Volume 1 No. 1, July 2011
International Journal of Science and Technology

http://www.ejournalofsciences.org

A survey on the effect of the industrial concentration index over the technical efficiency, Iran's Sugar and Industry

[1]S. Homayooni, [2]F. Karimzadeh , [3]H. Arabshahi

[1]Economic Department, University of Esfahan, Esfahan, Iran
[2]Economic Department, Allame Tabatabaii University of Tehran, Tehran, Iran
[3]Pjysics Department, Payame Nour University of Fariman, Fariman, Iran

ABSTRACT

Sugar and sugar lump are from the fundamental goods in Iran that with respect to their share in producing the agricultural products and also their role as an end consumed good or their supplementary and mediatory role in producing much of the family consumed goods, hare received attention. So, this protect has encountered the governmental heavy interferences, price severe fluctuations, vast production in the countries all over the world, also it hey a very vast market in Iran and all around the world, so this industry, requires an intensive survey either with respect to the production and its expense or from the consuming point of view. The purpose of this survey is to study about the effect of the concentration index on the technical efficiency of the sugar and (sugar lump) producing factories through estimating Boundary the required information collected from sugar production factories for years 1384-88, and after estimating the Tran slog production function with combinational data, the effective factors on their technical efficiency such as the amount of concentration, have been evaluated, too. The effective factors on the technical efficiency gas and residue (mazut) to beet, antiquity, extraction coefficient, silo drop, the number of work forces with the education higher than the licentiate's degree and the observation year. The results obtained from this model show that the average of the evaluated technical efficiency in industry is %89 and also average increases with increasing the inefficiency concentration in the industry.

Keywords: *Sugar; licentiate's degree; producing factories; mediatory role.*

1. INTRODUCTION

With the study of the economy of developed and industrialized countries, we realize that one of the main and common characteristics of the economies is their vast size and scale. Another characteristic of these countries is their confidence on rivalry and their combat with monopoly or restriction. Human life history always witnesses the efforts of special groups to attain monopoly situation in different aspects, including the economical aspect the have arised the reactions of the populations and the governments. With the appearance of the classic school and propagation of ideas of Adam Smith, the interference of the government in the economic affairs was criticized. He believed that the best government is the smallest government, and if the markets are given trust of confidence, the society welfare will be maximized. But this question exist that how much a Market system can allocate the unique resources to satisfy our needs effectively [1-3].

Some of the economist believed that under special condition's the Market system has not suitable efficiency, that is, in fact it cant allocate the resources very well and in other words, it acts inefficiently. (some of the economists believed that under special conditions, the Market system has not useful and suitable efficiency, that is, in fact it cant allocate the resources as well as possible, then the social welfare will be in the lower level than the deserved amount [4].

Complexional operation is an accepted criteria for the economists for evaluating the economical operation, in other words, when the economical operation of a Market is for away from the computational operation, there will be and equal inefficiency in the Market. In Iran and during recent years, specially during the economical social and cultural program, there has been an emphasize on increasing the efficiency and developing the competition in the economy. Also the topic of the liberalization and privatization together with developing the competition. Has received much attention, but the studies show that despite programming for miniaturization of the government and weakness of the monopolies of restrictions a considerable situation has not been attained.

On this basis, in this survey, we (primarily) study the concentration index in Iran sugar industry and we also survey the way of the Marked distribution between the companies existed in this industry. In the second stage, we calculate the aforementioned industry efficiency, using the Random Boundary Vector, and we will also study about the role of the concentration based other effective factors on efficiency. Our understudy statistical society are all of the sugar factories existed all around the Iran. The new phenomenon of "Universalizing Economy" and losing commerce borders of countries is expanding a lot, and in future the countries will be able to recede themselves from the course and only become spectator trade transition among countries. So, Iran also wants to accompany oneself with trade transition in the world as well as to become ready for competition, and entering in the international commerce scene. Perhaps, one of the necessary backgrounds before joining to universal trade organization is consolidating and expanding trade in the

framework of the background in which country has unique benefits.

2. THEORETICAL ASPECTS

In order to study the effect of the concentration index on sugar industry efficiency, in this chapter, at first we describe the basis of the concentration indexes, and then the event of the Random Boundary Vectors will be discussed,

The concept and the calculation of the concentration

In the experimental studies about the structure of the industries and Markets to judge about the competition degree and monopoly in each Market, usually the concept of the concentration is used. Then with the study of the concentration concept, we can attain the market distribution between the companies bound to the industry. Market concentration is as the way of the Market distribution between the different companies or in other words, the Market concentration show that how much of t he total market productions of a special product. Thus we can say that a concentrated market is a market that has been controlled by the limited number of the companies and it acquires the greatest share in the market. The concentration index should present some information about the number of the companies and the way of the market distribution between them, and in fact it should present a complete picture of the market structure in a definite and certain number.

In order to measure the concentration, till now very different criteria have been recognized that can be used for determining the companies distribution sizes in the market and specifying their dispersion degree. On this basis, in the present study, beside introducing one of these indexes, we will calculate the monopoly degree and the competitiveness of the sugar industry.

Herfindal Index-Hershman1

This index I s sum of the (share) portion square of the sale of productive companies inside an industry in a market with the polygala monopoly. We suppose that these companies produce homogeneous goods and also sell them with the same price. As a result, the price of goods doesn't have any in effect on the concentration coefficient.

Consider the company i that sales the amount of Q_i goods with the same price.

Then its sale portion share equals: $S_i = \frac{Q_i}{Q}$ where, Q is the industry supply.

Now, due to the uniformity of the produced goods by these companies, the goods have similar price and subsequently the sale worth portion as $M_i = \frac{PQ_i}{PG}$ equals with the sale portion (S_i) For the company i, the square of the market sale portion is (S_i^2), and on this basis, the Herfindal index is expressed as follows,

$$H = \sum_{1}^{n} S_i^2$$

In view of the fact that in the structure of this index, the companies market portion has received the square exponential we can conclude that great companies have much more impact on this index and in another words, in the structure of this index, the greater companies have much more importance. This index also has numerous applications in antimonopoly diplomacy and generating a competition ground. After determining the size and the amounts of the concentration, we can divide the industries on the basis of the recommended pattern (Khodadad Kashi 1379). On this basis, the industries which their Herfindal index is lower than 1000, are classified in the group of the computational markets, and if this index be more than 1000, these industries are called monopolistic. Now, with regard to the above matters, the amount of the market portion of the sugar production factories in the country. Have been calculated separately and their concentration index for the years 1384 to 1388 also have been obtained.

Now, with required to the obtained calculations, it is observed that in 1384, the concentration index in the sugar industry, according to the production level, equals to 471 that is lower than 1000. Thus sugar industry has the condition of lack of concentration and monopoly.

This index, also, has been calculated for the years 1385-1388 that with out the notation of the amount of the production for each factory and the amount of its portion from sugar market.

It is noteworthy that the reason for increasing the concentration index during the 1386 to 1388, is the decrease in the activity or departure of the smaller factories which is followed by an increase in the proportion of the bigger factories.

The Boundary (production) Expense Function and Inefficiency.

In the economical studies, at the time of estimating the expense functions or the production, the variables employed y the companies are used for example, in order to estimate the expense function of a company, the price of the production factors (pr, the company production (y) and the expenses done in the company © are used and a function as c = c (y, p) + ε in the form of Cobb Douglass Leontif or translog is evaluated. This estimating function = how the way of the company operation But according to the definition, the expense function show the least expense that the company can define for a determined (certain) production of the receiver, but the estimated function only shows the

intermediate portions of the company expenses and under any title it never showed the least expense function of the company. So this function doesn't = how the suitable operation of the company and only it shows the present operation of the company.

But, by using the Boundary function, we will be able to estimate the least expense function. In this state, our definition of the Boundary function includes the least expense function and deviation from this function, and we con show it as c = c(y,p)+u where, c(y,p) is the least expense and u, is the deviation from this function and it also showes the unsuitable operation of the company's management, and it will increase the production expenses. By comparing u and ε it is observed that at the time of estimation, except other statistical errors ε will include the factors that the company doesn't possess them, like water and atmosphere, unexpected events. But the company possess u and in the expense function it includes factors where the company, with an unsuitable operation, causes an increase in production expenses. So, always u≥0. With these explanation it is determined that the boundary function, in fact, specify the company efficiency and also show the border between suitable and unsuitable operation.

In t he boundary function mold, every deviation from the observed amount of the greatest amount of the theoretical production, is attributed to the company inefficiency.

In the Random Boundary method of each company, there is an especial production border in which the set of all Random ingredients which enter the model and are out of the company's control, specify the status of this boundary. In this expression: y = f(x, β), the only output of the production operation is (y), and (x) is a m th vector of inputs and (β) represent the parameters. This expression defines a theoretical boundary in production. This boundary shows the maximum amount of the single output of (y), which may be produced using the (x) input vector. But in practice, the companies may not operate over the production boundary and inefficiency in the operation causes a lower output than the production boundary. On this basis the production function of the singular companies (the Ran domical Boundary production) is as follows,

$$y_u = f\left(x_{it} : \beta\right)e^{\varepsilon_{it}}$$

$$\varepsilon_{it} = v_{it} + u_i$$

In the above equation, ε_{it} is the combined error sentence, which is sum of the symmetrical error sentence and is a representative of the Random factors v_i and non-negative variable that shows the factors tending to inefficiency u_i reflects this fact that the amount of each company production is placed under or over the boundary, $y = f(x:\beta) + v_i$

And this interference is the result of the under control factors of each company. Also, the production boundary itself with regard to the Random ingredient (v_i) can be different for each company. In the other words, we can state that in this way the technical efficiency is measured as $\frac{y_i}{f\left(x:\beta\right)+v_i}$ and not in the form: $\frac{y_i}{f\left(x:\beta\right)}$.

In the case of the expense function, schmidth 1 (1976) contidered the deviation of the optimal function as a one way Random and also showed the form of this equation as follows:

$$c = c\left(y, p\right) + u_i \qquad u_i \geq 0$$

Where, c_i is the processed expense in the company and c(y,p) is the least expense, (u_i) is the deviation from the least expense. Although he considered the Boundary functions as boundary, and cited the suitable way of estimating its parameters as a correctness showing maximum way, he didn't cite the applied method for estimating it.

Aigner, Loveland schmidth 2 (1977) introduced the applied method for estimating the Random Boundary functions in a common, investigation, and they developed several examples in the form of Mont Carlo investigations with synthetic data. This procedure is on the basis of the ML equation of Random Boundary functions and to obtain it, it is necessary to have the distribution of the error sentences of these functions, that is, it is necessary to obtain the common distribution of (u) and (v), and then we can extract the connection showing maximum function and estimate it. It is noteworthy that, by adding the bilateral (normal error sentence to the expense and production function, they converted it into a it as follows:

$$c = c\left(y, p\right) + \varepsilon_i \qquad c = c\left(y, p\right) + u_i + v_i$$

$$\varepsilon_i = u_i + v_i$$

In the above equation, $\varepsilon_i = u_i + v_i$ is as the combined error sentence is of sum of the normal error sentence (v_i) and subnormal error sentence (u_i) and referred as the combined error sentence. Estimating the Random Boundary Functions With the Butis and Coli Model (1995). In fact, this model has been introduced after the investigations of combhoger Gosh and McGokin (1997), in which these researchers have criticized the two-stage estimation models, so a brief look at the two-stage model, we will describe the characteristics of the Batis and Coli model (1995). In the two-stage model and in the first step, the production function, proportional to the understudy industry

$$LNY_u = \beta_0 + \sum_j \beta_j LNX_{ijt} + \frac{1}{2}\sum_j \sum_k \beta_{jk} LNX_{ijt} LNX_{kit} + U_{it}$$

where, t denotes the time and the interference ingredient (u_{it}) can be divided into the following ingredients,

$$U_{it} = \varepsilon_{it} + \phi_{it}$$

where, ε_{it} expresses the technical efficiency and ϕ_{it} also denotes the Random Interference Ingredient. ε_{it} also can be divided in to two ingredients as follows:

$$\varepsilon_{it} = \eta_i + \tau_{it}$$

Where, in this expression η_i is a constant ingredient and τ_{it} is the remaining part of the technical efficiency. Both of the two parts or ingredients constituting of the ε_{it} are negative.

Thus, in this model it has been supposed that the technical efficiency has been formed from two parts, Fixed and a discriminative part between (sections and the other is the interference part and is discriminative in time and between the sections. Now by substituting the second expression into the first expression and placing it in the translog function, we will have a new equation as follows,

$$LNY_{it} = \beta_0 + \sum_j \beta_j LNX_{ijt} + \frac{1}{2}\sum_j \sum_k \beta_{jk} LNX_{ijt} LNX_{kit} + \eta_{it} + \phi_{it} + \tau_{it}$$

$$LNY_{it} = \mu_i + \sum_j \beta_j LNX_{ijt} + \frac{1}{2}\sum_j \sum_k \beta_{jk} LNX_{ijt} LNX_{kit} + w_{it}$$

Where $\mu_i = \beta_0 + \eta_i$ and $w_{it} = \tau_{it} + \phi_{it}$, then according to the production function of the technical efficiency, (TE) is calculated as follows:

$$TE_i = \left[\exp\left(\mu_i - \max \mu_i\right)\right]$$

This index equals to 1 for the stage that have the greatest amount of μ, that is this stage exactly acts on the boundary function, so it is completely efficient and it is between zero and one for the remaining digital stages.

In the other words we will normalize all the stages into one of them, but on the opinion of the compiler, there is a question, do this special company has really an efficient operation or no?

Second step in the two-stage method with respect to TE acquired, is, regressing special quality variables that seem to have an influence on efficiency on it and with considering the coefficients acquired, analyzing the amount of the influence that variables have on efficiency.

In this method, the two stage estimates of the efficiency part acquired are regressed on some distinct variables, and this concept is in contrast with being independent on inefficiency part. This concept is presented by kumbhakar[1] (1991) and stevenson[2] (1991). so, they proposed Boundary functions with the error statement u_1 in the form of a distinct function from distinct variables and Random error part. In continue, Bitice and Coolie (1995), presented a model equal to that model with this difference in which use of combinational data became permissible.

Bitice and Coolie (1995) model characterstics are as following:

$$Y_{it} = X_{it}\beta + (v_{it} + u_{it}), i = 1.....N \quad t = 1.....T$$

where, v_{it} is Random variable with the distribution $idd.N\left(0, \delta_v^2\right)$, u_{it}: not negative Random variables, showing the technical inefficiency in production and it is assumed to have an in terrypted normal independent distribution in zero as $N\left(M_{it}, \delta_u^2\right)$, so, we will have:

$$M_{it} = Z_{it}\theta$$

Where Z_{it} is line P vector of variables which influences on a company and θ is columnar vector of variables which should be estimated.

It should be noted that in the mentioned subject which was about production function, U_i caused an activity under Boundary production function. Now, with the change of the error part of (v_i-u_i) to (v_i+u_i) we can define Boundary expense functions. The soft ware frontier 4.1 presented by coolie team in New England Univer city for estimating numerical parameters from the production functions and Random boundary expense whit the use of maximum correctness showing method.

The two considered basic models in this software are cooli and Bitice model (1995) and Coolie and Bitice model (1995). This program predicts the company technical efficiency with use the of estimated Random Boundary Functions at first, this software acquires primary functions from the parameters, then it will employ them in a repeatable algorithm named Psudo-Newotonian Davidon-Pawl fletcher algorithm in order to estimate final estimates with maximums correctness showing. This has the ability to be adapted to combinational data, variable efficiency with time, and in variable efficiency with time production functions and expense, interrupted and semi-normal and subordinate forms I which dependant variables are presented in the form of the main form or logarithmic.

The estimate of production Random Boundary and technical inefficiency with the use of signal data

Signal data has produced many capacities for estimating production boundaries and technical in efficiencies. The methods which are on the basis of fixed or Random Effect Models, have the capacity for adapted and robust estimation of in efficiencies. The model fixed effect has no need for interference independence of the model independent variables. But, unfortunately the model fixed effect necessitates using definite boundaries. But, the model Random Effect can be used for estimating Random boundary, in which independency assumption remains by itself. Consider the following simple model which includes N company and T observations:

$$Y_{it} = X_{it}\beta + (v_{it} + u_{it}), i = 1.....N \qquad t = 1.....T$$

By the use of the property of being signal for data and considering assumptions in respect to inefficiency, new statements, are acquired. If u_{it} be fixed with time, the model can be written as following:

$$y_{it} = \alpha_i + \beta' x_{it} + v_{it}$$
$$\hat{u}_t = Max_j - a_t$$

One of the company's (the most efficient) has zero inefficiency and others will have positive estimations of inefficiency. Now, by using mathematical program methods in definite boundary, the inefficiency can be estimated.

The main advantage of this method is that such method leaves the assumption of no correlation between company's inefficiency with structure level and more ever, there I s no need for normal disorder distribution. At last, estimations of this method are compatible. But there is a disadvantage in fined effect model, when there is the property of no change with time in the company's. If the model be dependant on some properties of the company's such as capital, local situation, … which are fined with time, then LSDV estimates can not be done, worse than it, if we omit this effects from the mode, they will be appeared in fined effects and show themselves in t he form off inefficiency, while, in fact they are opposite to that. The problem identification is presented have. Houseman and Taylor considered the situation for finding such effects and the estimation method in these states, but presenting discussions into statistical and Algabric form, is difficult. Neglecting the way fixed effects enter the above model, these effects appear again in inefficiency estimates, so they cause a kind of ambiguity in this estimates. In such states, other models, such as Random Effect Model.

If the assumption of independency in inefficiencies and structure levels can be kept, use of Random Effect model is preferred. One advantage of Random Effect Model is that it allows fined properties in a specific time in a company, for example the company current capital can be entered into the model in a state in a state which has not much growth. The familiar model of Fandom Effect Regression can be used easily with Boundary models: In the Random Effect Model, two estimators can be used: Generalized limit squres GLS maximums limit (ML)

Generalized limit squre (GLS) . For GLS model, t he model is written as,

$$\ln y_{it} = \alpha - E(u_i) + \beta' x_{it} + v_{it} - (u_i - E(u_i))$$
$$= \alpha^* + \beta' x_{it} + v_{it} - u_i^*$$
$$= \alpha^* + \beta' x_{it} + v_{it} + w_i$$

It should be noted that α^* has no depending on i, because $E(u_i)$ is a fixed (positive) amount. This model is completely compatible with the familiar model of Random Effect. Despite the shift in fixed expression of the above equation, this model can be estimated with the two step GLS. And at the first step, GLS estimations of all parameters are done and w_i and v_{it} variances are acquired by certain models (methods), then some estimation of $\beta.\alpha^*$ are acquires by the fulfilled Generalized Limit squires (FGLs). To acquire an estimate from inefficiency part ($E(u_i)$), the estimates are done:

$$\hat{w} = \frac{1}{T_i}\sum_{i=1}^{T_i}(y_{it} - a^* - b' x_{it}) = -(\hat{u}_i - E(u_i))$$

This estimator is compatible in T1, if b be compatible in N, Another estimator which has this property, is the best not oblique linear estimator.

$$w_i^* = \frac{-T_i\sigma_{it}^2 \bar{e}_i}{T_i\sigma_{it}^2 + \sigma_v^2} = -\frac{\lambda T_i}{1 + \lambda t_i}\bar{e}$$

$$\bar{e}_i = \hat{\alpha}_i = \hat{w}_i \qquad \lambda = \frac{\sigma_u^2}{\sigma_v^2}$$

In fact, none of them estimated u_i. For this purpose, there should be as estimates of $E(u_i)$. And so, there should be a more comprehensive definition from. The interference u_i if, for example u_i distribution be normal, then:

$$E(u_i) = \mu + \sigma_{it}\left[\frac{\varphi(-\mu/\sigma_{it})}{\phi(-\mu/\sigma_{it})}\right]$$

This definition is not according to $\hat{w}$ that is not zero, and parameters are calculated on the basis of the second and third moment of w, with this assumption that N is great sufficiently. In another way efficiency can be defined in a partial way in the fixed effect model. (Schmidt and sickles, 1984).

Model Estimate and Result Analysis

The method used in this research is estimating a Random Boundary Function on the basis of the presented model by Betice and Coolie (1995). Also, in this research, the translog Random Boundary production function used for estimating Random production Boundary, that it's total form is:

$$\ln y_{it} = \alpha_0 + \sum_{i=1}^{n}\alpha_i \ln x_{it} + \sum_{j=1}^{n}\sum_{k=1}^{n}\beta_{jk} x_{jit} x_{kit} + v_{it} - u_{it}$$

Where, y_{it} is the production of i th company in year t, x_1, number of work force, and x_2, consumed beet in company as the main primary material, x3, time trend.

Time variable has been inserted in production function for the purpose of creating displacement capacity

for production function in time length which is expressed as the technical change, and it is supposed that the time length of the working (dag in year), proportion ratio of gas and residue (mazut) to beet, antiquity, extraction coefficient, silo drp, number of work forces with education higher than licentiate's degree and the observation year, are parameters which in fluence on the company production efficiency. Also, the used statistical data is collected mainly from sugar company's trade association for all company's.

Acquired Results from the Translog Model Maximum Correctness Showing (the model for defining in efficiency factors)

Acquired amounts from Coolie and Bitice Random Boundary Function on this basis, in efficiency model estimates acquired by the method maximum correctness showing in final model are as following:

$$\hat{M} = 0.16 + 0.64Z_1 + 0.59Z_2 - 0.49Z_3 - 0.38Z_4 - 0.28Z_5 - 0.27Z_6 + 0.48Z_7$$

where, M is inefficiency part mean. In this relation, the increase of variable by positive coefficient with the increase of technical inefficiency and the increase of variable with negative coefficient, cause a decrease in technical inefficiency.

So, with respect to the variables, Z_i: the ratio of gas and mazut use to beet, which indicates machine's function. Z_2: antiquity, Z_3: extraction coefficient, Z_4: concentration index Z_5: number of work forces with education degrees higher than licentiate , Z_6: observation year , Z_7: silo drop so, the following result acquired:

1. With the more exact meaning of this index is that, by assuming fixed amount of the primary matter (beet), the increase in machine's consumed fuel, means the efficiency function of the machines and causes an inefficiency in production.
2. Companies with more antiquity have less efficiency, because the old companies mainly use old technology's with old production lines and conventional management methods.
3. The more extraction coefficient a company has, the more efficiencies it will have (the extraction coefficient is equal to the sugar ratio produced to the existing sugar in beet).
4. The results show that with the increase of company's concentration index, inefficiency increases, in another word, with the increase of concentration index for optimized allocation of resounces, the production with the least expense, proportional distribution, and reasonable resounces (between producer and consumer), and as a whole the things which are aims of competitive market, are not fulfilled.
5. The more specialist work forces a company's has the more the efficiency it will have.
6. Inefficiency decreases with passing time.
7. The more silo drop exists, the more inefficiency will be.

REFERENCES

[1] Iran sugar factory's Trade Association, different years, final report of current sugar industry condition.

[2] Mines and Industry Ministry, technical report for sugar industry.

[3] Central bank of Islamic republic of Iran, balance sheet and economic changes summary, different years.

[4] Producers and consumers support, organization, the report for a survey in internal production of sugar rate in beet and sugarcane and beet factory is (1384)

[5] Agricultural Jahad ministry, sugar comprehensive plan, aj beet 1383.