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Research Article

Exploring The Effects of Part-Time Hazelnut Farming on Agricultural Land Use Characteristics and Its Social Cost

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Abstract

The purposes of the study purpose were (i) to explore the effects of part-time farming on land use characteristics, productivity, and efficiency, and (ii) to estimate the social cost of part-time farming in hazelnut production. The research data were gathered from randomly selected 152 hazelnut farmers in Ordu and Giresun provinces, Turkey. When estimating the part-time farming social cost in hazelnut production, sacrificed production cost, yield losses, and price losses were assessed and combined. The stochastic frontier production function model was used to measure farm-level productive efficiency. The research findings showed that excessive chemical usage, shorter harvesting time, ignoring soil and leaf analysis results when applying fertilizers, lack of investments among farmers were the reasons for inappropriate land use for the part-time farms in the research area. Full-time farmers had a higher technical efficiency score than part-time farmers. The social cost of part-time farming was ₺4424 per hectare and ₺1.47 billion in Black Sea Region. The study suggested using a legislative process to transfer hazelnut orchards to full-time farmers. Facilitating the transfer of unproductive part-time hazelnut orchards to full-time operations may decrease the adverse effects of part-time farming on the sustainability of land use and of externalities. The study also recommended that prescribing part-time farmers to reach direct government support or benefit farmers' education programs may also reduce the social cost of part-time farming. Developing education and extension programs for increasing the qualification of both family and hired labor may positively contribute the sustainable land use in the region.

Key words: Hazelnut, part-time farming, efficiency analysis, social cost

Fındık Tarımında Kısmi Zamanlı Çiftçiliğin Tarımsal Arazi Kullanımına Etkilerinin ve Sosyal Maliyetinin Belirlenmesi

Öz

Bu çalışmada, (i) kısmi zamanlı çiftçiliğin arazi kullanım özellikleri, üretkenlik ve verimlilik üzerindeki etkilerini araştırmak ve (ii) fındık üretiminde kısmi zamanlı çiftçiliğin sosyal maliyetini tahmin etmektir amaçlanmıştır. Araştırma verileri Ordu ve Giresun illerinde tesadüfi seçilen 152 fındık üreticisinden toplanmıştır. Fındık tarımında yarı zamanlı çiftçiliğin sosyal maliyeti tahmin edilirken, katlanılan üretim maliyeti, verim kayıpları ve fiyat kayıpları değerlendirilmiş ve birleştirilmiştir. İşletme düzeyinde etkinliği ölçmek için stokastik sınır üretim fonksiyon modeli kullanılmıştır. Araştırma bulguları, araştırma alanındaki kısmi zamanlı çiftçiler için uygun olmayan arazi kullanımının sebeplerinin aşırı kimyasal kullanımı, hasat süresinin daha kısa olması, gübre kullanımında toprak ve yaprak analiz sonuçlarının göz ardı edilmesi, çiftçilerin yeterli yatırıml yapmaması gibi sebepler olduğunu göstermiştir. Tam zamanlı çiftçiler, kısmi zamanlı çiftçilerden daha yüksek bir teknik etkinlik puanına sahiptir. Karadeniz Bölgesi'nde kısmi zamanlı çiftçiliğin sosyal maliyeti hektara 4424 TL, toplamı ise 1.47 milyar TL'dir. Etkinliği düşük kısmi zamanlı çiftçilerin fındık bahçelerinin yasal hakları korunarak tam zamanlı çiftçilere geçişini kolaylaştırılması, kısmi zamanlı çiftçiliğin arazi kullanımının sürdürülebilirliği üzerindeki olumsuz etkilerini ve dışsallıkları azaltabilir. Çalışmada ayrıca, kısmi zamanlı çiftçilerin doğrudan devlet desteğine ulaşmalarının veya eğitim programlarından yararlanmalarının sağlanması

kısmi zamanlı çiftçiliğin sosyal maliyetini azaltabileceği önerilmektedir. Hem aile işgücü hem de ücretli işgücünün niteliklerinin artırılmasına yönelik eğitim ve yayım programlarının geliştirilmesi, bölgede sürdürülebilir arazi kullanımına olumlu katkı sağlayabilir.

Anahtar kelimeler: Fındık, kısmi zamanlı çiftçilik, etkinlik analizi, sosyal maliyet

Introduction

With the industrial revolution in the 18th and 19th centuries, the effect of new inventions on production has led to changes in employee-employer relations and working conditions in many sectors. Thus, the concept of flexible work has gained importance. Benefiting from state subsidies and other opportunities should be conditioned on living in rural areas (van Osch and Schaveling, 2017). In the world's agricultural sector, part-time farming also began to emerge and develop due to pushing factors of the rural location, pulling factors of the urban area, and policies on labor transfer from agriculture to other sectors. But, unlike other sectors, part-time farmers have continued to manage their farms on a part-time basis. In general, part-time farmers have managed their land by renting, hiring extra temporary workers, and using modern production technologies (Fernández-Gómez et al., 2010; Strijker, 2005; Yıldırım et al., 2022). Part-time farming has been considered an alternative solution for poverty in some rural areas in developed countries. However, many developing countries have delayed concentrating on the issue of part-time farming and its effects. Similarly, Turkey has experienced a part-time farming issue since the middle of the 19th century. Part-time farming has been widely observed in Turkey's Eastern Black Sea Region due to geographic limitations, inadequate income, and dependency on hazelnut production. Hazelnut is the primary cash crop in this region, which constitutes 80% of Turkey's hazelnuts areas (TSI, 2018). Since hazelnut production required lesser working capital and labor comparing other crops, many part-time farmers have continued the relationship with their villages and hazelnut production. Nowadays, full-time and part-time farmers simultaneously produce hazelnut, a natural phenomenon in the eastern Black Sea Region. That is why this region is such a natural environment to examine the differentiation between full-time and part-time hazelnut farming in the aspect of land use characteristics and economic performance and to estimate the social cost of part-time hazelnut farming.

Different empirical studies have reported the changes in land use characteristics and farm performance sourced by part-time farming. There have been different effects of part-time farming on land-use characteristics. Some researchers reported positive effects of part-time farming, while the rest have examined adverse effects. (Paudel and Wang 2002) suggested that part-time farming positively affected land use and increased total farm value. Similarly, (Taylor, Rozelle, and de Brauw 2003) claimed that part-time farming increased production because farms had a healthy financial structure and investment capability. Alwang and Siegel (1999) reported that part-time farming had increased the land use performance due to an increase in the labor hiring budget. On the other dimension, some previous studies reported negative impacts of part-time farming on total production and land use performance due to concentration on off-farm work and decreased labor productivity (Rudel, 2006; Zhang et al., 2008). (Xin et al. 2009) suggested that part-time farming reduced production value due to yield and quality loss. Moreover, part-time farming caused to increase in unused land and made farmers sacrifice the total production value thoroughly (Morera and Gladwin, 2006). According to the results of some previous studies, part-time farming led to affect fearfulness for farm development negatively, lose the potential opportunity, decrease in resource use efficiency, limit the dissemination of information, decrease the motivation of farmers and compromise the food security (Barlett, 1986; Bishop, 1955; Chen et al., 2010; Coutu, 1957; Swanson and Busch, 1985).

It has been clear predicate on the results of previous research that including the social cost of part-time farming when designing policy and selecting policy instruments related to rural areas would increase both the efficiency of policies and the impact of implemented policies. In spite of the fact that lots of previous research conducted worldwide explored the link between part-time farming and land use, ignoring the social cost calculation, there has still been an information gap related to sustainable land use and the social cost of part-time farming. Nowadays, examining the link between part-time farming and land use characteristics, together with the special consideration of calculating the social cost of part-time farming, has been vital for decision-makers worldwide. A similar situation is almost the case in Turkey. There has been no or less study on the micro and macro levels of effects of part-time farming and the social cost of part-time farming.

Especially, there has been no information about the effects of part-time farming on sustainable land use. Within the view of fulfilling the information gap, the study intended to answer whether part-time farming affects the land use characteristics and the individual and social costs of part-time farming in hazelnut production. The study aimed to test the hypothesis that full-time farmers use land more efficiently than part-time farmers, and there is a social cost of part-time farming issues for society. Therefore, the purports of the study were (i) to explore the effects of part-time farming on land use characteristics, productivity, and efficiency, and (ii) to estimate the social cost of part-time farming in hazelnut production in the Eastern Black Sea Region of Turkey.

Material and Methods

Research Area

Hazelnut production area extends 707 thousand hectares of farmland, and it is divided into three standard regions in Turkey (TURKSTAT, 2018). Artvin, Giresun, Ordu, Rize, and Trabzon occur within the 1st Standard Region, which is accepted as the most crucial region for hazelnut production. Ordu has the highest hazelnut production area, 214 thousand hectares, followed by Giresun with 93 thousand hectares. Since Giresun and Ordu have been produced 49% of hazelnut in Turkey, these provinces were selected as working areas of this study (Figure 1). Like most of Turkey's Eastern Black Sea coast, both provinces have a damp subtropical climate, with warm and moist summers and cool and humid winters. They have a high and evenly distributed rainfall during the year.

Ordu and Giresun are typical provinces, and their economy mainly based on agricultural production. Approximately 122 thousand farmers conducted their agricultural activities on 243 thousand hectares of land in Ordu, while Giresun was 145 thousand hectares and 79 thousand farmers, respectively (MAF, 2019a, 2019b). Hazelnut is the main cash crop in the research area. Ordu and Giresun are both Turkey's and the world's largest producers of hazelnuts.

Figure 1. Map of research areas

Research Data

The farm-level research data were collected from hazelnut farmers through questionnaires. Stratified cluster sampling was used to identify the surveyed farmers. Ordu and Giresun provinces were selected as the first sampling unit for representing the region in terms of agricultural technique. The second sampling unit was formed with the district of Ordu and Giresun that could represent the provinces. Farmers selected by random numbers table were examined in two separate layers as full-time and part-time and constitute the third sampling unit. Thus, full-time and part-time farmers became a different population, and clusters were heterogeneously distributed among themselves.

The research data were obtained from a Neyman's stratified sample of 152 hazelnut farmers in Ordu and Giresun by using structured questionnaire (Yamane, 2001). The levels of precision and confidence were 10% and 95%, respectively, when determining the optimum sample size.

$$n = \frac{\left(\sum N_h S_h\right)^2}{N^2 D^2 + \sum N_h S_h^2} \quad (Neyman)$$

In equation; n, number of selected hazelnut farms, N, number of hazelnut farms in the research area, N_h, number of hazelnut farms in each layer, Sh, standard deviation in each layer, and D, levels of precision.

The distribution of the number of farms to be surveyed according to standard deviation was determined with the following formula.

$$n_h = \frac{N_h S_h}{\sum N_h S_h} \times n$$

In this formula, n optimum sample volume, n_h, number of samples to be found in layer h, N_h,, number of farms in layer h ve S_h, Standard deviation of layer h.

Regarding the validity and reliability of the research data, focus group interviews were performed. The face and content validity of the questionnaire was provided via opinions collected from beneficiaries and subject matter expertise. The test-retest approach was used to assess reliability. A well-designed questionnaire (open ended and close ended) was conducted to the same group at different times when applying the test-retest method. We used the criteria of Cronbach alpha of 0.80 or higher to ensure internal reliability or consistency for a set of questions (Cramer, 1999). The Turkish average values of the investigated variables were based on the results of the previous research and the documents of related institutions and organizations.

Identification and Classification of Sample Farms

The conceptual framework was used to classify part-time and full-time farming in the study area. Previous studies made classification by income, farm size, labor force, farmers' residence status, farming income, and capital elements (Brosig et al. 2009; A. M. Fuller 1990; M. A. Fuller 1975; Ruth Gasson 1986; Greeley 1942; Kada 1980, 1982; Lien, Kumbhakar, and Hardaker 2010; Lund and Price 2007; Mittenzwei and Mann 2017; Paudel and Wang 2002; Pfeiffer, López-Feldman, and Taylor 2009; SCHMITT 1989; Shucksmith and Winter 1990; Singh and Williamson 1981). However, considering the socio-economic characteristics in the study area, we preferred to use the site-specific classification method. Due to the unique structure of agriculture, it would be more accurate to evaluate the working hours during a production period instead of weekly or monthly working periods such as the service and industry sectors. In addition, the need for labor in fruit production made from perennial plants such as hazelnuts is in certain periods. For these reasons, in this study, the phrase "working less than 2/3 of the normal working time" indicated in the Labor Law of the Republic of Turkey and the relevant Cabinet Decision has been taken into account. The study used the percentage of the payment for family members in total labor cost in hazelnut production as a classification criterion. When classifying the farmers, the labor cost coefficient was also used to reflect the risk and workload of each production activity, such as fertilizing, harvesting, etc. If the total labor cost percentage of family work payment were larger than 67%, the farms would be defined as full-time farms. Otherwise, farms were classified as part-time farms. The classification results showed that 53% of the total sample farms were full-time hazelnut farms, and the rest was part-time hazelnut farms. The percentages of part-time farms in Ordu and Giresun were 54% and 46%, respectively.

Measuring The Farm Level Productive Efficiency

The two-stage approach was used in this study to estimate the productive efficiency and inefficiency determinants in hazelnut production. In the first step of the efficiency analysis, the technical efficiency coefficients were estimated. In the second stage, the relationship between the variables that may have an effect on technical efficiency and efficiency was estimated with the highest likelihood function. The farm and farmers' characteristics used to interpret inefficiency were involved in the model when estimating the scores of technical efficiencies. We adopted the definition of inefficiency suggested by (Farrel 1957), which is the distance between an actual hazelnut production value of a farm and the estimated frontier hazelnut production value that belongs to the state of production technology. Technical efficiency scores of sample farms were estimated using the stochastic frontier production function model. Since the Cobb-Douglas form was more appropriate for the research data set than the translog one, we used the Cobb-Douglas production function to estimate the efficiency scores. Coefficients in Cobb-Douglas power function can be already interpreted as elasticities. There is also particular interest in testing if the Cobb-Douglas function is an adequate representation of the data, given the specifications of the translog stochastic frontier for the different models of the inefficiency effects. The study used the model suggested by (Battese and Coelli 1992).

$$Y_i = X_i\beta + v_i$$
$$v_i - u_i = \varepsilon_i$$

Where Y_i is the hazelnut production function of the farm, X_i is a vector of production factors of a farm, β is an unknown coefficient, v_i is the random variable that was supposed to be freely and similarly distributed with $Vi{\sim}iii\ N(0,\sigma v2)$ and independent of u_i and u_i is stands for the non-negative random variables, presumed both to correspond to technical inefficiency and be independently distributed as $Ui{\sim}iii\ N(\mu,\sigma U2)$.

The variables of labor, nitrogen, phosphorus, potassium, lime, and chemicals were

involved in the equation for estimating the stochastic frontier production function. Labor was measured in hours per hectare, while the variables of nitrogen, phosphorus, potassium, and lime were included in the model in kg per hectare. Chemicals were the value of cash expenses on pesticides and other plant protection chemicals per hectare.

The technical efficiency effect (TE) model was constructed to display the relationship between sample farms' social, economic, and technical characteristics and technical efficiency scores. The maximum likelihood function was used to estimate technical efficiency effect model parameters. Maximum-likelihood estimates of the parameters were acquired by Frontier 4.1.

The general form of the maximum likelihood function is as follows (Coelli et al. 1998):

$$L(\mu,\sigma) = \sigma^{-n}(2\pi)^{-n/2} exp\left[-\frac{1}{2\sigma^2}\sum_{i=1}^{n}(\tau_i-\mu)^2\right]$$

Where μ represents the mean value, σ represents the standard deviation, n is the number of farms and exp is an exponential function. The maximum likelihood estimator is as follows:

$$\theta = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Where θ represents the vector of unknown parameters, which maximize the probability, x_i is the joint probability, a product of explanatory variables multiplied by marginal probability.

Technical inefficiency was the dependent variable of the TE model. We included eight different explanatory variables into the TE model. The farmer type was included as a dummy variable, equal to 1 if the farmer was classified as a part-time and 0 otherwise. The farmer type variable involved in the TE model was applied to test the hypothesis that the technical efficiency of part-time farmers was less than that of full-time ones. The variables of farm size and slope of farmland are included in the TE model to discover the link between technical efficiency and farm size and slope of farmland. The variable regarding the number of farmers' training revealed the relationship between technical efficiency and information level of farmers related to hazelnut production. Since the investment, per capita farm income, and working capital may influence the technical efficiency, the TE model also covered the variables of farm investment, farm income, and working capital. However, the variables regarding the age of farmer, experience, schooling, family size, off-farm job, village, record keeping, profitability, and liquidity were also included in the TE model in the beginning, all of them were removed from the model due to problems arise during the parameter's estimation process.

Calculating The Social Cost of Part-Time Farming in Hazelnut Production

Social cost is the total cost to society. The part-time farming type exerts the cost to society that is not generally included in the cost of hazelnut production. By calculating the social cost, this loss suffered by the society with part-time farming has been determined.

When estimating the social cost of part-time farming in hazelnut production, sacrificed reduction in production cost, yield loss, and price loss were assessed and combined. The study used both the regional data such as the number of full-time and part-time farmers and hazelnut orchard size and variables measured in the study such as technical efficiency scores, hazelnut yield, hazelnut price, the production cost of hazelnut, and the percentage of part-time farming. Sacrificed reduction in production cost was calculated based on the input reduction quantities obtained from the efficiency analysis results. Following the calculation of the production cost difference between technically efficient farms and inefficient farms for full-time and part-time farms, the difference in production cost reduction between full-time and part-time farms was attributed to the sacrificed reduction in production cost. When calculating the income loss sourced by yield reduction in part-time farming, the yield difference between part-time and full-time farms is multiplied by the weighted average value of hazelnut price. The hazelnut price difference between part-time and full-time farms was attributed to the price loss of part-time farms. Farm-level loss of part-time farming equaled to sum of the sacrificed reduction in production costs and the income loss sourced from yield loss and price loss. The loss of part-time farming per hectare was calculated by dividing the farm level loss and farmland.

In order to calculate the social cost of part-time farming for the research area, part-time farming loss per hectare was multiplied by the total hazelnut area cultivated by part-time farmers in Ordu and Giresun. Then, social cost per capita and per farm were calculated by using the ratio among the total social cost of part-time farming, the number of farms, and family size. The family size was four persons based on the research results. The social cost of part-time farming was extended to the black sea region based on the percentage of part farming, which was 47%, and the social cost of part-time farming per hectare and farmland cultivated by part-time farms in the Black Sea Region, which was 287876 hectares.

Results

Land Use Characteristics of Farms

Some farmers' characteristics (age, agricultural experience, schooling, off-farm working, etc.) and land use characteristics of farms (farmland, yield, labor, farm income, etc.) associated with full-time and part-time farming were presented in Table 1. The mean age of farmers for full-time and part-time farmers was 54 years and 56 years, respectively, while that of agricultural experience of full-time and part-time farmers was 30 years and 32 years, respectively ($p>0.05$). Those values were close to Turkish average values. While schooling of part-time farmers was higher than that of full-time farmers ($p<0.10$), full-time farmers participated in more agricultural training than part-time farmers ($p<0.01$). Although the schooling of part-time farmers was higher than that of an average Turkish value, the reverse was the case for full-time farmers. On the other hand, family size, family labor potential, family labor working at the farm, residents of village ratio, and internal investment ratio of full-time farmers were larger than part-time ones ($p<0.10$). The family sizes of full-time and part-time farmers were nearly the same as the average value of Turkey. Turkey's percentage of village residents was lower than that of the value of the research area. Part-time farmers worked much more off-farm work ($p<0.10$) and earned much more non-agricultural income ($p<0.05$) than full-time farmers. The income of full-time farmers was mainly based on agriculture ($p<0.10$). The agricultural income of full-time farmers was higher than the average Turkish value. The credit use ratio of full-time and part-time farmers was 10% and 14%, respectively. There was no statistically significant difference between farming type age and agricultural experience ($p>0.05$). Part-time farmers also had more inherited farmland than full-time ones ($p<0,05$). Migrant farmers' rate was higher in part-time farmers ($p<0.10$). The rates of keeping farm records among farmers and innovativeness scores were higher in full-time farmers compared to part-time ones ($p<0.10$) (Table 1).

Concerning the land use characteristics of farms, the average altitudes of the full-time and part-time farms' hazelnut orchards from the sea level were 360 and 366 meters, respectively. The average orchard slope of full-time and part-time farms was 36% and 33%, respectively. There was no statistically significant difference between the two farming types regarding altitude from the sea level and the slope of hazelnut orchards ($p>0.05$). The sizes of farmland and hazelnut farmland of part-time farmers were larger than that of full-time farmers ($p<0.05$). In the research area, the farm size of full-time and part-time farms was smaller than that of Turkey's average value, which is 5.9 hectares. The number of parcels for full-time and part-time farms were 4.9 ha and 5.1 ha, respectively. There was no statistically significant difference between farming types in parcel number ($p>0.05$). Those values were more considerable than the Turkish average parcels number, which is 3.4 hectares. Regarding hazelnut production, full-time farmers produced more hazelnuts per hectare compared to part-time farmers ($p<0.10$). Those values were higher than the average Turkish hazelnut yield per hectare, 827 kg. Total working hours per hectare in full-time farms were higher than part-time farms ($p<0.05$). The same amounts of pure nitrogen, pure potassium, and lime were spread to hazelnut orchards by full-time and part-time farms, and the difference between farming types was not statistically significant ($p>0.05$). Full-time farms used more pure phosphorus and fewer chemicals in hazelnut orchards than part-time farms ($p<0.05$). Full-time and part-time farms had the same amount of working capital per hectare and invested a similar quantity of money on their farms for hazelnut farming. Similarly, full-time and part-time farmers had the same level of agricultural information, and they applied the same cultural practice such as fertilization, spraying, pruning, and caring in hazelnut farming in terms of implementation number ($p>0.05$), except for harvesting day ($p<0.01$). However, the applied fertilizer and chemicals implemented in the hazelnut orchards differed. The harvesting time of full-time farms was longer than that of part-time farms ($p<0.01$). The percentage of full-time and part-time farms that decision based on the soil testing was 34% and 36%, respectively. There was no statistically significant difference between part-time and full-time farmers following the soil test results ($p>0.05$). Following the leaf analysis results for deciding the amount of fertilizer in full-time farms was more than part-time ones ($p<0.01$). Full-time farms also had more potential and active family labor than part-time farms ($p<0.10$). Full-time farms earned much more per capita farm income than part-time farms ($p<0.01$) regarding monetary land characteristics. Labor cost excluding family labor payment of part-time farms was more than that of full-time ones. Total labor cost was nearly equal in both full-time and part-time farms, which was ₺6200 and ₺5000 per hectare. It was clear that full-time farmers produced more hazelnut with lower cost ($p<0.05$) and received a higher kernel yield compared to part-time ones ($p<0.10$). The hazelnut price of full-time farms was higher compared to part-time farmers ($p<0.05$) (Table 1).

Table 1. Some characteristics of sample farms and farmers

Characteristics	Full-time	Part-time	Turkish average[1]
Sample farms (%)	53.0	47.0	
Number of farms	80.0	72.0	
Farmers' characteristics			
Age (year)	54.0	56.2	53.0
Agricultural experience (year)	30.8	31.8	34.0
Schooling (year)*	6.9	9.1	8.5
Family size (person)*	4.0	3.0	3.4
Percentage of village residents (%)*	68.8	26.4	8.0
The percentage of farms having off-farm work (%) *	72.5	87.5	42.3
Agricultural income(₺/ha) *	13527.4	2318.4	3044.0
Non-agricultural income (₺/year)**	21795	41586	29800.0
Farm income per capita (₺) ***	3253.4	2002.1	61800.0
Farm investment (₺/ha) *	6776.1	10374.3	-
Working capital (₺/ha)	10284.8	12166.4	45600.0
Participation number of training (per person)***	1.1	0.2	3.2
The percentage of farms having farm investment (%)*	61.3	54.2	-
The percentage of farms keeping farm record (%) *	16.7	13.8	34.5
The percentage of farms using credit (%)	10.0	13.9	51.3
The percentage of farms having inherited farmland (%)*	82.5	90.5	-
Innovativeness (%) *	48.0	26.5	-
Agricultural information level (%)	71.0	67.3	-
The percentage of farms having migrants (%)	32.5	59.7	-
Family labor at the farm (potential)*	3.0	2.3	-
Family members working at the farm (%)*	86.8	59.8	-
Land use characteristics			
Meters above sea level (m)	359.7	365.6	-
The slope of orchards (%)	35.5	32.5	
Farm size (ha)**	1.3	1.7	5.9
Hazelnut land (ha)**	1.3	1.7	1.4
Number of the parcel (mean)	4.9	5.1	3.4
The yield of hazelnut (kg/ha) *	1129.4	866.1	827.0
Kernel yield (%) *	53.8	52.7	50.0
Price of hazelnut(₺/kg) **	11.8	11.3	11.0
Labor (hour/ha)**	777.8	642.2	-
Hiring labor cost (₺/ha) ***	1696.0	3820.9	-
Total labor cost (₺/ha)	6258.6	5063.9	-
Cost of hazelnut (₺/kg) **	10.7	12.3	9.5
N (kg/ha)	151.0	135.3	-
P (kg/ha) **	43.3	26.3	-
K (kg/ha)	17.4	18.2	-
Lime (kg/ha)	125.3	123.5	-
Chemical (₺/ha) **	82.3	132.5	-
Number of fertilization (in a year)	1.4	1.6	-
Number of spraying (in a year)	0.5	0.5	-
Number of pruning (in a year)	1.0	1.0	-
Number of caring (in a year)	1.3	1.2	-
Soil analysis (%)	33.8	36.1	-
Leaf analysis (%)***	10.0	1.4	-
Harvest time (day/year) ***	12.8	8.7	-

[1]Turkish farm average value was based on the result of (BOZ et al., 2016; Canan and Ceyhan, 2021; MNE, 2017; TSI, 2018, 2016; Yıldırım et al., 2020, 2017, 2016; Ceyhan et al., 2021)

*p<0,10, **p<0,05 and ***p<0,01 reflects that the difference between full-time and part-time farms is statistically significant.

$1=₺6.4; €1=₺7.1

Table 2. Distribution of efficiency score range by farmers' type

Efficiency score range	Full-time (%)	Part-time (%)	Overall (%)
0.240-0.499	-	6.9	3.3
0.500-0.799	25.0	43.1	33.5
0.800-1.000	75.0	50.0	63.2

Productive Efficiency of Full-Time and Part-Time Farms and Efficiency Determinants

The maximum-likelihood estimations of the TE model parameters are presented in Table 3. Based on the variance parameters, it was clear that technical inefficiency effects existed and affected the hazelnut production. Stochastic production frontier parameters had expected signs in the TE model, except for the chemical variable. The variables of labor, nitrogen, phosphorus, potassium, and lime positively affected hazelnut yield, while that of chemicals was negative. The estimated elasticities for labor, nitrogen, phosphorus, potassium, chemical, and lime were 0.33, 0.80, 1.48, 2.56, -0.25, and 0.15, respectively ($p<0.10$), which displayed that returns to scale were increasing in the research area. Nitrogen, phosphorus, and potassium use were the greatest elasticity, concluding that fertilizer application had a major effect on hazelnut production (Table 2).

Table 3. Maximum likelihood estimates of the Cobb-Douglass stochastic frontier model (Dependent variable: hazelnut production)

Variables	Parameters	Standard error	t-value
Production function			
Constant	77.382	1.782	43.430*
Ln (Labor) (hour/ha)	0.326	0.070	4.690*
Ln (Nitrogen) (kg/ha)	0.803	0.347	2.313**
Ln (Phosphorus) (kg/ha)	1.480	0.418	3.544*
Ln (Potassium) (kg/ha)	2.556	0.887	2.880*
Ln (Lime) (kg/ha)	0.154	0.156	0.988
Ln (Chemical) (₺/ha)	-0.249	0.178	-1.397***
Sum of elasticities of inputs	5.072		
Inefficiency effect model			
Constant	-2.445	1.892	-1.293***
Farm type	-2.537	1.910	-1.328***
Farm size (ha)	0.542	0.363	1.494***
The slope of orchards (%)	0.387	0.205	1.890**
Farm investment (₺/ha)	-0.003	0.001	-3.639*
Farm income per capita (₺)	-0.007	0.001	-4.784*
Participation number of training (number)	-2.948	2.294	-1.291***
Working capital (₺/ha)	-0.001	0.001	-1.302***
Information level	-5.802	3.998	-1.451***
Variance parameters			
σ^2	1356.196	1.012	1340.412*
γ	0.103	0.101	1.290***
Log-likelihood	739.33		
LR	44.09*		

*,** and ***significance at the 10%, 5% and 1% level, respectively.

Efficiency analysis presented that technical efficiency scores of farms varied from 0.24 to 1.00, and 0.82, on average. This indicated that there was an outstanding technical inefficiency in hazelnut production. Of the total farms, 97% had technical efficiency scores of 0.50, while the percentage with technical efficiency scores higher than 0.80 was 63%. When focusing on the difference between farming types, it was clear that the rate of farms having technical efficiency scores higher than 0.50 and 0.80 in full-time farms were 94% and 54%, respectively. These figures for part-time farms were 43% and 50%, respectively. The technical efficiency score of full-time farms (0.86) was higher comparing part-time ones (0.76). Full-time farms could decrease their inputs by 14% without reducing their hazelnut production by enhancing input usage, while part-time farms could be 22% (Table 2).

All the explanatory variables in the TE model were statistically significant, and their signs were suitable with expectations. Farm size ($p<0.10$), the slope of the hazelnut orchards ($p<0.05$), and investment ($p<0.10$) negatively affected the technical efficiency. Since part-time farming was an issue in the research area, increasing farmland and slope caused to decrease in technical efficiency. However, the effects of the farmers' type, farm income per capita, training, working capital, and information level on hazelnut production were positive ($p<0.10$). Positive sign of farmer' type implied that switching to part-time decreased technical efficiency. In the research area, the deficit of working capital because of small-scale farming and low returns on outputs, insufficient farm investment and technical information, and low participation in farmer education programs were widespread. This positively affected the farmers' technical efficiency scores (Table 3).

Table 4. The social cost of part-time hazelnut farming in the Black Sea Region

Variables	Giresun	Ordu
Number of the full-time farm	42391[1]	56022[2]
Farm size of full-time farm (ha)	63235[3]	104462[4]
Number of the part-time farm	36110[5]	65765[6]
Farm size of part-time farm (ha)	53867[7]	122630[8]
Full-time		Part-time
Hazelnut yield (kg/ha)*	1129.40[9]	866.10[10]
Hazelnut price (₺/kg)	11.81[11]	11.30[12]
Variable cost (₺/ha)	3711.00[13]	6326.61[14]
Technical inefficiency score*	0.14[15]	0.22[16]
Part-time farm size of black sea region (ha) (a=706667*%47)	287875.99	
Yield loss (kg/ha) *(b=9-10)*	263.30	
Price loss (₺/kg) *(c=12-11)*	0.51	
Sacrificed reduction in production cost (₺/ha) *(d=(14*16)-(13*15)*	872.31	
Income loss sourced by yield loss (₺/ha) *(e=b*11)*	3109.57	
Income loss sourced by price loss (₺/ha) *(f=10*c)*	441.71	
Social cost (₺/ha) *(A=d+e+f)*	4423.59	
Social cost for whole research area (million TL/year) *(B=A*(7+8))*	780.75	
Social cost per farm (₺/year) *(C=B/(1+2+5+6)*	3898.14	
Social cost per capita (₺/year) *(C/average family size)*	974.54	
Social cost for the part-time farm (₺/year) *(B/(5+6))*	7663.81	
Social cost for black sea region (billion TL/year) (a*A)	1.27	

* The difference between full-time and part-time farms was statistically significant at the 10% levels, respectively.

The Social Cost of Part-Time Farming

The results of the analysis of farm-level data showed that the hazelnut yield of the full-time farms (1129 kg/ha) was higher than that of part-time ones (866 kg/ha). Full-time farms produced 263 kg more hazelnut per hectare ($p<0.01$). Part-time farms sacrificed farm income by ₺3110 per hectare sourced by yield difference. In addition, the hazelnut price of full-time farms was higher by ₺0.51 than part-time farms, resulting in ₺442 sacrifice per hectare due to price difference. Regarding the reduction in production cost, part-time hazelnut farms sacrificed by ₺872 per hectare (Table 4).

When combining the income loss sourced by price and yield loss and reduction in production cost, it was found that the social cost of part-time farming was ₺4424 per hectare, and the annual social cost was ₺781 million for the whole research area. The social cost was ₺3898 per farm when whole farms in the research area included the analysis notwithstanding the classification of part-time and full-time, while that of solely part-time farms was ₺7664. Social cost per capita was ₺975 in the research area. When the calculation was extended to the regional level, the total social cost for Black Sea Region was ₺1.47 billion (Table 4). Regional loss sourced from part-time farming equaled 0.04% of the gross domestic product of Turkey, 0.7% of Turkey's agricultural gross domestic product, and 1.9% of Turkey's agricultural product export value.

Discussion

Due to many reasons, decision-makers are dealing with part-time farming, and they try to produce solutions to the structural problems sourced from part-time farming in agriculture. Since part-time farming is such kind of strategy for accumulating capital, decreasing risk, and increasing family welfare, it is necessary to comprehend the link between land use characteristics and part-time farming. (Gebremedhin 1991) suggested that the changing texture of agriculture has led some researchers to decide that farmers must "get large, get out of farming, or get off-farm work to survive." The study, therefore, empirically examined the hypothesis that full-time farming used the farmland more effectively than part-time farming.

Up to now, different previous studies have reported that insufficient resources, low level of farm revenue, and land use behavior of farmers were the fundamental reason for inappropriate land use (Barbier 2000; Caraveli 2000; Comission of the European Communities 1985; Lorent et al. 2008; Salvati and Zitti 2009). These inferences were corroborated with the research findings. Excessive chemical usage, shorter harvesting time, ignoring soil and leaf analysis results when applying the fertilizer, presence of a smaller number of farms having investment were the reasons for inappropriate land use for the part-time farms in the research area.

In developed countries, the positive effects of part-time farming were that part-time farming diversified the revenue, reduced the income difference, increased the living standard, and decreased the expenditure of welfare policy (Cavazzani 1977; Massey et al. 1993; Taylor 1999)(Jokisch 2002; Li and Tonts 2014). In addition, the positive contribution to sustainable agricultural production and industrial development via transferring people and causing demand increase for hiring labor was the other positive effects of part-time farming (Bishop 1955; R. D. Bollman 1982; R. Gasson 1988; Loumou et al. 2000). Although increasing farm revenue via benefiting from outside the farm has been wide, the agriculture sector has still dominated the economy in many developing countries due to food security problems (Agoramoorthy, 2008; Xin et al., 2009). When focusing on the Turkish case, the human source and capital movement from agriculture to industry and service sector have been reasonably accelerated by industrialization in the last two decades. That is why part-time farming and its social cost became a debate question for policymakers. This study indicated that the social cost of part-time farming was considerably high in hazelnut production, equaling 0.7% of Turkey's agricultural gross domestic product and 1.9% of Turkey's agricultural product export value. In general, policymakers ignored the disadvantage of part-time farming when designing the policy and transferred much more money to part-time farmers, resulting in an unexpected or low impact of policy (Khan, 1975; Latruffe and Mann, 2015). Some pioneer studies have recommended support programs considering the social cost of part-time (Wallace, 1962; Yrjola et al., 2002).

Based on the research results, it was clear that there was no difference between full-time and part-time farmers in terms of age, experience, and labor cost. This finding was not confirmed with the results of (Giourga and Loumou 2006; Haiguang, Xiubin, and Jiping 2013; Upton, Bishop, and Pearce 1982). They suggested a statistically significant difference between full-time and part-time farmers regarding labor characteristics and the operator's age. In the research area, slope and altitude of hazelnut orchards, number of the parcel, agricultural information level, amount of capital, and number of cultural practices such as fertilizing, spraying, pruning were resembling in full-time and part-time farms. These findings confirmed the results of (Brosig et al. 2009; Giourga and Loumou 2006; Haiguang, Xiubin, and Jiping 2013). The study's research findings related to the farm size, working time, investment, labor productivity, output productivity, and production cost confirmed the results of previous research. (Giourga and Loumou 2006; Haiguang, Xiubin, and Jiping 2013) stated that the size of farmland of part-time farmers was larger than that of full-time ones while working time at the farm of full-time farmers was more compared to part-time farmers.

They also stated that part-time farmers invested much more capital, higher production costs, and lower labor and output productivity than full-time farmers. The results reported by (Brosig et al. 2009; Giourga and Loumou 2006)) were closely parallel with research findings. (Brosig et al. 2009; Giourga and Loumou 2006)) determined that part-time farmers were more educated, had much more farmland, gained more revenue per capita, and had a higher migrant ratio. However, (Upton, Bishop, and Pearce 1982) suggested that the farmland of part-time farms was smaller than that of full-time ones.

Similarly, (Haiguang et al., 2013; Ma et al., 2017) emphasized that low productivity, conducting caring activities based on hiring labor, and leaning towards renting their farmland to other farmers were the main characteristics of part-time farmers. In developed countries where the labor is relatively in excess, part-time farming positively affects land use. (Alwang and Siegel 1999) put up the argument ignoring the qualification of labor that land-use efficiency in part-time farms was higher due to increasing demand for hiring labor positively affected the land-use efficiency. Moreover, (VanWey, Guedes, and D'Antona 2012) suggested that the negative effects of part-time farming could be ignored due to their contribution to employment. Conversely, ignoring the qualification of labor and disinterest of qualified people caused decreased land-use efficiency, resulting in agricultural production loss and increased the cost of society (Beyene 2008; Brosig et al. 2009; Coelli 2005; Gray 2009; Rudel 2006; Zhang et al. 2008). This judgment confirmed the research findings related to land use efficiency and the social cost of part-time farming.

Although the percentage of the farm having farm investment was higher in full-time farms, the amount of investment per hectare was higher in part-time farms in the research area. Although economically strong part-time farmers invested much more money, the few part-time farmers having investments eliminated the positive effect. The previous studies (Black 1993; Haiguang, Xiubin, and Jiping 2013; Jokisch 2002; Li and Tonts 2014; McCarthy et al. 2009; Preston, Macklin, and Warburton 1997) reported similar results. They suggested that part-time farmers were economically strong, but their land-use efficiency and productivity were lower than full-time ones due to lacking qualified labor. Contrary to research findings, some researchers stated that part-time farmers were willing to invest money in agriculture due to the presence of off-farm income (de Haas, 2006; Ishemo et al., 2006; Moran-Taylor and Taylor, 2010; Taylor et al., 2003).

Since implementing the decision into the practice at an appropriate time and place was vital for maximizing production, efficiency determinants were examined in the study. Based on the stochastic frontier model results, the production efficiency scores of full-time farms were higher than part-time ones, and the main reason for production loss in part-time farming was inappropriate land use. The results of (Amodu, Owolabi, and Adeola 2011; Bagi 1984; Brummer 2001; Ma et al. 2017; Mishra and Goodwin 1997; Singh and Williamson 1981) were corroborated with these research findings. They reported that part-time farming negatively affected production efficiency. However, (Chavas, Petrie, and Roth 2005) suggested no difference between full-time and part-time farms in terms of technical efficiency scores, while allocative efficiency scores of part-time farms were larger than that of full-time farms. On the other hand, (Lien, Kumbhakar, and Hardaker 2010) stated no positive or negative effects of part-time farming on-farm efficiency.

Farm size and farmland characteristics were the main drivers in shaping the technical efficiency of farms. The variables of farm size and slope of hazelnut orchards negatively affected the technical efficiency. When the farm size and slope increased, technical efficiency decreased in the research area. The results of previous studies conducted by (Amodu, Owolabi, and Adeola 2011) confirmed these research findings. However, (Bagi 1984) reported that the farm size positively affected the technical efficiency scores, while slope negatively affected the technical efficiency. The results of the inefficiency effects model showed that the variables of farm investment, farm income, the number of pieces of training, working capital, and information level positively affected the technical efficiency. Similar to the research findings, (Singh and Williamson 1981) and (Pfeiffer, López-Feldman, and Taylor 2009) suggested that capital and farm income positively affected farm efficiency.

Conclusion and Policy Implication

The study examined the effects of part-time farming on land use characteristics and explored both individual and social costs of part-time farming in hazelnut production. The study also revealed the differences between the production efficiency level of part-time and full-time farms. Based on the evidence from the research results, it was clear that those full-time farmers are technically efficient and produce much more hazelnut than part-time ones due to sustainable farmland use, having more working capital and intensive investment, and high participation in

farmers' education programs. In the research area, the steadfastness of full-time farmers to agricultural activities was stronger due to having relatively higher farm revenue than part-time farms. Encouraging part-time farmers to improve their inappropriate land use behavior may increase the technical efficiency in hazelnut production.

On the other hand, part-time farms allocated minimal time to hazelnut orchards for agricultural activities such as caring, pruning, etc., resulting in low productivity and technical efficiency. Especially, lacking well-qualified hiring labor was the main barrier for increasing hazelnut production and technical efficiency for part-time farmers and providing sustainable land use. Since unskilled labor in agriculture is the research area, part-time farms have a lower chance of finding qualified hiring labor. Designing the certification scheme to guarantee the qualification of hiring workers and generalizing the certificate education program for workers may help reduce the low level of productivity sourced by unqualified workers. Through the certification scheme, certified workers may match up the part-time farms with a good salary via a specialized service lease firm. Certification scheme may ensure that the workers joined the social security umbrella and their technical capacity up to date with the help of a specialized service lease firm. Giving government support to farms to employ certified workers may contribute to adopting a certification scheme. Developing an education and extension program for increasing family and hired labor qualification may positively contribute to sustainable land use. To increase the participation of farmers and workers in the education and extension programs, technology-based programs such as e-learning programs, etc., should be organized. The content of the education material should be attractive for farmers. Focusing on the optimum input use and monitoring the economic variables, especially input and output market variables in education and extension programs, may increase technical efficiency and sustainable land use in the research area.

The study also inferred that part-time farming created serious social costs in the research area. The social cost of part-time farming equaled 0,7% of the total agricultural export of Turkey and 0,04% of the GDP of Turkey. The study recommends using both regulatory and market-intensive approaches simultaneously. The study suggested using a legislative process to transfer hazelnut orchards to full-time farmers. Enhancing the transferring of unproductive hazelnut orchards from part-time farmers to full-time farmers may decrease the adverse effects of part-time farming on the sustainability of land use and externalities. The study also recommends creating a legislative system providing the opportunity for part-time farmers to rent their orchards to full-time farmers with a special and attractive contract. Government practices to supervise and control the part-time hazelnut farmers for reducing the social cost of part-time farming should be beneficial in the research area. Putting into practice some administrative approaches such as prescribing the part-time farmers to reach direct government support or benefit farmers' education programs may also reduce the social cost of part-time farming. Tie the receipt of production support of the government or other benefits such as farmers' education programs etc., should comply with the living production area. Adjusting government support oriented to farmers having small hazelnut orchards according to the social cost of part-time farming may positively reduce social costs in the research area.

Since socially efficient output rate is reached when individual and external costs are considered in production decisions, the social cost of part-time farming and effects of part-time farming on land use should be considered by policymakers when designing the policy-related hazelnut production. Involving communities during the designing policy related to hazelnut production and implementing it may increase the impact and efficiency of the policy. Decision-makers should look for ways to make hazelnut farms consider external costs during the production process.

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