

An Efficiency Analysis for the State-Owned Sugar Factories in Turkey: 2003-2016

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Extensive Summary

The agricultural sector, as a whole, is among the strategic sectors, especially for developing countries. In addition to this, for long term development plans, agricultural sector has an importance in terms of providing inputs to the other sectors. In the last 15 years, the share of agricultural sector has sharply declined in Turkish economy and this cause to several economic and social problems. The decrease in the share of agriculture in the national income is one of the most important causes of migration from rural to urban.

Sugar production and the sub-products also provide very important contribution to the economy. Both in Turkey and in the World, sugar production has a strategic importance. This is not only in the view of staple foods, but also, contribution to the other service sectors is very crucial such as employment and transportation.

Since sugar beet is an industrial plant, it is a one of the primary products in both our country and in many countries in terms of agricultural policies. Bagasse, molasses and ethanol are the by-products which the result of processing sugar beet. While bagasse and molasses are used as animal feed (fodder), sugar is raw material of many important products such as ferment, antibiotic and bioethanol.

Sugar cane and sugar beet, basically, are raw material of the sugar production. There is no a significant difference between two productions in terms of quality. Sugar cane can be grown only in tropical area and its cost relatively lower than sugar beet. Therefore, sugar produced from sugar cane costs lower than sugar produced from sugar beet. Sugar produced in Turkey is entirely produced from sugar beet and therefore, production cost in Turkey much more above the world average cost.

Compare with the global sugar production, Turkey has an important share. Turkey produce 2250 thousand tons crystal sugar, on average, annually and take in fifth place after Russia, France, USA and Germany. In addition to this, Turkey is in fourth place

between European Union countries. Sugar production is not only important in view of economy, but it's also crucial as socially for Turkey. Sugar beet production is directly and indirectly influencing about 10 million people when it comes to feedback effects and contributions to other sectors.

There are a many studies related with efficiency of sugar production in the literature. Some of them used parametric methods, others used non-parametric methods. Parametric methods are divided in to 3 in itself namely stochastic frontier approach (SFA), thick frontier approach (TFA) and distribution free approach (DFA). The most used method in econometric studies is SFA which was simultaneously developed by Aigner, D., & Lowell, J.A.K., & Schmidt, P. (1977), Meesuen, W., & Van Den Broeck, J. (1977) ve Battese, G.E., & Corra, G.S. (1977). Non parametric method can also be divided into 2 categories namely Data Envelopment Analyses (DEA) and Malmquist index. DEA was developed by Charnes, A., & Cooper, W.W., & Rhodes, E. (1978) and this is also called CCR model. This method is based on linear programming. DEA shows the relative efficiency of decision making unit (DMU). In this method, the best observations among DMUs are considered as efficiency frontier and the other observations are compared with the most efficient units.

In this study both DEA and Malmquist index were used to find the production efficiency scores and changes. Beside this, after determining the most efficient DMU's, super efficiency analysis were made for comparing them with each other. These measurements of technical efficiency (DEA and Malmquist Index) were made by using DEAP V2.1 package software program which developed by Coelli. Super efficiency measurement was made by using EMS (Efficiency Measurement System).

Our data set consists of 25 sugar factories belongs Turkish Sugar Industry between the years 2003-2016. Six inputs (arable beet area, farmers, factory workers, amount of processed beet, fuel consumption and accumulated depreciation) and two outputs (crystal sugar and molasses) were used for measurement of efficiency. Both inputs and outputs have been normalized by dividing into arable sugar beet land.

Regarding to findings, Corum, Eregli, Erzurum and Kars are the most efficient factories during the related periods. According to Malmquist Index, the highest unit of changing in total factor productivity (CTFP) is Malatya sugar factory with 1,085 at last five years. It means that an increase in TFP is 8,5% and the most important reason of this increase is the change in technology with 7,3%. The lowest unit of changing in total factor productivity is Elazig sugar factory with 0,921. It means that decrease in TFP is 7,9%. In addition to this, especially after 2012, as a whole, a decline in the efficiency of the factories is remarkable. In this sense, the modernization of the technological sub-structures of the factories handled in the study is very important for both the region and the country's economy.