Revenue insurance purchase decisions of farmers

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The objective of this study is to evaluate farm, household, and financial characteristics of cash grain farmers’ decisions of whether to purchase revenue insurance. Using farm-level data these characteristics were identified by estimating a logit model of revenue insurance purchase decisions by farm operators. Results indicate that farm operators with the ability to self-insure through accumulation of sufficient wealth reserves measured in terms of the ratio of debts-to-assets, operators with off-farm income, and participation in production and marketing contracts, are more likely to pursue these strategies as a substitute for federal revenue insurance programmes. Further, study finds that older and wealthy cash grain farmers are less likely to buy revenue insurance.

I. Introduction

Public policy has long acknowledged the risk and uncertainty facing grain and cotton farmers that arise from weather, biological processes, and the relative insensitivity of supply and demand to price changes. Farm programmes since the 1930s have sought to assist crop farmers by transferring some of their price and income risks to the public sector through agricultural price support programmes. Price support programmes have the disadvantage of being an ineffective method of stabilizing farm income and are also burdensome to taxpayers. Farmers’ incomes are far more variable than incomes of nonfarmers (Mishra \textit{et al.}, 2002). Sources of economic risk and their adverse affects on consumption are similar for farmers and all other households. Including other factors, Barrientos (2003), identifies variation in earnings as a major source of economic risk and concludes that private market insurance is one of the risk management strategies used by households to stabilize income and eventually consumption.

In 1994, Congress passed the Federal Crop Insurance Reform Act. The Reform Act mandated participation in the existing crop insurance programmes, a stipulation that was met with considerable protest by many producers. This requirement was subsequently lifted in 1996, though eligibility for disaster relief still required participation. A development that has proven to be very important for the safety net concept also originated in the 1994 Reform Act. The Act mandated the development of a cost of production insurance pilot. This along with private riders that provided indemnity payments at harvest time prices led to the introduction of a number of revenue insurance products. There are currently three major revenue insurance products: Crop Revenue Coverage (CRS), Revenue Assurance (RA), and Income Protection (IP). The revenue products pay indemnities on the basis of low prices, low yields,

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or a combination of both. The programmes vary in their operation and the extent and type of protection offered.

At the request of the Senate Agriculture, Nutrition, and Forestry Committee, the Congressional Budget Office (CBO, 1983) examined the role that revenue insurance could play in agricultural policy. This study concluded that revenue insurance would probably accomplish its purpose of protecting crop farmers against fluctuating incomes at less cost to taxpayers than current (price support policies) stabilization programmes. Thompson et al. (2004) argue that public agricultural policies not only provide protection in the form of an income (level) effects, but also a generally smaller, yet significant, insurance (stabilizing) effect. Frydenlund (2002) points out that revenue insurance is one of many private sector safety net programmes that the government should use to help farmers create their own safety net. The 1985 Farm Bill mandated studies into the feasibility of providing revenue insurance through subsidized put options on futures contracts and crop insurance (Glauber et al., 1989; Heffner and Wright, 1989; Plato, 1989). Revenue insurance products, Income Protection and Crop Revenue Coverage, first became available for a few crops in selected areas for the 1996 crop year, and Revenue Assurance was added in the 1997 crop year. In fact, for winter wheat, the USDA’s Risk Management Agency estimates that from 2000 to 2001, revenue insurance coverage increased from 17 to 58% of all acreage insured under federally sponsored crop insurance. In 2003, revenue insurance products represented about 60% of total crop insurance premium volume and about 55% of total acres insured (Risk Management Agency, 2004). Goodwin (2001) points out that revenue insurance is probably the most important development and change to crop insurance programmes. Recent changes to crop insurance programmes have important implications for the modeling of insurance demand, particularly for revenue insurance.

The primary objective of this study is to evaluate farm, household, and financial characteristics of cash grain farmers who purchase revenue insurance. An understanding of those factors related to participation and demand for insurance is essential for comprehending the operation of the programmes. Further, knowledge of factors affecting farmer purchases of revenue insurance is essential for evaluating the soundness and profitability of insurance programmes. Policymakers have a vital interest in understanding how farmers respond to new programmes. An awareness of which farmers are most likely to buy revenue insurance will help risk management policy officials to design insurance programmes better suited to the clientele. This information would also help insurance providers through improved insight for the development of new products for farmers who currently are not well served by existing policies. This study will identify farm, household, and financial characteristics by estimating logit models of revenue insurance purchase decisions by farmers. The analysis is conducted on a national level with the unique feature of a larger sample than previously reported, comprising farms of different economic sizes and in different regions of the USA.

II. Background

The discussion on revenue insurance has gained momentum in recent years for several reasons. First, the liberalization of agricultural markets may be associated with greater price instability. Second, under agreements with the World Trade Organization (WTO), public subsidies in the field of agricultural insurance policies would qualify under certain conditions as ‘green box’ policies (European Commission, 2001). This has had considerable importance. Finally, perhaps the main reason, is the idea that revenue insurance policies may be a more efficient alternative to the traditional policies, shifting the taxpayer burden from the latter to subsidize farmers’ insurance premiums.

In their assessment of Federal crop insurance and the 1990 Farm Bill, Glauber et al. (1989) point out that the target revenue insurance programme was best at stabilizing per-acre farmer income and market prices. Skees et al. (1998) point out that revenue insurance offers the possibility of combining existing price and yield guarantee programmes into one single

1 A crop insurance programme that provides coverage to producers against lost revenues (or incomes) caused by low prices, low yields, or a combination of low prices and low yields. An indemnity is paid to a producer when any combination of yield and price results in revenue that is less than a pre-specified revenue guarantee. The FAIR Act of 1996 mandates a USDA pilot programme for crop years 1997–2000 under which producers of feed grains, wheat, soybeans, and other crops in specified areas may elect to receive insurance against loss of revenue. The two largest pilot programmes to date are the Crop Revenue Coverage (CRC) programme and the Income Protection (IP) programme. The two programmes are similar, except that the CRC allows farmers to insure their revenue at either planting-time prices or harvest prices, whichever is higher. The full cost of the premium associated with CRC and IP is paid by the participating farmer.
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programme that may be easier to administer and easier for farmers to use. Turvey (1992) compared dollars of public expenditures per dollar of risk reduction and found revenue insurance was the best at promoting self-insurance through diversification. In another study Gray et al. (1994) found revenue insurance alternatives to be less expensive and more effective at supporting farm income than the current farm policy (deficiency payments). Similar results were obtained by Harwood et al. (1994, 1999) and Hennessey et al. (1997).

Calkins et al. (1997) show that revenue insurance allows the agricultural farmers of Quebec to obtain greater expected income than price insurance added to yield insurance. Their results also show that revenue insurance ensures greater efficiency of public expenditures, measured in terms of increases in gross margin per dollar of taxpayers contribution. On the other hand, Stokes et al. (1997) show that insuring for the whole farm’s revenues is much more efficient than insuring each crop by a different revenue insurance policy. Coble et al. (2000) show that revenue insurance products are potential substitutes for other risk reduction strategies, such as hedging in futures and options. In a recent study, Mahul and Wright (2003) show that revenue insurance contracts may be complementary to typical hedging instruments, such as options and futures.

Work on revenue insurance started in the mid-1980s. Trechter (1984) developed a theoretical model of the supply and demand for revenue insurance. At the same time, Gineo (1984) investigated how the design of a revenue insurance policy would affect farmers’ benefits and what would be the possible effects on production and resource allocation. Since then, there have been a limited number of empirical studies on this subject. Empirical work estimating participation in revenue insurance programmes has not received much attention in the literature. However, there has been considerable work done on conventional crop insurance demand and participation decisions. Three major studies have estimated models of crop insurance purchase decisions using county level data. They are Smith and Baquet (1996) for Montana wheat farmers, Smith and Goodwin (1996), Goodwin (1993), and Coble et al. (1996) for Kansas wheat farmers. There are several other studies of the demand for crop insurance that pursue a different angle of investigation. However, the ones mentioned above pay particular attention to the factors that affect the insurance purchasing decision of farmers. The present study differs from Smith and Baquet (1996); Smith and Goodwin (1996); Calvin (1992); Coble, et al. (1996); and Just and Calvin (1990) in two ways. First, our study investigates the factors affecting the use of revenue insurance. Previous empirical studies have focused only on crop (yield) insurance. Second, unlike previous studies that have used county or state data level, our study uses farm-level and household data.

III. Conceptual Model

Let us assume that a representative farmer maximizes expected utility of wealth. In the case of revenue insurance programme that is being analysed in this paper the farmer establishes a target revenue for the farm (or it could be for a commodity) for which indemnities are paid if actual (state dependent) revenues fall below the target, regardless of whether the shortfall is due to price and/or yield declines. Specifically, the farmer’s \( W_j \) (wealth that is state dependent) and can be defined as

\[
W_j = W_0 + \sum_{i=1}^{n} \left( \text{Max}(R_{ij}, R_{ij} - \lambda \theta_i - C_i) X_i \right)
\]

(1)

where \( W_0 \) is the initial wealth, \( R_{ij} \) are the coverage levels, \( R_{ij} \) is the state-dependent revenues, \( \theta_i \) are the actuarially sound premiums, \( \lambda \) is the proportion of premiums that must be paid by the farmer, and \( C_i \) are the costs of production. Maximization of the expected utility of wealth yields an expression relating a producer’s adoption of revenue insurance, represented by \( \lambda_{ij} \), and a set of observable farm and operator characteristics (\( X_i \))

\[
\lambda_{ij} = g(X_i \beta) + \epsilon_i
\]

(2)

where \( \beta \) is a parameter vector and \( \epsilon_i \) represents unmeasured factors related to adoption of revenue insurance. In that \( \lambda_{ij} \) is unobservable, we work with an estimable discrete choice version of this model represented by:

\[
Y_i = X_i \beta + \psi_i
\]

(3)

where \( Y_i \) is 1 if \( \lambda_{ij} > 0 \) and is 0 otherwise and \( \psi_i \) is a residual error.

Empirical framework and econometric procedure

Qualitative response models, which are strongly linked to utility theory, have been widely used in economics to investigate factors affecting an individual’s choice from among two or more alternatives (Amemiya, 1981; Greene, 2000). Maximum likelihood logistic regression (LOGIT) was used to analyse farmers’ participation in revenue insurance rather than Ordinary Least Squares (OLS) because
the dependent variable is binary (0,1) (Pindyck and Rubinfeld, 1991). Specifically, the logit is defined as the natural logarithmic value of the odds in favour of a positive response (in this case revenue insurance), that is:

\[ Y_i = \begin{cases} 
1 & \text{if farmer participates in revenue insurance program} \\
0 & \text{otherwise}
\end{cases} \quad (4) \]

An empirical representation of the participation in revenue insurance \((Y_i)\) model by producer \(i\) to observable explanatory variables, is given by,

\[ Y_i = X_i\beta + \psi_i \quad (5) \]

where \(X_i\) is a vector of explanatory variables relevant to producer \(i\)’s participation in revenue insurance alternatives, \(X\) is a vector of unknown parameters, and \(\psi_i\) is a residual error assumed normally distributed with a zero mean and constant variance. This modeling technique has also been used by Jin et al. (2005) in a crop insurance fraud context as a promising method to analyse and detect fraudulent claims. In a binary logit model, the marginal effect of a variable \(X_j\) on the response probability is:

\[ \frac{\partial P_i}{\partial X_j} = f(X_i\beta)\beta_j \quad (6) \]

where \(f(\cdot)\) is the normal marginal density function. For dummy variables, the marginal effect with respect to variable \(X_j\) is found by taking the difference in the predicted probabilities calculated at \(X_j = 1\) and \(X_j = 0\), holding other variables constant at their means. The dependent variable \((Y_j)\) is a binary variable representing the decision to purchase (1) or not to purchase (0) revenue insurance. Independent variables are included for farmer characteristics such as age, education level, and household income (farm and off-farm).

The choice of attributes associated with choosing revenue insurance plan is guided by human capital theory, farm and production characteristics, and other adoption models. Earlier research by Welch (1970), Khaldi (1975), Nelson (1985) and Wozniak (1989) uses education as a measure of human capital to reflect the ability to adopt innovation (either technology or insurance). Education level proved significant both for the purchasing and for the coverage level decision in the Smith and Baquet study. This confirms earlier studies by Just and Calvin (1990) and Edelman et al. (1990) who found that participation in MPCI is positively correlated with education level. Smith and Baquet also incorporated other demographic (age, years in farming) variables in their study. However, these variables were not found to be significant. In this study operator age is included as a proxy for farming experience. Experienced farmers know their farm production history and can better gauge their income and expenditures.

Farm size is another variable that has been used by various researchers to explain the crop insurance purchasing decisions by farmers. Goodwin found a positive and significant correlation between farm size and demand for MPCI. However, studies by Smith and Goodwin, and Smith and Baquet did not find any significant relationship. This study uses value of agricultural production on the farm as an indicator of farm size. The farm size variable is expected to have a positive influence on revenue insurance purchases. Many studies have used a measure of wealth, including a farmer’s net worth or a debt-to-asset ratio, and off-farm income. Smith and Baquet; Smith and Goodwin; and Coble et al. all found a farmer’s net worth to be a significant variable in explaining purchase decisions. However, off-farm income was not found to be significant by Smith and Goodwin. These findings suggest that farmers with larger beginning wealth or current period income are less likely to purchase crop insurance and therefore these would be indicators of a capability for self-insurance.

The history of receiving deficiency payments, disaster payments, and conservation reserve payments was an important variable in many previous studies on crop insurance demand and purchasing decisions. A deficiency payment variable was statistically significant in explaining the decision to purchase insurance in Smith and Baquet and Just and Calvin, but was not significant in studies performed by Barnett et al. (1990), Edelman et al. (1990) and Goodwin (1993). The researchers finding this variable significant argue that receiving deficiency payments may reflect higher returns to insurance because historically yields have been more variable. Under the 1996 FAIR Act, the government expected to bear little or no risk and government intervention was expected to be minimized. This may have been the intent of the 1996 Farm Bill, but certainly has not been the result. Emergency (market loss assistance and disaster assistance) payments, Agricultural Market Transition Act (AMTA) (production flexibility contract) payments, and loan deficiency payments (LDPs) have contributed to relative stability in income and considerable risk has continued to be borne by the government. Based on these facts it is assumed that farmers who participate in government programmes are less likely to buy revenue insurance.
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Ownership of the farm (full-time farmer, part-time farmer, and tenant) has an impact on decisions to purchase insurance. For example, it is expected that full-time farmers may have a higher degree of specialized expertise in production (more efficient) compared to part-time and tenants and thus are less likely to buy revenue insurance. However, a positive effect is also possible since part-time farmers have alternative sources of revenue and thus may be less likely to buy revenue insurance. Two dummy variables, part-time farmers and tenants, are included in the regression. Premium rates are included in the model to study crop insurance demand. However, premium rates do not directly represent differences in the expected returns to insurance for different producers. In the absence of premium rates an alternative, indemnity received, used by Calvin (1992) is used in this study. Soil productivity may convey information to a farmer regarding expected yields and certain level of income from farming. With higher soil productivity, one would expect short-run profitability to be higher for any given level of input use (Garcia et al., 1982). Thus, farmers who are farming on productive soils are less likely to buy revenue insurance. A soil productivity index² (0 = least productive, 100 = most productive), as defined by soil scientists, is included as a variable in the revenue insurance purchase model of gain farmers.

IV. Data

Data for the analysis were taken from the 1998 Agricultural Resource Management Study (ARMS, formerly known as the Farm Costs and Returns Survey (FCRS)). The ARMS is conducted annually by the Economic Research Service and the National Agricultural Statistics Service. ARMS uses a multi-phase sampling design and allows each sampled farm to represent a number of farms that are similar in the population, the number of which being the survey expansion factor (see Kott, 1997 and Dubman, 2000 for more technical detail). The expansion factor, in turn, is defined as the inverse of the probability of the surveyed farm being selected. The survey collects data to measure the financial condition (farm income, expenses, assets, and debts) and operating characteristics of farm businesses, the cost of producing agricultural commodities, and the well-being of farm operator households.

The target population in the survey is operators associated with farm businesses representing agricultural production, only cash grains, across the USA. A farm is defined as an establishment that sold or normally would have sold at least $1000 of agricultural products (cash grains) during the year. Farms can be organized as sole proprietorships, partnerships, family corporations, nonfamily corporations, or cooperatives. Data are collected from one operator per farm – the senior farm operator. A senior farm operator is the operator who makes most of the day-to-day management decisions. For the purpose of this study, operator households organized as nonfamily corporations or cooperatives and farms not growing cash grains were excluded.

Average financial characteristics of farm operator households are shown in Table 1. Farm operator households with revenue insurance are statistically different than their counterparts, with regard to financial performance (income, assets, debt, and net worth) and production characteristics. Data show that, on average, operator households with no revenue insurance produce on fewer acres, and have lower net cash farm income (almost 3.6 times) than their counterparts. However, farm operator households that do not purchase revenue insurance have higher levels of off-farm income and lower total household income ($59,572) when compared to their counterparts. Farm operator households with revenue insurance have, on average, higher farm debt ($144,996), lower non-farm debt, and higher household net worth (farm and non-farm net worth). Many of these farm households (with revenue insurance) operate larger farms, mainly cash grains and have substantial farm assets as a share of total household assets (90%), of which 70% is real estate, and lower off-farm income.

Summary statistics for each variable utilized in the analysis are presented in Table 2. The average age (OP_AGE) of the senior operator in the household was 53 years, with 13 years of education (OP_EDUC). The 1998 ARMS data show that average household income was $59,734 with an average debt of 18 cents per dollar of asset (18% debt-to-asset ratio). Thirty seven% of farm operator households received, on average $8,400, some form of

² A soil productivity index, ranging from 0–100 is used. This measure of ranking soil productivity classifies the least productive soil at zero with 100 being the most productive soil. See Pierce et al. (1993) for details.

¹ In 1998 a revenue insurance (crop revenue coverage, income protection, and revenue assurance) programme was offered in 42 states. For a complete list of participating states and revenue insurance programmes please visit http://www.rma.usda.gov/ftp/reports/summary_of_business/98stcrp.
government payments (GOVT_PAY) and 33% of farm operators participated in either production or marketing contracts (PM_CONTRACT). The 1998 ARMS survey queried farmers about their participation in revenue insurance programmes (such as income protection, crop revenue coverage, and revenue assurance) \( \text{YES} = 1 \) and \( \text{NO} = 0 \). The dependent variable (REV_INSUR) is used to investigate the effect of various farm, operator, and financial characteristics on the likelihood of purchasing revenue insurance. Therefore, REV_INSUR takes a value of one if the farm operator purchased insurance and zero otherwise.

### V. Results

The classification table (Table 3) tallies the percentage of correct and incorrect predictions. The columns are the two predicted values of the dependent variable (revenue insurance purchase decisions), while the rows are the two observed (actual) values of the dependent variables. In a perfect model, all cases will be on the diagonal and the predictions will be 100% correct. The overall percentage correctly predicted seems good at 88%. The Hosmer and Lemeshow goodness-of-fit test (Table 4) divides subjects into deciles based on
In the case of signs and are statistically significant at the 1% level. This indicates that, other things constant, the marginal effect is small. One explanation is that an older farm operator may have more wealth and less debt providing greater potential to self-insure. This notion is confirmed by a significant coefficient on the prediction model of revenue insurance purchase decisions of farmers. Table 3 illustrates this further. The actual and predicted outcomes for revenue insurance purchase are shown below.

<table>
<thead>
<tr>
<th>Actual</th>
<th>Predicted (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32 (0.289)</td>
</tr>
<tr>
<td>0</td>
<td>1 (0.447)</td>
</tr>
</tbody>
</table>

Notes: The threshold value is 0.50. Figures in parentheses are standard errors. Sample size = 1962 and population representation = 363,865.
1 = those who have revenue insurance. 0 = those with no revenue insurance.

Off-farm income diversifies a farm operator’s income portfolio and reduces the probability that a farm operator will purchase revenue insurance. Off-farm income provides additional income to households. Off-farm jobs usually yield more stable incomes than farming (Mishra and Goodwin, 1998) and can be useful in managing overall risks. Mishra and Goodwin (1997) point out that off-farm income reduces the instability in total household income. Using aggregate data from the US agricultural sector, Mishra and Sandretto (2002) arrive at a similar conclusion. The coefficient of off-farm income (TOTAL_OFI) is negative and statistically significant at the 1% level. This is consistent with the findings of Calvin, and Just and Calvin, Smith and Baquet, and Edelman et al.

The coefficient of the debt-to-asset ratio variable (DEBT_ASSETS) is positive and statistically significant at the 1% level of significance. Results suggest that as the debt-to-asset ratio increases so does the probability of purchasing revenue insurance, although at a decreasing rate (as implied from a negative sign on DEBT_ASSETS). The relatively large marginal effect (0.545) reveals that producers who have higher debt-to-asset ratios are more likely to purchase revenue insurance. One possible explanation is that farm operators with high debt-to-asset ratios are more likely to buy revenue insurance because of pressures from lending institutions.

The coefficient of farm size (VAL_PROD) is positive and statistically significant at the 1% level. However, the marginal effect is very small. Results suggest that as farm size increases, the probability of buying insurance also increases. As farm size (VAL_PROD) increases the variance of crop revenues increases more than proportionally, making revenue insurance more attractive. Our findings are consistent with the findings of Goodwin, Calvin, and Just and Calvin. This may reflect the fact that commissioned insurance sellers find larger farms more attractive and thus focus their sales efforts on larger enterprises. Results indicate that farm operators respond to returns to revenue insurance (INDEM_PAY). In our model we included the amount of indemnity4 the

4 We believe that farmers have good information about expected payouts and thus assume this is a good indicator of expected receipts.
Table 4. Logit regression results of revenue insurance purchase decision by cash grain farmers

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Parameter estimate (standard error)</th>
<th>Change in probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-3.967*** (0.075)</td>
<td>–</td>
</tr>
<tr>
<td>Farm operators’ education level (OP_EDUC)</td>
<td>0.091*** (0.003)</td>
<td>0.016</td>
</tr>
<tr>
<td>Age of the operator (OP_AGE)</td>
<td>-0.001*** (0.0005)</td>
<td>-0.001</td>
</tr>
<tr>
<td>Households off-farm income (TOTAL_OFI)</td>
<td>-0.006*** (0.0001)</td>
<td>-0.001</td>
</tr>
<tr>
<td>Debt-to-asset ratio (DEBT_ASSET)</td>
<td>2.261*** (0.046)</td>
<td>0.545</td>
</tr>
<tr>
<td>Debt-to-asset ratio squared (DEBT_ASSETSQ)</td>
<td>-1.044*** (0.037)</td>
<td>-0.002</td>
</tr>
<tr>
<td>Value of agricultural production sold by the farm, (VAL_PROD)</td>
<td>0.004*** (0.0003)</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean soil productivity index of the farm (MEAN_PI)</td>
<td>-0.0043 (0.0048)</td>
<td>-0.002</td>
</tr>
<tr>
<td>Indemnity payments received by the farm (INDEM_PAY)</td>
<td>0.008*** (0.0005)</td>
<td>0.002</td>
</tr>
<tr>
<td>Farm operated by part-owners (P_OWNER)</td>
<td>0.321* (0.017)</td>
<td>0.080</td>
</tr>
<tr>
<td>Farm operated by tenants (O_TEANANT)</td>
<td>0.525*** (0.019)</td>
<td>0.131</td>
</tr>
<tr>
<td>Participation in production and marketing contracts (PM_CONTRACT)</td>
<td>-0.264* (0.147)</td>
<td>-0.071</td>
</tr>
<tr>
<td>Total government payments received by the farm (GOVT_PAY)</td>
<td>0.803*** (0.356)</td>
<td>0.205</td>
</tr>
<tr>
<td>Interactive effect of operator age and wealth (net worth) (OP_AGE X NETW)</td>
<td>-0.0007** (0.0003)</td>
<td>-0.005</td>
</tr>
<tr>
<td>Log-Likelihood Ratio (LR) [−2 Log L]</td>
<td></td>
<td>68.21***</td>
</tr>
<tr>
<td>Correct Predictions</td>
<td></td>
<td>88%</td>
</tr>
<tr>
<td>Hosmer and Lemeshow goodness-of-fit test (chi-square test)</td>
<td></td>
<td>6.1208</td>
</tr>
</tbody>
</table>

Note: Single, double and triple asterisks (*) indicate statistical significance at 10, 5, and 1% level. Numbers in parentheses are the standard errors.

The empirical literature has shown that farm tenure (full-owner, part-owner, and tenant) has a significant impact on the adoption of technologies. Additionally, Gardner and Kramer note that part-owners are usually more leveraged and thus may be more subject to the insurance requirements of creditors. Ellinger and Barry (1987) also note that leverage tends to increase as reliance on leased land increases. Part-owners and tenants may also be less aware of the production characteristics of a given tract and thus may face greater production uncertainty. The coefficients of part-owner (P_OWNER) and tenant (O_TENANT) are positive and statistically significant at the 1% level. Results suggest that part-owners and tenants are more likely to buy revenue insurance compared to full-owners. The marginal effect (0.131) of O_TENANT suggests that tenants are 13% more likely to purchase revenue insurance compared to full-owners. Our findings are consistent with Gardner and Kramer (1996), and Goodwin (1993).

Both production and marketing contracting are private risk management strategies that farmers have used to reduce risk and uncertainty associated with farm income (Sonka and Patrick, 1984; Asplund et al., 1989; Harwood et al., 1999). Contracting transfers risk from the producers to the contractors or other agents. The literature shows that risk-averse producers participate in production and marketing contracts. In this study variable PM_CONTRACT is used to evaluate the presence of either production or marketing contracts on the probability that a farm operator will purchase revenue insurance. The coefficient on PM_CONTRACT is negative and statistically significant, indicating that farm operators with either production or marketing or both are less likely to purchase revenue insurance. The marginal effect (−0.071) suggests that producers who participate in private risk management strategies such as production and marketing contracts are 7.1% less likely to buy revenue insurance. This result demonstrates the farm operator’s ability to self-insure and that revenue insurance and production or marketing contracts (or both) are substitutes.

Although farm commodity programmes were revised under the 1996 Farm Bill, farm households have continued to receive agricultural market transition payments (AMTA), loan deficiency payments (LDP) and disaster payments. In particular, farms and farm households that participated in conventional commodity programmes continued to receive payments based on their previous participation level in the form of AMTA payments. Receiving payments from government programmes is often considered a primary risk-reducing mechanism (Kramer and Pope, 1981; Musser and Stamoulis, 1981). Goodwin and Schroeder (1994) note that government programmes are intended to decrease risk for

\[ \text{Parameter estimate} = \frac{\text{Change in probability}}{\text{standard error}} \]

\[5\] Full-owner is used as the benchmark group.
VI. Conclusions

This study has focused on identifying farm, operator, and financial characteristics of cash grain farms that are correlated with revenue insurance purchasing decisions. The identification of these characteristics would be beneficial to insurance providers, policymakers, and agencies in their efforts design insurance programmes better suited to the risk-reduction needs of farm operators. Further, identification of attributes associated with buying revenue insurance may provide insights for the development of new products for farm operators who currently are not served through existing policies.

Revenue insurance helps farm operators to reduce risk. The present study uses national farm-level data with great diversity regarding farm size, location, and risk management strategies (such as government programme payments, participation in production and marketing contracts). A logit model was used to identify the factors that influenced the likelihood that a farm operator would purchase revenue insurance. In addition to age and educational level of the farm operator, the model results suggest that use of production and marketing contracts, debt-to-asset ratio, returns to revenue insurance, and participation in government programmes are significant factors affecting the likelihood of purchasing revenue insurance. Size of farm operation (as measured by gross farm sales) and farm tenure also played an important role. Results indicate that farm operators with the ability to self-insure by accumulation of sufficient wealth reserves (in terms of debt-to-assets) and off-farm income are more likely to pursue these strategies as a substitute for the federal revenue insurance programmes.

Knowledge of how producers responded to the fundamental changes that occurred over the last several years is essential for an understanding of the operation of the programmes and the potential acceptance of new programmes that are continually being introduced. Our analysis provides such information and quantifies how farm and operator characteristics affect revenue insurance purchase decisions. Our results show a positive correlation between indemnity received by farmers and their participation in revenue insurance programmes. A number of other studies (e.g. Goodwin, 1993; Goodwin and Smith, 1995; Calvin, 1992) have shown a positive correlation between indemnity payments and premiums. In the absence of federal subsidies the premium might be prohibitively expensive in high-risk areas. Since higher premium rates would likely discourage participation, such areas would be less attractive markets for private companies selling policies. In this case federal subsidies increase the likelihood of insurance delivery, and consequently encourage more intensive production in high-risk areas, such as the Great Plains region of the USA.\(^6\)

The results of this study have policy implications. While the goal of federal premium subsidies is to alter behaviour – namely, increase participation in crop and revenue insurance markets – this also contributes to the higher goal of providing a more comprehensive package of risk management mechanisms. If successful, the insurance programme should increase the viability of agriculture and reduce the need for publicly funded ad hoc disaster assistance programmes. Additionally, findings of the research have implications for agribusiness and extension programmes. Marketing programmes targeted to more educated, large farms, part-owners, and tenants will likely be more successful in promoting adoption of revenue insurance.

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\(^6\) Agriculture is not the only sector that receives public funding. Public financing of health care expenditures, insurance, and health outcomes were examined by Berger and Messer (2002). The authors note that public financing of health care may or may not improve health outcomes depending on the mix of health care expenditures and the type of insurance coverage. However, increases in inpatient and ambulatory insurance coverage are associated with positive health care outcomes.
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References


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