ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/354411460

Factors Affecting Profit Efficiency of Greenhouse Producers in Antalya

Conference Paper · July 2021

CITATION
1

READS
285

4 authors, including:



Rahmiye Figen Ceylan
Akdeniz University
55 PUBLICATIONS **631** CITATIONS
SEE PROFILE



Burhan Ozkan
Akdeniz University
191 PUBLICATIONS **2,947** CITATIONS
SEE PROFILE



Cengiz Sayin
Akdeniz University
71 PUBLICATIONS **399** CITATIONS
SEE PROFILE

All content following this page was uploaded by Burhan Ozkan on 07 September 2021.

The user has requested enhancement of the downloaded file.

FACTORS AFFECTING PROFIT EFFICIENCY OF GREENHOUSE PRODUCERS IN ANTALYA

Rahmiye Figen Ceylan[1]
Burhan Ozkan[2]
Cengiz Sayın[3]
Metin Göksel Akpınar[4]

ABSTRACT

Agricultural activities have been supported almost in all countries on producer and/or consumer level. The relevant supports are provided by public authorities mostly with objectives as assuring sustainability of the sector to meet domestic and international demand, increasing value added of the sector and contributing to R&D activities. The relationship between receipt of supports and the factors affecting, has been a concern for future planning. Accordingly, the data retrieved from face to face surveys with 397 vegetable producers in Antalya, Turkey in 2020 was analysed due to Stochastic Profit Frontier approach to detect level of profit efficiency of the sample and measure the factors effective on this efficiency. The average profit inefficiency level of the surveyed producers had appeared as 21 %. Subsequently, socio-demographic and enterprise and supporting system related factors affecting this inefficiency level were detected. Accordingly, while rising age and the producer's being female were raising the inefficiency, education level had appeared as an inefficiency reducing factor. Among the agricultural supports supplied by public authorities and that could be reached by producers in Antalya, biological and biotechnical supports and Good Agricultural Practices supports had appeared as components that bring producers closer to the profit frontier.

Keywords: profit efficiency, greenhouse production, vegetable, Turkey, Antalya

1. INTRODUCTION

Providing public supports to agriculture is critical almost for all countries due to the basic reason of sustainability. Sustainability of agricultural activities both for the sector and people employed in the sector is rather important in addition to sustaining livelihoods through continues supply of food requirements. However, supporting schemes are more important for some countries due to the coverage of the sector or its prevalence in the national accounts. Turkey is one of these countries. In addition to maintenance of agricultural production and supplies, extension of agricultural employment potential and increasing quality of the labour

1 Dr. (Assoc.Prof.), Faculty of Agricultere Department of Agriculture Economics, Antalya, Turkey
2 Dr. (Prof.), Faculty of Agricultere Department of Agriculture Economics, Antalya, Turkey
3 Dr. (Prof.), Faculty of Agricultere Department of Agriculture Economics, Antalya, Turkey
4 Dr. (Assoc.Prof.), Faculty of Agricultere Department of Agriculture Economics, Antalya, Turkey

force is also important. This factual background has been the counterparts of supports provided.

Departing from this information, it was first intended to summarise the supporting system briefly. Following this abstraction, evaluation of supports on field level was considered as contributory. A face to face survey was conducted with 397 randomly selected farmers in Antalya, Turkey in 2020. Accordingly, with the focus on this relevant field it was aimed to evaluate the changing support reach among greenhouse vegetable producers and the relationship between support reach and profitability of those farmers.

Prior to evaluation of profitability, it is important to evaluate the system briefly.

2. AGRICULTURAL SUPPORT SYSTEM IN TURKEY

Being one of the countries that provide considerable supports to agriculture, Turkey had adopted the changing global agricultural conditions and requirements sincerely. The supporting mechanism and tools have changed due to the enforcements of the World Trade Organisation and within the process of adoption to the Common Agricultural Policy of the European Union (Civan, 2016). Prevalent supporting tool has been floor price – minimum accepted price implementations as in many countries. Yet, quantity based supports have been in use for specific products, while restricted as much in order not to affect trade competition negatively. Following these well-known tools, direct income transfers were involved as well as area based supports with regards to the EU process as mentioned earlier (Babacan, 1999). Existing supporting tools can be summarised as in the following table.

Table 1. Agricultural Supports in Turkey

Field-Based Supports	Support Family Farm Support	Per acre support for registered family farms.
	Good Agricultural Practices (GAP) Support	Aromatic and medicinal plants and greenhouse products are supported.
	Oil, Fertiliser, Soil Analysis (OFSA) Support	Per acre support for conventional products to assure sustainability of production following fallows.
	Organic Agriculture Support	Per acre support for certified organic production
Biological and Biotechnical Intervention Supports	Supports to reduce chemical use. Specific classification are made for open field and greenhouse production.	

Other Agricultural Supports	Nationally Certified Seed and Seedling Support	Seedling support for specific products and seed supports covers both use and production.
	Protection of Agricultural Fields for Environmental Purposes	Per acre supports to reduce soil, water, air pollution and restrict negative effects of agricultural production.
	Difference Payment Support for Basin Based Production Model.	Supporting maintenance of production of specific products in specific regions
	Agriculture and Rural Development Support Institution Supports	Supports provided in the scope of adoption to the EU CAP. IPARD funds are managed and delivered for supporting investments and capacities of agricultural enterprises to catch-up standards.

3. MATERIAL AND METHODOLOGY

Following explanation of the system in brief, it was intended to calculate profitability of 397 farmers and evaluate the effects of supports reached by those farmers on the profitability. However, the impact analysis was made based on profit efficiency of the unique farms.

Efficiency analyses have been used for agriculture both on micro and macro levels. With the current research, profitability of concerned farms and factors affecting the profitability in a reverse direction was measured with utilisation of Stochastic Profit Frontier (SPF). SPF approach dates back to efficiency analyses of Aigner, Lovell and Schmidt (1977) and Meeusen and Van den Broeck (1977) that embrace estimation of production, cost and profit frontiers. SPF, used hereby, resides on estimation of per farm gross profit towards the quantitative value of profits initially. After the profit of units are estimated, inefficiency of those units are retrieved from the outputs and those inefficiency levels are used to undermine effects of demographic and pre-determined factors via a second estimation.

As a random profit frontier was utilised, the concerning equation and attached variables should be explained in brief.

$$\pi_i = f\left(P_{ij}, Z_{ik}, D_{ij}\right)\exp(e_i)$$

π_i = Gross profit of farm i calculated as the difference between gross income and total variable costs (TL/decare)

P_{ij} = Cost of variable input j used by farm i (TL/decare)

Z_{ii}= Quantity of fixed production factor k owned by farm i

D_{ij}= Level of supports used by farm i (TL/decare)

e_i= stochastic errors

Subsequently, the relevant variable input costs considered in TL per decare (or per 0,247 acre) were seed/seedling, fertiliser, pesticide, irrigation, energy and insurance. In addition to these cost items, production wild again in decare and depreciation cost in TL were included in the profit estimation for the concerned analysis.

Yet, the main purpose is detection of inefficiency index which was related to the error terms (e_i) of this profit estimation. It was set forward that the variance of the error terms is composed of the profit inefficiency and stochastic variance of the model as following (Batesse and Cora, 1977; Batesse and Coelli, 1995; Kolawole, 2006).

$$б^2 = б_u^2 + б_v^2$$

It was understood that decomposition of the error variance would help detection of the profit efficiency, which is used as the dependent variable of the frontier analysis. The index is retrieved via anti-log transformation of the estimated error terms as PEI = (1-e(-ui)). After detection of the index, it needs to be estimated against social and economic indicators. The indicators mainly refer to age, gender and education level of the farmer, employment status of household members and ownership status of the farmlands. Yet, due to the main objective of this research, additional variables related to support reach were considered as effective. In addition to discrete variable referring the existence of support reach, value of the aggregate supports were considered as an explanatory variable.

4. FINDINGS

Firstly, the socio-demographic and farm level characteristics were explained. Middle aged farmers, with an average age of 45 were mostly male. Most farmers (94 %) were completely occupied with farm activities with their mostly female spouses. The education level of farmers were moderate as only 28 % were secondary or above graduates.

There is a high landownership with 391 farmers out of 397 and 13 % (51) of the sample seemed to have more than 20 years farming experience. The product specialisation was as expected that tomato has been produced in 117 farms (30 %), followed by fresh pepper (57-14 %), zucchini (50-13 %), cucumber (45-11%) and aubergine (38-10%).

4.1. Income, Cost Structure and Profitability of Farms

The average marketing revenue of 397 surveyed farms with reference to 2019 appeared as

$17.756,6 (101.035 TL)[1]. Yet, the average revenue per decare was $3.358,52. Considering the dispersion, 271 farms seemed to receive gross revenue per decare below $ 3.514,94.

Variable costs were evaluated as well. Average commission payment was $2.048,15/farm and $394,33/decare. Direct production costs were seed/seedling, pesticide and fertiliser use. The costs involve value of the physical input and labour utilised to use it. Accordingly, average costs per farm was $2.038,26 for seed and seedling, $753,74 for pesticide and $1.227,02 for fertiliser. Average costs per decare were $361,17, $113,58 and $241,13 consecutively.

The irrigation cost on average was $836,49/farm ($216,72/decare) for the season with the official prices (Anonymous, 2020a). Energy costs for use and maintenance of farm equipment were $903,63/farm and $185,41/decare.

In addition, renovation activities take place in plastic houses in every 5 years. The average renovation cost was $2.313,53 per year. Yet, annual renovation and specifically maintenance costs for glasshouses was $ 366,78. Regardless of investment and operational costs, glasshouses appear as more endurable than plastic houses.

Afterwards, profit levels were calculated to evaluate efficiency of farms. The average gross profit was $ 6.069,61 with alternative family labour cost and $ 7.173,28 disregarding family labour. Due to the first approach, 163 farms (41 %) seemed to receive above average profit and 258 farms were above break-even point. Due to second approach the figures appeared as 167 and 277, which also referred 30 % of farms (120) were in loss. The farm level profit distribution was demonstrated below.

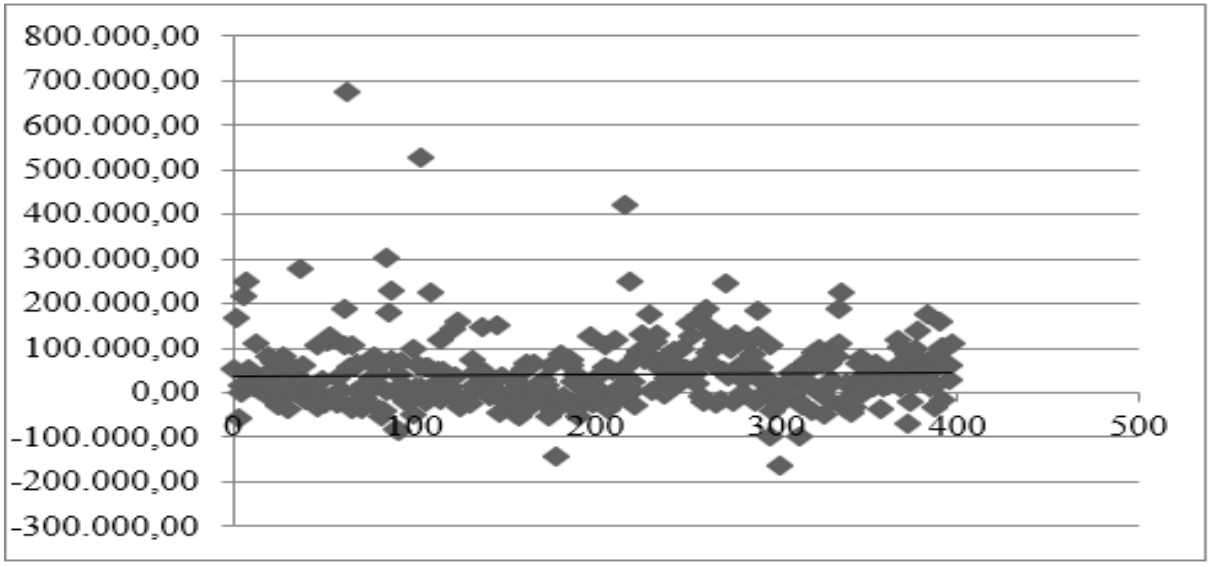


Figure 1. Distribution of Farm Profitability

So, as in the revenue and costs, profits were considered per unit area

1 Monetary variables in Turkish Liras were converted into US Dollars by using the 2019 average TL/$ rate of Central Bank of Turkey: 1 $= 7,017 TL

and average annual profitability per decare had appeared as $ 1.375,58.

4.2. PROFIT EFFICIENCY

4.2.1. Estimation of Farm Level Efficiency

The profit efficiency of farms was estimated in order to measure the distance of farms to the profit frontier. The log of cost variables and profit level was calculated for linear adjustment and the normality of the variables were tested on the first sense with Shapiro-Wilk W (Shapiro and Wilk, 1965) test and non-normality of variables was detected excluding amount of production lands.

With the support from Central Limit Theorem presuming normal distribution of the sample itself that include more than 30 observations, the analysis was pursued. Yet, the rotation need was evaluated to test whether the logged variables could be estimated exponentially (Tukey, 1977) and the requirement was confirmed. Existence of multicollinearity and specification error in the model concerning continues variables was tested with VIF (Variance Inflation Factor) and TOL (Tolerance) (Gujarati, 1995) and the findings were indicated in the below table.

Table 2. Multicollinearity Test Findings

Variable	VIF	SQRT VIF	TOL	R^2
ln_profit	1,02	1,01	0,9772	0,02
ln_fertiliser	1,28	1,13	0,7797	0,22
ln_pesticide	1,07	1,04	0,9317	0,07
ln_energy	1,04	1,02	0,9583	0,04
ln_seed	1,19	1,09	0,8384	0,16
ln_insurance	1,13	1,06	0,8846	0,12
ln_depreciation	1,25	1,12	0,8020	0,19

The average VIF was 1,14 and there appeared no variable with VIF above 5. Accordingly, there was no collinear relationship between variables. Following this confirmation, Linktest findings were referred to examine specification errors.

Table 3. Linktest Findings

Source	**Sum of Squares**	**SD**		
Model	168,65	2		
Residual - uhat	7038,38	394		
Total	7207,03	396		
F(2, 394) (p(F))	4,72 (0,009)			
R^2 - Adj, R^2	0,023 (0,018)			
ln_profit	**Coefficient**	**t (p(t))**	**95% C.I.**	
Error estimate	2,849	0,76 (0,45)	-4,56	10,26

Squared errors	-0,153	-0,49 (0,62)	-0,76	0,46
Constant	-5,531	-0,48 (0,63)	-28,01	16,94

When a variable that needs to be included in the model was excluded, there can be specification error. However, with above 10 % ρ of variables, there observed no specification error. Accordingly, inefficiency model was estimated with exponential rotation and findings were demonstrated below.

Table 3. Stochastic Profit Frontier Estimates

Variables	Coefficient	Z - p(Z)
ln_profit	0,628	9,37 (0,00)***
ln_fertiliser	0,022	0,92 (0,36)
ln_pesticide	-0,043	-1,96 (0,049)**
ln_energy	-0,208	-4,81 (0,00)***
ln_seed	-0,092	-3,19 (0,00)***
ln_insurance	-0,029	-2,12 (0,03)**
Constant	7,919	15,77 (0,00)***
Wald $X^2(6) – p(X^2)$	185,45 (0,00)	
X^2 mean ($p(X^2)$)	2 , 9 e + 0 2 (0,00)	
Log Likelihood – LR (p(LR))	- 9 9 0 , 2 9 8 (0,00)	

** %95; *** %99 C.I.

The signs of explanatory estimates are more important than their values. The constant of estimated gross profit per decare was $ 1,39, far from the measured average. However all parameter estimates were in the scope of economic expectations. The relationship between profit inefficiency of farms and relevant factors including agricultural supports were estimated afterwards.

4.2.2. Profit Inefficiency Estimation

The error terms of the first regression were used to retrieve inefficiency scores of farms as explained above. The inefficiency scores between 0 representing perfectly efficient farm, and 1 representing perfectly inefficient farm were demonstrated below.

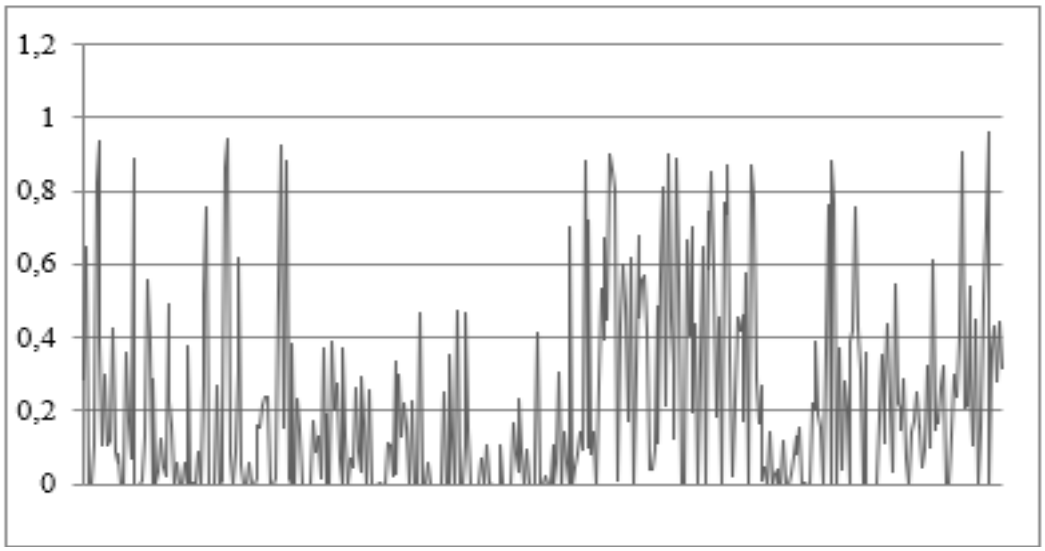


Figure 2. Distribution of Inefficiency Scores

The average inefficiency level of the farms was detected as 21 %. This average is understandable for production units with different characteristics. However, the score ranges between below 1 % and 97,5 %. The inefficiency level is above 70 % for 24 enterprises and below 15 % in 218 farms corresponding 56 % of the sample. Accordingly, the inefficiency level is comparatively low in the sample concerning vegetable production activities. However, the objective was not only to detect the inefficiency level, but also it to measure effects of the demographic and socio-economic factors on the inefficiency level. Therefore, the outputs retrieved from estimation of the inefficiency score were demonstrated below and evaluated thereafter

Table 4. Factors Affecting Inefficiency of Farms

Variable	Estimate	Z (p(Z))	Variable	Estimate	Z (p(Z))
Gender	0,72	2,14 (0,03)***	**Biological Intervention**	-0,32	-0,46 (0,64)
Age	0,01	1,06 (0,29)	**GAP**	-1,52	-1,52 (0,04)**
			OFSA Supports	0,99	1,36 (0,17)
Education	-0,21	1,47 (0,14)	**Out of farm employment**	0,85	0,93 (0,35)
Land ownership	1,12	1,18 (0,24)	**Constant**	0,33	0,28 (0,78)
Wald $X^2(6)$ – $p(X^2)$		61,06 (0,00)***			
Log Likelihood – LR (p(LR))			-977,70		

** %95; *** %99 (C.I.)

Prior to the evaluation of findings it is important to note one specific explanation. While the awareness level is high on public supports, reach to those supports are rather limited.

Reasoning behind this situation is strictly related with the developed agricultural structure in Antalya, Turkey. Accordingly, there remained few support accounts to be related with the efficiency and profitability. The relevant explanatory variables were noted as biologic/ biotechnical intervention, Good Agricultural Practices and Oil, Fertiliser, Soil Analysis supports.

The findings are significant in terms of the sample. Age and gender appeared as factors increasing inefficiency. Yet, it is important to remind that while the average inefficiency was 21 %, the constant of the estimation took the value of 33 %. Therefore, the estimates of explanatory variables, for our case demographics and support related factors, were expected to reduce the inefficiency to reach lower averages. When the fact that there are only 42 female farmers out of 397 is kept in mind, the inefficiency rising effect of gender factor can be neglected. In opposition, for male farmers that constitute 90 % of the sample, the gender factor has no effect.

When age and its inverse effect is considered, it is again essential to note that the average age is 45 and farming activities are maintained traditionally by middle aged above. Besides, rising inefficiency with age can also be related to declining inefficiency with rising education level. Thereafter, 112 farmers (28 %) have secondary or above education degrees. This rising categorised education leaded declination in inefficiency as expected. Accordingly, when considered together age and education level are considered in a complementary way, it can be said that profit efficiency of farms are correlated with education level and professionalization of agricultural practices indicated by lower age of the operator. To emphasize more, for greenhouse production of FFVs that is important both for domestic consumption and export markets, professionalization of farming activities is essential for efficiency and its sustainability.

Professionalization of farmers can be evaluated also with their occupational status having out-of-farm jobs. There are very few farmers (5) that work out of the farm for income. So, holding non-agricultural jobs seriously reduces the profit efficiency level. However, farmers declared that they would not need out-of-farm jobs only if they have access to accurate financial sources.

In addition, status regarding agricultural holdings has a significant effect on the inefficiency level, taking 0 as ‘the farm land and enterprise is owned by the farmer’. Yet, having rent or sharing agricultural lands lead to important rise in inefficiency. However, it is also noteworthy that almost all of the randomly selected farms were owned by the operators. Land ownership can be considered as an alternative cost for farmers, as costs are higher and profit is lower for the ones that own the land. However, holding the land reduces inefficiency even if it contributes to the rising costs of production for this case.

After this assessment, reach to public supports needs to be evaluated for sure. As it was set forward earlier, reach and use of different support accounts is limited somehow among the

randomly selected farmers. Accordingly, only the effective or widely used support components were used. Within the analysis period biologic/biotechnological supports and relevant financial contribution received seemed to reduce the inefficiency. In addition, GAP supports seemed to reduce the inefficiency and contribute to probability to receive more profits.

On the contrary, reaching oil, fertilised, soil analysis supports seemed to rise efficiency or reduce profitability. In fact, OFSA supports are expected to move enterprises to profit frontier. However, average OFSA financial supports reached by 10 farms in 2019 was $ 105,45. This allotment was $ 3.432,92 for 42 farms that received biologic/biotechnical supports and $ 1.351,86 for GAP supports. Therefore, 9 farms out of 10 declared that they reached to OFSA supports in 2019 and it might not be correct to generalise the negative impact considering the less than 1 year lag. However, there is dispersion for GAP and biologic/biotechnical supports within years and the experiences regarding support use might have an inefficiency reducing effect as the activities might be comprehended by farmers after using the support and being guided by authorities.

Besides, it was well known that farmers that could reach public supports do have higher education levels. With rising education and awareness on the probability to reach and methods to use the public supports, different support components might empower profitability of enterprises.

5. RESULTS

It is contributory to briefly summarise the findings reached with the survey and profit efficiency analysis. The surveyed farmers generally have moderate income and maintain both production and marketing activities with their family members. Almost all of the farmers in the sample were holding farm lands and they were specialised on products even if their operational specialisation is low. Most of their sales seemed to take place in wholesale markets. Yet, their risk awareness and risk management levels were low as well. Accordingly, it can be said that the traditional perspective has been maintained in greenhouse vegetable production, although the outputs are very important for agriculture as a sector and for Turkish economy.

In brief, while average gross profit for vegetable was $ 6.069,61 including family labour cost, and it was $ 7.173,28 when this labour cost was excluded due to 2019 data. Within the analysis the average profit inefficiency of concerned 397 farms was 21 %, which can be referred as a lower than expected value. The rate was detected as 57 % in an earlier study conducted in Antalya in 2016, which can be compared (Sayin et al., 2017). However, the difference between these rates can be attributed to difference in land ownership status of enterprises in the study as there were much fewer farms owned by the operators. Besides, this previous study also encompassed fruit production as well as vegetables. Considering multi-annual characteristic of fruit production, the reflection of profitability on data collection time might be lower (Celik et al., 2014).

The detected average inefficiency was analysed against pre-determined factors. Especially, gender and age appeared as inefficiency rising factors. Gender was considered as a negligible factor as most of the farmers were male. The effect of age can be considered as controversial. However, when accompanied with the inefficiency reducing effect of education level and limited number of highly educated people these inverse effects can be neglected as well. This is due to the traditional characteristics of farming operations in Turkey. Even if the greenhouse production is expected to be more professional, it was understood that awareness and intention to receive professional information and assistance was lower in the sample. There are additional depreciating effects as land ownership and full time employment in the farm. This finding reverses the demographic effects detailed upwards. Therefore, while young age and higher education reduces inefficiency, land ownership and full time occupation do reduce the rate as well. These impacts can be complementary and indicates rising profitability attached to rising professionalization.

In addition to these demographic and enterprise related factors, effects of the reach to different public support tools were evaluated within the stochastic frontier modelling. The findings revealed confirmatory statistical inferences. Reaching biologic/biotechnological supports and GAP seemed to have depreciating effect. But the effects of OFSA supports were reverse. The reasoning was first attributed to reach and use of these supports on the survey period, while timing of the previously acknowledged supports was varying. Therefore, generalisation of positive-negative effect of this component is not possible. When we are asked to sum up, it is possible to say that reaching public supports has profit inefficiency reducing effects, if measured accurately. This can also be read as the potential to reach higher profits. Therefore, even while the conventional production characteristics were considered for greenhouse farming in the target district, rising on or off farm education, rising awareness and consultancy reach on the efficient reach to and use of public supports will be promising activities. Therefore

Acknowledgement

The paper is prepared in the scope of FBA-2019-4612 - **Economic Efficiency Analysis of Supports Provided to Vegetable Production in Turkey: Antalya Case** project funded by The Scientific Research Projects Coordination Unit of Akdeniz University

REFERENCES

Aigner, D.J.; Lovell, C.A.K.; Schmidt, P. (1977) Formulation and estimation of stochastic frontier production functions. Journal of Econometrics, 6:21–37.

Babacan, A. 1999. "Income Payments System in the Framework of General Agricultural Policies". State Planning Organization Sector Report. Ankara: pp. 37. retrieved: https://sbb.gov.tr/wp-content/uploads/2018/11/Genel_Tarim_Politikalari_Cercevesinde_Dogrudan_Gelir_Odemeleri_Sistemi.pdf, on: 25.11.2020

Banerjee, A, Dolado, J.J. ve Mestre, R. 1988. “Error-Correction Mechanism Tests for Cointegration in a Single Equation Framework”. Journal of Time Series Analysis, 19(3):267-283.

Battese, G. E. and Coelli, T.J. 1995. “A Model for Technical Inefficiency Effect in Stochastic Frontier Production for Panel Data. Empirical Economics, Vol.20pp, 325-345.

Battese, G.E. and Corra, G. S. 1977. “Estimation of a Production Function Model with Applied to the Pastoral Zone of Eastern Australia”. Australian Journal of Agricultural Economics 21:169-179.

Çelik, Y . Karakayıcı, Z., Polat, A.T., Eşitken, A. 2014. “The Gross Profit Analysis of Outdoor Ornamental Plants in Konya Province”. Fruit Science, 1(2): 45-54.

Civan, A. 2016. “ Agricultural Subsidy Policies in Turkey “. Dokuz Eylul University Faculty of Economics and Administrative Sciences Journal, 25 (2016): 127-146.

Gujarati, D.N. 1995. “Basic Econometrics”. 3rd Ed., McGraw-Hill, New York.

Sayin C., Ceylan R.F., Mencet Yelboğa M.N., Özalp M., İlbasmiş E., Sav O. 2017. “Impact of Taxation on Price Formation in Agricultural Markets: Example from Antalya Greenhouse Production”. Journal of Agricultural Science, no.6, pp.120-130.

Shapiro, S. S., Wilk, M. B. 1965. “An Analysis of Variance Test for Normality (complete samples)”. Biometrika, 52 (3–4): 591–611. DOI: 10.1093/biomet/52.3-4.591. JSTOR 2333709. MR 0205384. p. 593

Tukey, J., 1977. “Explaratory Data Analysis”. Addison-Wesley.

Wim Meeusen; Julien van Den Broeck Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error International Economic Review, Vol. 18, No. 2. (Jun., 1977), pp. 435-444.

View publication stats