

# The Relationship Between Price Risk Management Tools and Off-Farm Income

by

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*California's agricultural producers indicate in surveys that the source of risk most important to them is "output price risk," but the level of use of price risk management tools is very low. Results indicate that farmers may be substituting off-farm income in place of price risk management strategies.*

**A**gricultural producers face many types of risks in their business. The most important source of risk ranked by California farmers in a survey conducted by the author in 1993 was "output price risk." That risk comes from the uncertainty faced by producers when trying to estimate what price they will receive in the future for their crops and/or livestock currently in production or being planned. Two tools that can be used to manage price risk are hedging with commodity futures or options contracts, and forward cash contracts. Commodity producers stand to derive considerable price risk reduction benefit from either hedging or using forward cash contracts, according to economic theory. However, very few farmers or ranchers use these tools. For example, a 1977 national survey by the Commodity Futures Trading Commission (CFTC) found that only about seven percent of U.S. grain farmers used futures, and many of those farmers were speculating rather than hedging. Only 20 percent of the farmers surveyed by the CFTC had ever used forward contracting. In subsequent years little has changed. The 1993 survey in California found that only six percent of producers reported use of futures and 23 percent reported use of forward contracts. Also, the CFTC survey found that farmers prefer forward contracting to direct hedging with futures contracts. Forward contracts are a substitute for futures contracts, as both provide an opportunity to reduce price risk. Yet, the question remains: why do so few farmers manage price risk with either futures or forward contracts?

Several possible answers have been posed, but few have been tested with farm-level data that place the question into the context of California's dynamic farming environment. This article uses new survey data to explore the question further by investigating economic factors and firm characteristics that influence a producer's decision to manage price risk in California. In particular, a new potential explanation is tested that focuses on the relationship between price risk management tools and an increasingly important

characteristic of farm households. It is posed here that off-farm income earned by farm household members is a "hedging" tool for managing income risk (of which price risk is a subset) that producers substitute for futures or forward contracts when they wish to manage their level of risk exposure. The results of this study have wide-ranging implications for both agricultural markets and policy.

## What is Hedging?

Hedging is generally described as a process of taking some action to reduce one's exposure to risk. There are many sources of risk, so there are many ways to hedge. Off-farm income, defined as income coming from any non-agricultural source (such as wages from a job), can be described as a hedging tool that reduces a farm household's income risk by making some portion of total household income more certain in its amount. Futures and forward contracts are both tools used to hedge against price risk. For example, a farmer who plans to sell some commodity in the future can reduce his uncertainty about the price he will receive by selling the products immediately using a forward contract. Such a contract is a legally binding agreement between seller and buyer that states what commodity is to be exchanged at a particular time in the future, plus it fixes the price per unit and the total quantity of the commodity to be exchanged. Forward contracts can be used by any two people wanting to exchange a product. Futures contracts essentially work the same as forward contracts except they are available only through a futures exchange, thus necessitating the assistance of a futures broker to make the transaction. Both forward and futures contracts can be useful price risk management tools.

## Data and Methods of Analysis

Another survey of California producers was conducted in 2002. Questionnaires were mailed to over 35,000 farmers in the state who grew specialty crops (among

other things). In total, over 15,000 responses were received and approximately 10,400 of those were complete enough to be analyzed.

The survey was part of a project funded by the United States Department of Agriculture's Risk Management Agency with the goal of assessing the attitudes of California's specialty crop growers toward risk management. The project was a greatly expanded update of the 1993 survey, which the USDA also funded. A summary of the project and the data, including a copy of the questionnaire, is presented online at <http://giannini.ucop.edu/researchreports.htm> (See Report #348).

The data revealed that hedging with futures was available to only three percent of California producers, meaning that there were no futures markets for the commodities grown by 97 percent of farmers. This is partially explained by the fact that futures markets exist for a limited number of agricultural commodities, such as grain crops, cotton, cattle and orange juice. Forward contracting was available to only 13 percent of respondents in 2002. Forward contracts can be written by any two people wanting to arrange a sale, thus the low level of availability reported for forward contracting indicates that it is not a common practice in many California product markets. Although this self-reported availability data may understate the actual case, it clearly indicates that access to price risk tools has not significantly improved since the 1993 survey.

Conversely, the availability and use of off-farm income has greatly expanded over the past decade. The 1993 survey found that 63 percent of California farm households earned at least some off-farm income, and the average portion of total income coming from off-farm sources for those households was 47 percent. The 2002 survey showed that 98 percent of the state's farm households earned some off-farm income, with the average share being 63 percent of total income.

To test whether the expansion of off-farm income in California has any effect on producers' use of price risk management tools, a model was estimated to predict what type of producer will use forward contracts. The following ten variables were chosen to represent a producer's predisposition toward using that risk management tool: operation size (acres, assets, total sales); experience (years farming, age, education); financial variables (off-farm income, debt/asset ratio); price fluctuation (perceived price risk); and, use of other price risk tools (futures hedging). The goal was to estimate the probability of a producer using forward contracts.

**Table 1. Forward Contract Model Estimation Results**

| Variable Name | Coefficient | t-Statistic | Marginal Effect(%) |
|---------------|-------------|-------------|--------------------|
| Assets        | -0.0744     | -1.98 (**)  | -0.0026            |
| Acres         | 0.00004     | 1.64 (*)    | 0.0014             |
| Price Risk    | -0.0892     | -2.30 (**)  | -3.122             |
| Age           | -0.1993     | -2.30 (**)  | -6.976             |
| TSales        | 0.2655      | 4.09 (**)   | 9.293              |
| Hedge         | 0.9217      | 3.54 (**)   | 32.26              |
| Off-Farm      | -0.2294     | -1.66 (*)   | -8.029             |

\*Coefficient is statistically significant at the 90% level  
 \*\*Coefficient is statistically significant at the 99% level

### Forward Contracting Results

The estimation results are found in Table 1. The model includes a number of significant variables representing individual producer attributes, operation attributes and market attributes. The dummy variable *Age* embodies the experience and knowledge of hedging for that person. The sign of the estimated coefficient for the *Age* variable is negative, signifying that older producers are less likely to use forward contracts than are younger producers. *Age* may represent many different grower perceptions and characteristics that influence decision making, such as financial position (debt/assets), operator planning horizon, experience in crop diversification or experience in marketing.

The variables indicating size of operation are *Acres*, *Assets* and *TSales* (total sales). The coefficients for these variables have conflicting signs. While the coefficient on *Acres* is positive, supporting the notion that operations of larger physical size are more likely to forward contract, the negative coefficient for the *Asset* variable shows the contrary for financial size. One possible explanation for the conflict between these two similar variables is that tenant farmers, who have relatively few assets, may be forward contracting more often than owner operators. The coefficient on the *TSales* variable is positive and highly significant. This indicates a positive relationship between high total gross sales (income) and the propensity to forward contract.

The dummy variable indicating whether the grower is a futures hedger is highly significant and positive. This result signifies some correlation between a grower's use of the two price risk management tools.

The estimated coefficient for *Off-Farm* income is negative and significant, thus indicating a farmer has a lower probability of using forward contracts as household non-agricultural income increases as a percentage of total household income. Generally, small-scale

operators are more likely to have off-farm income. If total income is considered for the farmer, then diversifying income out of agriculture may have a stabilizing effect on the variability of total income from year to year. The proportion of total income susceptible to the fluctuations in agriculture is smaller when income diversity is present. Hence, income diversity is its own form of risk management tool which, when implemented, may make forward contracting less attractive to that farmer. For example, the marginal effect of a one percent change in the portion of household income coming from off-farm sources for an average producer is eight percent, as shown in Table 1. Thus, if off-farm income increases one percentage point, as a share of total household income, the probability of that average household using forward contracts decreases about eight percent.

### The Effects of Off-Farm Income

The 1993 and 2002 surveys of California's producers show that access to price risk tools has not significantly improved in at least a decade. What has increased is producers' willingness to use the tools when they are available. For futures hedging, 29 percent of survey respondents who said the tool was available reported using it regularly in 2002. For forward contracts, 68 percent of producers used the tool when it is available to them. This implies (1) that farmers are well aware of their price risk exposure and want to manage it, and (2) that farmers will use well-designed risk management tools if they are available. Unfortunately, the poor level of availability for price risk tools has forced most producers to look for other risk management tools. This result is consistent with the large increase observed in the use of off-farm income. In 2002, 98 percent of the farm households surveyed earned at least some income from a non-agricultural source.

Off-farm income appears to have become a substitute for other risk management tools. This study found that off-farm income and use of forward contracts are negatively correlated, meaning that a farmer becomes less likely to forward contract as his/her off-farm income increases. This implies that substitution is occurring. However, it is unclear whether producers seek off-farm income because forward contracts are unavailable (or poorly suited to their needs), or if they seek forward contracts only when off-farm income is unavailable.

What is clear from survey responses is that off-farm income is a management tool used to reduce financial (income) risk, thus enabling many people to stay in

agriculture who could not do so without that income. The regression results show that total sales and off-farm income are negatively correlated, indicating that farmers earn less income off-farm as their farm sales increase. This implies that substitution of income between farm and non-farm sources is apparent, as economic theory expects. Also, for small-scale farmers, off-farm income is a necessary supplement to farm income if they are to continue operating.

A second result of this study that is also consistent with economic theory is that the availability of off-farm income seems to lead to the production of crops that are riskier than those that would be produced without off-farm income being available—although those risky crops are grown on a smaller portion of household acreage. The 2002 survey data show fruit/nut operations to be more risky and much smaller, on average, than vegetable operations. However, the attraction of tree crops is that they generate higher revenue on a per acre basis. Thus, it is not surprising that the average portion of total household income coming from off-farm sources is higher for the riskier operations: 64 percent of household income for fruit/nut producers, 42 percent for vegetable producers.

Finally, these two results can be combined to reach a third implication. Off-farm income may enable an increase in aggregate supply of specialty crops because more people are able to find an acceptable return-risk balance and continue producing those high-risk crops. This is due to the stabilizing effects of off-farm income on total farm household income. Without off-farm income, many producers would not be comfortable with the high degree of variability in farm incomes over time from tree crops and would have to leave those product markets. Ironically, because many growers are able to remain in the market due to off-farm income, their production adds to industry totals which lowers market prices, thus making the use of price risk management tools more important.

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