Parameters that Motivate Table Olive Farmers To Buy Agricultural Insurance: The Case of Western Turkey

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Abstract
Defining components that affect agricultural insurance contract decisions is indispensable to the sustainability of table olive cultivation in the region. The Akhisar district is located within the borders of Manisa province, a region in Turkey in which traditional, and the most famous, table olive varieties are grown. This study explores parameters that predict the decisions of farmers in this district to purchase agricultural insurance and identifies perceptions of agricultural insurance in the region. A survey was conducted among 121 purposefully selected farmers. Some farmers’ sociodemographic characteristics and their households were identified using basic descriptive statistics, such as arithmetic means and percentage rates, and factors that affect farmers’ decisions to buy agricultural insurance were defined using binary logistic regression. Although table olive farmers could insure their products against risk by buying full hail and frost packages within the scope of crop insurance, the desired success with agricultural insurance has not been achieved. Although the agricultural insurance that covers farmers who grow table olives remains insufficient, it still plays a role in patterns of agricultural production in the region, results in greater income than other agricultural products, and contributes to the government’s premiums for agricultural insurance. Future studies should expand insurance practices to improve farmers’ perceptions of agricultural insurance, especially regarding drought yield insurance for perennial fruit trees, including table olives.

Keywords Agricultural risk · Sustainability · Risk resources · Risk management · Olive farming

Introduction
Agricultural production represents an open-plan factory, with climate change, financial crises, price fluctuations, and uncertainty producing an agenda that is commonly discussed in the framework of plant and animal production, and most generally in agricultural production. Drought has especially begun to be a primary risk factor in Turkey, as it has worldwide. Various risk management tools exist that are used to reduce or even prevent the effects of potential risk factors on the income and costs associated with farming, which is a process that can be evaluated across two categories. The first, which includes espousal of technologies (e.g., irrigation and specialty seed election), rural dissemination plans, training for human resources, and government policies that prevent diseases, potentially increases yields and prevents the possibility of crop failures or livestock-related issues. The second emphasizes that operations such as rural area insurance, off-farm income, and crop diversity can be used to decrease the influence of biological formations or climatic events that negatively affect production (Buainain and Silveira 2017).

Agricultural insurance represents the most important tool for the management of such risk factors, with agricultural insurance policies capable of reducing, though not eliminating, the production risks that farmers experience, protecting them against yield losses (Goodwin 1994; Mishra and El-Osta 2002; Shaik 2013; Du et al. 2014; Zhou et al. 2018).

Farmers’ tendency to use subsidized agricultural insurance is affected by a variety of factors, which are divided into three general groups in the literature. The first comprises farmers’ characteristics, such as education, non–farm income sources, and risk attitudes. The second includes economic factors, such as income, debt, and insurance premiums. The third comprises other relevant factors, such
as geographic characteristics in and around an agricultural business, especially the land itself, soil quality, and social and economic infrastructures (Cabas et al. 2008; Kujawska and Rzechula 2018). Many studies have assessed factors that affect farmers’ purchasing of agricultural insurance, including a) demographics, income, and sources of income (Vandeveneer 2001; Farzaneh et al. 2017), b) number of years of experience in agricultural production (Ning et al. 2006; Lin and Wang 2013), c) level of activity and degree of specialization (Sherrick and Barry 2004; Qin et al. 2016), d) risks and disasters experienced during agricultural production (Goodwin 1993; Makki and Somwaru 2001), e) data on agricultural insurance (Boyd et al. 2011; Cai and Song 2017), and f) support and/or subsidies in relation to the agricultural insurance that governments provide (Just et al. 1999; Ginder et al. 2009).

Kujawska and Rzechula (2018) report two parameters that have a clear, positive effect on the probability that a farmer will purchase subsidized agricultural insurance: the number of people employed full-time and the damages that adverse weather conditions will cause to agricultural production. Mukhopadhyay et al. (2019) analyzed marginal farmers’ decisions to purchase farm insurance in the West Bengal region of India, using seven independent variables: education, age, arable land, self-help groups, marital status, gender, and income. A farmer’s income was found to be an especially important variable in the decision to purchase such insurance.

Sihem (2019) analyzed determinants of demand for agricultural insurance in the United States and Europe, using 276 observations from the International Agricultural Insurance Database Observatory. Cultural and socioeconomic policies were found to be potential determinants of demand for agricultural insurance.

Zhang et al. (2019) analyzed parameters that affect farmers’ judgments regarding purchasing agricultural insurance and being a member of an agricultural cooperative. They found that farmers’ judgments regarding the use of agricultural insurance and cooperatives correlate positively, suggesting that farmers who purchase agricultural insurance with the purpose of reducing production risks are more likely to join agricultural cooperatives to share market risks. Carrer et al. (2020) defined factors that affect farmers’ willingness to purchase agricultural insurance in São Paulo, Brazil, finding that such factors include education, farm size, access to technical assistance, and whether a farmer uses management tools.

Doherty et al. (2021) explored the attractiveness of government-sponsored climate-risk insurance proposals, examining preferences for elements in insurance plans that do not negatively affect incentives for farm adaptation on a broader scale. The results suggest that most farmers are willing to purchase state-sponsored agricultural insurance to protect themselves against extreme weather. Tang et al. (2021) found that farmers prefer weather index insurance over risk management strategies and that farmers’ characteristics influenced whether they use risk management strategies. Zhang et al. (2021) found a positive relationship between farmers’ perceptions of risk aversion and the use of crop insurance; they also found that a kinship network had a negative influence on the use of crop insurance, such that farmers with denser networks were less likely to purchase such insurance.

Yilmaz (2014) and Yilmaz et al. (2017) examined in detail the factors affecting the purchase of government-subsidized agricultural insurance by apple and grape farmers in Turkey. In relation to agricultural insurance, they found that access to credit and the adoption of new technologies increased the income levels of farmers and facilitated the purchase of insurance products.

In the introduction part of the study, the importance of the issue was tried to be revealed in the light of previous studies. The materials and methods section discusses data collection and analyses. Findings and a discussion of them follow, and a conclusion contains general evaluations.

**Materials and Methods**

**Study Area**

The Akhisar district is located within the borders of Manisa province in western Turkey (Fig. 1). The district is an important table olive growing region in the province (Fig. 2). Hazarhun and Tepeci (2018) declared that Akhisar Domat Zeytini and Akhisar Uslu Zeytini are registered in the Protected Definition of Origin (PDO) system. Manisa is among the most important olive producing cities in Turkey, and Akhisar district is the largest region of Manisa province. Out of 125 million olive trees in Turkey, 15 million are grown in Akhisar, and therefore the role of the county’s economy in olive and olive oil production is substantial. The reputation of Akhisar regarding olive and olive oil production has spread all over the world. About 100 thousand tons of olives are produced in Akhisar for table and olive oil. In addition, there are 192 olive enterprises and 15 olive oil enterprises in Manisa province, which export to 60 countries around the world. Of the 12 varieties of table olives with geographic protection in Turkey, two belong to Akhisar district; these cultivars are Akhisar Domat Zeytini and Akhisar Uslu Zeytini, with PDO certificates registered in 2012 (TURKPATENT 2021). In light of this information, Akhisar district was chosen as the study area.
The study was conducted from October to November 2019 in the Akhisar district, which comprises the villages of Zeytinliova, Medar, Dereköy, Ballica, Bünyani Osmaniye, Mecidiye, and Sünnetçiler, where table olive production is intense. Face-to-face surveys were conducted among 121 purposefully selected farmers. For choosing the sampling method, some important socioeconomic characteristics were considered, such as the total number of farmers growing table olives in the region, land sizes, parcel numbers of the farms, and producer ages. As a result, it was decided that the sampling distribution used would be the most appropriate approach.

**Analytical Approach**

This study assesses factors that affect farmers’ decisions to purchase agricultural insurance, and a binary logit model was constructed for this purpose. Many variables were used, including age, household members (HM), individuals in the household who worked in agriculture (IHWA), agricultural experience (AE), olive farming experience (OFE), size of the olive farming land (SOFL), education (ED), nonagricultural income (NAI), farmers’ record-keeping (FRK), and membership in a farmers’ cooperative (MFC).

**Factors that Affect Farmers’ Decisions To Purchase Agricultural Insurance**

Binary logistic regression was conducted using double-response dependent variables to reveal relationships between one or more explanatory variables and a binary response variable. Explanatory variables consist of either factor variables or covariates, with factor variables categorical with nominal scales and common variables continuous. During
binary logistic regression, the dependent variable can have only two results; the probability of an event is indicated by 1, and nonprobability is indicated by zero (Caudill 1987; Karagöz 2016):

$$Y_k = \rho + \delta_k \sum_{i=1}^z x_k + \epsilon_k$$

where \( Y_k \) represents the binary dependent variable (1 if farmers have agricultural insurance, and zero otherwise), \( \rho \) is the Y-intercept, and \( \delta_k \) is the set of coefficients to be estimated. \( x_k \) represents the explanatory variables, based on theory and a relevant econometric conceptual framework, which, in this study, is farmers’ likelihood of purchasing agricultural insurance, \( \epsilon_k \) is an error term. During the selection of the explanatory variables, parameters hypothesized to influence farmers’ likelihood of purchasing agricultural insurance were considered.

### Results and Discussion

#### Socioeconomic Characteristics of Farmers and Household Members

Responses with continuous data features of farmers’ socioeconomic characteristics are discussed first (Table 1). The farmers’ average age was 54.03 years, which is similar to that in extant studies (Giourga et al. 2008). It can be stated that olive farmers’ ages are generally high worldwide (Artukoglu 2002; Berg et al. 2018; Duarte et al. 2008; Giourga et al. 2008).

Some socioeconomic characteristics of the farmers are represented in Table 2.

Sixty-seven farmers (55.3%) were primary school graduates, 22 (18.2%) were secondary school graduates, and 25 (20.7%) were high school graduates. Six (5%) held undergraduate or graduate degrees. The education level of many of the farmers was thus low; these results are consistent with studies conducted in Mediterranean countries (Artukoglu 2002; Ligvani and Artukoğlu 2015; Sousa et al. 2020).

Forty-nine (40.5%) olive farmers had nonfarm income, and 72 (59.5%) were exploring such income. Giourga et al. (2008) report similar results (EC 2012). During farm management, good record-keeping provides optimal management, especially for tax purposes. Using financial records and an appropriate methodology offers an ideal assistive tool to achieve business profitability. Record-keeping and optimal interpretation of data help identify the weakest links of a farm’s operations in order to initiate corrective actions (Arzeno 2004). Sixty-five (53.7%) farmers kept records of their agricultural activities, and 56 (46.3%) did not keep any agricultural registration system. Keeping records of agricultural production is important to ensuring sustainability. Although they are not at the desired level, the figures in question are quite important and sufficient. Record-keeping during farm management is important. Ninety (74.4%) olive farmers were members of a cooperative, and the remaining 31 (25.6%) were not; thus, many olive farmers are members of a cooperative, making positive contributions to the adoption of innovation, benefiting from government support mechanisms, and keeping agricultural activities at a desirable level. Cooperative membership has been reported to be high, at 88% in SMOPS C01 (Metzidakis 2004) and 90% in Granada/Jaen (Duarte 2005a; Fleskens 2007). Of the farmers surveyed in Basilicata/Salerno, nearly all were members of a cooperative, with the most important reason for membership being qualification for Common Agricultural Policy subsidies (Duarte 2005b; Fleskens 2007).

#### Defining Factors that Affect Farmers’ Decisions To Purchase Agricultural Insurance

Logit model estimation results appear in Table 3.

No effect was found regarding age, ED, IHWA, OFE, or NAI on the probability that a farmer would purchase agricultural insurance (\( p > 0.10 \)). However, an effect was found regarding FRK (\( p < 0.10 \)), MFC (\( p < 0.10 \)), and SOFL (\( p < 0.01 \)) on the probability that a farmer would purchase such insurance; FRK increased the probability that a farmer would buy insurance by 2.089 times. Farmers who kept good records were expected to be more likely to buy agricultural insurance, since it positively motivates farmers to produce strategies against sources of risk. The MFC decreased the probability that a farmer would buy agricultural insurance by 0.416 times, and it made farmers less likely to...
buy agricultural insurance. Thus, MFC was a negative factor that caused farmers to report low probabilities of buying agricultural insurance, and the probability was less than 50%. Although the effect of membership in an agricultural cooperative on the decision to buy agricultural insurance was important, the effect was in a decreasing direction. Farmers appear to implement better management practices when experiencing agricultural risk through membership in a cooperative. The SOFL also positively affected farmers’ decisions to buy agricultural insurance, and the effect manifested as a 1.015-times increase. The most prominent statistical effect on the probability of a farmer buying agricultural insurance was the SOFL. Thus, as the scale of an enterprise grows, farmers’ economic gains increase and represent the most important parameter that encourages farmers to buy agricultural insurance to manage agricultural risk. Corroborating these findings, Sarris et al. (2006) and Smith and Watts (2014) argue that the greatest obstacle to buying agricultural insurance in low-income households is difficulties with paying premiums before harvest. Using data from 2002 to 2005, Enjolras and Sentis (2008) investigated factors that led farmers to insure against crop risks, finding that in comparison to uninsured farms, insured farms have larger financial and agricultural sizes and more diverse production patterns. Financial parameters also had less of an effect on farmers’ decisions to buy insurance, and yet a farm’s agricultural characteristics influenced subscriptions to crop insurance policies. Farrin et al. (2016) analyzed factors that affect farmers’ demand for agricultural insurance, arguing that if farmers have low incomes at the beginning, additional savings complement insurance such that farmers can pay insurance premiums. When farmers’ attitudes regarding agricultural insurance were examined for more than 1 year, demand was in direct proportion to financial wealth rather than risk. However, farmers with high incomes could not have agricultural insurance and yet be covered for damage using their savings in the case of a risk. The current study suggests that farmers who save more are less likely to buy

| Table 2  | Basic socioeconomic characteristics of farmers’ indicative discrete data |
|----------|---------------------------------------------------------------|
| **Variable** | **Description** | **Frequency (n)** | **Percentage (%)** |
| ED | Education | | |
| 1: Literate | 0 | 0.00 |
| 2: Primary school graduate | 67 | 55.30 |
| 3: Middle school graduate | 22 | 18.20 |
| 4: Lycée graduate | 25 | 20.70 |
| 5: High school graduate | 1 | 0.80 |
| 6: Undergraduate or graduate degree | 6 | 5.00 |
| NAI | Nonagricultural income | | |
| 0: No | 72 | 59.50 |
| 1: Yes | 49 | 40.50 |
| FRK | Farmers’ record-keeping | | |
| 0: No | 56 | 46.30 |
| 1: Yes | 65 | 53.70 |
| MFC | Membership in a farmers’ cooperative | | |
| 0: No | 31 | 25.60 |
| 1: Yes | 90 | 74.40 |

**Table 3** Binary logit model estimation results

| Dependent variable | Independent variable | B    | SE    | Wald  | Exp(B) |
|--------------------|----------------------|------|-------|-------|--------|
| Purchase of agricultural insurance | Intercept | -1.499 | 1.599 | 0.880 | 0.223 |
| | Age | 0.028 | 0.025 | 1.271 | 1.029 |
| | ED | 0.343 | 0.237 | 2.100 | 1.409 |
| | IHWA | -0.236 | 0.225 | 1.101 | 0.789 |
| | OFE | -0.032 | 0.020 | 2.673 | 0.968 |
| | NAI | 0.037 | 0.440 | 0.007 | 1.038 |
| | FRK | 0.737* | 0.446 | 2.732 | 2.089 |
| | MFC | -0.876* | 0.483 | 3.283 | 0.416 |
| | SOFL | 0.015*** | 0.005 | 7.158 | 1.015 |

Cox and Snell R-square is 0.164; Nagelkerke R-square is 0.221; –2 log likelihood is 141.701; Hosmer and Lemeshow test is 12.302

*p < 0.10, **p < 0.05, ***p < 0.01
crop insurance. In the econometric model tested, the relationship between the purchase of crop insurance and assets owned by a farm was not quite linear, making it difficult to interpret point estimates. Liu et al. (2016) argue that farmers’ income sources should be increased to purchase agricultural insurance. Net income is the most important factor when deciding to buy agricultural insurance, so farmers’ incomes should be balanced and consistent. Yilmaz (2014) and Yilmaz et al. (2017) emphasized that access to credit and adoption of new technologies associated with agricultural insurance could increase the income of the farmers and that the purchase of agricultural insurance products by the farmers could be more attractive. In addition, it was recommended that TARSIM (insurance provider for agriculture in Turkey) and government extension organizations make more efforts to increase the recognition and awareness of agricultural insurance.

Finally, farmers’ education in rural areas should be increased, and internships and work opportunities should be encouraged for students working in the agricultural field. Agricultural insurance would thus spread more among farmers in rural areas. Adnan et al. (2020) report that risk management reduces uncertainty for farmers, and a farmer’s age, education, monthly household income, extension experience, agricultural land, land ownership, and nature of risk aversion are among the most significant factors that affect the decision to use risk management strategies. Ali et al. (2020) argue that despite uncertainties and significant risks for farmers in emerging and developing countries regarding production, little success has been achieved to encourage farmers to buy agricultural insurance and thus reduce production risks. They found that although farmers’ risk aversion is necessary to generate agricultural insurance demand, liquidity constraints, time preference rates, trust, and underlying risks have equal relevance in explaining insurance demand in poor countries. Using logit econometric models, Carrer et al. (2020) analyzed determinants affecting the purchase of agricultural insurance in a study of farmers in São Paulo, Brazil. The results suggest that a farmer’s education, access to technical assistance, ability to use management tools, and farm size have positive effects on the likelihood of buying agricultural insurance. Farmers who produced maize and/or soybeans were also more likely to buy insurance, and the greater a farmer’s risk-taking tendency, the lower the probability of buying insurance. These results are like those of the current study. Gu and Wang (2020) interviewed 46 agricultural cooperatives in Shanghai, China, regarding the COVID-19 outbreak, finding that farmers’ incomes had declined, with traditional and small-scale farmers suffering the most. However, agricultural insurance stabilized vegetable supplies to the city. To minimize the influence of the epidemic regarding vegetable production and to balance both farmers’ incomes and urban shopping carts, further improvements must be made to agricultural insurance, especially concerning the provision of insurance to reduce market risks. Senapati (2020) argues that despite the spread of information in India for more than two decades, crop insurance purchases remain low there. That study evaluated farmer households’ willingness to purchase insurance for their produce and whether they were able to pay for insurance designed to aid rural Indian farmers with the management of risks from drought and flood. Using a probit model, they found several determinants against farmers’ willingness to buy insurance, as well as the role that risk aversion plays in decisions related to purchasing insurance. The results suggest that regarding farmers’ risk preferences, risk aversion plays an indirect role in interaction with expected losses, which in turn affects willingness to buy insurance. Peng et al. (2021) estimated the influence of risk perceptions and disaster shocks on farmers’ willingness to purchase insurance, with results suggesting that farmers’ general willingness to purchase crop insurance is low. However, due to perceptions about increased risk and disaster shocks, farmers’ willingness to purchase crop insurance increased. A parametric analysis suggested that perceptions about increased risk and disaster shocks have a positive effect on a farmer’s willingness to purchase crop insurance. Perceptions about such risks also partially mediated disaster shocks and a farmer’s willingness to buy crop insurance. Thus, not only do disaster shocks directly affect a farmer’s willingness to buy crop insurance, they indirectly affect willingness to insure crops based on perceptions of risk. Therefore, farmers should be encouraged to participate in early-warning programs for disasters to increase their awareness of and resilience to weather changes.

Several studies have assessed both the agricultural insurance that Turkish farmers request and factors that influence its purchase, demonstrating that multiple factors determine willingness to pay for insurance. Binici et al. (2003) assessed the absolute risk coefficients of farmers, finding that most are risk-sensitive, depending on the type of function used because the degree of absolute risk coefficient varies. Thus, farmers are prone to risk-reducing their businesses and are interested in well-designed insurance programs. Bora (2010) found that across Turkey’s regions, with their disparate topographic and climatic conditions, risk shifts from one farm type from another, with shifts especially moving from larger to smaller farms. Success and productivity with agricultural insurance depend on many factors that interact, including economics, climate changes, farmers’ behaviors, and trust. Gülsen (2004) analyzed the effects of sociodemographics and prices on farmers’ agricultural insurance purchasing decisions. Logistics estimation suggests that household income from education and agriculture positively affects the probability of buy-
ing insurance. Insurance demand also related negatively to premiums paid per insured value, suggesting that it is a normal good. Farmers were willing to pay higher premiums if insurance offered higher coverage rates. Using a survey conducted among farmers, Akcaoz et al. (2009) found that the most important risk source during banana production was changes to product and input prices, and the most prominent risk management strategy was establishing a pesticide and heating system against disease and pests. Yılmaz (2014) recommended that producers strongly increase awareness of agricultural insurance. Hayran and Gül (2015) analyzed farmers’ risk management strategies and perceptions regarding dairy cattle breeding, finding that although the most important risk source was feed price variability, the most important risk management strategy was taking precautions against diseases. Şimşek (2020) proposes a premium calculation for risk assessment of return losses. Using the model based on all districts, provinces, and selected districts, results of the calculation concerning determined coverage levels were obtained. Hayran et al. (2021) assessed cattle farmers’ perceptions regarding risk, risk management strategies, and their determinants using partial least squares regression and factor analyses. The results suggest that feed price variability, insufficient farm income, and government policies that contain uncertainties are perceived as the most significant risks. Management strategies perceived to be most unique are off-farm income, clean cattle shelters, and monitoring and prevention of livestock diseases, and major risk sources are economy based. Therefore, government policies should prevent input and output prices from fluctuating.

Conclusion

This study was conducted in the Akhisar district of Manisa Province in Turkey, where both the flavor and aroma of the olive varieties that it produces, and the experience and habits in Turkey’s table olive production, have peaked. From surveys conducted in the region and on-site observations, table olive production is not just an income-generating activity but a way of life. In addition to farmers, chambers of agriculture, public institutions, and legal entities are working intensely on olive production.

The purpose of this study was to assess determinants of farmers’ decisions to buy agricultural insurance and explore farmers’ attitudes toward buying such insurance in the region. A survey was conducted among 121 purposefully selected farmers. Using binary logistic regression, this study defines factors that affect farmers’ decisions to buy agricultural insurance. The variables FRK, MFC, and SOFL appear to affect the probability that farmers will buy agricultural insurance. Although the agricultural insurance that covers farmers who grow table olives remains insufficient, it still plays a role in patterns of agricultural production in the region, results in greater income than for other agricultural products, and contributes to the government’s premiums for agricultural insurance. Although table olive farmers could insure their products against risks by buying full hail and frost packages within the scope of crop insurance, the desired success with agricultural insurance has not been achieved. Future studies should expand insurance practices to improve farmers’ perceptions of agricultural insurance, especially regarding drought yield insurance for perennial fruit trees, including table olives.

As a result, it can be stated that the awareness level of the farmers against various risk sources in table olive cultivation is high, and their motivation to purchase insurance for the agricultural products they produce is quite good. On the other hand, it was found that some farmers still consider it insufficient, despite the certain level of grants made by the state for the insurance products provided by TARSIM and for the premium payments to be paid. It is thought that it is very important to pave the way for the use of various risk management strategies such as purchasing agricultural insurance products by providing improvements in producer incomes.

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Conflict of interest N. Tok, F. Çobanoğlu, and R. Tunaloğlu declare that they have no competing interests.

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