

Opportunity Costs, Share Leasing, and Prevented Planting Claims in Crop Insurance

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ABSTRACT

This paper determines whether the opportunity costs of share leasing and the share amounts of farmers/tenants affect the likelihood of submitting a prevented planting claim. Results from our empirical analysis of crop insurance data shows that the opportunity costs of share leasing has a negative relationship with the probability of submitting a prevented planting claim, while the share percentage of farmers/tenants have a positive relationship. These results also imply that farmers not involved in a share lease contract (i.e. farmers with 100% share) have a higher probability of submitting a prevented planting claim, relative to producers in a share-leasing arrangement with less than a 100% share. Thus, a share leasing contract seems to be an institutional mechanism that can dampen the probability of submitting prevented planting claims. These results have potential implications for setting prevented planting buy-up rates and crop insurance compliance procedures.

Keywords: Crop Insurance; Opportunity Costs; Prevented Planting; Share Leasing

JEL Classification: G22, Q12, Q18, Q19

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The prevented planting provision is a standard element of crop insurance contracts. This provision allows an insured producer to receive an indemnity payment if he fails to plant an insured crop before a designated planting date, due to a valid cause of loss. The Risk Management Agency (RMA) Compliance Office views prevented planting as a potential source of program vulnerability because producers can receive this payment without incurring the major costs of production associated with carrying the crop to harvest. Payment received due to prevented planting is a positive cash flow to the producer without expending the effort and financial resources to grow, tend, and harvest the crop. Hence, an insured dishonest producer may have incentives to take advantage of this provision and submit a fraudulent prevented planting claim, instead of bringing their crop to harvest.

The objective of this study is to explore how share leasing opportunity costs and farmers' share lease amount affect the likelihood of submitting a prevented planting claim. Understanding the relationship between opportunity costs, share lease amounts (or percentage), and prevented planting claims can help RMA formulate strategies that can help mitigate the abuse of this provision. Ratemaking for additional prevented planting coverage may also be improved with the knowledge about the relationship of opportunity costs, share lease amounts, and the probability of prevented planting. Moreover, RMA can also use the information from this study to help profile farmers that are more likely to submit prevented planting claims and investigate them pro-actively to deter potentially fraudulent claims (GAO).

The paper is organized as follows. A theoretical model elucidating the hypothesized effects of opportunity costs and a tenant's share lease amount on the probability of filing a

prevented planting claim is developed in the next section. The empirical methods, results, and conclusions are discussed in the remaining three sections.

Conceptual Framework

The conceptual framework below investigates the influence of opportunity costs and share leasing arrangements of farmers or tenants under a single proprietorship ownership structure.¹ In this framework, single proprietor farmers are assumed to have a share leasing contract with a specific landlord. These contracts are usually negotiated or renewed by the tenants and landlords periodically and, hence, are less permanent arrangements.

Farmland Control Options

Farmland leasing has become an increasingly popular strategy for expanding control of farmland acreage. In 1998, leased farmland comprised 43.8% of farmland acres in the country. This figure is much higher than the average proportion of leased acreage for most of the census years since the turn of the century (Hoppe and Wiebe). Farmland leasing options include the payment of cash rents, sharing of production revenues and costs between the farmer and the landlord or hybrid contracts involving combinations of these two options. This study focuses only on single proprietor farmers/tenants with share leasing contracts, in as much as the farmer is able to maintain autonomy in making business decisions under a cash-leasing contract.

Relative to farmland ownership, a share lease contract provides farmers with significant incentives that include higher farm returns, business risk reduction and improved liquidity conditions. Empirical evidence suggests that farm operators generally realize higher accounting rates of return under a leasing strategy (Scott; Ellinger and Barry). Owned farmland traditionally

¹ In several surveys conducted by the USDA during the last few decades, results have consistently shown that 9 out of 10 farms in the country have been organized as single proprietorships. Thus, there is no significant loss of generality in considering only those farmers under single proprietorships.

generates low current farm returns due to its non-depreciability and the accrual of capital gains that are only realized upon liquidation of the asset (Oltmans; Barry and Robison).

Moreover, a share lease contract is a much more risk efficient farmland control option compared to land ownership (Janssen; Barry, *et al.*). The positive correlation between value of harvested crops and the tenant's rental payments to the landowner stabilizes the farmer's net income, thus providing greater risk-reducing benefits to the farmer.

Share leases also provide farmers with liquidity-enhancing opportunities. Under these contracts, the landlord is obligated to disburse his/her contribution of the variable costs whenever such costs are incurred and paid. Surveys and studies in the Midwest (Bullen; Reiss and Koenig) indicate consistent sharing of costs of fertilizer, pesticides, seed and other crop expenses between tenants and landlords. Other contracts may extend cost sharing to expenses for drying, storing and insuring crops. The sharing of these costs offers significant liquidity relief for the farmers who only procure funds to pay for his/her share as stipulated in the leasing contract.

These incentives, however, are weighed against a "premium" that a farm operator assigns to the benefit of autonomy enjoyed under full land ownership. The autonomy premium becomes an important consideration in the issue being analyzed in this study where farmers consider the filing of prevented planting claims.

Share Leasing and Prevented Planting Claims

Consider a risk-averse tenant (or producer) and a risk-averse landlord with a share tenancy leasing arrangement. Further, assume that both the producer and the landlord bought an Actual Production History (APH) crop insurance contract covering their respective shares of crop output.² The APH contract is an individual yield insurance plan that protects producers and

² Even if only APH crop insurance contract is modeled here, the authors believe that the qualitative results will not be significantly altered under revenue insurance.

landlords against yield shortfalls if their share of actual yield falls below the guaranteed level. APH insurance includes catastrophic coverage (CAT) and optional buy-up levels of coverage above CAT. For a flat fee per crop per farm, CAT provides a 50 percent yield guarantee and pays an indemnity based on 55 percent of the projected price. In this paper, we separate CAT and APH buy-up coverage and hereafter refer to APH buy-up as APH insurance.

APH insurance provides yield protection of up to 85 percent of the producer's or the landlord's share of average historical yield, with a premium based on a chosen yield coverage level. Let I be the tenant's share of the yield and let $(1 - I)$ be the landlord's share of the yield. An APH contract pays an indemnity if the producer's actual yield ($Y_F^a = IY^a$) or the landlord's actual yield ($Y_L^a = (1 - I)Y^a$) falls below the guaranteed yield level (Y^g), but offers no price protection.³ The guaranteed yield for the tenant and the landlord is computed based on the following formula:

$$(1) \quad Y_F^g = q_F I Y_F^e$$

$$(2) \quad Y_L^g = q_L (1 - I) Y_L^e$$

where q is the percent yield coverage chosen by the producer or landlord ($q = 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85$) and Y^e is the expected yield based on the average historical yield.⁴

If Y^a at harvest is greater than Y^g for both the producer and landlord, then the insured producer and the landlord do not receive indemnity payments and their payoffs are

$Y_F^a P^m - hC^p$ and $Y_L^a P^m - (1 - h)C^p$, respectively, where P^m is the market price at harvest, h is

the cost share of the producer, and C^p is the total cost of production through harvest. On the

³ Hereinafter, notations with F subscripts pertain to the tenant/producer and notations with L subscripts pertain to the landlord.

⁴ If the producer/landlord has no adequate yield history (i.e. 4-year yield history), assigned transitional yields (T-yields) are used in its place.

other hand, if $Y_F^a < Y_F^g$ and $Y_L^a < Y_L^g$ at harvest, then both the insured producer and landlord receives an indemnity payment. Their payoffs are $(q_F \mathbf{I} Y_L^e - \mathbf{I} Y^a) P_F^g + \mathbf{I} Y^a P^m - h C^p$ and $[q_L (1 - \mathbf{I}) Y_L^e - (1 - \mathbf{I}) Y^a] P_L^g + (1 - \mathbf{I}) Y^a P^m - (1 - h) C^p$, respectively, where P^g is the guaranteed or elected price. The guaranteed price is a certain fixed proportion of the expected price, which is usually the USDA's projected farm level price for the crop year. This chosen fixed proportion of the expected price ranges from 0.59 to 1.00.

For notational simplicity, let the following expressions hold:

$$(3) \quad \Phi_F^C = q_F \mathbf{I} Y_F^e P_F^g - \mathbf{I} Y^a P_F^g + \mathbf{I} Y^a P^m - h C^p,$$

$$(4) \quad \Phi_L^C = q_L (1 - \mathbf{I}) Y_L^e P_L^g - (1 - \mathbf{I}) Y^a P_L^g + (1 - \mathbf{I}) Y^a P^m - (1 - h) C^p,$$

$$(5) \quad \Phi_F^D = \mathbf{I} Y^a P^m - h C^p$$

$$(6) \quad \Phi_L^D = (1 - \mathbf{I}) Y^a P^m - (1 - h) C^p.$$

Assuming that the insured producer and the insured landlord have a von Neumann-Morgenstern utility function with $U' > 0, U'' < 0$, the producer's and the landlord's expected utilities can then be expressed as follows:

$$(7) \quad h U_F(W_F + \Phi_F^C) + (1 - h) U_F(W_F + \Phi_F^D)$$

$$(8) \quad h U_L(W_L + \Phi_L^C) + (1 - h) U_L(W_L + \Phi_L^D)$$

where h is the probability of $Y^a < Y^g$ and W is the non-contingent wealth defined as initial wealth less the insurance premium (p) paid ($W = W_0 - p$).

Prevented planting provisions are included in standard APH crop insurance contracts. As mentioned above, the prevented planting provision in the U.S. crop insurance program allows for insured producers to receive an indemnity payment if a producer fails to plant an insured crop

before a designated planting date for that crop and county, due to a valid cause of loss. The cause of loss must be general in the surrounding area and must have prevented similar producers in the area from planting their crops. Prevented planting payments for the producer and the landlord are based on a guaranteed prevented planting yield computed as follows:

$$(9) \quad Y_F^{gp} = \mathbf{g}_F \mathbf{q}_F \mathbf{l} Y_F^E = \mathbf{g}_F Y_F^g$$

$$(10) \quad Y_L^{gp} = \mathbf{g}_L \mathbf{q}_L (1 - \mathbf{l}) Y_L^E = \mathbf{g}_L Y_L^g$$

where \mathbf{g}_F and \mathbf{g}_L are the prevented planting guarantee reduction percentage chosen by the producer and landlord ($\mathbf{g}_F = \mathbf{g}_L = 0.60, 0.65, 0.70$).⁵ Prevented planting guarantee reduction levels at 0.65 and 0.70 are additional buy-up coverage. If an insured producer is prevented from planting and receives a prevented planting payment, his utility can be expressed as

$U_F(W_F + \Phi_F^A)$, where $\Phi_F^A = \mathbf{g}_F \mathbf{q}_F \mathbf{l} Y_F^e P_F^g - \mathbf{h} C^{pp}$ and C^{pp} is the production cost incurred by the producers at the point that he was prevented from planting (i.e. fertilizer, herbicide, land rental, tillage cost, other pre-planting costs). Consequently, the landlord's utility will be $U_L(W_L + \Phi_L^A)$, where $\Phi_L^A = \mathbf{g}_L \mathbf{q}_L (1 - \mathbf{l}) Y_L^e P_L^g - (1 - \mathbf{h}) C^{pp}$.

If the submission of prevented planting claims by the tenant and the landlord are totally independent, then the tenant and the landlord will submit prevented planting claims if and only if the following conditions hold for each of them respectively:

$$(11) \quad U_F(W_F + \Phi_F^A) \geq h U_F(W_F + \Phi_F^C) + (1 - h) U_F(W_F + \Phi_F^D)$$

$$(12) \quad U_L(W_L + \Phi_L^A) \geq h U_L(W_L + \Phi_L^C) + (1 - h) U_L(W_L + \Phi_L^D).$$

⁵ The prevented planting guarantee reductions presented here apply to most crops (i.e. corn, wheat, grain sorghum, soybeans), but some crops have different selection guarantee reduction choices. For example, rice has prevented planting guarantee reductions of 0.45, 0.50, and 0.55, while cotton has prevented planting guarantee reductions of 0.50, 0.55, and 0.60.

However, submitting prevented planting claims by the tenant and the landlord are not usually independent. The tenant typically has the primary responsibility to decide whether to submit a prevented planting claim or not. If the tenant submits a prevented planting claim, the landlord has no choice but to also submit a prevented planting claim. The tenant is the key decision-maker in this case because he decides whether to submit a claim or not.

The landlord, on the other hand, can agree or disagree with the decision of the tenant, even though he has no choice but to follow the tenant's decision when the tenant decides to submit a prevented planting claim. If the landlord agrees with the tenant, then conditions (11) and (12) hold and both are content. If the landlord disagrees with the tenant submitting a prevented planting claim, the landlord will terminate the relationship with the tenant after the season and the tenant loses the future income streams from leasing the landlord's land. The tenant's opportunity cost of disagreeing with the landlord can be defined as:

$$(13) \quad \Lambda = \sum_{n=1}^N \frac{[(IY_F^a P^m - hC^p))^{LL} - (IY_F^a P^m - hC^p))^{AL}]_n}{(1+r)^n}$$

where $[(IY_F^a P^m - hC^p))^{LL}]$ is the potential net revenue from the present landlord's land in year n , $[(IY_F^a P^m - hC^p))^{AL}]$ is the potential net revenue from an alternative landlord's land in year n , N is the time horizon, and r is the discount rate.

The tenant's expected utility can now be defined as:

$$(14) \quad gU_F(W_F + \Phi_F^A) + (1-g)U_F(W_F + \Phi_F^A - \Lambda)$$

where g is the probability that the landlord agrees with the decision to submit a prevented planting claim. Therefore, the tenant will submit a prevented planting claim if and only if:

$$(15) \quad gU_F(W_F + \Phi_F^A) + (1-g)U_F(W_F + \Phi_F^A - \Lambda) \geq hU_F(W_F + \Phi_F^C) + (1-h)U_F(W_F + \Phi_F^D).$$

Assume that there exists a landlord agreement probability \tilde{g} that makes the tenant indifferent between submitting a prevented planting claim and pushing through with growing the crop to harvest:

$$(16) \quad \tilde{g}U_F(W_F + \Phi_F^A) + (1 - \tilde{g})U_F(W_F + \Phi_F^A - \Lambda) = hU_F(W_F + \Phi_F^C) + (1 - h)U_F(W_F + \Phi_F^D).$$

This implies that:

$$(17) \quad \tilde{g} = \frac{hU_F(W_F + \Phi_F^C) + (1 - h)U_F(W_F + \Phi_F^D) - U_F(W_F + \Phi_F^A - \Lambda)}{U_F(W_F + \Phi_F^A) - U_F(W_F + \Phi_F^A - \Lambda)}.$$

From (17), we can show that the tenant share amount (?) has no definitive relationship with \tilde{g}

(i.e. $\frac{\partial \tilde{g}}{\partial I} >$ or $<$ 0) and the opportunity cost ? has a positive relationship with \tilde{g} (i.e. $\frac{\partial \tilde{g}}{\partial \Lambda} >$ 0).

See Appendix for the proof.

Let a be the probability that the tenant will submit a prevented planting claim. The tenant's problem is to choose a to maximize expected utility

$$(18) \quad V = \mathbf{a}[gU_F(W_F + \Phi_F^A) + (1 - g)U_F(W_F + \Phi_F^A - \Lambda)] \\ + (1 - \mathbf{a})[hU_F(W_F + \Phi_F^C) + (1 - h)U_F(W_F + \Phi_F^D)].$$

This implies:

$$(19) \quad \mathbf{a} = 0 \quad \text{if } g < \tilde{g},$$

$$(20) \quad \mathbf{a} \in [0,1] \quad \text{if } g = \tilde{g}, \text{ and}$$

$$(21) \quad \mathbf{a} = 1 \quad \text{if } g > \tilde{g}.$$

Since $\frac{\partial \tilde{g}}{\partial \Lambda} >$ 0, then a is a decreasing function of ?. Since there is no definitive

relationship between the tenant share amount (?) and \tilde{g} , we must empirically test whether a is an increasing or a decreasing function of ?.

The theoretical results above can be summed-up in the following propositions:

Proposition 1. Tenants that have lower opportunity costs of terminating a relationship with the landlord are more likely to submit a prevented planting claim.

Proposition 2. The effect of the tenant's share amount on the likelihood of submitting a prevented planting claim is theoretically ambiguous and must be verified empirically.

Lower opportunity costs for the tenant means that the income streams, among other factors, that he will forego by submitting a prevented planting claim (when the landlord disagrees) is lower. Thus he has more incentives to go ahead and submit a prevented planting claim even if the landlord disagrees. As mentioned above, the effect of tenant share needs to be empirically tested because the theoretical model indicates that tenant shares may either have a negative or a positive relationship with the likelihood of submitting a prevented planting claim.

Empirical Methods and Data

A binary choice model is used to empirically test the theoretical predictions above. An insured producer has to make a single choice between submitting a prevented planting claim or not. From the theory, an insured producer will submit a prevented planting claim if the expected utility of claiming prevented planting is greater than the expected utility of bringing the crop to harvest. Since the expected utility of submitting a prevented planting claim is unobservable, we model the difference between the expected utility of prevented planting and bringing the crop to harvest as:

$$(24) \quad y_i^* = \beta' x_i + e$$

where y_i^* is the unobservable variable. The x_i vector represents the variables that affect likelihood of submitting a prevented planting claim and the β' vector is the corresponding parameters. We assume that e has a normal distribution with mean 0 and variance 1.

We do not observe expected utility but we do observe whether a prevented planting claim has been submitted or not. Thus, a binary variable can be defined as:

$$(25) \quad y = 1 \quad \text{if } y_i^* > 0$$

$$(26) \quad y = 0 \quad \text{otherwise.}$$

In our case, $y = 1$ if a prevented planting claim has been submitted and $y = 0$ otherwise. It follows that:

$$(27) \quad \begin{aligned} \text{Prob}(y = 1) &= \text{Prob}(\mathbf{e} > -\boldsymbol{\beta}' \mathbf{x}_i) \\ &= F(\boldsymbol{\beta}' \mathbf{x}_i) \end{aligned}$$

where F is the cumulative distribution function of \mathbf{e} (Greene). Since we assumed a normal distribution for \mathbf{e} , the probit form of the model is estimated here. The probit distribution is given by

$$(28) \quad \text{Prob}(y = 1) = \int_{-\infty}^{\boldsymbol{\beta}' \mathbf{x}_i} \mathbf{j}(t) dt$$

where \mathbf{j} represent the standard normal distribution. Maximum likelihood procedure is used to estimate the parameters of the binary choice models above. Because the estimated coefficients arising from these regressions are not marginal effects, additional calculations are necessary.

Following Greene, the marginal effects for the probit model is given by:

$$(16) \quad \frac{\partial E[y | \mathbf{x}_i]}{\partial x_i} = \mathbf{j}(\boldsymbol{\beta}' \mathbf{x}_i) \boldsymbol{\beta}.$$

Note that the marginal effects in this study are computed at the means of \mathbf{x}_i .

In this study, only RMA data of insured producers for reinsurance year (RY) 2001 are considered and Catastrophic (CAT) insurance policies are excluded from the analysis. Only crop insurance data under the RMA's southern regional compliance office (RCO) for cotton is considered. Single proprietor farmers who bought a valid insurance policy are included in the

data, regardless of whether they submitted a prevented planting claim or not. The data is aggregated at the crop policy level for a particular, crop, type and practice. This results in 41,561 valid observations.

The dependent variable in this study is a binary variable (PPC) where $PPC = 1$ if a prevented planting claim was submitted and $PPC = 0$ otherwise. The elements of vector x_i representing the independent variables of the model are listed in Table 1. To empirically verify proposition 1, a proxy variable for opportunity costs has to be chosen. The variable representing expected yield (YIELD) is used as the proxy for the opportunity cost because expected yield based on a 4-10 year yield history represents the potential productivity of the landlord's land. From proposition 1, we would expect the sign of YIELD to be negative. Proposition 2 is empirically tested by examining the sign related to farmer-tenant's share in the leasing contract (SHARE) in all four models. From the theory, there is no *a priori* expectation for the sign of this variable. There are no *a priori* expectations for the rest of the dummy variables included in the model (i.e. geographical dummy variables, etc.). Summary Statistics and frequencies of the dummy variables are in Table 2. A planted acres variable (ACRES) was also included in the model to allow for scale effects.

Results and Discussion

Estimation results of the probit model, together with the estimated marginal effects, are presented in Table 3. The likelihood ratio (LR) test indicates that the coefficient vector is not zero because the LR chi-square statistic with 8 degrees of freedom is significant at the 1% level. However, the reported goodness-of-fit measures (i.e. pseudo-R-squared, McFadden's R-squared, McKelvey and Zavoina R-squared) indicate that the regression line only fits moderately well.

The coefficients and marginal effects of main interest in this paper are the ones associated with the variables YIELD and SHARE. As expected, the variable that proxies for the opportunity cost of terminating the landlord-tenant relationship (YIELD) has a statistically significant negative effect on the probability of submitting a prevented planting claim. However, the magnitude of the marginal effect of YIELD on the likelihood of submitting a prevented planting claim is small. A one unit increase in YIELD decreases the probability of submitting a prevented planting claim by 0.000004, all else equal. The negative sign of the YIELD coefficient verifies our theory that lower opportunity costs increases the likelihood of submitting a prevented planting claim (and vice-versa), but the magnitude of this effect may be trivial. A lower expected yield means that future income streams from the share lease arrangement that the producer might forego (by submitting a prevented claim) is lower. In this case, there are stronger incentives to submit a prevented planting claim even if there is a chance that the landlord might disagree and terminate the relationship in the future, because the potential income streams that the producer might forego is lower.

The estimated coefficient related to the SHARE variable has a statistically significant positive sign. As tenant share amount increases, the likelihood of submitting a prevented planting claim increases. Furthermore, the marginal effect indicates that as the farmer or tenant share increases relative to the landlord share, the probability of submitting a prevented planting claim increases by 0.011672 (*ceteris paribus*). This result is intuitive because tenants with higher share amounts bear more of the production risk relative to tenants with lower share amounts. Given the higher risk, it is logical to expect that tenants who bears a higher production risk is more likely to submit a prevented planting claim that pays with certainty, rather than push the crop to harvest and face an uncertain payout at harvest. Another intuitive explanation for the empirical result

above may be linked to the decision-making “influence” of tenants with higher shares. It can be argued that landlords with lower shares have a smaller stake in the potential returns from carrying the crop to harvest such that it is “easier” for the tenant to convince the landlord to agree to file a prevented planting claim. In contrast, if the landlord has a higher share he has a bigger stake in the operation such that it may be harder for the tenant to influence the landlord to agree to file a prevented planting claim.

The empirical result with regards to the SHARE variable also implies that single proprietor farmers that are not in share leasing arrangements are more likely to submit a prevented planting claim relative to farmers having share lease contracts. Farmers who do not have share lease contracts are essentially farmers with a 100% share. Farmers not in a share contract arrangement (100% share) are more likely to submit a prevented planting claim relative to farmers who have a share lease agreement with a landlord (farmer has less than 100% share). Based on our conceptual model, this result makes intuitive sense because a farmer with no share lease agreement have an autonomy premium where they do not have to consider the opportunity costs of terminating a share lease contract, as well as the uncertainty as to whether or not the landlord will agree to file a prevented planting claim. Therefore, the share leasing contract seems to be an institutional mechanism that dampens the likelihood of a farmer/tenant to submit a prevented planting claim.

The coefficients related to planted acres (ACRES), insurance plans (APH), and geographic regions also deserve some discussion here. The marginal effect of planted acres is negative and statistically significant, but it is small (0.000038). Higher scales of operation, therefore, tend to reduce the likelihood of submitting a prevented planting claim, albeit a small amount. This supports the notion that higher-scale operations involve higher fixed or sunk costs,

which then reduces the attractiveness of submitting a prevented planting claim as compared to planting the crop and carrying it to harvest. The coefficients of the insurance plan dummy variables (APH) suggests that producers who purchased APH contracts are less likely to submit a prevented planting claim relative to producers who bought a CRC insurance plan.

The coefficients and marginal effects of the state dummy variables (ST1-ST6) also suggest that there are some significant geographical effects. In general, producers in Louisiana, New Mexico, Oklahoma, and Texas tend to have a higher probability of submitting a prevented planting claim, relative to the excluded state (Arkansas). However, the higher probabilities for Louisiana and Mexico are not statistically significant.

Conclusions

Results of this study suggest that the opportunity costs and the share percentage of farmers with a share lease contract have a statistically significant effect on the probability of submitting a prevented planting claim in crop insurance. In particular, farmers in share lease contracts with lower opportunity costs and higher share amounts are more likely to submit a prevented planting claim. This result also implies that autonomous farmers who are sole proprietors and are not involved in a share leasing contract have a higher likelihood of submitting a prevented planting claim. This result is intuitive because there is no institutional mechanism that can potentially discourage the autonomous producer from filing a prevented planting claim. For example, there is no landlord that can influence or disagree with the decision to submit a prevented planting claim.

Share leasing arrangements seem to be an institutional “self-policing” mechanism that reduces the probability of submitting prevented planting claims. This in turn can reduce the probability to abuse the prevented planting provision. Given this result, RMA can reformulate

their ratemaking procedures for additional prevented planting buy-up coverage by considering the claim dampening effect of a share lease contract, especially if the tenant has a lower share amount. Alternatively, premium discounts to prevented planting buy-up coverage can also be given to producers that have share leasing contracts or low tenant share amounts. Furthermore, share amounts can also be used by the RMA compliance office as an additional variable to profile producers that are most likely to abuse prevented planting provisions, in conjunction with other “fraud” indicator variables. RMA may be able to better prioritize individuals worthy of further investigation or worthy of in-season checks for abuse of the prevented planting provisions (USDA OIG).

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Table 1. Independent variables used in the empirical model and its description

Variable Name	Variable Definition
YIELD	Expected yield based on a 4-10 year yield history (or T-yields if history is not adequate)
SHARE	Farmer tenant's percentage share under a share leasing contract
ACRES	Producers' planted acres
CRC	Dummy variable representing the Crop Revenue Coverage (CRC) insurance plan. CRC = 1 if the insurance plan is CRC, CRC = 0 otherwise. CRC is the excluded category.
APH	Dummy variable representing the standard APH (or MPCCI) yield insurance plan. APH = 1 if the insurance plan is APH, APH = 0 otherwise.
ST1-ST7	Geographical state dummy variable. The states in the southern RCO with cotton production are (1) Louisiana, (2) Mississippi, (3) New Mexico, (4) Oklahoma, (5) Tennessee, (6) Texas, and (7) Arkansas. Arkansas is the excluded category. $ST(j) = 1$ if state is j ; $ST(j) = 0$ otherwise (where $j = 1$ to 8 above).

Table 2. Summary statistics of continuous variables and frequency of dummy variables.

(a) Continuous Variables	Mean	Standard Deviation	Min.	Max.	No. of Obs.
SHARE	0.4405	0.3373	0.0010	1.0000	41,561
YIELD	470.0327	211.1337	39.0000	1,578	41,561
ACRES	126.2022	214.2154	0.0800	3,198.5	41,561
(b) Dummy Variables	Frequency		Percent		
PPC	389		0.94		
CRC	4,742		11.41		
APH	36,819		88.59		
ST1	2,387		5.74		
ST2	1,692		4.07		
ST3	224		0.54		
ST4	1,558		3.75		
ST5	1,276		3.07		
ST6	1,276		3.07		
ST7	32,103		77.24		

Table 3. Estimation results of the probit model for single proprietor cotton farmers with share leasing arrangements (dependent variable: PPC)

Variable	Single Proprietorship Farms	
	Coefficient Estimate	Marginal Effect
---- (standard errors in parentheses)----		
INTERCEPT	-3.1474 [*] (0.348753)	
YIELD	-0.00051 [*] (0.00012)	-0.000004 [*] (0.000001)
SHARE	1.40159 [*] (0.02070)	0.011672 [*] (0.001229)
ACRES	-0.00451 [*] (0.00004)	-0.000038 [*] (0.0000001)
APH	-0.51420 [*] (0.04848)	-0.007715 [*] (0.001315)
ST1	-0.24506 (0.39702)	0.002277 (0.005861)
ST2 ^a		
ST3	-0.46025 (0.50805)	0.007376 (0.013371)
ST4	1.17767 [*] (0.34589)	0.046968 [*] (0.032378)
ST5 ^a		
ST6	1.12790 [*] (0.33518)	-0.004669 [*] (0.000823)
Observations	38,593	
Log Likelihood	-1,829.610	
LR chi square (8 d.f.)	691.5 [*]	
McKelvey & Zavoina's R ²	0.448	
Pseudo R ²	0.1589	

Notes: * Significant at the 1% level.

^a Dummy variables ST2 and ST5 were dropped from the estimation because it predicts failure perfectly (i.e. there were no PPC = 1 in these states)

Appendix

In this Appendix, we show that $\frac{\partial \tilde{g}}{\partial \Lambda} > 0$ and $\frac{\partial \tilde{g}}{\partial I} < \text{or} > 0$. To reduce notational clutter,

assume that:

$$(A1) \quad \Psi^N = hU_F(W_F + \Phi_F^C) + (1-h)U_F(W_F + \Phi_F^D) - U_F(W_F + \Phi_F^A - \Lambda) \text{ and}$$

$$(A2) \quad \Psi^D = U_F(W_F + \Phi_F^A) - U_F(W_F + \Phi_F^A - \Lambda).$$

This implies that:

$$(A3) \quad \tilde{g} = \frac{\Psi^N}{\Psi^D}.$$

Note that $(0 < \tilde{g} < 1)$, $\Psi^N > 0$, and $\Psi^D > 0$.

The first derivative of \tilde{g} with respect to Λ is

$$(A4) \quad \frac{\partial \tilde{g}}{\partial \Lambda} = \frac{[U_F'(W_F + \Phi_F^A)][\Psi^D] - [U_F'(W_F + \Phi_F^A - \Lambda)][\Psi^N]}{\Psi^{D^2}} > 0.$$

Since $0 < \tilde{g} < 1$, then we know that $\Psi^D > \Psi^N$. Moreover, $U_F'(W_F + \Phi_F^A) > U_F'(W_F + \Phi_F^A - \Lambda)$ because $U_F' > 0$ and $W_F + \Phi_F^A > W_F + \Phi_F^A - \Lambda$. Given these conditions, the numerator of (A4) is positive and therefore (A4) is positive.

The first derivative of \tilde{g} with respect to I is

$$(A5) \quad \frac{\partial \tilde{g}}{\partial I} = \frac{[\Omega^1 + \Omega^2 - \Omega^3][\Psi^D] - [\Omega^4][\Psi^N]}{\Psi^{D^2}} > \text{or} < 0,$$

where:

$$(A6) \quad \Omega^1 = [hU_F'(W_F + \Phi_F^C)][\mathbf{q}_F Y_F^e P_F^g - Y^a P_F^g + Y^a P^m],$$

$$(A7) \quad \Omega^2 = [(1-h)U_F'(W_F + \Phi_F^D)][Y^a P^m],$$

$$(A8) \quad \Omega^3 = [U_F'(W_F + \Phi_F^A - \Lambda)][\mathbf{g}_F \mathbf{q}_F Y_F^e P_F^g], \text{ and}$$

$$(A9) \quad \Omega^4 = [U'_F(W_F + \Phi_F^A)][\mathbf{g}_F \mathbf{q}_F Y_F^e P_F^g] - [U'_F(W_F + \Phi_F^A - \Lambda)][\mathbf{g}_F \mathbf{q}_F Y_F^e P_F^g].$$

If $[\Omega^1 + \Omega^2 - \Omega^3] > 0$ and $[\Omega^1 + \Omega^2 - \Omega^3] > \Omega^4$, then (A5) is greater than zero. On the other

hand, if $[\Omega^1 + \Omega^2 - \Omega^3] < 0$, then (A5) is less than zero.