

# Validating Structure Conduct Performance Model in Passenger Vehicle Segment of Indian Automobile Industry

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## Abstract

The study considers the hypothesis of industrial organization theory, the structure-conduct-performance, and validates the same for passenger vehicle segment of Indian automobile industry. A total of eight parameters have been shortlisted for testing purpose. The model is constructed with one structure variable, which is market concentration and denoted by Herfindahl-Hirschman index. While debt equity ratio, advertising expense to sales ratio, size set up and efficiency in use of total assets have been identified to explain conduct, 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 2016 for the identified variables, the model fit and variable significance have been evaluated. The empirical results confirms validity of the structure-conduct-performance hypothesis. The finding emphasizes debt equity ratio, advertising intensity and return on net worth as the key influencers of the concentrated market structure for the chosen automobile segment in India.

**Key words:** Structure-Conduct-Performance model, automobile industry, passenger vehicle, regression, industry concentration

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## 1. Introduction

The automotive industry is one of the focus industries for an emerging economy like India. Demographically and economically, India's automotive industry is wellpositioned for growth, servicing both domestic demand and increasingly, export opportunities. Domestically, some consolidation or alliances might be expected, driven by the need for access to better technology, manufacturing facilities, service and distribution networks. The components sector is in a strong position to cash-in on India's cost effectiveness, profitability and globally recognized engineering capabilities. Post 1991 the introduction of New Industrial policy coupled with the elimination of license raj, the automobile industry was allowed to expand. The passenger car segment has been dominated by three vendors – Maruti Suzuki, Hyundai and Tata Motors, which together accounted for 70 percent of passenger car sales in 2009-10 (SIAM). Considering the robust growth that the industry is currently witnessing, it is clear that any new entrant would need to demonstrate consistent and clear differentiators to make a play for a leadership position in the Indian market.

After the relaxation of restriction in FDI, many multinationals like Daewoo, Peugeot, General Motors, Mercedes-Benz, Honda, Hyundai, Toyota, Mitsubishi, Volvo, Ford and Fiat have entered the Indian automobile market.

It is a known fact that health of country's automobile industry is one of the key indicators of the manufacturing competitiveness of a country. India has emerged as one of the key global hubs in automobile sector (both from consumption and production point of view) and particularly in last few years it has witnessed tremendous growth. It has also become the base for global automobile manufacturers. All the top brands including those of Volkswagen, Nissan, Renault, General Motors, Ford, Honda, Suzuki, Hyundai, Daimler, BMW, Skoda, Audi, are present in India today. In June 2014, the domestic passenger vehicle (PV) industry sales volume stood at 218,828 units, recording a year on year (YOY) growth of 11.2% (SIAM). This is a reasonably strong performance considering the persistent weakness in demand that has weighed on industry growth in the last three years. In terms of market share, the largest player Maruti Suzuki improved its share in the domestic PV industry to 44.0% in 2014-15 from 42.1% in 2013-14, with seven out of its 10 key models witnessed a positive growth. Compared to 2013-14, Hyundai and Honda also improved their market share with the latter emerging as the fourth largest player after Maruti Suzuki, Hyundai and M&M and overtaking Tata Motors (SIAM). The Indian automobile industry is set to continue its growth trajectory, in the medium term, on the back of steady economic growth. Some consolidation or alliances could possibly be expected, driven by the need for access to technology, manufacturing facilities, service and distribution networks. Some evidence of this has already been seen with Fiat's diesel engine being used in Suzuki's vehicles, as well as Tata vehicles - Tata is managing the service and distribution facilities for Fiat India (KPMG, 2010).

The 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. The market power versus efficiency debate in industrial organization is well known. Proponents of the market power argument attribute the positive correlation between market concentration and profitability to collusion. Proponents of the efficiency argument assert the correlation reflects the superior efficiency of large firms. 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.

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 automobile industry is uniquely poised. Industrial 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 and 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 is affecting industry concentration for any industry, has been taken into account.

The present study makes an attempt to analyze the impact of the major determinants affecting the concentration (market structure) of Indian automobile industry. The same have been found to be a less researched area in Indian context by the researchers which also forms the motivation for the study. The subsequent research work is structured in different sections, the second one being the research framework. It is here where the variable selection is detailed followed by data collection, its treatment and the analytical method used. Section 3 elaborates the findings and analysis while in section 4 conclusion is drawn.

## 2. Research Framework

### 2. I. Variable Selection

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 (1991-2016). Traditionally, the SCP hypotheses have been examined using the traditional measures of profit/profit margin as indicator of performance. This can be represented as:  $\text{Performance} = F(X, Z)$  where X is set of SCP variables and Z are other associated variables. The studies by Ahmed and Khababa (1999), Eriotis, Frangouli, and Ventoura-Neokosmides (2002), McDonald (1999), Ganesan (2001), Kambhampati and Parika (2003), Lee, Lee, and Lee (2000), Frech, III and Mobley (2000), and Clow and Wilson (1998) investigate the factors that affect the performance of various industries in the context of market structure and conduct. The

variables of structure, conduct and performance form the explanatory variables here. 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	ADVSR
	Efficiency in use of Total Assets	EFTA
Performance	Sales	SALES
	Profit after Tax	PAT
	Return on Net Worth	RONW

Source: Authors Computation

**Dependent Variable:** The measure of concentration has been used as dependent variable in our empirical analysis is the Herfindahl Index. 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 of 26 years for Automobile Industry.

**Explanatory Variables:** The study initiates from the traditional formulations of structure performance relationship which seeks to explain variations in performance in terms of differences in concentration. The factors behind the performance variations are named as conduct variables which are as follows:

(i) **EFTA:** It is an efficiency ratio that measures ability to generate sales from its assets. It is calculated by dividing net sales with average total assets. **EFTA= Net Sales / Average Total Assets**

(ii) **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. The ratio is useful as a measure of how well a company is utilizing the shareholder investment to create returns for them, and can be used for comparison purposes with competitors in the same industry.

(iii) **DEBT-EQUITY RATIO:** Theory suggests that a firm's capital structure affects pricing and output choices. Empirical evidence on the link between debt and competition is still limited.

Recent papers test the relation between a firm's capital structure and several aspects of product market competition, such as industry concentration (Kovenock & Phillips, 1997; MacKay & Phillips, 2005). Debt Equity Ratio has been taken to represent the capital structure. 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. It can be calculated using a simple formula: **Debt Equity Ratio = Total Liabilities / Shareholders Equity**

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. Dasgupta and Titman (1998) explains that long term debt induces firms to compete less aggressively in the market because it increases the rate at which future profits are discounted. In another theoretical framework Faure-Grimaud (2000) also finds that debt causes firms to compete less aggressively. so it can be expected that the higher debt equity ratio can give a positive level of concentration and less competition.

**(iv) 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.

**(v) ADVSR:** Advertising to sales ratio is considered as the important conduct variable which represent for creating entry barrier aspect for individual industry. The advertising-to-sales ratio is a measurement of the effectiveness of an advertising campaign calculated by dividing total advertising expenses by sales. The advertising to-sales ratio is designed to show whether the resources a firm spends on an advertising campaign helped to generate new sales. Sutton (1991) argued that this size-structure relation may break down in industries in which advertising play an important role. Suppose the nature of the industry or product is such that firms have an incentive to increase advertising 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. In such industries, larger market size may be associated with an escalated expenditure on advertising rather than competition. Like many other studies profit ratios has been used as measure of performance. The following variables are considered to represent profitability.

(vi) **SALES:** Sales of an industry represents the total revenue earned by organizations representing it. Industry sales are considered as an output function that is a resultant of various inputs. The inputs are considered to be the conduct variables performed collectively in an industry according to SCP theory parlance. Output on the other hand is regarded as performance. The researchers have considered sales 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. Further, it is the sales volume and value that determines the industry size and also plays an important role in determining the profitability. From a consumer perspective, sales is an indicator of the relative acceptance of product and services in a market place.

(vii) **PAT:** 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. In an industry scenario where multiple inputs are rationally exploited to arrive at the desired output. The inclusion of profit after tax is thus justified as a performance variable according to SCP terminology.

## 2. II. Regression Model

Multiple linear regression is regarded as one of the most widely used statistical techniques in analytical research. It is a multivariate technique that determines the correlation between a response variable and some combination of two or more predictor variables (Montgomery & Peck, 1982); Draper & Smith, 1998; Tamhane & Dunlop, 2000; McClave & Sincich, 2006, among others). It can be used to analyze data from causal-comparative, correlational, or experimental research. It can handle interval, ordinal, or categorical data. In addition, multiple regression provides estimates both of the magnitude and statistical significance of relationships between variables. A multiple linear regression model with  $k$  predictor variables  $x_1, x_2, \dots, x_k$  and a response  $Y$ , can be written as

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_kx_k + \epsilon \dots\dots\dots (1)$$

where  $\beta_0, \beta_1, \beta_2, \dots, \beta_k$  are the regression co-efficients in this model.

More complex models may include higher powers of one or more predictor variables that includes

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2^2 + \dots + \epsilon \dots\dots\dots (2)$$

and or interaction effects of two or more variables

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_{12}x_1x_2 + \dots + \epsilon \dots\dots\dots (3)$$

Models of these types are termed as linear regression models as they can be written as linear combinations of the  $\beta$ -parameters in the model. The  $x$ -terms are the weights and it does not matter, even if they are non-linear in  $x$ . Models of the type represented by equation (2) are also at times

unexpectedly called non-linear regression models or polynomial regression models, as the regression curve does not represent a straight. Models of type shown in equation (3) are usually called linear models with interaction terms. The goal in regression is to fit the available data into the equation to the best possible extent using least-squares regression such that the sum of squared residuals is minimized.

$$\sum_{i=1}^n \epsilon_i^2 = \sum_{i=1}^n \left( Y_i - \beta_0 - \sum_{j=1}^k \beta_j x_{ij} \right)^2$$

**Assessing Model Adequacy:** There are several ways to judge how well a specific model fits. 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 the square of the correlation coefficient between the predictor and the response. In general,  $R^2$  is the proportion of variation in the response that is explained through the regression by all the predictors in the model. Including more predictors in a multiple regression model will always bring up the value of  $R^2$ . 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.

## 2. III. Data

A longitudinal data set from 1991 to 2016 has been used in the present study. Data for each year acts as observations in the multiple linear regression model. The data for automobile industry has been collected from CMIE database.

## 3. Findings & Analysis

On an aggregated scale it can be concluded that automobile industry in passenger vehicle segment is quite concentrated with few major players and significant market share. Before conducting the regression analysis which is aimed at validating SCP model in Indian Automobile Industry (Passenger Vehicle Segment). The correlation study between seven predictor variables was conducted. Looking at the lower tail of the correlation matrix (Table 2), it is seen that none of the variables are very strongly related to each other. Though a mixed of positive and negative relation exists, the correlation coefficients have been found to be less than 0.65. The result also suggests that presence of multicollinearity is remote with the chosen variable. Thus, the researcher have included all the seven covariates in the subsequent regression analysis.

The multiple regression 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, advertising to sales ratio and return on net worth while both debt equity ratio denoting the capital structure of the specific industry, advertising intensity denoted by ADVSR, are the conduct variable. The performance is represented in terms of Return on Net worth. These three



variables combine explains the concentrated market structure. Further, it is evident from VIF results that none of the predictor variables have problems of multi-collinearity (VIF values < 10).

Table 4 shows the goodness of fit of the model. The researcher have used the adjusted R<sup>2</sup> to explain the same. A value of 0.78 indicates that 78% of the total variance is explained by the significant covariates which are three in numbers. However if only R<sup>2</sup> value is considered the same model explains 84.2% 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 Automobile Industry.

Table 2: Correlation Matrix

		HERFIN D	DER	SIZESETU P	ADVSR	EFTA	SALES	PAT	RONW
Pearson Correlation	HERFIND	1.000	.619	-.112	.310	-.281	.007	-.451	.038
	DER	.619	1.000	-.205	-.012	-.384	-.310	-.555	-.618
	SIZESETUP	-.112	-.205	1.000	-.240	.110	.203	.470	.271
	ADVSR	.310	-.012	-.240	1.000	-.479	-.457	-.038	-.009
	EFTA	-.281	-.384	.110	-.479	1.000	.293	.282	.553
	SALES	.007	-.310	.203	-.457	.293	1.000	-.052	.443
	PAT	-.451	-.555	.470	-.038	.282	-.052	1.000	.383
	RONW	.038	-.618	.271	-.009	.553	.443	.383	1.000

Source: Authors Computation

Table 3: Regression Results

		Coefficients <sup>a</sup>												
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics		
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF	
1	(Constant)	.100	.121		.823	.421	-.155	.355						
	DER	.199	.028	1.009	7.162	.000	.141	.258	.619	.860	.671	.442	2.260	
	SIZESETUP	.001	.006	.015	.131	.897	-.012	.014	-.112	.031	.012	.637	1.569	
	ADVSR	.005	.002	.371	2.473	.024	.001	.009	.310	.504	.232	.389	2.570	
	EFTA	-.055	.067	-.124	-.822	.422	-.197	.086	-.281	-.190	-.077	.385	2.600	
	SALES	.002	.001	.224	1.581	.131	-.001	.005	.007	.349	.148	.439	2.278	
	PAT	-6.431E-7	.000	-.092	-.662	.516	.000	.000	-.451	-.154	-.062	.452	2.213	
	RONW	.012	.003	.666	4.031	.001	.006	.019	.038	.689	.378	.322	3.105	

a. Dependent Variable: HERFIND

Source: Authors Computation

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.918 <sup>a</sup>	.842	.780	.05956	1.810

Source: Authors Computation

#### 4. Conclusion

Summarizing the result of the above model it can be concluded that this model fulfilled the sufficient condition of validating SCP model in passenger vehicle in Indian Automobile 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 output of the model synchronize with the theories. The passenger car segment of the automobile industry deals with the product which is high involvement durable product where persuasion plays the most critical role in sales generation. Communication and repeated communication is required to build momentum of persuasion which can be achieved only through advertisement in different mediums. As the literature supported this study, the high profitable industry gained by larger market share have an incentive to increase advertising expenditure to create barriers. Concentration leads to have a positive relationship with profitability. Theory suggests if firms are faced with less competition or the number 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 metrics including those of Sales, PAT and RONW are sufficient enough in explaining the reason for gaining larger market share vis-a-vis industry concentration in passenger vehicle segment of Indian Automobile Industry.

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