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## ENGINE INDUSTRY IN INDIA –A COMPREHENSIVE STUDY OF VALIDATING STRUCTURE CONDUCT PERFORMANCE FRAMEWORK

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**Abstract:** This paper aims to consider the theoretical SCP framework from popular industrial organization theories and test the interaction between three important aspects namely industry structure, conduct and performance (SCP) for Indian Engine Industry. A total of eight variables have been shortlisted for testing purpose. The model is constructed with one structure variable, which is market concentration denoted by Herfindahl-Hirschman index, while debt equity ratio, advertising expense to sales ratio, size set up, efficiency in use of total assets, marketing expenses to sales ratio have been identified to explain conduct, and profit after tax, sales and return on net worth represent the performance covariates. Using multiple regression and time series data between the periods 1991 to 2017 for the identified variables, the model fit and variable significance have been evaluated. The empirical results confirm the validity of the structure-conduct-performance hypothesis. The findings emphasizes debt equity ratio, Profit after Tax and return on net worth as the key influencers of the concentrated market structure for the chosen Engine Industry under Indian Manufacturing Industry Segment.

**Index Terms - Structure-Conduct-Performance Model, Engine Industry, Industry Concentration, Multiple Regression**

### I.INTRODUCTION

Engines can be considered as the major source of power for various machineries which are utilized in automobiles, construction, agriculture and various industry verticals. There are two relevant areas of classification for engine industry which has been considered significant with this work. According to fuel type the classifications are i) diesel ii) Gasoline iii) others. By application area the classifications are quite a large like automotive, agriculture, power generation, construction equipment, and Marine. India engine market revenues are projected to grow at a CAGR of 4.9% during 2018-23. According to TechSci Research Report Indian Engine market is anticipated to surpass \$31 billion by 2023. India engines market stood at \$ 20.7 billion in 2017 and is forecast to reach \$ 31.8 billion by 2023 on account of growing demand for automobiles in India( Techsciresearch Report, 2018). The increase in farm mechanization in agricultural sector leads to boost in tractor sales which is the major end user of the engines, and enormous boom in retail and logistics sectors contributing towards the boost in sales of commercial vehicle, rising demand in passenger car segment for rising per capita income and urbanization are the prime drivers of demand in engine industry. Moreover various Govt. initiatives like 'Make in India' in manufacturing sector, Pradhan Mantri Awas Yojana, Blue Revolution Deep Sea Fishing Scheme add a boom in demand for engine as engines play the pivotal role in the growth of machine driven manufacturing sector and meet up the increasing requirement of power backup solutions with fostering commercial and industrial

activities. Reciprocated engine based gensets are the highly saleable and least expensive alternative for distributed power generation technologies. The Indian engine industry is dynamics, 'robust and firm' by retaining pricing power & discipline even in this tough environment. Technology and distribution network are very high creating entry barriers for any new player; sheer price competition will not serve business ambitions. As power deficit scenario is pertinent in India, it will work as boon for diesel and gas engine industry. This industry is characterized by (a) pricing power, (b) strong technology led entry barrier –which needs to be constantly upgraded and (c) not so easily replicable distribution channel. The high replacement demand after the useful life of any engine adds another prospect to the business of this particular industry. So this type of industry can be categorized as concentrated in nature in manufacturing segment. The numbers of firms in this particular industry are very few. The dominant players are Ashok Leyland Limited, Bajaj Auto Limited, Cummins India Limited, Greaves Cotton Limited, Kirloskar Oil Engines Limited, Mahindra & Mahindra Limited, Tata Motors Limited etc. (TechSciResearch, 2018). This research work is based on the traditional theoretical perspective of **Structure Conduct Performance** paradigm. Econometric studies of structure-conduct-performance relationships typically show a strong positive effect of product differentiation on profitability, with weaker and smaller positive effects of scale economies and market concentration. The structure-conduct-performance school of industrial economics has interpreted the positive impact of market concentration on profitability as evidence of the exercise of market power in oligopoly. It would also confirm the efficiency-profitability hypothesis, which suggests that large firms are more profitable in concentrated industries because industries become concentrated when it is efficient to organize production in large units. There are two competing hypotheses in the SCP paradigm: the traditional structure performance hypothesis and efficient structure hypothesis. The structure performance hypothesis states that the degree of market concentration is inversely related to the degree of competition. This is because market concentration encourages firms to collude. This 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. The efficiency structure hypothesis states that performance of the firm is positively related to its efficiency. This is because market concentration emerges from competition where firms with low cost structure increase profits by reducing prices and expanding market share.

The present study makes an attempt to analyze the impact of the major determinants affecting the Concentration (market structure) of Engine under Indian Manufacturing Industry Broad group. The same has been found to be a less researched area in Indian context by the researchers which also forms the motivation for the study. The subsequent portion of this research paper is designed in different sections. In the Literature Review section, reviews of past studies that include both theoretical and empirical considerations have been detailed. In the Research Methodology section, a stepwise development of the research methodology is being discussed. The findings and analysis of this study are highlighted next. In the final section, conclusion has been drawn.

## II. LITERATURE REVIEW

Early studies by Bain (1951) hypothesized a positive relationship between industry concentrations, barriers to entry and profits. One excellent thoughts somewhat dated reviews with extensive bibliographies can be found in Weiss (1971). The market structure i.e., the concentration of Indian engine industry is uniquely poised. Industry concentration refers to the extent to which production is concentrated amongst firms in an industry. The number of active firms in the industry provides a simple measure of concentration: the greater is the number of firms, the less concentrated (or more fragmented) is market structure. A long-standing and plausible approach relates concentration levels to set-up costs in that industry. Set-up costs refer to the cost of setting up a plant of minimum efficient scale, which is determined primarily by the technology in use. If the market size or the level of demand is large relative to set-up costs, a large number of firms may be able to exist profitably, creating a more fragmented structure. On the other hand, if the market size is small relative to set-up costs, the industry would be more concentrated. In other words, it can be expected concentration to be a decreasing function of the ratio of market size to set-up costs. Sutton (1991) argued that this size-structure relation may break down in industries in which advertising and technology play an important role. Suppose the nature of the industry or product is such that firms have an incentive to increase such expenditures to gain market shares. In the long run, the increased level of expenditures is sustainable only if profitability in that industry is high enough. Relatively fragmented market structures are unlikely to sustain such high levels of profitability. Even if the market structure was fragmented due to historical factors, exit and consolidation is likely to create a more concentrated structure eventually. In such industries, larger market size may be associated with an escalated expenditure on advertising and/or technology expenditures, rather than fragmentation. In contrast, in industries where advertising and technology do not matter, as market size increases, concentration levels might fall. Theory suggests that a firm's capital structure affects pricing and output choices. Empirical evidence on the link between debt and concentration in Indian perspective is still limited. Some papers have tested the relation between a firm's capital structure and several aspects of product market competition, such as industry concentration (Kovenock & Phillips, 1997;), the extent of competitive interaction (Lyandres, 2006), Another work (De Jong, Nguyen & van Djick, 2008) zooms in on another key variable related to a firm's competitive position in the output market, its market share. It adds to the studies on industry concentration, competitive interaction, and output market uncertainty by studying the impact of capital structure choice on strategic competition at the level of the individual firm. In the model of Dasgupta & Titman (1998), long-term debt induces firms to compete less aggressively in the output market, because it increases the rate at which future

profits are discounted. Their model is based on the argument of Klemperer (1987) that a firm can improve short-term profits at the expense of long term profits. Raising long-term debt increases a firm's discount rate for future profits, because outstanding debt raises the cost of new borrowing. In a different theoretical setting, Faure-Grimaud (2000) also found that debt causes firms to compete less aggressively. In his model of debt contracting levered firms behave less aggressively in the output market because they aim to limit the size of the default and increase the probability of getting a good credit record. The increase in borrowing costs due to existing debt can be traced back to the debt overhang problem of Myers (1977), who argues that debt removes the incentive to invest in positive net present value projects, because when debt repayments are large enough, the benefits from profitable investments go straight to creditors. The higher discount rate decreases the relative importance of long-term profits. Previous studies have identified a significant impact of the market position of a firm on its capital structure choice (Kovenock & Phillips, 1997). A firm's market share is an important indicator of its current market position and its market power within the industry. Therefore, both directional effects in the empirical analysis of the interaction between financing choice and market share of firms, which are affecting industry concentration for any industry, have been taken into account.

### III. RESEARCH METHODOLOGY

The measure of concentration has been used as dependent variable in our empirical analysis is the Herfindahl-Hirschman Index (HHI). The coverage of firms is not uniform across years, so the number of firms in an industry fluctuates due to reporting variations. It is hard to distinguish these reporting variations from entry of new firms or exit of existing firms. Nevertheless, it offers long data series (1991-2017). Traditionally, the SCP hypotheses have been examined using the traditional measures of profit/profit margin as indicator of performance. This can be represented as: Performance= F(X, Z) where X is set of SCP variables and Z other associated variables.

#### III.I.Data and Sources of Data

A longitudinal data set from 1991 to 2017 has been used for the study .Industry data has been collected from CMIE database. Apart from the dependent variable (HHI),the independent variables or the explanatory variables shown in Table 1, each of which is explained subsequently.

**Table 1: Structure Conduct Performance Variables**

Variable Type	Variable Names	Abbreviations Used
Structure	Herfindahl-Hirschman Index	HHI
Conduct	Debt Equity Ratio	DER
	Size Setup	SSU
	Advertising Expense to Sales Ratio	ADVINT
	Efficiency in use of Total Assets	EFTA
	Marketing expenses to Sales Ratio	MKTINT
Performance	Sales	SALES
	Profit after Tax	PAT
	Return on Net Worth	RONW

Source: Authors Computation

#### III.I.I. Dependent Variable:

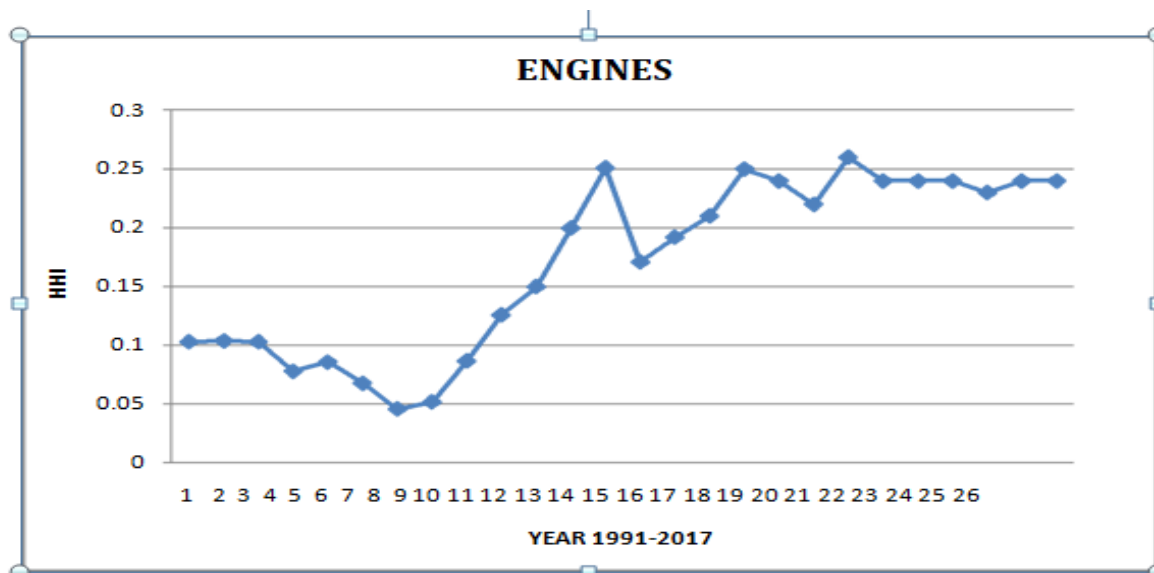
The measure of concentration has been used as dependent variable in our empirical analysis is the **Herfindahl Hirschman Index**. The coverage of firms is not uniform across years, so the number of firms in an industry fluctuates due to reporting variations.

##### i) Herfindahl Hirschman Index (HHI)

Herfindahl Hirschman Index (HHI) has been used as measure of industry concentration in this research work. This index is computed as the sum of the squared market shares of all firms in any industry;

$$HHI = S_1^2 + S_2^2 + \dots + S_K^2 = \sum_{i=1}^K S_i^2$$

Here K is the number of firms in the industry and  $S_i$  denotes the market share of firm i. **HHI** is measured by industry and by year. The time frame used here in 1991-2017. The trend of industry concentration in Indian Engine Industry has been depicted diagrammatically for 26 years which is as follows:

**Fig. 1: Trend on Industry Concentration in Indian Engine Industry**

### III.I.II. Explanatory Variables:

The research work begins with the traditional formulations of structure performance relationship which seeks to explain variations in performance in terms of differences in concentration.

#### i) Debt Equity Ratio

The debt-equity ratio is a measure of the relative contribution of the creditors and shareholders or owners in the capital employed in business. Simply stated, ratio of the total long term debt and equity capital in the business is called the debt-equity ratio. This financial tool gives an idea of how much borrowed capital (debt) can be fulfilled in the event of liquidation using shareholder contributions. It is used for the assessment of financial leverage and soundness of a firm and is typically calculated using previous fiscal year's data. Debt equity ratio represents the capital structure or the financing choice of the active firms in the industry.

#### ii) SIZESETUP

The SIZESETUP measures the size of the market relative to the setup cost of a typical production unit. The size of the market for any industry is measured by aggregating the sales in that industry, while setup costs are measured as net fixed assets in that industry. Set up costs refer to the cost of setting up a plant of minimum efficient scale. If the size of the market (the average level of demand) is large relative to set up costs, a large number of firms may be able to exist profitably creating a more fragmented structure. On the other hand if the market is small relative to setup costs, the industry would be more concentrated.

#### iii) EFTA (Asset Turnover Ratio)

EFTA is an efficiency ratio that measures ability to generate sales from its assets. The asset turnover ratio is calculated by dividing net sales by average total assets.

#### iv) RONW

The return on net worth states the return that shareholders could receive on their investment, if all of the profit earned were to be passed through directly to them. Thus, the ratio is developed from the perspective of the shareholder, not the company, and is used to analyze investor returns.

v) **MKTINT**

A marketing control measure used to determine whether the cost of the marketing activities engaged in to produce the level of sales in a given period. MKTINT for any industry is computed as the ratio of total marketing expenses to the value of industry sales.

vi) **ADVINT**

Advertising intensity is calculated by the advertising-to-sales ratio is a measurement of the effectiveness of an advertising campaign calculated by dividing total advertising expenses by sales. The **ADVINT** is designed to show whether the resources a firm spends on an advertising campaign helped to generate new sales.

vii) **SALES**

Sales of an industry represent the total revenue earned by organizations representing it. Industry sales are considered as an output function that is a resultant of various inputs. Sales have been considered as a performance variable in this study as it holds a critical position in estimation of the share of a particular industry in the overall market scenario. It is the sales volume and value that determines the industry size and also plays an important role in determining the profitability.

viii) **PAT ( Profit After Tax)**

Profit after tax is a financial metrics used by both analysts and investors to measure and evaluate the ability of an industry or a company to generate income (profit after tax) relative to revenue. This indicates how well the firm as well as the industry at an aggregate level utilize their resources or inputs. Thus PAT is calculated by deducting all operating expenses, interest, taxes and stock dividends from the total revenue. It is considered as one of the indicator of performance measurement.

### III.II. Multiple Regression Model

Regression analysis is concerned with the study of the relationship between one variable called explained and one or more other variables called independent or explanatory variable. When more than one variable is used to explain the behavior of the dependent variable it is known as multiple linear regression.

When we have multiple regression equation with K regressors, in stochastic form

$$Y = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \dots + \beta_k X_{kt} + \epsilon \dots \dots \dots (1)$$

Where  $\beta_0, \beta_1, \beta_2, \dots, \beta_k$  are the regression coefficients in this model.

Where  $Y$  = the dependent variable

$X_1$  and  $X_k$  = the explanatory variables

$\epsilon$  = the stochastic disturbance term

$t$  = The  $t$ th observation

$\beta_0$  is the intercept term.  $\beta_1, \beta_2, \dots, \beta_k$  are the partial regression coefficients which means that what part of change in the mean value of  $Y$  can be directly attributable to  $x_1, x_2, \dots, x_k$ . A partial regression coefficients reflects the partial effects of one explanatory variable on the mean value of the dependent variable when the values of other independent variable in the model are held constant (Gujarati, 2010).

**Assessing Model Adequacy:** There are several ways to judge goodness of fit of a specific model. In general, a smaller residual variance is desirable. Other quantities that describe the goodness of fit of the model are  $R^2$  and adjusted  $R^2$ .  $R^2$  is known as multiple coefficient of determination and provides the proportion or percentage of total variation in the dependent variable  $Y$  explained by the explanatory variables. But using more predictors is not necessarily better. To weigh the proportion of variation explained with the number of predictors, adjusted  $R^2$  is preferred.

## IV. RESULTS AND DISCUSSION

In this research work multiple regression analysis has been applied to predict the relationship between industry concentration denoted by HHI in this research work and the eight independent variables.

Table 2 shows the goodness of fit of the model. We have used the adjusted  $R^2$  to explain the same. A value of 0.844 indicates that 84.4% of the total variance explained by the significant covariates which are three in numbers. However if only  $R^2$  value is considered the same model explains 84.4% of the variance with all the seven covariates considered. Thus this model can be claimed to be a good fit model explaining the theoretical excellence of SCP model in Indian context for Engine Industry.

The interpretation of slope coefficients and test of significance result has been shown in Table 3. Out of the seven indicator variables three variables have been found to be highly significant at 95% level. These variables include debt equity ratio, return on net worth and Profit after Tax where debt equity ratio denoting the capital structure of the specific industry and the performance is represented in terms of Return on Net worth and PAT. These three variables combination explains the dependent variable Herfindahl Index vis a vis concentrated market structure. Further, it is evident from VIF results that none of the predictor variables have problems of multi-co linearity (VIF values < 10).

## IV.I. Regression Results of Study Variables

**Table 2:**

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.918 <sup>a</sup>	.844	.770	.03555	1.752

a. Predictors: (Constant), EFTA, DERATIO, SIZESETUP, MKTINT, ADVINT, SALES, PAT, RONW

b. Dependent Variable: HERFIND

### ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.116	8	.014	11.458	.000 <sup>b</sup>
	Residual	.021	17	.001		
	Total	.137	25			

a. Dependent Variable: HERFIND

b. Predictors: (Constant), EFTA, DERATIO, SIZESETUP, MKTINT, ADVINT, SALES, PAT, RONW

Source: Authors Computation

**Table 3: Partial regression result and test of significance**

### Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	.112	.052		2.152	.046	.002	.223		
DERATIO	-.088	.025	-.487	-3.456	.003*	-.141	-.034	.464	2.154
SIZESETUP	-3.996E-5	.000	-.017	-.165	.871	-.001	.000	.906	1.103
RONW	-.007	.002	-.611	-3.530	.003*	-.011	-.003	.307	3.258
MKTINT	-.002	.001	-.294	-2.814	.012	-.003	.000	.846	1.182
ADVINT	3.377E-5	.000	.080	.716	.484	.000	.000	.737	1.356
SALES	.001	.001	.167	1.200	.247	-.001	.003	.475	2.106
PAT	8.742E-6	.000	.585	4.476	.000*	.000	.000	.539	1.857
EFTA	.127	.048	.422	2.635	.017	.025	.228	.359	2.785

Dependent Variable: Herfindahl Index

Source: Authors Computation

Summarizing the result of the above model it can be concluded that this model fulfilled the sufficient condition of validating SCP model in Indian engine Industry by testing the interaction between the Structure Conduct Performance variables chosen in this research framework. The result shows the capital structure choice of this specific industry signifies as important influencer of industry concentration. Though empirical evidence on the link between capital structure and concentration in Indian perspective is very limited, yet theory suggests that capital structure affects the pricing and output choice. Also gain in market share (concentration) in any industry depends on the strategic choice of price and output. The test outputs of the model synchronize with the theories. The engine industry deals with the product which is high involvement durable product where persuasion plays the most critical role in sales generation. Theory suggests if firms are faced with less competition or

the numbers of rivals are less (concentrated market structure) they are more likely to have opportunities to gain market share generated by profits. The result of this model also represent the fact that the profitability matrices which are considered here as performance variable, PAT and RONW are sufficient enough in explaining the reason for gaining larger market share vis-a-vis industry concentration in Indian engine Industry.

## 5. Conclusion

Technology and distribution network created very high entry barriers for any new player; sheer price competition will not serve business ambitions. As power deficit scenario is pertinent in India, it will work as boon for diesel and gas engine industry. This industry can be categorized as concentrated in nature in manufacturing segment. The numbers of firms in this particular industry are very few. The dominant players are Ashok Leyland Limited, Bajaj Auto Limited, Cummins India Limited, Greaves Cotton Limited, Kirloskar Oil Engines Limited, Mahindra & Mahindra Limited, Tata Motors Limited etc. An attempt was made to analyze the impact of the major determinants affecting the concentration (market structure) of Indian engine industry. The multiple regressions approach was applied to establish the association between the dependent and independent variable. These variables include debt equity ratio, return on net worth and Profit after Tax where debt equity ratio denoting the capital structure of the specific industry and the performance is represented in terms of Return on Net worth and PAT. Thus this can be claimed to be a good fit model explaining the theoretical excellence of SCP model in Indian context for Engine Industry.

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