.32	—		—
Spring Wheat	4 T-Yields	—	0.56	-2.60	-0.82	—		—
	3 T-Yields	—	0.06	-2.99	-1.25	—		—
	2 T-Yields	—	1.24*	-1.18	-1.26	—		—
	1 T-Yield	—	-0.62	-0.68	-0.80	—		—
	New Producer	—	1.70	0.60	-1.66	—		—
	New practice, type, or variety	—	2.46*	-1.06	-1.74	—		—
Corn	4 T-Yields	-20.24	—		—	-2.36		-1.52
	3 T-Yields	-11.37	—		—	-9.26		0.07
	2 T-Yields	-17.08	—		—	-13.85		0.21
	1 T-Yield	-17.85	—		—	-11.34		0.43
	New Producer	#	—		—	-5.32		2.55*
	New practice, type, or variety	-18.47	—		—	5.49*		0.58
Other	4 T-Yields	-5.33	0.37	-2.17	-0.54	-0.59		-0.23
	3 T-Yields	-5.18	0.46	-1.58	-0.09	-2.82		0.02
	2 T-Yields	-6.41	0.31	-0.49	-0.47	-3.46		1.13
	1 T-Yield	-5.52	-1.23	-1.90	0.27	-4.58		1.55
	New Producer	3.90*	-0.33	-2.60	-0.58	-3.25		2.74*
	New practice, type, or variety	5.99*	-1.78	-2.24	0.69	0.43		-1.87
No. of Observ.		90869	55286		44921	47444		186654

Note: * implies parameter is significant at the 0.05 level.
implies coefficient not estimated due to high VIF.
[a] Units are in dollars per acre.

Table 5. T-yield Parameter Estimates with Producer Return as the Dependent Variable [a]

Crop	Number of or type of T-yield(s)	Region: OK	North-Central MT: Summer fallow	North-Central MT: Continuously cropped	Eastern WA	Western NE: Summer fallow	Western NE: Continuously cropped	IA
Wheat (Soybeans in Iowa)	4 T-Yields	-0.73	—		—	0.51	-1.18	-0.08
	3 T-Yields	-1.48	—		—	0.04	-3.39	-0.62
	2 T-Yields	0.61*	—		—	-1.40	-2.83	-0.23
	1 T-Yield	1.16*	—		—	-0.37	-2.76	0.29
	New Producer	5.46*	—		—	2.86*	-0.78	1.66*
	New practice, type, or variety	1.83*	—		—	-0.45	-2.33	1.02*
Winter Wheat	4 T-Yields	—	1.39*	1.10	-0.35	—		—
	3 T-Yields	—	1.43*	2.96*	0.26*	—		—
	2 T-Yields	—	1.57	1.94*	0.45	—		—
	1 T-Yield	—	1.47*	0.80	0.68	—		—
	New Producer	—	2.84	3.84	3.98*	—		—
	New practice, type, or variety	—	5.80*	4.81*	-0.01	—		—
Spring Wheat	4 T-Yields	—	0.76*	-2.62	-0.63	—		—
	3 T-Yields	—	0.23	-2.93	-1.08	—		—
	2 T-Yields	—	1.42*	-1.21	-1.22	—		—
	1 T-Yield	—	-0.51	-0.59	-0.75	—		—
	New Producer	—	1.98	0.94	-1.29	—		—
	New practice, type, or variety	—	2.52*	-1.46	-1.40	—		—
Corn	4 T-Yields	-20.33	—		—	-2.04		-1.00
	3 T-Yields	-10.36	—		—	-9.39		0.41
	2 T-Yields	-17.47	—		—	-14.05		0.32
	1 T-Yield	-16.00	—		—	-11.20		0.65*
	New Producer	#	—		—	-5.23		2.92*
	New practice, type, or variety	-16.51	—		—	5.52*		0.57
Other	4 T-Yields	-5.67	0.36	-1.94	-0.38	-0.33		0.01
	3 T-Yields	-5.15	0.41	-1.43	0.09	-2.56		0.16
	2 T-Yields	-6.49	0.24	-0.34	-0.37	-2.89		1.37
	1 T-Yield	-5.07	-1.51	-1.89	0.35	-3.72		2.11*
	New Producer	5.32*	-0.47	-2.57	-0.42	-3.00		2.79*
	New practice, type, or variety	8.85*	-2.17	-2.54	1.16*	0.47		-1.79

Note: * implies parameter is significant at the 0.05 level.
implies coefficient not estimated due to high VIF.
[a] Units are in dollars per acre.

Table 6. Estimated Amount of Buy-up Coverage and Revenue Insurance Producer Opportunism due to Subsidy [a]

Crop	Coverage Level or Revenue Insurance	Region						
		OK	North-Central MT		Eastern WA	Western NE		IA
			Summer fallow	Continuously cropped		Summer fallow	Continuously cropped	
Wheat (Soybeans in Iowa)	55% Coverage	—	—		—	—	—	—
	60% Coverage	0.62*	—		—	—	—	—
	65% Coverage	0.69*	—		—	—	—	—
	70% Coverage	1.67*	—		—	1.77*	—	—
	75% Coverage	1.76*	—		—	2.95*	—	—
	80% Coverage	2.09*	—		—	—	—	—
	85% Coverage	-0.22	—		—	8.37*	—	—
	Crop Rev Coverage	0.92*	—		—	1.08*	—	—
	Income Protection	—	—		—	—	—	—
	Revenue Assurance	0.96*	—		—	—	—	—
Winter Wheat	55% Coverage	—	—	—	—	—		—
	60% Coverage	—	—	—	—	—		—
	65% Coverage	—	—	—	—	—		—
	70% Coverage	—	—	—	—	—		—
	75% Coverage	—	1.54*	2.85*	—	—		—
	80% Coverage	—	3.62*	3.60*	—	—		—
	85% Coverage	—	—	3.87*	—	—		—
	Crop Rev Coverage	—	1.34*	1.42*	1.05*	—		—
Spring Wheat	55% Coverage		—	—	—	—		—
	60% Coverage	—	—	—	—	—		—
	65% Coverage	—	—	1.07*	—	—		—
	70% Coverage	—	1.16*	1.51*	—	—		—
	75% Coverage	—	1.42*	1.66*	—	—		—
	80% Coverage	—	2.66*	—	—	—		—
	85% Coverage	—	—	—	—	—		—
	Crop Rev Coverage	—	0.95*	—	1.53*	—		—
Corn	55% Coverage	—	—		—	—		—
	60% Coverage	—	—		—	—		—
	65% Coverage	5.61*	—		—	0.84*		—
	70% Coverage	7.84*	—		—	2.48*		—
	75% Coverage	10.90*	—		—	4.40*		—
	80% Coverage	—	—		—	8.01*		—
	85% Coverage	—	—		—	8.42*		—
	Crop Rev Coverage	—	—		—	1.32*		—
	Income Protection	—	—		—	—		-1.75*
	Revenue Assurance	—	—		—	—		—
Other	55% Coverage	—	-0.19	—	—	—		-0.30*
	60% Coverage	—	—	—	—	0.25		—
	65% Coverage	1.71*	—	—	—	0.47*		—
	70% Coverage	—	—	—	—	1.14*		—
	75% Coverage	—	—	—	—	4.24*		—
	80% Coverage	—	—	—	0.74*	—		—
	85% Coverage	—	—	3.77*	1.06*	—		—
	Crop Rev Coverage	—	—	—	—	—		—
	Income Protection	—	—	—	—	—		—
	Revenue Assurance	—	—	—	—	—		—

Note: * implies parameter is significant at the 0.05 level.
[a] Units are in dollars per acre.

Table 7. Estimated Amount of T-yield Producer Opportunism due to Subsidy [a]

Crop	Number of or type of T-yield(s)	Region: OK	North-Central MT: Summer fallow	North-Central MT: Continuously cropped	Eastern WA	Western NE: Summer fallow	Western NE: Continuously cropped	IA
Wheat (Soybeans in Iowa)	4 T-Yields	—	—		—	—	—	—
	3 T-Yields	—	—		—	—	—	—
	2 T-Yields	0.11*	—		—	—	—	—
	1 T-Yield	0.07*	—		—	—	—	—
	New Producer	-0.01	—		—	0.59*	—	0.12*
	New practice, type, or variety	-0.06	—		—	—	—	-0.13*
Winter Wheat	4 T-Yields	—	0.13	—	—	—		—
	3 T-Yields	—	0.17*	-0.12	0.12*	—		—
	2 T-Yields	—	—	0.50*	—	—		—
	1 T-Yield	—	0.09	—	—	—		—
	New Producer	—	—	—	0.20	—		—
	New practice, type, or variety	—	-2.94*	-0.41	—	—		—
Spring Wheat	4 T-Yields	—	-0.20*	—	—	—		—
	3 T-Yields	—	—	—	—	—		—
	2 T-Yields	—	0.18*	—	—	—		—
	1 T-Yield	—	—	—	—	—		—
	New Producer	—	—	—	—	—		—
	New practice, type, or variety	—	0.06	—	—	—		—
Corn	4 T-Yields	—	—		—	—		—
	3 T-Yields	—	—		—	—		—
	2 T-Yields	—	—		—	—		—
	1 T-Yield	—	—		—	—		0.22*
	New Producer	—	—		—	—		0.37*
	New practice, type, or variety	—	—		—	0.03		—
Other	4 T-Yields	—	—		—	—		—
	3 T-Yields	—	—		—	—		—
	2 T-Yields	—	—		—	—		—
	1 T-Yield	—	—		—	—		0.05*
	New Producer	1.42*	—		—	—		0.08
	New practice, type, or variety	2.86*	—		0.47*	—		—

Note: * implies parameter is significant at the 0.05 level.
[a] Units are in dollars per acre.