Efficiency Measurements in Turkish Brewing Industry using Data Envelopment Analysis

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Graduate School of Human and Socio-Environmental Studies
Ezan Aykut Ilhan

Abstract

Turkish Beer Industry had been evolved from a monopoly, made by government, to a duopoly, constituted by private entities, within the last forty years. Government regulations and bans played crucial roles in shaping the outlines of the industry and in affecting the efficiency measures of the firms. The industry being stabilized, saturated and maturated, carries the effects of these regulations both in coordinative and destructive ways. Production and marketing functions' separability assumptions had been discussed by scholars and varied within different markets.

This study draws on research conducted by a method called the "Data Envelopment Analysis" to evaluate Turkish Brewing Industry with regards to profitability,marketability and productivity functions. Data Envelopment Analysis, abbreviated as DEA (for the easiness) had been widely used, since 1978 to evaluate efficiency measures of organizations called "Decision Making Units". On the basis of the evidence currently available this paper evaluates Turkish Beer Industry with the help of DEA using the data gathered from financial statements and annual reports of the companies.

Keywords

Data Envelopment Analysis, Turkish Beer Industry, Tuborg, Efes

包絡分析法を用いたトルコのビール醸造産業における効率性の測定

人間社会環境研究科　人間社会環境学専攻
イルハン エザン アイクット

要旨

トルコのビール産業は過去40年の間に，政府により独占体制から私企業による複占体制になった。政府の規制が産業の形成や企業の効率性に大きく影響している。ビール産業は安定化，飽和化し成熟しており，規制の結果は良くも悪くも出ている。生産とマーケティング機能の可分性について学識者の間で仮説が立てられ他のマーケットでも多様化されている。この研究はDEA（包括分析法）で導かれるトルコのビール産業における収益性，市場性，生産機能に関する評価に頼ることとなる。DEAは1978年以来，能率性をはかる評価方法として使用されてきた。この論文は企業の財務諸表と年次報告から収集されたデータを使用し，DEAを用いてトルコのビール産業を評価したものである。

キーワード

包括分析法，トルコのビール産業，ツボルグ，エフェス

1. Introduction

Beer industry is a remarkably good pool to study for many diciplines. Some of the main theoretical premises behind this claim can be reasoned as follows:

- Relationships among players are well defined and clear.
- Beer Industry is not complicated; further than that comparatively easy industry to study.
- The industry is highly regulated; having 80 −90 percent of data trackable down.
- Market is imperfectly competitive.
- Markets are saturated therefore less room is left for externalities.

The last fact regards the industry's stability and saturation and brings on the importance of efficiency issues since expansion opportunities are very limited. Only hostile moves like predatory advertising creates new customers by capturing from competitors' market shares. In industries like Turkish Beer Industry where advertising and licensing has strict regulations and bans moreover this option had been swept away, which resulted efficiencies in all aspects becoming a major strategic option.

Turkish Beer Industry occupied as a monopolistic market situation, from 1934 to 1968. During these 34 years the industry did not gain big access, even though the monopoly company, Tekel was a foundation of the government. With the new regulation which allowed new firms for market entry, Turkish Efes and Denmark's Tuborg became the new players in Turkish market. These two companies quickly seized bigger portions of the overall industry and the market moved from a monopolistic character to a knit tight duopolistic character. The evidence supports that Efes with its marketing success and wider access became the leader of the market, whereas Tuborg targeted a premium niche market positioning. Efes captured customers from a wider access while Tuborg mainly focused on residual demand portion of Efes'.

A new regulation in 1973 made a significant impact over the market, which converted beer to be sold as a social beverage under 4.2 percent of alcoholic content. This was the main fueling factor for the rocket-wise growth in Efes' success and nationwide accessibility. However the next regulation in 1983 created a negative wind on the market conversely, by banning all broadcast and media advertising and putting stricter criteria on licensing. From then and on market moved in a saturated and stabilized pace and the two players became sole dominant actors of the duopoly where a 99 percent of the market share.

Today, together they occupy more than 40 brands including the imported brands with exclusive rights, mainly 3 out of these 40 occupy a 88 percent market share: Efes, EfesXtra and Tuborg. There seems no compelling way to argue that with the rise of Islamic way and conservative wing in government side has been harder and wearing for players to survive. Both companies made an escape patch by entering export markets and reduced the risks of relying only on a primitive field.In today's world efficiency issues became a crucial and irrevocable factor since no company can handle the expenses of inefficient units.

There is an ample support for the claim that Data Envelopment Analysis at this point gives further options and improvement chances to managements, for savings and developments by conducting efficiency measures. Besides, with the sufficient management support, expertise and improvement can be transferred to those

units relatively inefficient.

Data Envelopment Analysis, is applied in our study for Turkish Beer Industry as a benchmarking process. Three staged approach was put in life for conducting efficiency scores. First two stages; marketability and profitability were applied by different scholars in different fields. An extension made to this model with the addition of productivity stage, using inseparability assumption of production and marketing functions.

Turkish Beer Industry in overall shows an efficient pattern in companywise. Efes being market leader with 88 percent market share can be recognized as efficient in technical efficiency terms, however Tuborg, in addition to being comparatively easier to control and keep higher standards, is operating almost at full efficiency range. In scale and cost efficiency matters Efes uses the economy of scale and scope advances, wider market accessibility and stronger financial infrastructure for risk aversion.

Regarding to Fisher's findings of beer as a "recession proof" good; both Efes and Tuborg suffered from bans and regulations more than external economic conditions. On the contrary to overall economic perspective, regarding only to efficiency concerns, regulations played a positive role in maintaining efficiency allocations where coordination made by government was needed.

2. Data Envelopment Analysis

2.1. What is Data Envelopment Analysis?

Data Envelopment Analysis, is a service management and benchmarking technique; using a non parametric mathematical linear programming approach. On the contrary to the well known methods like: regression analysis and stochastic frontier analysis data envelopment analysis deals with identifying optimal ways rather than averages.

Decision Making Units (DMUs) are the basic elements, subject to the application of the DEA methodology. DMUs are the homogenous units performing same or similar activities and converting multiple inputs to multiple outputs. Without requiring a priori assumptions, evaluating an appropriate efficiency index that is: summed weighted outputs, divided by summed weighted inputs, was stated by Fare et al 1994. [2]

The original work was made by Farrell (1957) and initial DEA model was named CCR with the initials of the presenters: Charnes, Cooper and Rhodes in 1978.

As Seiford and Thrall (1990) stated, DEA: "floats like surface to the rest on the top of the observations" the efficiency of a DMU is calculated relative to the group's observed best practice. The set of peer organizations are evaluated regarding to their distances to the linear surface, which "envelops" all the rest; said to be relatively inefficient.

Using a mathematical duality structure,DEA is decomposed into two parts; multiplier side from the dual model and envelopment side from the primal model.

DEA can identify top performers, among peer groups and introduce suitable strategies for top performers for improving their performances.

2.2. Models and Types of DEA

Data Envelopment Analysis is decomposed into various models and types, regarding to their orientations, methodologies and convexity situations.

The underlying arguments in favor of DEA varies over 30 different models, regarding to the methods they use. The first basic model of Farrell (1957) was developed by Charnes, Cooper and Rhodes (1978), and named after the initials of their names as: CCR.

In their study; DEA was described as a mathematical programming model,applied to observational data and factors rather than central tendencies or averages that were used to provide empirical estimates. Besides CCR, BBC and the additive model are widely used and mostly well known methods in today's world for efficiency measures.

DEA is divided into two models with regard to constraints of the sectors they are working on:

Input oriented models: With outputs being kept fixed, minimization or reduction of inputs used is aimed.

Output oriented models: With inputs being kept fixed, maximization or augmentation of output production is aimed.

The constraints of the sector and the purpose of the analysis is crucial,in choosing the orientation to focus on. In some sectors both output augmentation and input reduction can be emphasized simultaneously. An additive model is used in such situations providing a proportional reduction of excessive inputs (input slacks) and proportional augmentation of lacking outputs (output slacks). In either way of orientations, same efficient frontier is estimated as a benchmarking process.

Convexity situations and returns to scale variations address the two components of DEA: constant returns scale (CRS) and variable returns to scale (VRS).

The result of VRS is more precise and realistic in real life situations, unless the organization is running below optimal conditions, where a CRS model becomes more appropriate Along similar lines it is argued that, imperfect competition, regulations, legal and juridical constraints and other factors are the main reasons of non optimal conditions. Variable returns to scale can show increasing, decreasing, non-increasing and non-decreasing patterns depending on their convexity situations.

By using DEA models and returns to scale patterns, we reach the efficiency measures as below:

Technical efficiency, is a reduction in inputs or augmentation in outputs radially for given level of outputs/inputs respectively. Technical efficiency is a management and scale problem rather than prices and costs.

Scale efficiency, is a measure how optimal a DMU or augmentation is in size. It is a score of the difference between VRS and CRS. New technologies and improvement in production processes are the solutions for the scale inefficiencies.

Allocative efficiency,is the ability of a firm, using its inputs in a very optimal proportioning. It requires a preliminary condition for an organization being fully technically efficient in order to be allocatively efficient.

Price efficiency, is reached by combining process of the two measures. (TE and AE). It is also called cost efficiency or total economic efficiency. An organization is cost efficient if and only if it is both technically and allocatively efficient.

2.3. Graphical Illustration of DEA Concept

Input oriented measures keep outputs fixed, indicating by how much input quantities be proportionally reduced holding output constant; whereas output oriented measures keep inputs fixed, indicating how much output quantities be proportionally increased holding input constant.

Illustrating both measures along with scale efficiency, comparatively on a graph with CRS and VRS assumptions would be as below:

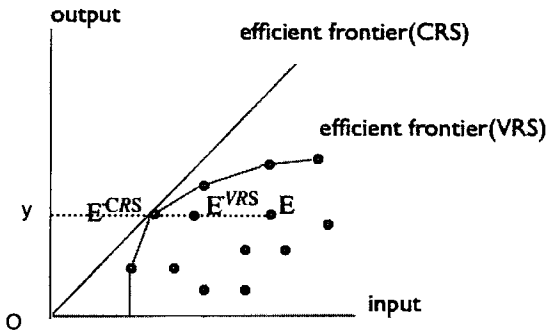

Figure 1

Efficiency measures from the graph above are as follows:

$$Input\ Efficiency\ (CRS) = \frac{YE^{CRS}}{YE}$$

(scope for output augmentation)

$$Output\ Efficiency\ (CRS) = \frac{YE^{VRS}}{YE}$$

(scope for input reduction)

The input -output combination bounded by the efficient frontier, which is formed by the best practice units, gives us the production possibility set region. The borders of the production possibility set is extended using the vertical line and horizontal line from the first and last dots representing two of the efficient DMUs respectively.

The idea of illustration of the efficiency evolved from the location of a firm in a graph comes from where a piecewise linear convex isoquant represents possible production limits and an isocost/isorevenue represents possible cost/revenue limits, are found. Farrell's findings lend support to claim that either this non parametric piecewise linear convex isoquant or a parametric function which fits the data, encloses all observed points as seen in Figure 2.

Under the assumption of constant returns to scale, input oriented model scoping for output augmentation,and output oriented model scoping for input reduction can be illustrated as in the

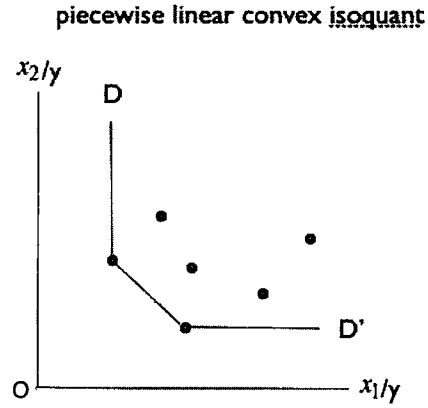

Figure 2

graphs follow. In addition; technical, allocative and cost efficiency measures can be conducted comparatively together in the same graphs in Figure 3.

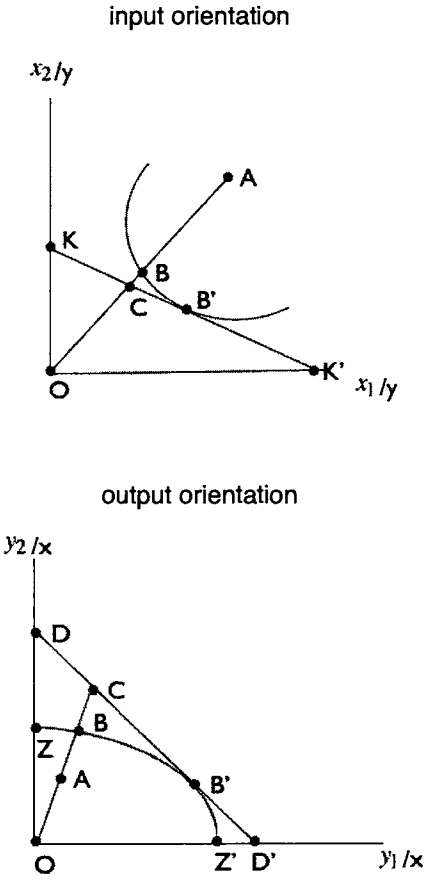

Figure 3

In both illustrations same capitals were used in order to make a comparative evaluation.The illustration on the left side represents an input oriented model where the firm is active at point A, within the set of production possibility yet inefficient. Firm at point of operation ; A, would reduce its input usage radially until point B which is the optimum production frontier. This reduction ratio of inputs proportionally (without reducing the outputs) gives us the technical efficiency score of an input oriented model. However, firm at point B, being on the efficient frontier, faces a situation of optimal usage of input proportions hence cost reduction. The firm,therefore tends to move to point B' where the firm becomes allocatively and technically efficient. The distance AB represents radial reduction of input usage for the firm to become technically efficient; and CB is the reduction amount where a cost reduction represented by CB' induces the firm to contract towards the origin for reaching an allocatively efficient level. The distance represented by AC represents the total distance a firm has to reduce in order to become both technically and allocatively efficient.C is the projection of point B' on the OA line. Point B' is the optimal operation point for the firm where isocost and production possibility frontier became tangent.

A similar approach can be applied on the output oriented model: where A is the point of the firm operating, B is the point firm increases outputs without extra inputs needed; therefore reaching a technically efficient level. With the price information iso-revenue line DD' could be drawn and a revenue increase can be shown with the segment of CB'. Similar to the previous model C is the projection of point B' on the OA line. Point B' is the optimal operation point for the firm where the isorevenue and production possibility frontier become tangent.

Showing all measures for the figures above as follows:

Input oriented Scope	Output Oriented Scope
TE=OB/OA	TE=OA/OB
AE=OC/OB	AE=OB/OC
EE=OC/OA	EE=OA/OC
=(OB/OA)x(OC/OB)	=(OA/OB)x(OB/OC)
=TExAE	=TExAE

TE: technical efficiency
AE: allocative efficiency
EE: economic efficiency

The efficiency score from the measures above bound between zero and one. Production is technically inefficient when the score is less than one and fully efficient when the score equals to 1. The inefficiency scores are calculated by subtracting efficiency scores from one. An efficiency score can be interpreted with multiplying the scores by 100 and reaching a percentile notion. For example a DMU having a 0.8 technical efficiency score tells us it is 80% technically efficient and without changing the output, by proportionally reducing its input usage at 20% level, it can become fully efficient.

2.4. Mathematical Formulation of the DEA

DEA uses a dual structure linear programming problem to reach the efficiency measures. The most common method was introduced by Charnes et. al. as a ratio definition of efficiency and had been known as CCR model since then. This model improved the initial model of Farrell's (1978) which had failure in offering a model with various inputs and outputs.

Maximizing the efficiency scores for each decision making units having efficiency scores smaller than or equal to 1, an input oriented model with CRS assumption is as follows:

$$maksimize \quad \theta_0=\frac{\sum_{r=1}^{s} u_r\, y_{r0}}{\sum_{i=1}^{m} v_i\, x_{i0}}=\frac{weighted\ sum\ of\ outputs}{weighted\ sum\ of\ inputs}$$

$$subject\ to \quad \frac{\sum_{r=1}^{s} u_r\, y_{rj}}{\sum_{i=1}^{m} v_i\, x_{ij}} \le 1$$

$$u_r, v_i \ge 0 \ for\ all\ r\ and\ i$$

This equation maximizes the numerator for the observed unit,targeting to assign the highest possible productivity score.The denominator is set as 1,relating to Charnes & Cooper transformation .The model above is rewritten algebraically as below:

$$maximize \quad \theta_o=\sum_{r=1}^{s} u_r\, y_{ro}$$

$$subject\ to \quad \sum_{r=1}^{s} u_r\, yrj \le \sum_{i=1}^{m} v_i\, x_{ij}$$

The fractional form targets to find the set of coefficients (u's and v's) to give the highest possible efficiency ratios for the outputs and inputs of the decision making units being evaluated, respectively.

In the model:

- j : number of decision making units (DMUs) being compared in the data envelopment analysis
- θ : efficiency score of the DMU being evaluated
- y_{ri} : amount of output r used by DMUj
- x_{ij} : amount of input i used by DMUj
- i : number of inputs used by the DMUs
- r : number of outputs produced by the DMUs
- u_r : coefficient or weight assigned by DEA to output r
- v_i : coefficient or weight assigned by DEA to input i

The mathematical model becomes:

Objective function:

$$maksimize \quad \theta=\frac{u_1y_{1o}+u_2y_{2o}+\ldots+u_ry_{ro}}{v_1x_{1o}+v_2x_{2o}+\ \ldots+v_mx_{mo}}\frac{\sum_{r=1}^{s} u_r\, y_{ro}}{\sum_{i=1}^{m} v_i\, x_{io}}$$

Maximizing the efficiency score θ for the DMU being evaluated is subject to the constraint that the same set of u and v coefficients is applied to all other DMUs being compared, no DMU will be more than 100% efficient as follows:

$$DMU_1 \quad =\frac{u_1y_{11}+u_2y_{22}+\ldots+u_ry_{r1}}{v_1x_{11}+v_2x_{21}+\ \ldots+v_mx_{m1}}\frac{\sum_{r=1}^{s} u_r\, y_{r1}}{\sum_{i=1}^{m} v_i\, x_{i1}} \le 1$$

...

$$DMU_o \quad =\frac{u_1y_{1o}+u_2y_{2o}+\ldots+u_ry_{ro}}{v_1x_{1o}+v_2x_{2o}+\ \ldots+v_mx_{mo}}\frac{\sum_{r=1}^{s} u_r\, y_{ro}}{\sum_{i=1}^{m} v_i\, x_{io}} \le 1$$

...

$$DMU_j \quad =\frac{u_1y_{1j}+u_2y_{2j}+\ldots+u_ry_{rj}}{v_1x_{1j}+v_2x_{2j}+\ \ldots+v_mx_{mi}}\frac{\sum_{r=1}^{s} u_r\, y_{rj}}{\sum_{i=1}^{m} v_i\, x_{ij}} \le 1$$

$$u_1,\ldots,u_s \ge 0 \ and\ v_1,\ldots,v_m \ge 0$$

The fractional form converted to a linear programming formulation as follows:

$$maximize \quad \theta_o = \sum_{r=1}^{s} u_r\, y_{ro}$$

$$subject\ to \quad \sum_{r=1}^{s} u_r\, y_{rj} - \sum_{i=1}^{m} v_i\, x_{ij} \le 0 \quad j=1,...,n$$

$$\sum_{i=1}^{m} v_i\, x_{io} = 1$$

$$u_r, v_i \ge 0$$

The above weights formulation (also called "multiplier model") can be completed by using a duality structure.The second part of the linear programming (also called "envelopment model") is as follows:

$$minimize \quad \theta_o$$

$$subject\ to \quad \sum_{j=1}^{n} \lambda j\, x_{ij} \le \theta x_{io} \quad i=1,...,m$$

$$\sum_{j=1}^{n} \lambda j\, y_{rj} \ge y_{ro} \quad r=1,...,s$$

$$\lambda_j \ge 0 \quad j=1,...,n$$

with applying a dual linear programming model,minimize θ subject to the constraint:

(a) weighted sum of inputs of other DMUs besides the one being evaluated is less than or equal to the inputs of the DMU observed.

(b) weighted sum of outputs is greater than or equal to the DMU observed's. the weights are the λ (lambda) values.

The extension of the CRS DEA model can be made for VRS DEA situations, by adding a convexity constraint as follows:

$$minimize \quad \theta_o$$

$$subject\ to \quad \sum_{j=1}^{n} \lambda j\, x_{ij} \le \theta x_{io} \quad i=1,...,m$$

$$\sum_{j=1}^{n} \lambda j\, y_{rj} \ge y_{ro} \quad r=1,...,s$$

$$\lambda_j \ge 0 \quad j=1,...,n$$

$$\sum_{j=1}^{n} \lambda j = 1 \quad convex\ constraint$$

The convexity constraint helps to the calculation of technical efficiency devoting effects of scale efficiencies.

2.5. Advantages and Disadvantages of the DEA

DEA has fostered to debate to reveal hidden points that the classic approaches like regression analysis and stochastic frontier analysis,become short of explaining. Besides its advantages, it still has some limitations as both include the following:

Advantages:

- DEA, can handle complex processes in which multiple inputs / outputs and multiple models models can be seen.
- DEA is unit invariant, in other words inputs and outputs may vary in units of measurement.
- A priori assumption is not required for relating inputs to outputs. In other words, building a functional form is not necessarily needed as a precondition.
- Regarding to the results of efficiency measures,management can implement further improvements and savings. Management support and expertise can be transferred to those units relatively inefficient.

- A dual structure is used; therefore the analyst is able to imply the DEA according to his/her purpose.
- Optimal ways are conducted, rather than the averages.
- DEA is applicable from the entire organization to the sub-units and departments in an identical way.

Disadvantages:

- Using DEA no absolute efficiency is reached, instead, a relative efficiency is conducted among peer groups.
- Only a few factors have the impact on the total efficiency scores.
- DEA is evaluating optimal ways; whereas no random mistakes are assumed.
- A positive correlation among factors can mislead the analyst with reading the results of efficiency scores in a healthy way.
- Results may vary and there is always open room for manipulation, since input-output combination is chosen by the analyst.

2.6. What Questions are Answered by DEA

Questions answered by DEA including Fried, Lovell and Schmidt's work (1994) are as follows:

- How do i select appropriate role models for the performance improvements?
- Which production facilities are the most efficient ones among the DMUs?
- What are the amounts of input reduction/ output augmentation to reach efficient frontier?
- What is optimum scale for operations?
- What are the "benefits of doubt" as stated by Sherman an Zhu [7] for each unit being evaluated, trying to make it look as efficient as possible in comparison with other unit?

3. Components of Production and Marketing Functions

Production and marketing functions hold a separability assumption regarding to the market characteristics, and how firms adopt themselves against these characteristics.

This assumption can be seen in mature markets where product characteristics are well established and marketing is focused on promoting goodwill; however this assumption fails in markets where firms frequently introduce new products. In such markets according to Chaloupka's studies, production and marketing divisions work in accordance to enable successful marketing campaigns. (Tremblay, 2005)

In this paper the discussion centers on Turkish Beer Industry in terms of components as a production and marketing function at the last stage of efficiency measurements as follows:

Production Function:

Production function mainly include three inputs: labor, capital and materials.

Materials(M): Beer is made from four ingredients: water, hops, yeast and grains. Cereal grains include: malted barley, corn, rice, wheat and so on.

Usage of materials inputs may vary according to the trends and customer preferences. The market leader, Efes captured its leading position by identifying customers' complaints about Tekel beer ; a government made firm as the previous monopolistic market leader. Even though consumers liked Tekel's taste, they wanted more consistency, higher alcohol content and more foam. In response Efes brewed a slightly higher alcohol level with more foam. (4.2 percent to Tekel's 3.8 percent)[9]

Labour(L): Inputs of labor,include number of all production and non-production employees.

Hospitality and retail sector are stimulated positively with the jobs created by beer industries. However, in this study only direct employment is the subject of labor inputs in evaluating efficiency scores.

In general beer industry has higher productivity of employees referring to Tremblay's study; where brewing sector's share in overall value added arising from the production and sale of beer is 45%, which is much higher than the brewing sector's share in total employment from beer. (4.5%)

In today's world,a decline in overall employment due to labor saving technology changes replaces capital to labor.

Capital (K) : Inputs of capital include depreciable assets and exclude inventories and intangible assets. Brewing equipments depreciate slowly, fixed and sunk costs are high in the industry.

In brewing industry, according to the financial statements no R&D expenditures are made and technical advances from outside the industry are used for benefits (i.e.: fast canning lines, effective foaming and so on)

Marketing Function :

Marketing function includes inputs in three categories: broadcast (television and radio), print and other marketing messages. Television and radio advertising messages, newspaper and magazine advertising messages and all other marketing media messages are subject to calculation of efficiency measures.

Before regulation in 1984, broadcast advertising accounted a significant portion of total advertising messages,but after the Ban where TV and radio commercials were strictly prohibited, other marketing media messages replaced as main marketing instruments.

According to the empirical evidence, advertising has little or no effect on total beer demand (Lee and Tremblay 1992, Gissor 1999, Nelson 1999, Coulson et al 2001) In markets where advertising is predatory, that leads companies steal from each other, a regulation is needed in order to sell the same amount of output with less advertising expenses. However in a market like Turkish Beer Industry,where the roles of the firms are clearly determined and overall market share is saturated,a regulation may not be considered as a coordinating factor, because stealing from each other or capturing new customers are not the main focus of the competitors' mainstream strategies.

Despite Ackoff's findings of television is the most effective media type for marketing and outdoor advertising had no effect on sales; Efes and Tuborg found different ways to promote their brands such as: sponsorships to sports teams, social projects and events, testimonials by celebrities,promotional allowances, coupons and discounts,public entertainment and so on.

4. Brief History of Turkish Beer Industry

Turkish Beer industry showed a monopolistic character formed by Tekel company started as a government entity in 1934. Until 1969, Tekel was the only Turkish brewer. Despite its monopolistic market power stimulated by the government, Tekel suffered of low product acceptance, limited distribution channels and inefficiency issues.

With the allowance of other firms enteries to the market, in 1969 the market structure changed drastically. Two firms, Denmark's Tuborg and Turkey's Efes Pilsen entered the market and a rapid increase (fourfold) in industry sales occurred within the following eight years' period.

Despite the overall expansion of the market, the growth was not evenly divided among the competitors. After 34 years of government monopoly, a growth and competition period followed from 1969 to 1977. Efes pioneered the growth era with Tuborg's company. Efes owed its market leader position to maintaining its two core objectives: building product acceptance and building brand position.

Efes started its efforts with a market research that identified customers' complaints about Tekel beer. Customers liked te taste of Tekel beer, however they wanted more consistency, higher alcohol content and more foam.

As a response Efes produced a slightly higher alcohol level (4.2 percent to Tekel's 3.8 percent) and positioned beer as a social beverage, rather than an alcoholic beverage. With the acceptance of beer as a social beverage by government, a big boost in Efes' marketing strategy occured. With this acceptance, the company made its rapid market penetration by selling in coffee houses, the most popular gathering places of Turkish men. On the contrary positioning the brand as an alcoholic beverage would have run counter to Islamic prohibition as stated in Demirel and Murray's words.

The beer pub and promotional programs at the trade were other pioneering effects for the boost of Efes as a market leader, however at this stage of growth and competition only a little attention to potential women customers were paid, since penetration of the market was the prior target for the companies which was instituted by mainly male customers.

65/35 split was the main course of maintaining the quality control with the instruments of distribution channels.For Efes it was crucial to shrink territories and add new distributors to support increased demand.

At this stage Efes positioned its beer as a social beverage, in between Tekel (an inexpensive beer) and Tuborg (a premium beer with price) .However facing to new competition area as a social beverage with soft drinks, coffee, fruit drinks etc and high brand price elasticity due to low per capita income level in Turkey were new constraints that Efes had to pay attention to. With the consideration of such factors; first quality, second price policy were taken into account, which resulted Efes occupying a same quality and taste level with Tuborg, on the other hand yetat a cheaper price level below Tuborg. Price conscious and quality conscious customers were captured as a result of the right timing and positioning.

Rocket-wise growth turned into a slower pace after 1977. In the maturated markets product acceptance and positioning were supposed to be stabilized, that was what happened in Turkish Beer Market. However the market sales did not follow the usual expected pattern, on the contrary Efes' sales more than doubled and market share increased more than 34 percent.

Penetration to rural areas and new type of customers with the distributors efforts and addition of new beer concepts like 50 cl bottle for home consumption were some of the main factors lying beneath Efes' success.However Efes' increase in market share came in expense of Tekel, the first Turkish brewer.

Industry sales were stabilized and Efes was the market leader with a high market share which left only a few converts left to win. Destructive strategy was kept into plan aiming to assault Tuborg's brand position as the premium, with import beer in the market. Tuborg moved with a new brand which had a

lower price than Efes to compete against. Efes counter attacked this move with entering the premium market with a German brand Lowenbrau. Efes put into consideration its expectations to capture 20 percent of market share of Tuborg.

Secondly expansion to overseas markets and developing a non alcoholic beer to export to the Islamic countries were other moves for winning the trophies yet left.

However June 22 1984 goverment's announcement of beer as an alcoholic beverage again made a drastically negative impact on Turkish Beer Industry. Advertising on TV and radio,and strict licensing rules made it harder to reach new customers. Promitioning became very limited without broadcast media and more difficult the distribution with coffee houses being off-limit. Thus a sharp decline in beer sales was witnessed, such as a 38 percent decline in two years time. Efes still kept its market leader position with the same overall market share.

As a survival kit promotionning through print and point-of-purchase promotional media and lobbying became new instruments. Another promotional effort was seen with the Efes Pilsen basketball team which has been competing very successfully in Turkey and in Europe, with enhancing name recognition and even directly preserving broadcast media exposure. (Fred Miller & A. Hamdi Demirel).

Turkish Beer Market had been witnessing product proliferation and diversification more than a price constraint competition. Efes from the rocket-rise of growth period of the industry had been occupying its leadership position. Tuborg, on the other hand, had been accepting its follower position since then, targeting the residual demands and serving mainly to a premium niche market base. From the early 70's to nowadays market had completed its stabilization with the two main players. Despite the market entry of other player,so called the "microbrewers", these two players had been capturing the 99 percent of the entire industry. The government's brewer, Tekel couldn't use its first mover's advantage and therefore its customer base switched to Efes meanwhile Tuborg kept its particular customer portfolio with a sense of brand loyalty who possessed the brand with the motto of "Real men drink real beer".

The dramatic regulation in 1984 led companies struggle and try to find new areas to expand like overseas market. Efes pioneered this period by opening facilities to Kazakhistan, Russia and Romania which converted the company to grow as one of the main players in Europe.

90s was an era of import products entrance to the Turkish market. Corono of Mexico, Heineken of Holland, Beck's of Germany, Budweiser and Miller of America and Fosters of Australia were some of the major examples of these entrants. However due to the complicated bureaucracy, beer having too little space for profit margin,a wide distribution channelling requirement were the main burdens in front of export brands.

2000－2001 was a time with a significant change in Turkish Beer Market. Efes started producing Miller, the product of Miller which is the 4th biggest player in the world.Same year Carlsberg acquired Danish Tuborg and became the biggest shareholder of Tuborg with a 50.01 percent of overall share. Same year Carlsberg beer took its places on the shelves of Turkish market.

5. Data Issues and Methodology

5.1. Methodology

The Data Envelopment Analysis is used to conduct efficiency measures in Turkish Beer Industry. The efficiency measures are subject to three concerns: profitability, marketability and producivity. The first two concerns follow a specific pattern used in Professor Zhu's papers and books well as Fortune magazine's work on Fortune 500 companies to make a comparative study. The output variables of the profitability stage serves also as input variables of the marketability stage, in other words they occupy as intermediate factors.

All the variables during this study are collected from the last seven years' financial reports of the two companies: Efes and Tuborg. The first model, consists two stages and the performance of the companies are evaluated as a function of the production process of profitability and marketability, The second model, uses the inseparability assumption of the production and marketing functions and performances are evaluated as a function of productivity.

At profitability stage, abilities to generate revenues and profits in terms of labor, assets and capital stock were targeted to view. At marketability stage companies' stock market performances using their revenues and profits generated were targeted to view. (Zhu 2000). Third part uses an inseparability assumption because the beer market is maturated and stabilized, an ongoing coordination is strictly required. With the lack of private cost information; raw materials' expenses used during production process and advertising and promotional input expenses by categories are out of accesibility, yet a generic datagathered from financial statements is preferred.

5.2. Data

The financial statements and stock market values ere used in order to estimate efficiency results. The nominal values of each statement were deflated by the given years PPI (producer price index) in Turkey. Being a relative benchmarking instrument and units invariant decimal numbers and percentages are used together and a common PPI used for deflating the items provided from financial statements.

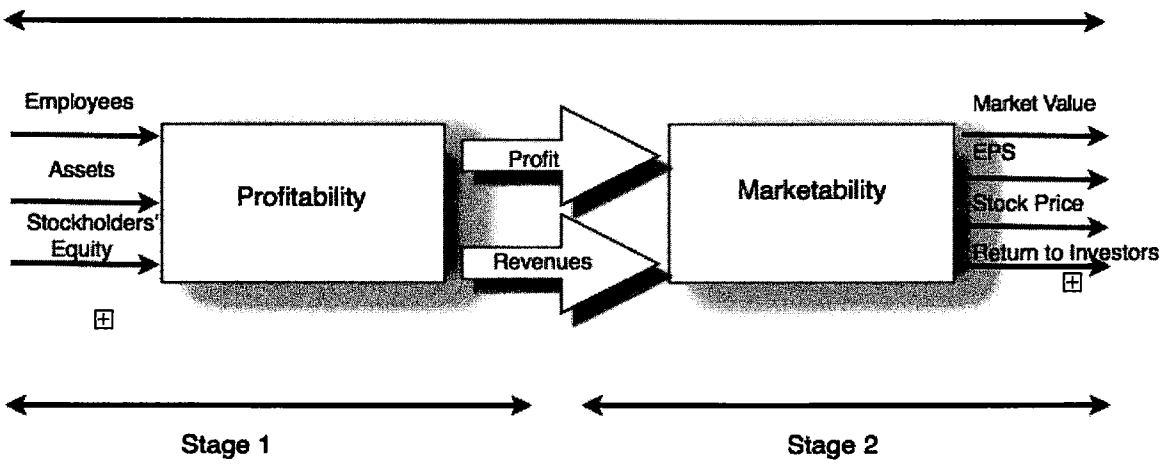

Figure 4. Two staged profitability-marketability process

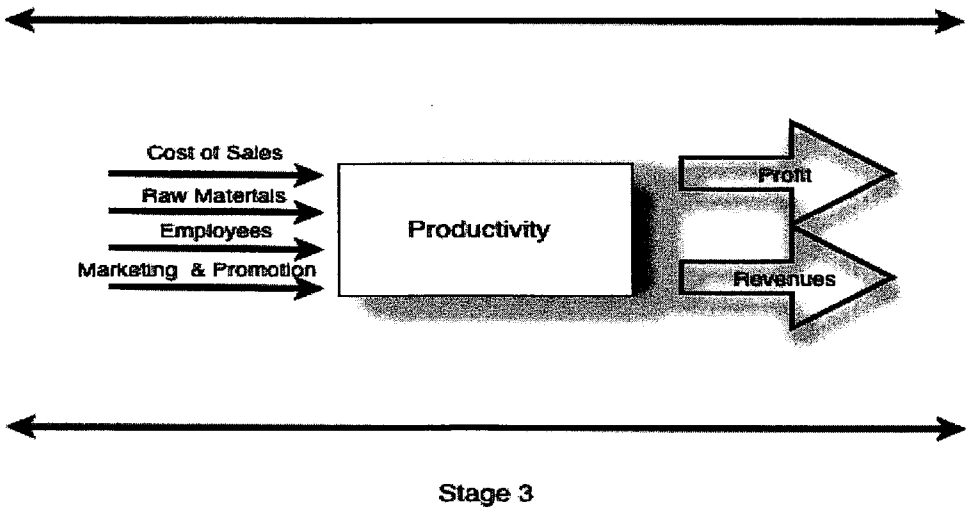

Figure 5. One staged productivity process

(ie deflation by all commodities instead of a distinction with deflation by capital equipment or PPI for farm products etc)

Using the economy of scale and common facilities and storehouses, advertising and accounting departments it is almost impossible to make a distinction by separating beer production units as an ex ante factor. Therefore number of all employees, amount of total depreciated assets, entire marketing, selling and distribution expenses are used from the consolidated financial statements in our calculations.

Turkish Beer Industry is a newly transparent market but yet fairly kept confidential to access private cost information. Therefore consolidated financial statements between years 2007 to 2014 are used, considering the data's accessibility and computability oppurtunities by any user who has access to internet.

The market is stabilized and maturated, only destructive advertising could have made a significant distinction for creating extra customer portfolios, therefore input orientation is used in our calculations rather than output concentrations. It is presumably assumed that both companies operate in optimal conditions therefore variable returns to scale were taken in account.

In our study each year for each company is considered as a separate decision making unit thus fourteen separate DMUs for two main players in seven years period were used in our calculations

6. Concluding Remarks

Turkish beer market, has two big players dominating the 99 percent of the market with their certain roles accepted as; Efes the market leader and Tuborg the follower. Tuborg opts a premium brand positioning and targets residual demands of Efes. However observing the results of the DEA scores Tuborg seems fully efficient on the frontier line with 100 percent of BCC technical efficiency in variable returns to scale pattern,as seen in Table 1. Stage 1 tells us how efficient companies use the labor,assets and capital stock in order to employ revenue and profit.

Efes having a 80 percent of average BCC technical efficiency at the first stage (Table 1)

may tell us it has still room to reduce its inputs while maintaining same output levels to reach the frontier. However, the efficiency scores are relative benchmarking evaluations therefore we have no clues whether Efes is efficient or not in absolute terms. Regarding to Efes' product proliferation,economy of scope and scale, overseas markets it is not an easy task for Efes to maintain overall performance with the high efficiency levels as it is for Tuborg. Also brewing equipment depreciates slowly, fixed and sunk costs are high, therefore the bigger the company the harder to maintain despite the lower costs due to economy of scale. The profitability stage efficiency measures can be seen in percentile notion at Table 1 and Table 2 consequtively as follows.

At the stage 2, where we can observe how well companies perform in the stock market using their profit and revenues, both companies seem fairly and perfectly efficient Tuborg with the mean BCC technical efficiency score of 100% and Efes with 93%. (Table 3) Stable market and saturated customers and their diverse portfolios to reduce risks and excess capacity are some of the main factors explaining

Table 1

Stage 1-Profitability

	Scale Efficiency (in %)	BCC* Efficiency (in%)	CCR** Efficiency (in %)
Efes 2014	100	100	100
Efes 2013	100	100	100
Efes 2012	71.17	49.69	35.36
Efes 2011	68.96	61	42.06
Efes 2010	62.38	93.28	58.19
Efes 2009	64.53	87.04	56.17
Efes 2008	70.89	69.67	49.39
Tuborg 2014	100	100	100
Tuborg 2013	100	100	100
Tuborg 2012	85.03	100	85.03
Tuborg 2011	100	100	100
Tuborg 2010	20.26	100	20.26
Tuborg 2009	19.6	100	19.6
Tuborg 2008	24.47	100	24.47

Table 2

Stage 1-Profitability

	BCC Efficiency (in %)	Cost Effiiency (in %)	Allocative Efficiency (in %)
Efes 2014	100	100	100
Efes 2013	100	100	100
Efes 2012	49.69	48.86	98.34
Efes 2011	61	54.3	89.01
Efes 2010	93.28	81.97	87.88
Efes 2009	87.04	71.46	82.1
Efes 2008	69.67	55.07	79.04
Tuborg 2014	100	100	100
Tuborg 2013	100	100	100
Tuborg 2012	100	100	100
Tuborg 2011	100	100	100
Tuborg 2010	100	86.79	85.79
Tuborg 2009	100	100	100
Tuborg 2008	100	100	100

Table 3

Stage 2-Marketability

	Scale Efficiency (in%)	BCC Efficiency (in%)	CCR Efficiency (in %)
Efes 2014	3.05	100	3.05
Efes 2013	35.57	100	35.57
Efes 2012	100	100	66.16
Efes 2011	66.16	100	64.48
Efes 2010	64.48	100	57.93
Efes 2009	71.77	80.72	54.1
Efes 2008	73.11	73.99	100
Tuborg 2014	100	100	100
Tuborg 2013	100	100	100
Tuborg 2012	100	100	100
Tuborg 2011	100	100	100
Tuborg 2010	94.67	100	94.67
Tuborg 2009	70.04	100	70.04
Tuborg 2008	100	100	100

Table 4

Stage 2 -Marketability

	BCC Efficiency (in%)	Cost Effiiency (in%)	Allocative Efficiency (in%)
Efes 2014	100	8.37	3.05
Efes 2013	100	100	35.57
Efes 2012	100	100	66.16
Efes 2011	100	100	64.48
Efes 2010	100	98.12	57.93
Efes 2009	80.72	78.37	54.1
Efes 2008	73.99	73.5	100
Tuborg 2014	100	100	100
Tuborg 2013	100	100	100
Tuborg 2012	100	100	100
Tuborg 2011	100	100	100
Tuborg 2010	100	100	100
Tuborg 2009	100	100	100
Tuborg 2008	100	100	100

Table 5

Stage 3 -Productivity

	BCC Efficiency (in%)	Cost Effiiency (in%)	Allocative Efficiency (in%)
Efes 2014	100	100	100
Efes 2013	100	100	100
Efes 2012	43.9	42.26	96.26
Efes 2011	36.36	35.12	96.61
Efes 2010	54.64	13.9	25.44
Efes 2009	50.94	48.53	95.27
Efes 2008	40.44	37.32	92.27
Tuborg 2014	100	100	100
Tuborg 2013	100	100	100
Tuborg 2012	97.99	21.57	22.01
Tuborg 2011	99.31	86.78	87.38
Tuborg 2010	100	89.16	89.16
Tuborg 2009	100	100	100
Tuborg 2008	100	16.47	16.47

the observed scores. The stage 2, marketability efficiency measures are depicted at table 3 below.

At the last stage both companies reached full efficiency in their last two years, however especially Tuborg suffered comparatively of higher costs of production and marketing departments to Efes' bigger scaled operations. Effects of 2008 recession can be seen in between 2008 and 2010 for both companies with the very low efficiency levels of production-marketing stage. Besides, MES (minimum efficient scale) is large comparing to the size of the market and only a few rivals are allowed to compete in. The minimum efficient scale requires minimum 6 to 7 facilites in order to perform efficiently. At this stage Efes and Tuborg employs around 63 percent mean technical BCC efficiency levels. The efficiency scores for the last stage is seen at Table 5 below.

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