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Cross-Country Comparison of Efficiency in the Olive Oil Sector: Italy-Turkey*

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Abstract

In this study, Turkish and Italian mills were compared in terms of efficiency scores and quality and environmental sensitivity. In the study, metafrontier method was used to determine efficiency scores, and indexes formed from responses obtained through questionnaires were used to determine quality and environmental sensitivities. In addition, the factors that affect the efficiency scores were determined by 1000 repeated trunceted regression analysis. The estimated efficiency scores for CCR, BCC and SCA models are respectively 74%, 80% and 93% for Turkish mills and 81%, 87% and 84% for Italian mills. It is also determined that Turkish mills and Italian mills can increase their olive oil production about 45% and 49% respectively without changing their existing inputs. When we check the factors which thought to affect the efficiency scores, we estimated that the number or partners and number of the permanent unskilled labour have negative effect and production managers experience, special training and quality index have positive effect on efficiency scores in Turkish mills. In the Italian mills, production managers experience, special training, quality index and environmental index were found to have a positive effect on efficiency scores. As a result, Turkish mills have to increase their quality and environmental sensitivities and decrease the number of partners, number of permanent unskilled labour for the competition of Turkish olive oil.
Key words: Efficiency, Environment, Italy, Olive Oil, Quality, Turkey

Zeytinyağ Sektöründe Çapraz Ülke Etkinliği: İtalya-Türkiye

Özet

Bu çalışmada, Türk ve İtalyan zeytinyağı sıkım tesisleri etkinlik, kalite ve çevre duyarlılığı açısından karşılaştırılmaya çalışılmıştır. Çalışmada etkinlik skorlarının belirlenmesinde meta sınır analizi yöntemi, kalite ve çevre duyarlılığı indekslerinin belirlenmesinde ise yüzyüze anket çalışması sonucu elde edilen cevaplar kullanılmıştır. Etkinlik skorlarına etki eden faktörlerin belirlenmesinde ise 1000 tekrarlı truncated regresyon analizi kullanılmıştır. CCR, BCC ve SCA modellerine göre tahmin edilen ortalama etkinlik skorları sırasıyla Türkiye için %74, %80 ve %93, İtalya için ise %81, %87 ve %84 olarak belirlenmiştir. Bunun yanında Türk ve İtalyan sıkım tesislerinin mevcut girdileri ile sırasıyla %45 ve %49 oranında çıktı artışı yaratabilecekleri belirlenmiştir. Etkinlik skorlarına etki eden faktörler incelendiğinde, Türkiye için ortak sayısı ve daimî vasıfsız işçi sayısının negatif; üretim müdürünün tecrübesi, özel eğitim ve kalite indeksinin etkinlik skorları üzerinde pozitif etkili olduğu görülmüştür. İtalya için ise üretim müdürünün tecrübesi, özel eğitim, kalite indeksi ve çevre indeksinin etkinlik skorları üzerinde pozitif etkili oldukları belirlenmiştir. Sonuç olarak Türk zeytinyağının uluslararası rekabeti için Türk zeytinyağı sıkım tesislerinin kalite ve çevre duyarlılıklarını arttırmaları ve ortak sayısı ile daimî vasıfsız işçi sayısını azaltmaları gerektiği belirlenmiştir.
Anahtar kelimeler: Verimlilik, Çevre, İtalya, Zeytinyağı, Kalite, Türkiye

1.INTRODUCTION

The olive tree cultivation has a long history in the Mediterranean. This long-lived tree is integrated with the social, cultural and economic structure of the Mediterranean people. Even today, olive cultivation and the fruit juice “which named as olive oil” obtained from this unique fruit is an important source of income for the Mediterranean countries.

The countries that have coasts to the Mediterranean all over the world have the most suitable areas for olive production due to their climate. The fact that 76% of the world olive production, which is about 16 million tonnes, is concentrated in six typical Mediterranean countries is an important detail. Shares of these countries are respectively, 31% Spain, 13% Greece, 12%Italy, 10% Turkey, 5% Morocco and 4% Tunisia (FAO, 2016).

The order of the countries may vary according to the periodicity seen in olives. Likewise, in the production of olive oil, these six countries meet 86% of the world production and Turkey's share is again 5% (FAO, 2014). However, when the export amounts and values of olive oil are examined, the situation is different. It is seen that Turkey meets only the 1% of both quantity and value of the total olive oil export (FAO, 2016). It seems that there is something wrong with the olive oil export of Turkey. It can be considered that the problem depends on Turkey's olive oil consumption but Turkey consumes less olive oil then the other leading countries (IOOC, 2013). In general, it would not be wrong to call this problem as branding.

Today's consumers are using their preferences for qualifed, safe and environmentally friendly products. Therefore, it is thought that the production of such products is important for branding. It should also be noted that olive oil is a flavor business and it is also expected that consumers will choose products that are suitable for their taste. The taste can be the subject of another study. First of all, we decided to study the olive oil in terms of qualified product and environmentally friendly production that we considered important in terms of branding and we decided to make a project which we can make a comparison of technical efficiency with Turkey and the other three leading countries "Spain, Italy and Greece" (Ozden and Dios-Palomares, 2015). This paper was emerged on the second stage of this idea and is based on a comparison of the olive oil mills of Italy and Turkey.

The comparison within Desicion Making Units (DMU) can be made by the performance of DMU's. There are some ways to measure the performance of an DMU but for the last two decades efficiency measurement is the most common way to do it. Efficiency and productivity indexes can be used for estimating of the performance of a DMU (Armagan et al., 2010). Effciency is very important for all production sectors. However, the importance of the agricultural sector which aims to feed the world can not be discussed. The efficiency in the agricultural sector is also important for the sustainability of agricultural production. There are various efficiency studies which performed to compare agricultural production from different views (Moreira and Bravo-Ureta, 2009; Headey et al., 2010; Latruffe, 2010; Hoang and Alauddin, 2011; Kastner et al., 2014; Vlontzos et al., 2014).

It is known that food products with high environmental and quality sensitivity are more responsive to consumer expectations. In this view, these kind of food getting important if you want to sell your product. This is why, not only technical efficiency but also quality and environmental sensivities of the mills have become necessary to estimate.

As a consequence, it is understood that, the only way to gain a net income in this sector in the future is to increase the production efficiency. However, besides increasing the efficiency, quality must be increased and environmental damage must be diminished in order to increase the international competitiveness of Turkish Olive Oil Sector.

The main purpose of this study is to reveal the technical efficiency scores of the olive oil mills and to compare Italian and Turkish olive oil mills with a DEA based, output oriented metafrontier approach.

Truncated regression was used to determine the efficiency factors. Also producers' quality and environmental sensitivities will present in the study by quality and environmental indexes which created with two round Delphi Metod. The findings of the study are believed to be an important source of information for the olive mills and also for policy makers.

2.MATERIAL and METHODS

The olive oil production efficiency analysis for Aydın (Turkey) and for Foggia (Italy) was performed applying production frontier methods. Although each frontier was estimated by Data Envelopment Analysis (DEA), metafrontier methodology was carried out in order to consider two different countries: Turkey and Italy.

Puglia is one of the south regions of Italy and produces 39% of the Italy's total olive oil production and Foggia province produces 20% of the Puglia's and 8% of the Italy's olive oil production. The production of olive oil in Turkey, the west coast, also known as the Aegean Region is ranked first in terms of its shares of (47%) in olive oil. The Aydın province, with its substantial percentage of Turkey's production of olive oil at (12%) and one fifth of Aegean regions production (22%) is an essential area of olive oil production (TURKSTAT, 2014).

Data

The data, comes from a sample of olive oil mills and were compiled by face to face survey method for the 2015-2016 and 2016-2017 harvest season in Aydın (Turkey) and Foggia (Italy). Tha data for Aydın-Turkey was collected in April and May 2017 and the data for Foggia-Italy was collected in June, July and August 2017. We determined that there are some production problems for olive and also olive oil for 2016-2017 season in Turkey and also in Italy. For this reason, we chose to use the data for the 2015-2016 season in the analysis.

There are totaly 186 olive oil mills in Aydın and 96 olive oil mills in Foggia. We contact with all of them and within the positive responses that we have received from the mills for the questionaries, we were able to get full response from 45 mills for Aydın and 41mills for Foggia. Data about 41 olive mills in Foggia-Italy and 45 olive oil mils in Aydın-Turkey was used for the study.

Esmiation of Technical Efficiency

Quantity of olive oil produced (OOP) (tonnes) is the output and five inputs are as follows:

1. Olives milled (OM) (tones),
2. Skilled labour (SL), which includes technical and management jobs (total working hours).
3. Unskilled labour (USL) which involves the unqualified jobs (total working hours),
4. Floating capital (FLC) (Euro) taken into account the operating and maintenance costs,
5. Fixed capital (FXC) (Euro) it was derived by subtracting accumulated capital from gross capital stock (Dios-Palomares and Martinez-Paz, 2011).

These are the main variables in the output oriented DEA model, which was solved for 45 olive oil mills as decision making unit (DMU) for Turkey and 41 olive oil mills for Italy in the research.

Quality and environmental levels in the mills were also quantified and evaluated by mean of the design and implementation of two indexes.

It is also interesting to detect which factors effects on the effciency of the olive oil mills. With this aim, truncated regression models with bootstrap has been estimated where the efficiency score (truncated between 0 and 1) is the endogenous variable. Eight additional explicative variables regarding the mills performance are included in the model.

Technical efficiency framework

The efficiency was estimated using DEA methodology with a metafrontier approach (Coelli et al., 2005, O'Donnell et al., 2008), and dealing with two frontiers corresponding to the two technological groups considered: Italy and Turkey.

The formulation of the DEA mathematical model starts with the definition of the n decision making units (DMU) under study. The j-th DMU is denoted by DMUj with j = 1, …, n. DMUj uses m inputs (indexed i =1, …, m) to produce s outputs (indexed r = 1, …, s). Every DMU is characterised by its inputs and outputs, i.e., if $x \in \mathbb{R}_+^m$ is the vector of inputs and $y \in \mathbb{R}_+^s$ is the vector of outputs of a DMU, such DMU is characterised by the pair $(x,y) \in \mathbb{R}_+^{m+s}$ In this way, the so-called production possibility set could be defined by the set $P = \{(x,y) \in \mathbb{R}_+^{m+s} / x \text{ can produce } y\}$ This set will be estimated on the basis of the values of the sample of n DMU_s. Thus, if $x_j \in \mathbb{R}_+^m$ is the vector of inputs of DMU_j, and $y_j \in \mathbb{R}_+^s$ is its vector of outputs, for every j = 1, …, n, then the data of the problem are characterised by the matrix of inputs $X = (x_j) \in \mathbb{R}_+^{m \times n}$ and the matrix of outputs $Y = (y_j) \in \mathbb{R}_+^{s \times n}$ In a classical DEA model proposed by Banker et al. (1984), the production possibility set can be estimated as $P_{BCC} = \{(x, y) \in \mathbb{R}_+^{m+s} / x \geq X\lambda, y \leq Y\lambda, e\lambda = 1, \lambda \geq 0\}$ where $\lambda \in \mathbb{R}^n$ and e is a row vector with all elements equal to 1, i.e.,$e\lambda = 1$ means $\sum_{j=1}^{n} \lambda_j = 1$ Then, for each fixed DMUo (with o varying o = 1, …, n) the envelopment form of the output-oriented BCC model is written in the way:

$$\max_{\eta,\lambda} \eta$$

subject to

$$X\lambda \leq x_o$$
$$\eta y_o - Y\lambda \leq 0$$
$$e\lambda = 1$$
$$\lambda \geq 0$$

where the scalar η measures the efficiency of the DMUo, λ is a column vector (n1) which weighs the DMUs of the sample, and the constraint $e\lambda = 1$ means $\sum_{j=1}^{n} \lambda_j = 1$ and characterises variable return of scale models.

Firstly, pure efficiency (also called BCC-efficiency) was estimated with this BCC model. Then, technical efficiency (also called CCR-efficiency) was estimated with a CCR model with constant returns to scale (Charnes et al., 1978). In this CCR model, the constraint $e\lambda = 1$,i.e $\sum_{j=1}^{n} \lambda_j = 1$,is omitted. Scale efficiency is then computed as the ratio between pure (BCC) and technical (CCR) efficiencies.

The metafrontier concept, developed by O'Donnell et al. (2008), was applied. This model considers that technical efficiencies of the farms with different technologies are not comparable under the same production frontier. The frontiers of the two countries were estimated separately. The intra-group efficiency $TE_{j_k}^k$ with K groups, nk units (DMUs) in each group k, and k = 1, …, K, with $n = \sum_{k=1}^{K} n_k$ the total number of DMUs and jk = 1, …, nk, is the technical efficiency of the DMU jk of the group k respect to the DMUs of its group k. In our case, k = 1 for the HTG group and k = 2 for the LTG group. Then, given a farm jk, $TE_{j_k}^k$ is its technical efficiency regarding its group k. This value $TE_{j_k}^k$ is estimated with the distance to the frontier. This is a mark of the efficiency of each DMU compared with the DMUs which use the same technology. In addition, the metafrontier is estimated considering all the n DMUs, i.e., all the DMUs of both countries. The efficiency of the DMU_{j_k} regarding this metafrontier is denoted by TE_{j_k}, jk = 1, …, nk, and k = 1, …, K. The meta-technology ratio (MTR_{j_k}) is the ratio between both efficiencies, i.e. $MTR_{j_k} = \frac{TE_{j_k}}{TE_{j_k}^k}$,when the DMU_{j_k} belongs to the group (country) k. This ratio represents the distance between the frontier of each group and the metafrontier.

After the efficiency estimation, the following analysis was conducted in order to detect the effect of some factors on the efficiency of the olive oil mills. It is a well-known general result that if the endogenous variable is bound, truncated regression and bootstrap techniques are suitable to its estimation (Simar and Wilson, 2005). Thus, truncated regression models were estimated, with 1000 bootstrap samples, to describe the estimated efficiency index TE by a group of L efficiency factors by the F function, i.e. $TE = F(\beta, f) + \varepsilon$ with $\varepsilon \in N(0, \sigma2)$, and $0 < TE < 1$.

The variables which can influence the level of efficiency were the following:

1. Number of Partners (NOP)
2. Number of Permanent Unskilled Labour (NPUL)
3. Production Managers Experience (PME) (years)
4. Special Training About Sector (no=0, yes=1)
5. Membership in the Farmer's Association (no=0, yes=1)
6. Membership in the Marketing Association (no=0, yes=1)
7. Quality Index (continuous variable between 0-1)
8. Environmental Index (continuous variable between 0-1)

Quality and environmental complex indexes

The quality and the environmental indexes were calculated for each DMU in order to quantify how the mills behavied regarding these two important aspects in the olive oil industry in Aydın and in Foggia. Two complex indexes, quality and environmental, each one independently, were carried out by the following procedure. First of all, the atributes that capture aspects in relation with the subject were determined, and also the variables that evaluate the atributes were measured (0= absence, 100= presence). Then a weight for each atribute is determined to give it its relative importance: 0 null importance, 5 maximun importance was applied to evaluate the atributes referring to the quality and environmental sensitivites in olive oil industry. As a result, after two-round Delphi survey (Dalkey and Helmer,1963; Mili and Rodriguez Zuñiga, 2001) to the groups of 11 experts (Aydın) and 10 experts (Foggia) in the olive oil production process, the weights were determined. Finally, a powered mean was calculated to assign a index score to each DMU (Schoemaker and Wail, 1982). This procedure was applied to calculate both: quality and environmental indexes and the variables considered in the evaluations can be seen in Table 2.

3.RESULTS and DISCUSSION

Descriptive statistics of the outputs and inputs are given in Table 1.

Table 1. Descriptive Statistics of Output and Inputs

	OOP (tonnes)	OM (tonnes)	FXC (1000 Euro)	FLC (1000 Euro)	SL (hours)	USL (hours)
Turkey (n=45)						
Mean	549.87	3106.18	719.30	74.66	4334.93	9162.67
SD	876.62	3937.05	611.92	157.24	6365.96	9623.97
Min.	40.00	132.00	15.00	2.70	0.00	0.00
Max.	6000.00	26400.00	3500.00	1000.00	29952.00	54912.00
Italy (n=41)						
Mean	392.32	3037.56	705.35	125.25	5397.07	3759.22
SD	553.34	5069.66	598.95	196.20	5065.17	10479.21
Min.	2.00	15.00	15.00	5.14	0.00	0.00
Max.	3000.00	26000.00	2400.00	1086.55	26400.00	66240.00
All Mills (n=86)						
Mean	474.76	3073.47	713.10	96.79	4841.30	6586.60
SD	740.37	4485.50	602.45	176.00	5773.73	10343.65
Min.	2.00	15.00	15.00	2.70	0.00	0.00
Max.	6000.00	26400.00	3500.00	1086.55	29952.00	66240.00

Table 2 shows the components and their weights that were used for the calculation of the quality and environmental indexes. The weight of the components (questions) was determined by experts. Except for the "waterproof pools" and "location of the mill", it was seen that the environmental and quality sensitivities of Turkish and Italian mills have very similar results.

Table 2. Components and Weights Used for the Calculation of the Quality and Environmental Indexes

	Weights*	
Weights of the Environmental Index Questions	**Turkey**	**Italy**
Environmentally Friendly Waste Management	0.213	0.212
Two or Three Phase Extraction system	0.168	0.149
Waterproof Pools for Waste Water	0.156	0.194
Using Environmentally Friendly Fuel	0.165	0.175
Location of the Mill (Outside of the Urban Area)	0.193	0.132
Certificated by ISO 14000	0.105	0.137
Total Weight	**1.000**	**1.000**
Weights of the Quality Index Questions	**Turkey**	**Italy**
Classifiying the Olive by Variety and Typ e (Harvest-Transport)	0.141	0.140
Controlling of the Production Process (Cleanliness-Time-Temparature)	0.153	0.148
Checking of the Critical Control Points	0.100	0.118
Product Tracebility	0.101	0.104
Experienced Production Manager	0.140	0.123
Determining the Features by Laboratory Analysis	0.122	0.115
Certificated by ISO 9000	0.077	0.091
Having an Own Marketing Brand	0.074	0.080
Have Received Quality Awards	0.092	0.083
Total Weight	**1.000**	**1.000**

**Was calculated by the authors based on the Delphi Process*

It is necessary to calculate the partial productivities "which are simple ratio of output and input" to see if meta frontier approach is essential. When we check the partial productivities it is seen that we have to calculate the meta frontier approach scores (Table 3).

Table 3. Partial Productivities

	OOP/OM	OOP/FXC	OOP/FLC	OOP/SL	OOP/USL
Turkey	0.18	1.58	20.93	0.17	0.09
Italy	0.15	1.83	9.20	0.09	0.18

Estimates of efficiency levels with respect to the group (partial) frontiers and meta-frontier have been obtained with output oriented DEA model. Technical efficiency scores for separated groups and pooled group (meta-frontier) are presented in Table 4. The efficiency scores of the Italian mills are higher than Turkish mills for both in themselves and in communal pool with Turkish mills.

Table 4. Efficiency Scores for Group and Meta Frontier

	Turkey			Italy		
Partial Frontiers	**CCR**	**BCC**	**SCA**	**CCR**	**BCC**	**SCA**
Mean	0.85	0.90	0.95	0.90	0.93	0.96
SD	0.36	0.45	0.72	0.21	0.21	0.75
Min.	1.04	1.10	1.04	1.00	1.00	1.00
Max.	0.16	0.15	0.08	0.15	0.15	0.07
% Efficient Mills	22	44	22	39	63	41
Meta Frontier	**CCR**	**BCC**	**SCA**	**CCR**	**BCC**	**SCA**
Mean	0.74	0.80	0.93	0.81	0.87	0.94
SD	0.30	0.38	0.74	0.21	0.21	0.47
Min.	1.00	1.00	1.00	1.00	1.00	1.00
Max.	0.18	0.19	0.08	0.19	0.19	0.10
Efficient Mills (%)	18	36	18	22	32	24

When efficiency estimate is determined, it will be good to calculate the slacks for each output to find out the increase percentage they could accomplish if the inefficiency is eliminated. Table 5 shows the means of the total slacks. As it seen Turkish mills can increase their olive oil production about 45% without changing existing inputs. This rate was estimated at 49% for Italian mills. When we look the inputs, it is also relevant to highlight the mean slacks of unskilled labour in Turkish and fixed capital, floating capital and skilled labour in Italian mills.

Table 5. The Average Improvements in Variables for Technical Efficiency (%)

OOP	OM	FXCAP	FLCAP	SL	USL
			Turkey		
44.94	-0.35	-28.04	-14.51	-28.81	-45.45
			Italy		
48.59	-1.87	-55.28	-57.71	-42.56	-13.49
			All		
46.68	-1.08	-41.03	-35.11	-35.37	-30.21

Meta Technology Ratio (MTR) is a ratio between partial and pooled efficiency scores. MTR scores can be seen in Table 6 and they are also higher in Italian mills.

Table 6. Meta Technology Ratios

	Turkey			Italy		
	CCR	BCC	SCA	CCR	BCC	SCA
Mean	0.86	0.89	0.97	0.89	0.92	0.97
Minimum	0.82	0.62	0.83	0.62	0.62	0.63
Maximum	1.00	1.00	1.00	1.00	1.00	1.00
Standart Deviation	0.07	0.10	0.06	0.13	0.12	0.06

To determine the profiles of the most influential firms, a study was made by bootstrapped regression. Descriptive statistics of effficiency factors are presented in Table 7.

Table 7. Descriptive Statistics of Efficiency Factors

	Turkey (n=45)				Italy (n=41)			
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
Continuous Variables								
NOP	93.71	191.11	1.00	847.00	43.94	109.93	0.00	518.00
NPUL	3.58	4.31	0.00	24.00	2.23	3.92	0.00	20.00
PME	18.73	12.12	1.00	50.00	20.26	11.70	4.00	40.00
QI	0.64	0.21	0.26	1.00	0.70	0.17	0.24	1.00
EI	0.68	0.24	0.16	1.00	0.70	0.17	0.22	1.00
Binary Variables (Yes%)								
SPT				55.56				80.65
FARASS				84.44				38.71
MARASS				8.89				9.68

The truncated regressions estimated with bootstrap for both Turkish and Italian mills and all mills for CCR, BCC and SCA scores are shown in Table 8, Table 9 and Table10.

When we check the results for CCR scores, it is seen that PME, SPT and QI have positive and NOP and NPUL have negative impact on efficiency scores inTurkish mills also PME, SPT, QI and EI have positive impact on efficiency scores in Italian mills (Table 8, Table 9).

Table 8. Bootstrapped Truncated Regression Results for Turkey[1]

	Observed Coefficient	**Bootstrap Std. Err.**	**P>|z|**	**Normal-Based (95% Confidence Interval)**	
CCR				Lower	Upper
NOP	-.0381581	.0155788	0.014**	-.0686919	-.0076242
NPUL	-2.028613	.9238689	0.028**	-3.839.363	-.2178635
PME	.6603983	.2567278	0.010**	.1572211	1.163575
SPT	.7507117	.2823477	0.009***	.1872274	1.29401
FARASS	.0020775	.0030743	0.499	-.003948	.0081031
MARASS	-.0000309	.0000651	0.634	-.0001584	.0000966
QI	.0793792	.03295	0.016**	.0147983	.14396
EI	.2231005	5.542549	0.968	-10.64	11.086300
BCC					
NOP	-.0247473	.0270427	0.360	-.07775	.0282554
NPUL	-1.726618	1.111529	0.120	-3.905174	.451938
PME	.562069	.3719734	0.131	-.1669854	1.291124
SPT	.7406187	.2975561	0.013**	.1574195	1.323818
FARASS	-.0014815	.0019308	0.443	-.0052658	.0023028
MARASS	1.072044	15.50369	0.945	-29.31462	31.45871
QI	.0734437	.2379376	0.758	-.3929054	.5397929
EI	.258282	.4359393	0.554	-.5961434	1.112707
SCA					
NOP	-.6313046	.3354909	0.060*	-1.288855	.0262455
NPUL	.2050522	1.742805	0.906	-3.210783	3.620887
PME	.6683078	.7198531	0.353	-.7425784	2.079194
SPT	.0514729	.0148889	0.001***	.0222911	.0806547
FARASS	-.0011915	.0024361	0.709	-.0001684	.0002475
MARASS	.0000396	.0001061	0.658	-64.18105	40.54639
QI	.082827	.0456385	0.070*	-.0066227	.1722768
EI	.0559656	.7469417	0.940	-1.408013	1.519945

[1]*Observation number = 45; replications number = 1000*
**P<0.1. **P<0.05. ***P<0.01*

Table 9. Bootstrapped Truncated Regression Results for Italy[1]

	Observed Coefficient	Bootstrap Std. Err.	P>|z|	Normal-Based (95% Confidence Interval)	
CCR				Lower	Upper
NOP	.0180965	.0337956	0.592	-.0481416	.0843346
NPUL	-.2481934	.7546762	0.742	-1.727332	1.230945
PME	.7514595	.2196848	0.001***	.3111831	1.172332
SPT	.7417575	.2635014	0.005***	.2253041	1.258211
FARASS	3.948388	8.118881	0.627	-11.96433	19.8611
MARASS	7.782448	14.65483	0.595	-20.94048	36.50538
QI	1.844541	.54741	0.001***	.7716367	2.917444
EI	.0828196	.0385354	0.032**	.0072916	.1583475
BCC					
NOP	-.0529184	.0312387	0.090*	-.1141451	.0083083
NPUL	-1.562563	.8799806	0.076*	-3.287293	.1621673
PME	.0106162	.3025314	0.972	-.5823344	.6035669
SPT	3.531478	9.321173	0.705	-14.73769	21.80064
FARASS	.0975863	6.705497	0.988	-13.04495	13.24012
MARASS	-.0289791	.3835099	0.940	-.7806446	.7226865
QI	.6293785	.3464446	0.069*	-.0496404	1.308397
EI	.345742	.2467583	0.161	-.1378955	.8293795
SCA					
NOP	-.0633169	.0403048	0.116	-.1423129	.0156791
NPUL	-3.30153	1.385417	0.017**	-6.016897	-.5861625
PME	.2309335	.3611414	0.523	-.4768906	.9387575
SPT	14.77327	11.87497	0.213	-8.501245	38.04778
FARASS	5.789042	8.018672	0.470	-9.927266	21.50535
MARASS	.3142522	6.718255	0.963	-12.85329	13.48179
QI	.6992446	.3309048	0.035**	.0506832	1.347806
EI	.3311777	.4193699	0.430	-.4907723	1.153128

[1]*Observation number = 41; replications number = 1000*
**P<0.1. **P<0.05. ***P<0.01*

When we check the results for pooled CCR scores, it is seen that PME, SPT and QI have positive impact on efficiency scores.

Table 10. Bootstrapped Truncated Regressions for All Mills1

	Observed Coefficient	Bootstrap Std. Err.	P>|z|	Normal-Based (95% Confidence Interval)	
CCR					
NOP	.0650236	.0421338	0.123	-.0175572	.1476044
NPUL	2.815696	2.320717	0.225	-1.732826	7.364218
PME	.7497575	.2196848	0.001***	.3111831	1.172332
SPT	.6603983	.1793201	0.000***	.3089373	1.011859
FARASS	7.261646	7.109899	0.307	-6.6735	21.19679
MARASS	-11.6697	12.30657	0.343	-35.79013	12.45073
QI	.0832605	.0343225	0.015**	.0159897	.1505313
EI	.0569902	.3532025	0.872	-.635274	.7492543
BCC					
NOP	.0942885	.0514802	0.067*	-.0066108	.1951879
NPUL	-.0348801	1.131251	0.975	-2.252091	2.182331
PME	.02475	.4254295	0.954	-.8090764	.8585764
SPT	.6577317	.1236567	0.000***	.415369	.9000944
FARASS	13.33724	9.563978	0.163	-5.407817	32.08229
MARASS	-.0016601	.0349812	0.962	-.0702221	.0669018
QI	.3493624	.2915926	0.231	-.2221486	.9208734
EI	.0510979	.04516	0.258	-.0374142	.1396099
SCA					
NOP	.9527826	.244594	0.000***	.4733872	1.432178
NPUL	.7190405	1.603627	0.654	-2.42401	3.862091
PME	-.058451	.6632207	0.930	-1.35834	1.241438
SPT	1.460766	.4661671	0.002***	.5470955	2.374437
FARASS	8.682383	13.41719	0.518	-17.61482	34.97959
MARASS	.0017525	.0032739	0.592	-.0046643	.0081692
QI	.6611283	.3868101	0.087*	-.0970056	1.419262
EI	.3728772	1.452889	0.797	-2.474733	3.220487

[1]Observation number =86; replications number = 1000
**P<0.1. **P<0.05. ***P<0.01*

4.CONCLUSIONS

In this study we estimated the efficiency scores of Turkish and Italian olive mills. Estimated scores shows that Italian mills have better efficiency scores than Turkish mills. As a result of the answers given to the questions determining the quality and environmental indices, theoretically the quality and environmental sensitivities are very close to each other. However, when we look at the practice, it is seen that Italian mills are in better condition than Turkish mills. It is also determined that both Turkish and Italian olive mills can improve their outputs 45% and 49% respectively with the amount of their available input. In addition to this, it is also determined that, if the Turkish and Italian mills reduce the amount of inputs by estimated amounts (olive by 1.87%, 1.08%, fixed capital by 28.04%, 55.28%, floating capital by 14.51%, 57.71%, skilled labour by 28.81%, 42.56%, unskilled labour by 45.45%, 13.49%) they can also reach the amount of available output.

In Italian mills, production managers experience, quality and environmental sensitivities and the rate of special training are higher than Turkish mills. Number of partners and number of unskilled labour are higher than İtalian mills in Turkish mills. It is seen that these calculations also have an effect on the efficiency scores. In Turkish mills NOP and NPUL have negative and PME, SPT, and QI have positive impact on efficiency scores (NOP-0.04%, NPUL-2%, PME-0.6%, QI-0.08%, SPT-0.7%). When we check the Italin mills, it is seen that PME, SPT, QI and EI have positive impact on efficiency scores (PME-0.8%, .SPT-0.7%, QI-1.8%, EI-0.08%). In the pool when the both Italian and Turkish mills considered, PME, SPT and QI have positive impact on efficiency scores (PME-0.8%, SPT-0.7%, QI-0.08%).

Consequently, it would not be wrong to say that Turkish mills should increase their quality and environmental sensitivity in both mental and practical applications. In addition, it is seen that Turkish mills have to reduce NPUL and NOP. Priority steps for the branding of Turkish olive oil were determined in this way. The results are thought to be important for producers and and also policy makers.

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