Test Of Structure-Conduct-Performance And Efficient-Structure Hypotheses In Sugar Industry Of Pakistan

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ABSTRACT

 In this study the validity of Structure-Conduct-Performance (SCP) and efficient-structure (ES) hypotheses is empirically tested in the sugar industry of Pakistan. The data set consists of the 29 sugar mills registered at the Karachi Stock Exchange (KSE) for the financial year 2016. To test the relation of market power, efficiency and performance, we used market concentration and market share as the measurement of market power. In addition, the DEA method to measure firm's efficiency, while ROE is used as an indicator of performance and three control variables. The result of this study support the traditional SCP hypothesis and indicates that there is positive and significant relation between market concentration and performance, while Reject the ES hypothesis..

 Key Words: Structure-Conduct-Performance, Efficient-structure, Data Employment analysis, Sugar industry

 JEL Classification: M10, M11, L10

Yapı-Davranış-Performans (SCP) Ve Etkin-Yapı (ES) Hipotezlerinin Testi: Pakistan'ın Şeker Endüstrisi

ÖZ

 Bu çalışmada, Yapı-Davranış-Performans (SCP) ve etkin-yapı (ES) hipotezlerinin, Pakistan'ın şeker endüstrisinde ampirik test edilmiştir. Veri seti Karachi Borsası'nda (KSE) kayıtlı 29 şeker fabrikasından 2016 mali yılı için oluşmaktadır. Piyasa gücü, verimlilik ve performans ilişkisini test etmek için piyasa yoğunluğunu ve pazar payını, piyasa gücünün ölçümü olarak kullandık. Ek olarak, firmanın verimliliğini ölçen Veri Zarflama Analizi (VZA) yöntemi, Öz Sermaye Kârlılığı (ROE) ise performansın göstergesi ve üç kontrol değişkeni olarak kullanılır. Bu çalışmanın sonucu, geleneksel SCP hipotezini desteklemektedir ve piyasadaki performans ile performans arasında pozitif ve anlamlı bir ilişki olduğunu gösterirken, ES hipotezini reddetmektedir.

 Anahtar Kelimeler: Yapı-Davranış-Performans, Etkin-Yapı, Veri Zarflama Analizi, Şeker endüstrisi

 JEL Sınıflandırması: M10, M11, L10

I. INTRODUCTION

 Sugar is the world's most important mean of satisfying the human desire for sweetness. It has a unique property of sweetening without changing the color of food and drink. The consumption of sugar in the world has been gradually increasing since the past few decades while the production has observed up and downs. According to the data issued by International Sugar Organization (ISO) August 2017-18 the world sugar production achieved a remarkable 191.81 million

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tons which is the highest in history of sugar production, 27.07 million tons more than year 2015-16 and 17.83 million from previous year 2016-17. The consumption of sugar gradually increased from the last 5 years to 174.125 million tons in 2017-18.. World per capita consumption also decreased to 23.7 kg, as against 24.1 kg in 2010. In 2011 the world observed a production surplus of 7.8 million tons after a consecutive three years of deficit.

The sugar industry is the 2nd largest agro base industry in Pakistan. According to the ISO (2017) Pakistan is the 7th largest producer of sugar, producing 7.42 million tons. The sugar production is almost depending on sugar cane (98 %) while only 2 percent is produce from beet. Pakistan is the 6th largest country in the world in terms of area under sugar cane cultivation. In 2016 the per capita consumption of sugar has increased almost 1.2kg to 23 kg as compared to 2011. The consumption of sugar is 4.76 million tons. In the last decade the consumption of sugar had once decreased in 2005-06 and in 2010-11 but after 2011 it has been steadily increasing. In 2007 and 2008 Pakistan was in production surplus of .10 and .45 million tons with production of 4.35 and 4.99 million tons respectively. The sugar industry in Pakistan has been volatile in case of production. On one and it is the seventh largest production and was facing deficit of .05 million tons in 2011. The production of sugar observed continues decrease in the year's following 2011 to 2015. With this scenario the present sugar crisis has opened up new avenues for researchers to analyze the performance and efficiency of the Industry.

In this study the Structure-Conduct-Performance (SCP) paradigm approach is used to empirically analyze the impact of market power and efficiency on performance of sugar industry in Pakistan. The framework of SCP is drawn from the Industrial Organization (IO) economics, in which the interrelation of the element of operation of a market is examined that are structure, conduct, and performance (Scherer and Ross, 1990; and Shepherd, 1990). The primary SCP model (Bain, 1951) was usually applied to the manufacturing industry. According to Bain (1951, 1956) The SCP model concerned with one-way relationships from market structure to conduct and performance, also the market structure affected the firms' performance directly. Efficiency factors can be evaluated by examining industrial structure, conduct and performance (Abbott and Makeham, 1979).

The data set consists of 29 sugar mills for the financial year 2016 which were registered at Karachi stock exchange. To test the SCP hypothesis as an integrated model, this study followed the model developed by Comanor and Wilson (1967). The variables used were market concentration and market share as the measurement of market power, Data Envelopment Analysis (DEA) for firm efficiency, return on equity (ROE) as a proxy for performance. The result of this study is in favor of the traditional SCP hypothesis and indicates that there is positive and significant relation between market concentration and performance, while Reject the ES hypothesis.

The article is divided into 6 sections, Section 2 includes the literature review which follows by the hypothesis development. Section 4 is the methodology, Section 5 consists of the results and discussion portion while the last section is the conclusion.

II. LITERATURE REVIEW

In this section the various aspects to estimate the interrelationship between the three factors that are market structure, Conduct and Performance of SCP paradigm is presented.

A. Market Structure

Market structure includes - a) the degree of buyer and seller concentration, b) the degree of market transparency which refers to the availability of relevant market information, its distribution among buyers and sellers, and its adequacy in terms of price sharpening, quality comparisons and risk reduction or uncertainty about the future c) Barriers to entry and exit. This is generally determined by the advantages that established sellers have over potential entrants (Clodius and Mueller, 1961). According to Bain (1972) Market structure is a combination of two dimensions within which firm competes; a) technical and b) economical. Porter (1980) argues that on the base of market structure firms chooses the type of strategic to adopt against their competitor in the industry. According to Scherer and Ross (1990) the number of consumers and the degree of market power are the two major characteristics of market structure. On the other hand, Martin (1979) considers three significant elements of industry structure that contributes to the profitability and performance of the firm, which are (1) factors that influence the degree of rivalry (and the ease of collusion) in an industry, (2) entry barriers, and (3) demand conditions.

In literature the degree of buyer and seller concentration are mostly measure by concentration ratio (CR) and Hirschman Herfindahl Index (HHI). Cowling and Waterson (1976), among others, have observed, the HHI of concentration, equal to the sum of squared market shares, emerges as an endogenous correlate of industry profitability in a Cournot model of oligopoly with cost differences. Concentration ratio is one of the commonly used measures of market power, which in other words, refer to the number and relative size of distribution of buyers or sellers in a market. Cetorelli and Gambera (2002) states that in the traditional SCP hypothesis the positive relationship between concentration and margins can be negatively affected by a third variable.

Barrier to entry is another element of market structure and it is widely measure by economies of scale, absolute cost advantage and capital cost. Economies of scale is achieved by a firm when large volume of product or activities are produced or performed efficiently, it can also be stated as the change in operational cost associated with the change in size of the firm (Porter, 1980). Example of economies of scale is when a firm build a plant at a particular site or size to produce product at a reasonable cost. Bain (1956) performed a detailed structural analysis of each of the industries in his sample and classified them

915

according to the height of the barriers to entry in each. Comanor and Wilson (1967, 1974) and many others have measured the importance of scale economies by the ratio of the output of a plant of minimum efficient scale (MES) to the output of the market as a whole.

B. Conduct

According to the SPC model, the way in which firms are organized in the market structure tells a great deal about how they make decisions about conduct, this, in turn changes the level of efficiency and fairness in the market performance. Conduct refers to the behavior of firms, whether competitive or collusive. The variables used to capture firm behavior includes pricing strategies, collusion, advertising, research and development and capacity investment. Some have interpreted conduct as whether firms collude or compete. Scherer and Ross (1990) made this clear that performance in particular industries or markets is said to depend upon the conduct of sellers and buyers. An individual firm's ability to successfully enter a new industry will vary based on the effectiveness of its conduct, i.e., choice of a particular strategy. The major aspects according to Scarborough and Kydd (1992) include pricing and selling policies and tactics, overt and tacit inter-firm co-operation, or rivalry, and research and development activities. According to Abbott and Makeham (1981) conduct is pattern of behavior which enterprise follow in adopting or adjusting to the market in which they sell or buy", in other words the strategies of the actors operating in the market.

C. Performance

The term 'performance' as used by industrial organization economists generally refers to the degree to which the operation of a market can achieve economic efficiency. The primary approach of examining market performance has been known as the SCP paradigm, which postulates that certain market attributes (such as market concentration and barriers to entry) effect company profitability within the relevant market (Aleksandrova and Lubys, 2004). The considerations of different aspects of market performance are, such as, production efficiency, advanced technology, product quality, profit rate and outcome or equilibrium assessed in terms of allocative efficiency. A market is said to perform poorly if undue market power is experienced. To detect market power, one commonly used indicator is the price-cost markup or the Lerner index. This measurement expresses how far the market price of a good exceeds the marginal cost of production. Two other performance gauges are rate of return and Tobin's Q (Carlton & Perloff 1994).

Farell, (1957) empirically measured the efficiency for the first time and Charnes et al., (1978) developed a new tool called Data Envelopment Analysis (DEA) by generalizing the concept of single input, single output technical efficiency measure of Farrell's to the multiple inputs and multiple output case, which is known as CCR model. As pointed out by Charnes et al. (1978), DEA is "a mathematical programming model applied to observational data that provides a new way of obtaining empirical estimates of relations that are cornerstones of

modern economics." Cooper et al. (2000) suggest that as compared to traditional method, DEA is a better method to measure performance. Bayyurt and Duzu (2008) compared efficiency between Chinese and Turkish Manufacturing firms by DEA approach using input-oriented CCR model. Inputs used were number of employees (NE); inventory turnover (IT); receivable turnover (RT); total asset / total debt; cash flow; current ratio and property, plant and equipment / total asset. Outputs were net income per employee; growth in sales; net income per share and earnings before income tax.

III. HYPOTHESIS DEVELOPMENT

Positive correlations between market concentration and profitability can be explained by the structure performance hypothesis or the efficient structure hypothesis. Berger and Hannan (1989) used price information collected by the Federal Reserve System on banking institutions to examined price-concentration relationships instead of the profit concentration relationship in order to eliminate the efficient structure hypothesis as an alternative explanation of the results. The results of this analysis support the structure performance hypothesis.

Smirlock et al.(1984) tested the structure performance hypothesis and efficiency hypothesis using OLS regression of the firm's profitability against the traditional hypothesis with a proxy for relative efficiency. The firm's profitability was measured by Tobin's q which is the firm's market value divided by replacement costs of its assets, the variables used to represent the traditional hypothesis were concentration, entry barrier, and growth rates, and the proxy used for relative efficiency was the firm's market share. The results of this analysis strongly supported the efficient structure hypothesis.

The traditional industrial organization literature, implicit in the SCP hypothesis (Mason, 1939 and Bain, 1951) says that structure causes performance in the sense that market power due to barrier to entry or implicit collusion leads to concentration and higher profitability from this point of view.

The traditional theoretical view implicit in the SCP has been challenged by the efficiency structure (ES) hypothesis. According to the ES view, efficiency causes structure. Specifically firms which increases their efficiency gain market share at the expense of less efficient firms so that concentration increases.

There exists a close cousin to the SCP theory known as Market power hypothesis (MP) which is developed in Mueller (1983) and Ravenscarft (1980) for example. According to the MP theory, market power due to product differentiation or quality allows banks to capture market share, charge higher prices and earn higher profits.

Now the traditional SCP hypothesis will be supported if positive relationship between market concentration (measured by concentration ratio) and performance (measured by profits) exist, regardless of efficiency of the firm (measured by market share). Thus firms in more concentrated industries will earn higher profits than firms operating in less concentrated industries, irrespective of their efficiency.

H1: *There is a positive relationship between the degree of market concentration and Performance of the firm.*

The efficiency structure hypothesis states that performance of the firm is positively related to its efficiency. That is, increased profits are assumed to accrue to more efficient firms because they are more efficient and not because of collusive activities as the traditional SCP paradigm would suggest (Molyneux and Forbes, 1995).

H2: *There is a positive relationship between efficiency and performance of the firm.*

IV. METHODOLOGY

Total sugar mills operating in Pakistan is 81 out of which 36 are registered with the Karachi Stock Exchange (KSE) of Pakistan. The data set consists of the 29 sugar mills firms for the financial year 2016 which were registered at KSE because the financial data of the remaining sugar mills were unavailable.

A. Model Specification

To test the SCP hypothesis as an integrated model, this study followed the model developed by Comanor and Wilson (1967).

$$P_{it} = f(M_{it}, EFE_{it}, C_{it}) + e_{it} \qquad (1)$$

P_{it} = profitability of firm *i* at time *t*.

M_{it} = the variable of market power of firm *i* at time *t*.

EFE_{it} = firm efficiency score, measured using the DEA methods of firm *i* at time *t*.

C_{it} = control variables of firm *i* at time *t*.

And e_{it} = is error terms

B. Variables

To test the relation of market power, efficiency and performance, we used market concentration and market share as the measurement of market power. In addition, the DEA method to measure firm's efficiency, while profitability is used as an indicator of performance. Different variable are used to measure profitability but in this study, the proxy used for measuring profitability is return on equity (ROE).

1) Market Power: For market concentration calculation I have used the HHI model instead of concentration ratio. One critique of the concentration ratio is that it does not take into account the distribution of market share across all firms in an industry. A concentration index that does not share this weakness is the HHI so for this study HHI and Market share is used as a proxy for market power that is:

$$S_i = \frac{Sale_i}{T.Sale} x100 \qquad (2)$$

Where, S_i = Market share.

Sale $_i$ = sale of firm

T. Sale= total sale of industry

$$HHI = \sum_{i=1}^{K} S_i^2 \qquad (3)$$

Where, K= the number of firms

2) Efficiency: Firm efficiency is measured through data employment analysis (DEA) which was introduced by Farrell's (1957) in his pioneering work. Efficiency is evaluated through different decision-making units (DMUs). Assuming the number of DMUs is "s" and each DMU uses "m" inputs and produces "n" outputs. Let DMU_k be one of "s" decision units, $1 \le k \le s$. There are "m" inputs which are marked with $X_i^k (i = 1,...,m)$, and "n" outputs marked with $Y_j^k (j = 1,...,n)$. The efficiency equals the total outputs divide by total inputs. The efficiency of DMU_k can be defined as follows.

$$\text{The efficiency of } DMU_k = \frac{\sum_{j=1}^{n} u_j Y_j^k}{\sum_{i=1}^{m} v_i X_i^k} \qquad (4)$$

$$X_i^k, Y_j^k \ge 0, i = 1,...,m, j = 1,...,n, k = 1,...,s$$

$$u_j v_i \ge 0, i = 1,...,m, j = 1,...,n$$

The DEA program enables one to find the proper weights which maximize the efficiency of DMU and calculates the efficiency score and frontier. DEA technique has been applied successfully as a performance measurement tool in many fields including the manufacturing sector, hospitals, pharmaceutical firms, banks, education and transportation. In this study, an input orientation as opposed to output orientation has been adopted.

In this study, DEA model is used with 3 Inputs and 2 outputs employed. The outputs are sales and earnings before income tax whereas the inputs are cost of goods sold; General administration and other expense; and turnover inventory.

C. Control variables

Many control variables have been employed in cross-section studies of profitability order to control for the effects of disequilibrium (Ravenscraft,1983; and Bothwell, Cooley, and Hall , 1984). In this study three Control variables are used a) Debt to equity ratio and b) Cost per production and c) Earnings per share.

V. RESULTS AND DISCUSSION

In table 1 the descriptive statistics of the variables are given. The average REO is 28.45 percent while the average technical efficiency used for production by the industry is 94.62 percent, and the average market share in terms of sale is 3.764 percent of total sale. Debt to equity ratio is 3.6453 while cost per production is Rs. 55.877 per kilogram of sugar, earnings per share is 1.539 percent.

Table 1: Descriptive Statistics

Variables	Mean	Std. Deviation	N
Return on equity	0.2845	0.2543	29
Tech Efficiency	0.9462	0.08564	29
Market Share	3.654	3.2453	29
Debt equity ratio	3.6453	5.64328	29
cost per production	55.8779	15.6743	29
Earnings per share	1.5396	14.5632	29
HHI share	3.764	8.39253	29

The concentration of the industry is shown in table 2. The concentration ratio (CR) in the table shows that the top four firm of the industry has capture 37 percent of the total sale of the industry while the CR8 value is 55 percent. On the base of CR the results show that the top eight companies have control more than half of the industry total sales. On the other hand the HHI index which is consider more reliable model then CR show that the value of all the firm HHI is 723.456. Which according to the U.S. Department of Justice the industry is considers as a competitive market because the result is less than 1000.

Table 2: Concentration Of Industry

Concentration	CR	HHI
Top 4 Firm	37	356.82577
Top 8 Firm	55	442.79206
Total Firm	100	723.45689

Table 3 shows the pearson correlation analysis between the different variable. The table shows that ROE has a significant negative correlation with technical efficiency (-.693) and earning per share (-.301) and positive significant of .145 with Market share and .395 with Debt equity ratio. . Technical efficiency is positively significant correlated with market share (.317) and earning per share (.701). Market share is positively significant correlation with all the variable. Debt to equity ratio is positive significant correlated with ROE (.395), market share (.318) and cost per production (.436). Earnings per share is only negatively significantly correlated with ROE (-.304) but with Technical efficiency, market share and HHI share is is positively significant correlated as .701, .413 and .396 respectively. HHI is highly positive correlated with market share and moderated positive correlated with earning per share.

Table 3: Pearson Correlation Analysis

	1	**2**	**3**	**4**	**5**	**6**	**7**
Return on equity	1.00						
Tech Efficiency	-.693***	1.00					
Market Share	.145**	.317**	1.00				
Debt equity ratio	.395***	.137	.318*	1.00			
cost per production	.164	-.253	.305**	.436**	1.00		
Earnings per share	-.304**	.701***	.413**	.014	.023	1.00	
HHI share	.056	.245	.904***	.245	.083	.396**	1.00

Significant level: *90%, **95%, ***99%

The regression analysis is exhibited in table 4, which indicates that a unit change in the firm technical efficiency will lead to decrease of -4.495 unit change in the ROE ratio. The market share has a significantly relationship with ROE score which means that a unit change in market size will lead to a .212 unit change in a ROE. A unit change of debt equity ratio would have 0.985 on the ROE. Cost per production is significantly negatively relationship with return on equity, which means that a unit change in cost per production will decrease .034 unit in return on equity. So the overall analysis indicates the entire variable significantly explain performance of the firm.

Table 4: Regression Analysis

Model	Coefficients	t	Sig.
(Constant)	2.453	4.692	.000
Tech Efficiency	-4.495	-4.622	.000
Market Share	.212	1.724	.013
Debt equity ratio	0.985	2.345	.028
cost per production	-.034	-3.414	.057
Earnings per share	.365	1.604	.538
HHI share	-.064	-1.947	.018

a. Dependent Variable: Return on equity%

From the regression equation is it observed that when the degree of market concentration increased (market share) the sugar industry average return on equity increase hence performance increases. The reason is that the more concentrated the industry; less firm captures majority of market. In the case of Pakistan sugar industry top 4 firm capture 37 percent of the market therefore the majority of the return is high for these firm and will increase with market capitalization. In this study, the first hypothesis is accepted that is the test of validity of SCP, because regression equation indicate that a percent increase in market share increases the return on equity by .212 percent.

The second hypothesis, which is a test validity of efficient structure hypothesis, is not accepted in case of Pakistan sugar industry. The regression equation show that increase in technical efficiency decreases the return on equity. The reason could be that mostly in short term when industry invest in technology and major resource of finance is equity then due to increases equity ROE will decreases. However, in the long run it may change, due the technology efficiency the return will increase and will lead to increase the ROE.

CONCLUSION

The overall objective of this study was to test the impact of market power and efficiency on performance of firm so it leads to testing validity of the SCP and ES hypotheses in the sugar industry of Pakistan. The data set consists of the 29 sugar mills firms for the financial year 2016 which were registered on KSE. To test the relation of market power, efficiency and performance, market concentration and market share were used as the measurement of market power. In addition, the DEA method to measure firm's efficiency, while ROE is used as an indicator of performance and three control variables. The result of this study support the structure performance hypothesis and indicates that there is positive and significant relation between market concentration and performance, while a negative and significant relation between efficiency and performance. For future research, time series analysis for the validity of ES hypothesis should be conducted. This will show a more in-depth analysis of the short and long term validity of ES hypothesis.

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