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The Effects of Subsidies on the Profitability of Dairy Cattle Farming in Türkiye

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ABSTRACT
The main purpose of this study is to investigate the impact of subsidies on dairy farm profits in Türkiye. To satisfy this objective, the Treatment Effect and Switching Regression models were used. The assessment may conclude that revenue will grow, decline, or remain unchanged. The sample size was determined as 662 by using the number of dairy cattle in the enterprises in 12 provinces and the stratified sampling method. In this study, the status of dairy cattle farms benefiting from subsidies, the socioeconomic factors affecting this level, and the effects of subsidies on the profit of the farms were analyzed. According to the results, 70.1% of dairy farms benefited from livestock subsidies. Moreover, farm size, cultivated area, forage area, lactation period, milk productivity, gross profit, and net profit have positive and statistically significant effects on livestock subsidies. According to the results of the treatment effect model, benefitting from farmers' support will increase farmers' revenue and profit. The benefits from livestock subsidies of farmers will increase the gross production value by approximately $8636.4. This is important for the sustainability of agricultural activity. The research findings will provide valuable information for the Ministry of Agriculture and Forestry, and policymakers.

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Türkiye'de Süt Sığırcılığında Uygulanan Desteklerin İşletme Kârlılığı Üzerine Olan Etkileri

ÖZET
Bu çalışmanın amacı Türkiye'de süt sığırcılığı yapan tarım işletmelerinde desteklemelerin üretici kârlılığı üzerine olası etkilerini ortaya koyaktır. Araştırmada yöntem olarak Muamele Etkileri ve Switching Regresyon Modelleri kullanılmıştır. Süt Sığırcılığında teşviklerin kullanılmasının işletme kârlılığını arttıracağı, azaltacağı veya değiştirmeyeceğinden yola çıkılmıştır. Bu amaçla 12 ildeki işletmelerde bulunan süt sığırı sayısı ve tabakalı örnekleme yöntemi kullanılarak önek büyüklüğü 662 olarak belirlenmiştir. İşletmelerin desteklerden yararlanma durumları, bu düzeye etki eden sosyoekonomik faktörler ve desteklerin işletme kârı üzerine olan etkileri analiz edilmiştir. Araştırma sonuçlarına göre, Anket yapılan işletmelerin %70,1'i süt sığırcılığında uygulanan desteklerden yararlanmaktadır. İşletme genişliği, toplam ekim alanı, yem bitkisi ekim alanı, laktasyon süresi, süt verimliliği, brüt kar ve net kar ile işletmelerin süt sığırcılığı desteklerinden yararlanmaları arasında pozitif ve istatistikî olarak önemli bir ilişki vardır. İşletmelerin desteklerden yararlanma durumu gayrisafi üretim değerini yararlanmadığı duruma göre yaklaşık 8636.4 $ civarında artıracaktır. Bu, tarımsal faaliyetlerin sürdürülebilirliği için önemlidir. Araştırma bulguları Tarım ve Orman Bakanlığı ve politika yapıcılar için değerli bilgiler sağlayacaktır.

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INTRODUCTION

Among the most important problems that societies encounter, a balanced diet, and adequate nutrition are major problems (Akbay & Ahmadzai, 2020; WHO, 2022). Dairy products play a significant role in meeting the daily protein needs of humans. Livestock farming is one of the sub-branches of farming that meets the basic needs of foodstuffs, notably meat, milk, and eggs, and has a significant role in the development of the countries.

Livestock farming is of particular importance in developing and developed countries. For instance, the ratio of the livestock sector to the total farming income is an average of 44.6% in the European Union (EU) and this ratio has increased to 70% in some EU countries. In Türkiye, livestock farming accounted for approximately 56% of the agricultural production value in 2020 (TÜİK, 2022).

In Türkiye, cow's milk constitutes 90.5% of the total milk production of 23 million tons. Despite a decrease in the number of dairy cattle in Türkiye, the number of native cattle breeds is decreasing, and cultured cattle breeds are increasing significantly. For example, while the share of culture breed ratio was only 10.6% in 1990, it increased to 49.4% in 2019 (TUİK, 2022).

Although the ratio of livestock to the gross domestic product is low, the importance of the sector continues to increase due to the strategic nature of animal products. Supporting the sector in Türkiye, both to enhance livestock and to raise the share of livestock in farming, is indispensable not only for adequate and balanced nutrition of the society but also for the surveillance of the population residing in rural regions.

Dairy farming is a significant sub-branch of livestock that contribute to national development in many ways. A significant part of people residing in rural areas earns their lives doing livestock farming activities. In Türkiye, among the most important problems of livestock, farms that are mostly small and scattered, low productivity rates compared to developed countries, inadequate lack of policy implementations and factors such as inadequate subsidization can be counted. Studies conducted in different regions regarding dairy cattle farms in Turkey show that there are structural problems in the sector. These structural problems mostly arise due to the financial difficulties of dairy farms. The solution to the problems will only be possible with the monetary incentives of the state, and the adoption of innovations in animal husbandry (Boz et al., 2011; Akbay & Akdoğan, 2022; Kılıç & Eryılmaz, 2020).

Among the most important livestock policies in EU are the spread of the cooperative system and the activities carried out mostly by organized farmers of livestock, sufficient production of forage, adequacy of product processing and storage facilities, the spread of animal product processing industry branches, and improving marketing opportunities for animal products. Since Türkiye is in the stage of membership to the EU, livestock should be supported by more rationalist and economic policies. In this context, Türkiye entered into negotiations with the EU on also farming, the effectiveness of policies that meets the demand in the livestock sector give importance to livestock animals' health, increase productivity and the income of the farms are indispensable should be analyzed.

The general objective of the subsidization policy was stated, as is expected, as "adequate nutrition of the population, increasing efficiency in farms, increasing income of animal breeders, reaching self-sufficiency in dairy foods and ensuring rural development." The share of total livestock support, 4.45% in 2002, increase to 30.0% in 2020 (Official Gazette, 2022). In Türkiye, to improve the conditions of the livestock sector that have recently become difficult, the Ministry of Agriculture and Forestry has developed some regulations and policies. Livestock support and subsidizations have been given to the dairy cattle farms for the purchase of culture breeding animals, to calves and crossbreeds that were born from artificial insemination, to the raw milk that has been produced, to the cattle in farms that are free from diseases, and to the cattle to which Brucellosis S-19 and alum vaccine were injected (Official Gazette, 2022). However, these subsidies have been paid under certain limitations and conditions. For instance, payments, which differ according to whether the rootstock cattle are registered to studbook or not, are made to the breeders that are registered to a completed parent livestock organization that is at the national level, that are registered to a database of animal identification system and studbook and pre studbook system (e-reclamation), which have at least five rootstock cattle that are culture breeds or crossbreeds.

In Türkiye, the majority of studies have been conducted on livestock policies and economic analyses of livestock farms. However, there are almost no studies on the effects of dairy subsidies on livestock farm income. In this regard, most previous studies have analyzed their separate impacts on the dairy sector using various types of data and econometric methods. These studies analyzed either the effects of subsidies on farm production, cost, revenue, and profit (e.g. Henningsen et al., 2011; Trnkova et al, 2012; Bezlipkina et al, 2001; Semerci & Celik, 2017) or technical and economic efficiency (Zhu et al., 2008; Latruffe et al., 2011; Vozarova & Kotulic, 2016; Ağır and Akbay, 2022). This study considers these two major developments simultaneously, enabling a more complete analysis of subsidy effects on dairy farm performance.

The main objective of our study is to analyze the effects

of subsidies on breeders' income, mainly on dairy livestock, and to research how to enhance its efficiency. With the data that will be derived from the research, the contributions are expected to provide an increase in the productivity and the breeders' income in livestock farming, notably the production incentives, and the applied livestock support, the strategies for effective farming policies on livestock subsidies are based on original data by presenting examples of the results. Considering the probable increase, decrease, or pegging of the profitability of the farmers using incentives, we used the treatment effect model (TEM) because of its known theoretical properties and popularity, which allows for comparisons with other studies. Since this model searches for the effects of incentives on the profitability of farmers on dairy livestock, and because it is the first in Türkiye and since there are no known studies, this paper will provide significant contributions.

MATERIAL and METOD

The main material of this study is composed of data derived from a survey of dairy cattle farms in 2014. The research was carried out in 12 different located provinces (Balıkesir, Adana, Konya, Sivas, Erzurum, Malatya, Şanlıurfa, Samsun, Tekirdağ and Ankara) that were chosen considering the number of cattle. At least three districts were chosen in those provinces, considering the benchmarks of their capacity to represent the province in terms of livestock, socio-economic characteristics, and agricultural potential. In these districts, at least three villages were chosen considering the same benchmarks. After determining the villages in the research, dairy farmers were selected. In the determination of the farmers, the number of cows, heifers, female calves, and calves was obtained from Cattle Breeders Association (CBA). The base number of cows was determined as at least five. The appropriate sample size was determined using the stratified random sampling method (Yamane, 2001):

$$n = \frac{\sum (N_h S)^2}{N^2 D^2 + \sum N_h S_h^2}, \qquad D^2 = \frac{e^2}{t^2} \qquad (1)$$

where n is the sample size; N is the number of farmers in the population; N_h = Number of units in the h^{th} strata for h =1,…,5; S_h = Standard deviation in the h^{th} strata; e = Percentage error allowed by the average of the population; t = t-table value corresponding to the allowed confidence interval. In the sample, 5% errors and 95% confidence intervals were considered. To achieve the targeted objectives of this study, the sample size was determined to be 662 by considering the rate of distribution in the provinces. The number of samples in each stratum (n_h) is determined by the following formula:

$$n_h = \frac{N_h}{\sum N_h} * n \qquad (2)$$

According to the formula, 27.9% of the holdings are in <10 farm size group, 54.6% are in the group with 10-30 animals, and 27.9% are in the >30 farm size group. In a way to represent the production regions and taking into account the total number of animals in the provinces, surveys were conducted with 87 farmers from Konya, 90 from Erzurum, 79 from Balıkesir, 85 from İzmir, 73 from Sivas, 44 from Adana, 50 from Samsun, 34 from Denizli, 36 from Ankara, 28 from Tekirdağ, 29 from Şanlıurfa, and 27 from Malatya province. To gather better information from questionnaire forms, some support was received from experienced, leader farmers who are trusted and well known among the farmers. Besides, the increase in the reliability and intelligibility of the survey, misunderstood and open-ended questions were corrected by conducting a preliminary survey.

In this study, considering the probable increase, decrease, or pegging of farmers' profitability by using support for livestock (Chandel et al., 2019), a TEM was developed. Our statistical model includes two variables: Profit variable (y) with a continuous feature and government incentive variable (d) with a binary selection feature. Due to the impossibility of being present in both cases, the farmer either receives or does not receive animal support. The possible net profit or gross revenue is unknown when the farmer does not benefit from the state-aid animal subsidy program. In this case, as a solution, such a gap was filled by selecting farmers with the same characteristics but not receiving animal support to create a match to the net profit or gross revenue, which would have been the case if the farmer had not benefited from animal support. To consider empirical details, suppose we are comparing the effect of an endogenously determined variable, or binary variable, in combination with other factors, on the dependent variable 'y', the profit variable:

$$y = x'\beta + \gamma d - v \qquad (3)$$

Where 'd' was determined by the stochastic binary probit function as:

$$\begin{aligned} d &= 1 \;\; if \;\; z'\alpha - u > 0 \\ &= 0 \;\; if \;\; z'\alpha - u \le 0. \end{aligned} \qquad (4)$$

In equations (3) and (4), x and z respectively represent the vector of exogenous variables, β and a sets are estimated parameter vectors corresponding to the factor sets x and z and γ is the scale parameter that captures the effect of an incentive program. v and u are disturbance terms and their average is 0, their standard deviations are (σ, 1) with their linear correlation (ρ), all being independently and normally

distributed. The model stated in equations (3)-(4) is known as the TEM. The intention of 'treatment' conveys the incentives or subsidies program applied to the farmers by the Ministry of Agriculture and Forestry. In other words, it evaluated the possible effects of an incentive program on farmers' profits. This model has been expanded with different studies and ways. The most common use of it is the switching regression model (SRM) (Barnow et al., 1980; Angrist, 2001; Greene, 2012; Heckman et al., 2003; Kasteridis & Yen, 2012; Maddala, 1986; Rosenbaum and Rubin, 1983):

$$\begin{aligned} y_1 &= x'\beta_1 + \gamma - v_1 \quad \text{if } d=1 \quad (\text{or if } u < z'\alpha) \\ y_0 &= x'\beta_0 - v_0 \quad \text{if } d=0 \quad (\text{or if } u < z'\alpha), \end{aligned} \tag{5}$$

Here y_1 and y_0 represent the farm's profit in the presence and absence of the agricultural subsidy program, respectively, while β_1 and β_0 respectively represent the estimated coefficient vectors related to the benefits from incentives (d = 1) and without incentives (d = 0). The three-variable average of the error terms (v_1, v_0, u) is zero and the standard deviations corresponding to them are $\sigma_1, \sigma_0, 1$ with the normally distributed variance-covariance matrix as:

$$\begin{pmatrix} v_1 \\ v_0 \\ u \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}\begin{pmatrix} \sigma_1^2 & 0 & \rho_{1u}\sigma_1 \\ 0 & \sigma_0^2 & \rho_{0u}\sigma_0 \\ \rho_{1u}\sigma_1 & \rho_{0u}\sigma_0 & 1 \end{pmatrix}\right] \tag{6}$$

The covariance between v_1 and v_0 is assumed to be equal to zero since it is impossible for the farmer to benefit from and not benefit from animal support at the same time. The certain discrimination in the model conveys only one condition out of the two cases. ρ_{1u} and ρ_{0u} terms respectively give the correlation between v_j (j=1,0) and u.

Besides, if $\beta_1 = \beta_0$, $\sigma_1 = \sigma_0$, and $\rho_{1u} = \rho_{0u}$ coefficient restrictions were transferred into the practice of equation, SRM was degraded to TEM which was indicated in equations (3) and (4). Two staged estimation method (Maddala, 1999) creates consistent but insufficient estimations. We have applied a more efficient (full information) maximum likelihood technique. This does not require a covariance matrix to be corrected, more importantly, it enables ρ_{1u} and ρ_{0u} to be estimated simultaneously, which is impossible for a correlation coefficient in a two-stage estimation method.

The log-maximum likelihood function for SRM is as follows:

$$\begin{aligned} L &= \prod_{d=1}\int_{-\infty}^{z'\alpha} f(y_1 - x'\beta_1 - \gamma, u)du \prod_{d=0}\int_{z'\alpha}^{\infty} f(y_0 - x'\beta_0, u)du \\ &= \prod_{d=1}\frac{1}{\sigma_1}\phi\left(\frac{y_1 - x'\beta_1 - \gamma}{\sigma_1}\right)\Phi\left[\frac{z'\alpha + \rho_{1u}(y_1 - x'\beta_1 - \gamma)/\sigma_1}{(1-\rho_{1u}^2)^{1/2}}\right] \\ &\quad \times \prod_{d=0}\frac{1}{\sigma_0}\phi\left(\frac{y_0 - x'\beta_0}{\sigma_0}\right)\Phi\left[-\frac{z'\alpha + \rho_{0u}(y_0 - x'\beta_0)/\sigma_0}{(1-\rho_{0u}^2)^{1/2}}\right], \end{aligned} \tag{7}$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ symbolize the probability density function (PDF) and cumulative distribution function (CDF). When $\beta_1 = \beta_0$, $\sigma_1 = \sigma_0$, and $\rho_{1u} = \rho_{0u}$ parametric constraints are put into practice in equation 7, the maximum likelihood function for TEM will be derived. Whether SRM outperforms TEM in terms of fit to data can be calculated with the help of three conventional tests (Wald, Lagrange Multiplier, and Likelihood Ratio). The expected profit of the farmer when benefiting from agricultural incentives (regime 1) and not (regime 2) is as follows:

$$\begin{aligned} E(y_1 \mid d=1) &= x'\beta_1 + \gamma - E(v_1 \mid u < z'\alpha) \\ &= x'\beta_1 + \gamma + \rho_{1u}\sigma_1\frac{\phi(z'\alpha)}{\Phi(z'\alpha)} \end{aligned} \tag{8}$$

$$\begin{aligned} E(y_0 \mid d=0) &= x'\beta_0 - E(v_0 \mid u \geq z'\alpha) \\ &= x'\beta_0 - \rho_{0u}\sigma_0\frac{\phi(z'\alpha)}{1-\Phi(z'\alpha)}. \end{aligned}$$

Treatment effects can be derived from both SRM and TEM models. Primarily, Treatment Effect (TE) on farm profits depends on incentive use for the SRM model is indicated in the following equation:

$$\begin{aligned} TE &= E(y_1 \mid d=1) - E(y_0 \mid d=0) \\ &= \left(x'\beta_1 + \gamma + \rho_{1u}\sigma_1\frac{\phi(z'\alpha)}{\Phi(z'\alpha)}\right) - \left(x'\beta_0 - \rho_{0u}\sigma_0\frac{\phi(z'\alpha)}{1-\Phi(z'\alpha)}\right), \end{aligned} \tag{9}$$

It equals the difference in the expectation of profit between the use and disuse of agricultural supports. Average Treatment Effect (ATE) and Treatment Effect on the Treated (ATT) are indicated, respectively:

$$ATE = x'\beta_1 - x'\beta_0 = (\beta_1 - \beta_0)'x$$

$$\begin{aligned} ATT &= E(y_1 \mid d=1) - E(y_0 \mid d=1) \\ &= \left(x'\beta_1 + \rho_{1u}\sigma_1\frac{\phi(z'\alpha)}{\Phi(z'\alpha)}\right) - \left(x'\beta_0 + \rho_{0u}\sigma_0\frac{\phi(z'\alpha)}{\Phi(z'\alpha)}\right) \\ &= ATE + (\rho_{1u}\sigma_1 - \rho_{0u}\sigma_0)\frac{\phi(z'\alpha)}{\Phi(z'\alpha)}. \end{aligned} \tag{10}$$

ATT is the difference between the variable of profit when the farm received the incentive and the profit the farm would have had if it had received the incentive. The effects of the incentive program on untreated farmers' profit can be derived similarly, as well. The treatment effect is shown as follows:

$$TE = E(y \mid d=1, x, z) - E(y \mid d=0, x, z)$$
$$= \gamma + \rho\sigma \frac{\phi(z'\alpha)}{\Phi(z'\alpha)} - \rho\sigma \frac{-\phi(z'\alpha)}{1-\Phi(z'\alpha)}$$
$$= \gamma + \rho\sigma \left\{ \frac{\phi(z'\alpha)}{\Phi(z'\alpha)[1-\Phi(z'\alpha)]} \right\}. \quad (11)$$

Providing that the correlation coefficient is ρ = 0, the treatment effect equals 'γ'. This outcome corresponds with the average treatment effect. On the other hand, ATT is the difference between the treated farms' average profit and the ordinary profit of those farms on the condition of being untreated. This is simply equal to $\gamma + 2\rho\sigma\phi(z'\alpha)/\Phi(z'\alpha)$.

The MAF naturally connects a treatment to the presence of another program. For example, for farmers to get the incentive for a calf born from artificial insemination, they must have the Brucellosis S-19 vaccine injected into their female livestock. Under such a condition, the effects of sequential treatment on farm profit are derived according to a similar event. Here, the socio-demographic factors of both farms and farmers (education, age, gender, marital status, number of livestock, territory, distance from city center, milking system, other agricultural or non-agricultural activities, loan usage, number of years of treatment etc.) are included. The factors affecting treatment will be derived similarly and not let the identification problem between the two variables occur; some variables will be excluded in only one model, and vice versa. To prevent a probable bias, the variance in the prices affecting the profit in terms of input, output, and local differences will be considered.

Incentives, which are among the integrative aims of the research, to analyze the effects of treatments on producers' profits, primarily the cost of milk, increase in the productive value of the stock (PVS), and the value of gross output and net profit need to be calculated.

The gross output value is calculated by multiplying of the amount of produced milk and milk prices that producers obtain and with the addition of PVS and fertilizer income. PVS will be determined by extracting the value of herd at the beginning of the year and the value of purchased animals from the end of year herd value, the value of sold animals, and the total value of animals.

Gross profit is the gross output value minus variable expenditures and net profit is calculated by subtracting production expenditures from gross output value (Karagölge, 1996). Expense items related to milk costs are classified as fixed and variable costs (Kıral et al., 1999). The variable cost of milk production consists of forage cost, occupational rate, salt, veterinary and medicine, insurance, artificial insemination, electricity, water, bearing, and cleaning material costs. Fixed costs consist of the family and permanent labor force, general administrative expenses, amortization, and capital interest costs.

RESULTS and DISCUSSION

To analyze the effects of incentives on dairy cattle farming in terms of productivity, gross production value, and net profit, TEM and SRM were both used. According to the results, the average age of the farmers who engaged in dairy farming was 45.9 years old, the majority of farmers (66.2%) had primary education, and the average household size was 5.2 persons (Table 1). Moreover, the variance inflation factor indicated that there was no multicollinearity between the independent variables.

In the first stage, the gross production value equation is analyzed. Here, primarily the TEM equation outcomes and later the SRM equation outcomes will be discussed. To eliminate the endogeneity problem in the probability of obtaining an animal support equation and gross production value or net profit equations, some significant variables were included in the probability of getting dairy cattle subsidies but excluded from the outcome (e.g., net profit). Similarly, while some variables were included in the value of gross output or net profit variable equations, they were excluded from the equation of the decision to have dairy cattle incentives. This attitude is considered a solution to the problem of endogeneity.

According to the analysis outcomes in the TEM (Table 2), after the controlling explanatory variables in the system, the effect of uncontrolled factors affecting the relationship between the decision to receive subsidies from the state and the gross production value is very strong and positive. In this context, in the variable of the probability of getting animal incentives, one standard deviation change, and in the variable of total revenue, it will move along with an approximately 0.97 standard deviation change ($p<0.01$) or vice versa.

Whether the correlation coefficient in The TEM is zero or not, in other words, the basic hypothesis (shortage) alleges there is no linear relationship between the equation of the likelihood to get animal incentives and the equation of the gross output value should be tested. In this context, against the theorem in a basic hypothesis that alleges there is not a simultaneous relationship between the equations should be tested. The likelihood ratio test (LR) was adapted by considering the two-stage model considering zero correlation coefficient (ρ) and the simultaneous model considering a set of correlation relationships:

LR = - 2*(LL-probit + LL-selection – LL-simultaneous selection)

where, LL-probit is the log-likelihood function value that measures the equation of likelihood of getting animal incentives and belongs to the independent

probit model, LL-Selection is an independent ordinary least squares method that also contains variable of inverse mill ratio, or log-likelihood function value in the equation of gross output, that can be measured by the maximum likelihood method, and LL simultaneous selection contains the log-likelihood function value in simultaneous TEM. The LR test value was calculated as 76.74 and was found to be statistically significant ($p<0.05$), supporting the simultaneous determination of both equations.

Table 1. Descriptive statistics for variables on the model
Çizelge 1. Modeldeki değişkenlere ait tanımlayıcı istatitikler

Variables	Unit	Mean	Std. dev.	VIF
Total revenue	TL/1000	111.877	88.105	---
Benefit status from animal supports	If benefits 1, otherwise 0	0.684	0.465	---
Total amount of support	TL/1000	4.882	6.206	---
Secondary school graduate	Middle school graduate 1; otherwise 0	0.172	0.378	1.289
High school graduate farmer	High school graduate 1; otherwise 0	0.166	0.372	1.366
University graduate farmer	University graduate 1; otherwise 0	0.041	0.199	1.202
Household size	Number	5.235	2.192	1.171
Age of farmers	Year	45.940	11.861	1.406
Membership status to CBA	A member of the DSBY 1; otherwise 0	0.507	0.500	1.667
Cooperative membership status	a co-operative member 1; otherwise 0	0.879	0.326	1.544
Having record system in farms	Have record system 1; otherwise 0	0.906	0.293	1.331
Input-output recording status	Keep input-output records 1; otherwise 0	0.156	0.363	1.245
Stud book recording status	Farm records stud book 1; otherwise 0	0.533	0.499	1.191
Barn type	Farm has off-barn 1; otherwise 0	0.172	0.378	1.244
Milking type	Milking through machinery 1; otherwise 0	0.763	0.425	1.757
Producing silage in farm	Farms produce silage 1; otherwise 0	0.522	0.500	2.026
Having culture breeding in farm	Having culture breeding 1; otherwise 0	0.801	0.399	2.556
Having cross breeding in farm	Having cross breeding in farm 1; otherwise 0	0.030	0.170	1.241
Aegean	Farm is in the Aegean region 1; otherwise 0	0.180	0.385	1.782
Mediterranean	Mediterranean region 1; otherwise 0	0.061	0.240	1.475
Central anatolia	Central Anatolia region 1; otherwise 0	0.161	0.367	1.649
Southeastern anatolia	Southeastern Anatolia region 1; otherwise 0	0.084	0.278	1.618
East anatolia	East Anatolia region 1; otherwise 0	0.265	0.442	3.080
Farm size (= 0)	Farm without agricultural land 1, otherwise 0	0.066	0.249	2.095
Farm size (0 – 100)	Less than 100 decare 1, otherwise 0	0.614	0.487	1.174
Farm size (101 – 250)	Between 101-250 decare 1, otherwise 0	0.245	0.430	1.805
Numbers of animal (10 – 30)	Have animals between 10-30 1, otherwise 0	0.556	0.497	3.461
Numbers of animal (> 30)	Have animals bigger than 30 1, otherwise 0	0.175	0.381	2.753
Milking animal share	Share of milking animal in total livestock (%)	0.666	0.167	1.593
Farmers that grows feed crops	If farmer grows feed crops 1, otherwise 0	0.589	0.492	1.972

*: 1 US$= 2.2 TL

When the factors that affect the likelihood of getting animal incentives are viewed from a statistical perspective, compared to the farmers with elementary school degree and those who are either illiterate or literate but without an elementary school degree, the farmers who are middle school, high school and college graduates have an increasing ratio of using incentives; however, only college graduates are statistically significant ($p<0.05$). Farmers who are members of the breeding cattle cooperative have an increased likelihood of using incentives compared to non-cooperative members ($p<0.001$). In another similar situation, farmers who are members of any cooperative compared to those who are non-cooperative members are more likely to use incentives; however, the increase is not statistically significant.

In farms, although income and pedigree holders are more likely to use animal incentives than those who do not, both variables are not statistically significant. Similarly, the likelihood of off-barn-type farms' benefitting from animal incentives has been increasing compared to the open barn-type farms ($p<0.10$). The off-barn-type farms operate more organized based on intensive technology and labor and are more willing to receive the incentives than the open barn-type farms. On the other hand, farms that carry out milking through machinery are more likely to increase the use of incentives rather than farms that carry out milking conventionally by hand ($p<0.05$). Machinery milking

farms are known as technology-intensive farms and their level of knowledge about the environment is more sensitive than other farms, therefore it is assumed that they are more likely to benefit from government-led incentives.

Table 2. Maximum likelihood parameters of treatment effect model for total revenue
Çizelge 2. Toplam hasılat için muamele etki modelinin en yüksek olabilirlik parametre değerleri

Variable	Probability of receiving animal support		Total revenues	
	Parameter	t-value	Parameter	t-value
Constant	-0.4064	-0.54	38.4049*	1.82
Secondary school graduate farmer	0.4479	1.49	19.7682***	3.10
High school graduate farmer	0.3272	1.27	8.2112	1.18
University graduate farmer	0.9685**	2.28	18.3062*	1.87
Household size	0.0100	0.21	-0.9091	-0.93
Age of farmers	-0.0041	-0.50	0.0893	0.43
Membership status to CBA	1.0561***	4.97	35.8772***	6.64
Cooperative membership status	0.4387	1.39	18.8487*	1.70
Having record system in farms	-0.2619	-0.83	0.1474	0.01
Input-output recording status	0.2909	1.07	8.4411	1.40
Stud book recording status	0.0883	0.49	9.1412*	1.88
Barn type	0.5251*	1.69	3.8131	0.58
Milking type	0.5419**	2.31	21.1155***	2.64
Producing silage in farm	0.3606	1.43	18.5260***	2.96
Having culture breeding in farm	0.7064**	2.08	26.0593**	2.34
Having cross breeding in farm	1.0361**	2.21	26.7292	1.50
Aegean	-0.4734	-1.49	5.8183	0.84
Mediterranean	-1.1639	-1.24	-25.5407**	-2.26
Central Anatolia	-0.5647*	-1.65	0.3261	0.05
Southeastern Anatolia	-1.1139***	-3.95	-41.4253***	-4.2
East Anatolia	-0.9045***	-3.50	-37.1412***	-3.87
Farm size (= 0)	-0.1563	-0.24	-7.6948	-0.55
Farm size (0 – 100)	----	----	-13.7026*	-1.90
Farm size (101 – 250)	----	----	-12.3636*	-1.76
Numbers of animal (10 – 30)	----	----	41.0207***	7.42
Numbers of animal (> 30)	----	----	158.0910***	26.88
Milking animal share	-0.4999	-1.31	----	----
Farmers that grows feed crops	0.2645*	1.67	----	----
Farm receiving animal support (d = 1)			-66.6801***	-11.97
σ		49.4978***	33.16	
ρ_{12}		0.9741***	50.44	
Log Likelihood value		-3298.4285		

Note: *, ** and *** show statistically important variables at %10, %5 and %1 level.

Farms having culture and cross-breeding livestock are of an increasing likelihood to use incentives rather than the farms having the native race of livestock ($p<0.05$). Farms having native race have the characteristics of a temporary income for the family; on the other hand, because of having the other two races of livestock and carrying out the production intended for the market, the likelihood of them using the incentives will increase gradually.

The likelihood of using animal incentives is seen to have been low in regions compared to Marmara and Black sea regions. Thus, in the two base regions, more modern agricultural livestock activities have been carried out, and because they are informed about the incentives individually, they are highly likely to use animal incentives.

Agricultural farms that breed forage plants are highly likely to receive animal incentives compared those that do not ($p<0.1$). Farms breeding forage plants are of a high likelihood of producing animal foods compared to the ones which do not, and thus, they will have an increased likelihood of benefitting from such incentives. Such results are in agreement with those of Erdal et al. (2020) and Isık et al. (2009). Erdal et al. (2020) showed that increasing farm size, education and age of the farmers increased the likelihood of using incentives. Isık et al. (2009) found having culture breeds, growing feed crops, membership status to unions or cooperatives, and education of farmers affected the livestock support utilization level positively, while the farmer's age affected negatively.

When the factors affecting the value of gross output are viewed in the TEM (Table 3), the farmers who are middle school, high school and college graduates have

more total income compared to the elementary school or lower degree farmers ($p<0.05$). The total revenue of farms that are members of the CBA has increased compared to nonmembers. Thus, farm members of both cooperative types have increased their total income by sharing and using the information obtained from the associations personally or synergistically. In agricultural farms, those that keep a record of studbook have more income than those that do not ($p<0.05$).

Table 3. Parameters value of the mazimum likelihood function for the switching regression model for the total revenue

Çizelge 3. Toplam hasılat için giden/kalan manevra modeline ilişkin en yüksek olabilirlik fonksiyonun parametre değerleri

	Prob. of receiving animal support		Total revenue when d=1		Total revenue when d=0	
Variable	Parameter	t-value	Parameter	t-value	Parameter	t-value
Constant	-1.054	-1.19	-99.835***	-2.63	34.916**	2.26
Secondary school graduate	0.464	1.56	18.695**	2.34	7.868	1.55
High school graduate farmer	0.440	1.32	7.210	0.82	-2.571	-0.43
University graduate farmer	0.952**	2.12	27.730*	1.94	-16.888*	-1.93
Household size	0.009	0.23	-1.342	-1.00	-0.437	-0.70
Age of farmers	-0.009	-1.04	0.146	0.54	-0.019	-0.11
Membership status to CBA	1.009***	4.47	31.260***	4.03	-3.355	-0.37
Cooperative membership status	0.974***	3.01	54.929*	1.90	5.029	1.06
Having record system in farms	-0.125	-0.42	11.150	0.55	-1.343	-0.25
Input-output recording status	-0.047	-0.16	8.880	1.15	-0.942	-0.14
Stud book recording status	0.253	1.13	9.769	1.56	6.747*	1.94
Barn type	0.652	1.46	2.099	0.28	-0.558	-0.02
Milking type	0.567**	2.24	26.897**	2.08	10.455***	2.73
Producing silage in farm	0.437	1.56	14.950*	1.71	2.410	0.50
Having culture breeding	1.191***	3.41	44.847**	2.46	7.021	1.25
Having cross breeding in farm	1.538***	2.63	23.121	0.99	14.883*	1.89
Aegean	-0.383	-1.09	5.201	0.61	9.084	0.96
Mediterranean	-1.280***	-2.61	-24.877	-1.62	7.5866	0.70
Central Anatolia	-0.646	-1.56	0.479	0.06	6.390	0.62
Southeastern Anatolia	-1.349	-3.19	-35.568**	-2.44	1.006	0.11
East Anatolia	-0.751**	-2.42	-39.464***	-2.96	0.503	0.06
Farm size (= 0)	-0.063	-0.13	-11.185	-0.59	-7.108	-0.73
Farm size (0 – 100)	----	----	-11.777	-1.11	-14.867**	-2.27
Farm size (101 – 250)	----	----	-11.348	-1.15	-10.551	-1.63
Numbers of animal (10 – 30)	----	----	44.227***	5.51	29.842***	7.87
Numbers of animal (> 30)	----	----	177.961***	21.48	90.124***	19.82
Milking animal share	-1.131*	-1,90	----	----	----	----
Farmers that grows feed crops	0.251	1,12	----	----	----	----
σ_0		17.34***			14.76	
ρ_0		-0.15			-0.28	
σ_1		52.24***			25.85	
ρ_1		0.93***			19.58	
Log Likelihood value				-3185.601		

Note: *, ** and *** show statistically important variables at %10, %5 and %1 level.

In agricultural farms, machinery milking increases the total revenue, and in farms that make their silage, we can say that they have more agricultural income than those that do not. The process of making silage can be assumed an opportunity cost. The farms that carry out such activities compared to those that do not, make a more rational time selection, and thus save time and have a high likelihood of increasing economic profit and agricultural income. As expected, the number of farms that have culture and crossbreed livestock is more than the ones that have a native race of livestock ($p<0.05$). Agricultural livestock farms that operate in the Marmara and Black Sea regions have more agricultural income compared to those that operate in the Mediterranean, Southeast, and Eastern Anatolian regions($p<0.05$).

The dairy farms that are between the size of fewer than 250 decares (da) have been found to have less income compared to those that are larger than 250 da. As the size of the farm increases, the total agricultural income

correspondingly increases. Similarly, as the number of livestock increases, the total income increases correspondingly ($p<0.05$). However, the size of agricultural land and the variables of livestock existence fail to determine which farms are technically and economically more efficient. As technical and economic effectiveness show different approaches, they were excluded from our study. On the other hand, although it was mentioned that the treated farms have more agricultural income compared to those that have not used animal incentives, it cannot provide certain information about whether the monetary amount of the treatment will be positive or negative. Such an outcome can only be achieved by measuring the effect of the treatment.

For the equation of value of gross output, before the effects of the SRM model are mentioned, a simultaneous equation needs to be tested to determine whether it is suitable for the data. In the simultaneous equation system, three variables (likelihood of getting animal incentives, value of gross output of the farms that received the incentives, and the value of gross output of the farms that did not get the incentives) are included in an equation system, against the hypothesis that the likelihood of getting the animal incentives equation is in a relationship with one of the variables of gross output value, which consists of testing the basic hypothesis suggesting the absence of such a relationship. To carry out this test, Wald test statistics were used. The Wald test statistic value was calculated as 33.88 and statistically significant ($p<0.001$). Thus, the simultaneous measurement of the three equations, in terms of being undeviating, consistent, and having the minimum variance, is of great importance.

When the cross-correlation coefficient between treated and untreated farms is viewed in terms of the variables of gross output value and the equation of likelihood of receiving livestock incentives (Table 3), although there is a linear negative relationship between the likelihood of getting livestock incentives and the gross output value of untreated farms, this relationship is statistically important. On the other hand, contrary to this, there is a positive force (0.93) and linear and statically significant relationship between the variable of gross output of the farmers benefitting from agricultural incentives and the variable of the likelihood of getting livestock incentives. This positive linear relationship confirms the correlation coefficient in the TEM. Thus, there will be a linear relationship in the same direction and force among the uncontrollable factors, a change in a dependent variable, and

the other dependent variables in the system.

The directions of factors in the SRM model for gross output value are viewed in Table 3. We can see similar outcomes in the likelihood model as in the probit model in the TEM. Farmers with college degrees, a member of CBAs, and members of any agricultural cooperative increase their chances to benefit from livestock incentives. On the other hand, raising livestock in indoor places, carrying out milking through machinery and agricultural animal farms having culture and cross-breeding race are more likely to benefit from livestock incentives provided by the state compared to farmers who do not have such qualities. Meanwhile, agricultural and livestock farms operating in the Marmara and Black sea regions are more advantageous in terms of using incentives than those operating in other regions. The farms operating in the Mediterranean and Eastern Anatolia regions as well as having a lower likelihood of benefiting from the incentives compared to the underlying regions, the coefficients related to these regions were found to be statistically different from zero.

As the number of milking livestock out of the total animals increases, the state of the likelihood of benefitting from the incentives decreases. Probably, the increase in the number of milking livestock deprives other kinds of animals of incentives and decreases the likelihood of getting livestock incentives. On the other hand, when the factors effecting on total income of treated farms are viewed, we can see that middle school, high school or college degree farmers have more income than the underlying ones. As the labor force increases, the total agricultural income of treated farmers also increases. Moreover, being a member of the CBA or of any agricultural association increases in total income. The treated farms carry out milking through machinery have an advantage in terms of agricultural income compared to those carrying out milking conventionally. Similarly, the treated farms making their silage, compared to those deprived of such activities, are advantageous in terms of total income. The treated farms having culture breed race, compared to the treated ones having the native race, have more agricultural income in total.

Farms operating agricultural livestock in the Marmara and Black Sea regions have more income in total than those similar ones in other regions of our country. The treated farms operating in Eastern and Southeastern Anatolia regions, compared to the underlying regions, have statistically less agricultural income. While most of the farms operating in both regions carry out production extensively, in other words, in a primitive and labor-intensive manufacturing way, in the underlying region, technology-intensive manufacturing is in question. In parallel with the increase in cultivation area and the number of cattle, the income of the farms increased. As expected, as the cultivation area and the number of livestock increased, the total income of treated farmers also increased. When the factors that affect the total income of the untreated farms are viewed, the increasing level of education decreases the total agricultural income. Thus, because the opportunity

cost of education is high in such farms, we can say that an increasing level of education uses the labor force in other activities. It can be inferred from this that the farm members of CBA provide less income compared to the non-member farms. Despite this, the total income of farmers keeping records of studbooks or having indoor barns increase, and the untreated farms having cross-breeding races have more agricultural income compared to the untreated ones having native race of livestock.

As increasing farm size leads to a decrease in the total income of untreated farms, the increase in the number of total livestock increases the income of the farmers in this group. The parameter coefficients were statistically significant in terms of increasing agricultural territory and the number of livestock. These results are in agreement with those of Bezlepkina et al. (2005), Barnes (2006), Ooms & Peerlings (2005), McCloud & Kumbhakar (2008), D'Antoni & Mishra (2011), Sandika (2011), Zhu et al. (2008 and 2012), Terin et al. (2022).

We now will examine the treatment effect, average treatment effect and the effects of the treatment and average treatment effects on the farms benefitting from agricultural incentives through both the value of gross output and the variables of net profit. The effects on the variables of the value of the gross output of the three treatments are given in Table 4. The approximate amount of treatment effect in the TEM was calculated as 18987 Turkish Lira (TL) and the monetary value was found to be statistically significant. Thus, the state benefits from the incentives will increase gross output approximately by 19000 TL. Thus, when agricultural incentives are considered as an element of financial improvement of farms, it is important to maintain the consistency of agricultural activities in terms of sustainability.

Çizelge 4. Toplam hasılat için muamele, ortalama ve muamele görenler üzerindeki etki miktarları
Table 4. Treatment effect, average treatment effect, and amount of effects on the treated for total revenue

Variables	Treatment Effect Model		Mover/Stayer Switching Model	
	Parameter	t-test	Parameter	t-test
TE	18.987***	8.40	80.498***	13.00
ATE	----	----	6.131	0.43
TTE	----	----	26.768*	1.89

Note: *, ** and *** show statistically important variables at %10, %5 and %1 level.

All the indications related to the net profit variable are presented in Tables 5 and 6. Similar results were also obtained. According to the test results, in the TEM, two dependent variables should be discussed simultaneously and three dependent variables in the mover/stayer SRM, parameter values should be obtained in a similar way and the indication that the three variables in a system should be solved simultaneously. The LR test in the TEM was calculated as 33.05 and Wald test statistics in mover/stayer switching model was calculated as 472.07, and the values were found to be statistically significant.

Since the indicators related to the coefficient of dependent variables show similarities to the indicators in gross output value, they will not be suggested here again. Independent value of gross output in both the TEM and Mover/Stayer SRM, contrary to the variable, we can say that it has a limited effect on the net profit. Maybe the biggest reason for this is that if some farms being in loss are considered, since the net profit shows a difference, we can say that it originates from the system deprived of the factors able to reach the variables of the size of the loss.

On the other hand, the amount in the three-treatment effect was found approximately four times more than the amount in the TEM. The value in the SRM stems from the triple regime forecast. This value was 80498 TL and statically significant. The value for the average treatment effect was calculated as 6131 TL, however, this was not found to be statically significant. Thus, although incentives increase average income, it is not at the targeted level. Farmers should be supported by reconstruction and varying incentives. In addition, when we consider the effect of treatment on the farmers that benefit from the incentives, livestock incentives, in this group, increase the gross output value by approximately 26768 TL and this value is statistically significant. Untreated farmers should be informed and encouraged about using the incentives, and the place and importance of sustainability of animal production incentives are of high importance to be relayed to farmers by related institutions.

The effects of treatments on net profit are given in Table 7. Primarily, the point to be considered here is that net profit consists of both positive and negative values. The amount of treatment in the TEM was similar to the amount of treatment in gross output. The amount of treatment in the mover/stayer switching regression model was calculated as approximately half the amount of gross output value. This is based on the excessive variability of net profit and being exposed to negative observations. This value, amounting to 39369 TL, was statistically significant. Thus, the total effect of incentives on net profits was found to be positive and significant. In contrast, the average treatment effect was negative and statistically insignificant. Similarly,

the effect of treatment on the net profit of the farmers relatively used the incentives was found to be 18761 TL but statistically insignificant. Although these findings differ from some published studies (Zhu et al., 2012; Latruffe et al., 2017; Garrone et al., 2018; Zhu et al., 2012), they are consistent with those of Hadley (2006) and Bezlepkina ve ark. (2005). Latruffe et al. (2017) found a negative association between subsidies and technical efficiency in Belgium and the United Kingdom, and a positive relationship between Spain and Portugal. Zhu et al (2008 and 2012) showed that while the subsidies provided within the scope of the EU Common Agricultural Policy negatively affected the technical efficiency of dairy cattle farms in Germany and the Netherlands, they did not have a statistically significant effect in Sweden. While the subsidies given to Dutch farms increased their competitiveness, it had a positive effect on the increase of technology levels of dairy farms in Germany and Sweden. Garrone et al. (2018) and Zhu et al. (2012) report subsidies may reduce productivity and income. On the other hand, McCloud & Kumbhakar (2008) found that subsidies positively affected productivity and increased technical efficiency in dairy farms in Denmark, Finland, and Sweden.

Çizelge 5. Net kar için muamele etki modelinin en yüksek olabilirlik parametre değerleri
Table 5. The maximum likelihood parameter values of the treatment effect model for net profit

Variable	Probability of receiving animal support		Net profit	
	Parameter	t-value	Parameter	t-value
Constant	-1.211	-1.47	19.641	0.83
Secondary school graduate farmer	0.404	1.60	4.384	0.68
High school graduate farmer	0.429	1.41	4.939	0.64
University graduate farmer	1.349***	3.48	20.698*	1.81
Household size	0.027	0.70	0.144	0.15
Age of farmers	-0.002	-0.20	-0.034	-0.14
Membership status to DSYB	1.014***	4.83	23.436***	3.30
Cooperative membership status	0.699**	2.47	21.144	1.37
Having record system in farms	-0.251	-0.89	-5.231	-0.50
Input-output recording status	-0.060	-0.19	-0.801	-0.13
Stud book recording status	0.391**	2.08	8.219	1.60
Barn type	0.673**	2.23	-5.012	-0.74
Milking type	0.382	1.62	12.306	1.04
Producing silage in farm	0.555**	2.56	11.100	1.53
Having culture breeding in farm	0.861**	2.52	19.144	1.31
Having cross breeding in farm	0.900	1.51	9.873	0.45
Aegean	-0.204	-0.57	0.121	0.02
Mediterranean	-1.216**	-2.40	-26.425*	-1.78
Central Anatolia	-0.288	-0.90	-4.648	-0.69
Southeastern Anatolia	-1.108***	-2.94	-30.419***	-2.80
East Anatolia	-0.784***	-2.71	-22.905*	-1.73
Farm size (= 0)	-0.004	-0.01	-2.840	-0.16
Farm size (0 – 100)	----	----	-4.883	-0.62
Farm size (101 – 250)	----	----	-9.253	-1.29
Numbers of animal (10 – 30)	----	----	19.472***	2.59
Numbers of animal (> 30)	----	----	98.073***	12.78
Milking animal share	-0.492	-0.82	----	----
Farmers that grows feed crops	0.162	0.86	----	----
Farm receiving animal support (d = 1)			-66.535***	-6.75
σ		52.994***		40.73
ρ_{12}		0.841***		21.47
Log Likelihood value			-3484.026	

Note: *, ** and *** show statistically important variables at %10, %5 and %1 level.

RESULTS and RECOMENDATIONS

According to the results, agricultural supports are important in terms of sustainability in agricultural activity, as they are considered as financial improvement of farms. On the other hand, when we look at the three types of treatment effects in the switching regression model, the treatment effect in the TEM was found to be approximately four times greater. The average treatment effect value was calculated as $2787, but it was not statistically

significant. Although animal supports increase the average total income, it is not at a desirable level. Therefore it may be necessary to support farmers by restructuring and diversifying animal support schemes. In addition, when we look at the effects of treatment on farmers benefiting from subsidies, it is seen that animal support increases the gross production value of these groups by approximately $12167 and this value is statistically significant.

Çizelge 6. Net kar için manevra modeline ilişkin en yüksek olabilirlik fonksiyonun parametre değerleri
Table 6. Parameter values of the maximum likelihood function for the switching regression model for net profit

	Probability of receiving animal support		Total profit when d=1		Total profit when d=0	
Variables	Parameter	t-value	Parameter	t-value	Parameter	t-value
Constant	-2.123**	-2.57	-102.513	-1.59	14.386	0.60
Secondary school graduate farmer	0.636**	2.21	0.322	0.04	6.527	0.78
High school graduate farmer	0.650*	1.95	0.971	0.09	-0.706	-0.08
University graduate farmer	1.679***	3.93	24.385	1.63	-12.506	-0.60
Household size	0.044	1.10	0.706	0.52	-0.588	-0.52
Age of farmers	-0.001	-0.13	-0.139	-0.41	0.146	0.53
Membership status to DSYB	0.891***	4.31	29.340***	2.87	-15.375	-1.32
Cooperative membership status	1.006***	3.12	54.940	0.96	5.254	0.72
Having record system in farms	-0.287	-1.09	-10.739	-0.70	-3.292	-0.42
Input-output recording status	-0.084	-0.25	0.879	0.11	-7.955	-0.85
Stud book recording status	0.337*	1.66	10.956	1.61	3.841	0.66
Barn type	0.787**	2.09	-3.153	-0.36	-22.463	-0.23
Milking type	0.486**	1.96	17.927	0.98	5.043	0.83
Producing silage in farm	0.593**	2.54	10.202	1.00	6.067	0.74
Having culture breeding in farm	1.205***	3.75	27.645	1.12	0.273	0.03
Having cross breeding in farm	0.859	1.40	5.902	0.18	4.940	0.51
Aegean	-0.297	-0.84	-1.310	-0.13	6.573	0.37
Mediterranean	-1.287***	-2.70	-25.705	-1.22	5.239	0.39
Central Anatolia	-0.090	-0.23	-8.270	-0.93	34.094**	2.39
Southeastern Anatolia	-1.243***	-3.12	33.740**	-2.13	14.748	1.26
East Anatolia	-0.629**	-2.03	-22.669	-1.13	13.410	1.12
Farm size (= 0)	-0.028	-0.06	6.804	0.27	-14.506	-1.24
Farm size (0 – 100)	----	----	10.236	0.92	-31.207***	-3.80
Farm size (101 – 250)	----	----	1.534	0.15	-26.241***	-2.79
Numbers of animal (10 – 30)	----	----	17.511	1.53	17.199***	2.58
Numbers of animal (> 30)	----	----	95.861***	7.92	69.284***	8.18
Milking animal share	-0.501	-0,79	----	----	----	----
Farmers that grows feed crops	0.149	0,72	----	----	----	----
σ_0	23.388***				15.19	
ρ_0	-0.202				-0.34	
σ_1	60.442***				31.61	
ρ_1	0.928***				21.72	
Log likelihood value	-3400.999					

Note: *, ** and *** show statistically important variables at %10, %5 and %1 level.

Çizelge 7. Net kar için muamele, ortalama ve muamele görenler üzerindeki etki miktarları
Table 7. Treatment, mean and amount of effect on the treated for net profit

Variables	Treatment Effect Model		Mover/Stayer Switching Model	
	Parameter	t-test	Parameter	t-test
TE	12.803***	6.92	39.369***	4.60
ATE	----	----	-3.857	-0.15
TTE	----	----	18.761	0.75

Note: *, ** and *** show statistically important variables at %10, %5 and %1 level.

As a priority problem, high feed prices hurt producers. For this, it is necessary to lower the tax rates applied to the feed and to give the difference to the producer. In recent years, animal imports have negatively affected production and prices. Therefore, the production of quality breeding materials should be

emphasized, and the amount of support given in this regard should be increased. As in most agricultural farms in Türkiye, a low ratio of the firms surveyed was holding input-output recording. For this purpose, the farm accounting data network system should be extended to more farmers. Although most of the farmers surveyed produce roughage, roughage production is inadequate in areas with high livestock production capacity. Unintended use of agricultural land should not be allowed to increase the production of roughage, and farm sizes should be regulated according to the land plan.

A council should be established to ensure the implementation of regulations governing dairy policies and practices in Türkiye. Important goals must be achieved through this council by increasing raw milk quality, determination of raw milk price according to quality, increasing consumption of milk and dairy products, planning imports and exports, and ensuring the stability of production. The continuity of dairy cattle farming in Türkiye is related to the capital of farms, in kind and cash incentives, support, and subsidies given by the government. In recent years, organizations such as the CBA and the Milk Producers Association have been influential in promoting the demands and needs of producers to authorities and marketing their products. Producers should be encouraged to become members of agricultural organizations in their respective fields of activity. Non-member producers should be encouraged to become members, and the cooperation of members with their organizations should be increased.

In provinces such as Tekirdağ, Balıkesir, İzmir, Konya, and Denizli, the rate of organization and cooperation in dairy cattle farms is higher than that in the Eastern and Southeastern Anatolia region. Higher utilization rates are among the most important factors contributing to high milk productivity and profitability in these regions. In these provinces, where animal husbandry is carried out under intensive conditions, similar practices should be made widespread in all provinces by taking into consideration the fact that there are a large number of producers producing economically for the market, the producers have strong connections with the market, and the awareness levels about livestock support are high. In particular, to increase supports to enable small-scale enterprises to reach the targeted economic size, legal arrangements should be made and all farmers should benefit from these supports. Farmers who do not receive support should be encouraged to receive support, and the importance of support in the sustainability of animal production should be transferred to farmers by related institutions.

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The authors declare that they have contributed equally to the article.

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The authors of the article declare that there is no conflict of interest between them.

REFERENCES

Akbay, C. & Ahmadzai, A.Z. (2020). The factors affecting food security in the eastern region of Afghanistan. *KSU Journal of Agriculture and Nature*, *23(2)*, 467-478. DOI:10.18016/ksutarimdoga.vi.596442

Akbay, C. & Akdoğan, F. (2022). Economic analysis of dairy cattle farms in Izmir province of Türkiye. *KSU Journal of Agriculture and Nature*, *25(3)*, 598-605. DOI: 10.18016/ksutarimdoga.vi.800409

Ağır, H.B. & Akbay, C. (2022). Impact of contract farming on beef cattle farmers' income: A Propensity Score Matching Analysis. *Journal of Agriculture and Nature*, *26(2)*, 392-399. DOI:10.18016/ksutarimdoga.vi.896094.

Angrist, J.D. (2001). Estimation of limited dependent variable models with dummy endogenous regressors: Simple strategies for empirical practice. *Journal of Business and Economic Statistics*, *19(1)*, 2-28.

Barnow, B.S., G.G. Cain & Goldberger, A.S. (1980). Issues in the analysis of selectivity bias. In evaluation studies review annual, vol. 5, ed. E.S. Stromsdorfer and G. Farkas, 43-59. Beverly Hills, CA: Sage.

Bezlipkina, I., Lansink, A.O. & Oskam A. (2001). Farm firm micro-econometrics modeling: Emrirical evidence from Russian dairy farming. Paper prepared for the annual meeting of the American Agricultural Economics Association in Chicago (August 5-8).

Boz, I., Akbay, C., Bas, S., & Budak, D.B. (2011). Adoption of innovations and best management practices among dairy farmers in the Eastern Mediterranean Region of Turkey. *Journal of Animal and Veterinary Advances*, *10(2)*, 251-261. DOI: 10.3923/javaa.2011.251.261

Chandel, BS., Lal, P. & Kumari, B. (2019). Livestock production systems, subsidies and its implications: An investigation through review of literature. *Indian J Dairy Sci.*, *72(2)*, 121-128. DOI:10.33785/IJDS.2019.v72i02.001

Dorward, (2015). Heroes, villains and victims: Agricultural subsidies and their impacts on food security and poverty reduction. Handbook on the Globalisation of Agriculture.

Erdal, G., Erdal, H. & Çiçek, A. (2020). An analysis of the effects of livestock support policies on breeders: An example of TR83 region in Turkey. *Turkish Journal of Agriculture- Food Science and Technology*, *8(11)*, 2378-2387. DOI:https:// doi.org/10.24925/turjaf.v8i11.2378-2387.3676

Garrone, M., Emmers, D., Olper, A. & Swinnen, J. (2018). Subsidies and agricultural productivity: CAP payments and labour productivity (convergence) in EU agriculture. LICOS Discussion Paper Series. Discussion Paper 409/2018.

Greene, W.H. (2012). Econometric analysis, 7th Edition. New York: Prentice Hall.

Hadley, D. (2006). Patterns in technical efficiency and technical change at the farm-level in England and Wales, 1982–2002. *Journal of Agricultural Economics*, *57*, 81-100. https://doi.org/10.1111/j. 1477-9552.2006.00033.x

Heckman, J.J., Tobias, & Vytlacil, E. (2003). Simple estimators for treatment parameters in a latent variable frameJ.work. *The Review of Economics and Statistics*, *85(3)*, 748-755.

Henningsen, A., Kumbhakar, S. & Lien, G. (2011). Econometric analysis of the effects of subsidies on farm production in case of endogenous input quantities. In EAAE 2011 Congress - Change and Uncertainty, Zurich, Switzerland.

Isık, HB., Aksoy, A. & Yavuz, F. (2009). Factors affecting dairy farmers' utilization of agricultural supports in Erzurum, Turkey. *Scientific Research and Essay*, *4 (11)*, 1236-1242.

Karagölge, C., 1996, Tarımsal işletmecilik, tarım işletmelerinin analizi ve planlaması, Atatürk Üniversitesi Ziraat Fakültesi Yayınları no:326, Erzurum.

Kasteridis, P.P. & S.T. Yen. (2012). Smoking cessation and body weight: Evidence from the behavioral risk factor surveillance survey. *Health Services Research, 47*, in press.

Kılıç, O., & Eryılmaz, G.A. (2020). Samsun ilinde süt sığırcılığı yapan işletmelerin yapısal özellikleri. *Türk Tarım ve Doğa Bilimleri Dergisi*, *7(3)*, 637-645. https://doi.org/10.30910/ turkjans.682932

Kıral, T., Kasnakoğlu, H., Tatlıdil, F., Fidan, F. & Gündoğmuş, E. (1999). Tarımsal ürünler için maliyet hesaplama metodolojisi ve veri tabanı rehberi, Tarımsal Ekonomi Araştırma Enstitüsü Yayın No:37, Ankara.

Latruffe, E., Bravo-Ureta, B.E., Moreira, V.H., Desjeux, Y. & Dupraz, P. (2011). Productivity and subsidies in European Union countries: An analysis for dairy farms using input distance frontiers. Paper prepared for presentation at the EAAE 2011 Congress Change and Uncertainty, Challenges for Agriculture, Food and Natural Resources, August 30 to September 2, 2011 ETH Zurich, Zurich, Switzerland.

Maddala, G.S. (1986). Disequilibrium, self-selection, and switching models. In Handbook of econometrics, vol. 3, ed. Z. Griliches and M.D. Intriligator, 1633–1688. Amsterdam: Elsevier Science Publishers BV.

Maddala, G.S. (1999). Limited-dependent and qualitative variables in econometrics. Cambridge, MA: Cambridge University Press.

Official Gazette, (2022). Resmi gazete. "http://www.resmigazete.gov.tr/eskiler/2013/05/201 30525-3.htm"

Rosenbaum, P.R. and D.B. Rubin. 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika, 70(1)*, 41–55.

Semerci, A. & Celik, A. (2017). Reflections of animal husbandry subsidies on dairy cattle enterprises: A case study of Hatay Province-Turkey, *Journal of Tekirdag Agricultural Faculty*, *14(2)*, 92-100.

Terin, M., Ceylan, M., Çiftçi, K. & Yıldırım, I. (2022). Damızlık Sığır Yetiştiricileri Birliğine üye olan ve olmayan süt sığırcılığı işletmelerinin hayvancılık desteklerinden faydalanma durumlarının analizi. *Atatürk Üniversitesi Ziraat Fakültesi Dergisi* , *53 (1)*, 42-50. DOI: 10.54614/AUAF.2022.960031

Trnkova, G. & Mala, Z. & Vasilenko, A. (2012). Analysis of the effects of subsidies on the economic behavior of agricultural businesses focusing on animal production, AGRIS on-line Papers in Economics and Informatics, Czech University of Life Sciences Prague, *Faculty of Economics and Management*, *4*, 1-12.

TÜİK, (2022). Hayvancılık istatistikleri. Türkiye İstatistik Kurumu (www. Tuik.gov.tr)

Vozarova, I.K. and Kotulic R. 2016. Quantification of the effect of subsidies on the production performance of the Slovak agriculture. *Procedia Economics and Finance*, *39*, 298-304. https://doi.org/10.1016/S2212-5671(16)30327-6

WHO, (2022). The nutrition challenge and food system solutions. World Health organization. https://apps.who.int/iris/bitstream/handle/10665/2 77440/WHO-NMH-NHD-18.10-eng.pdf

Yamane, T. (2001). Temel örnekleme yöntemleri. Çevirenler: Alptekin Esin, Celal Aydın, M. Akif Bakır, Esen Gürbüzsel. Literatür Yayıncılık, İstanbul

Zhu, X., Demeter, R.M. & Lansink, A.O. (2008). Competiveness of dairy farms in three countries: the role of CAP subsidies. 12. Congress of the European Association of Agricultural Economists-EAAE, 2008.

Zhu, X., Demeter, R.M. & Oude Lansink, A. (2012). Technical efficiency and productivity differentials of dairy farms in three EU countries: The role of CAP subsidies. Agricultural Economics Review, *13 (1)*, 66-92. DOI: 10.22004/ag.econ.253496