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MEASUREMENT OF MARKET POWER AND COST EFFICIENCY IN MANGO PULP INDUSTRY OF ANDHRA PRADESH[1]

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I. Introduction:

In the context of reported implications of imperfect competition on efficiency and distribution of welfare of different policy and technological interventions, now it is being felt that investigation of competition in the market, measuring extent of imperfection in competition, identifying sources of market power is an important precursor to conducting policy analysis. Rogers and Sexton (1994) suggested some structural features as indicators to identify sectors which have more probability of experiencing oligopsony condition. The features suggest that food-processing sector can be a sector with imperfect competition. In the present study mango pulp industry is taken as a test case. Andhra Pradesh being one major mango producing state in India and significant contributor to total pulp production of the country, was selected for the present study.

The specific objectives formulated in the present study are i) to analyze cost efficiency of mango pulp units, (ii) to test for market power in procurement of mango for pulp production, and (iii) to analyze the extent of trade-off between cost efficiency and market power if any.

The paper is organized as follows. Following introduction, in section two brief account of mango pulp industry in study area is presented. In section three methodology followed in the study is discussed. In section four results are presented and discussed and is followed by conclusions.

II. Brief account of mango pulp industry:

Mango which is national fruit of India, was cultivated in 2163 thousand hectares in 2014-15, constituting 34.69 percent of total area under fruits in India. In 2014-15 Andhra Pradesh is the number one state in terms of area under Mango (315.69 thousand

[1] The paper is largely drawn from the Ph. D thesis work submitted by the author to Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu

ha). Other important Indian states cultivating mango are Uttar Pradesh, Bihar, Tamil Nadu, Maharashtra, Gujarat and Karnataka. Mango Pulp is one of the major processed product with high export potential and is prepared from fruits of selected varieties of mango viz Totapuri, Alphonso, and Kesar. In 2014-15 India exported mango pulp of value 841.38 crore Rs, out of which major value export was through Chennai Port in Tamil Nadu. There are two major clusters of mango Pulp in India viz; Chittoor in Andhra Pradesh and Krishnagiri in Tamil Nadu. From Chittoor mango pulp is exported through Chennai port. In 2014-15 year, 112515.24 metric tonnes of mango pulp was exported through Chennai port (accounting for 73 percent of total mango pulp export from India) and in the same year mango pulp production from pulp units of Chittoor district was 102670.75tonnes (constituting 91.25 percent of total mango pulp exported through Chennai Port) . Chittoor was notified as Agri Export Zone (AEZ) for mango pulp on 08-03-2002.

Fruit processing activity in Chittoor commenced during 1965 with setting up of a small unit, which worked for some years and closed later. "India canning" is the first mechanized fruit processing unit established in the district in 1970. But no new unit was established during 1971-80. Later mango pulp units establishment progressed and in the year 2005, 51 units worked, out of which 7 were aseptic units. As on today 85 pulp processing units are there in the district, out of which 15 are aseptic units. Aseptic units use a technology which involves separate sterilization of pulp and container which are then combined in sterile environment. In addition to this, several operations in pulp manufacturing are mechanized in aseptic units. Aseptic units pack mango pulp in containers of size 200 Kg each, on the other hand conventional units pack mango pulp in cans of 3.1Kg each.

Mango pulp units in Chittoor district are working under two systems viz; (i) own processing and (ii) job work. Under job work system, buyers of mango pulp (merchandise exporters, food product manufacturers, NDDB etc) provide raw materials like mangoes, additives like sugar and chemicals) and packaging materials, the processing units have to bear labor, fuel and electricity costs. The firms will receive job work rate on tonnage basis of pulp produced. A federation viz; "Chittoor fruit processors federation" is working in the district.

III. Methodology:

Earlier, Structure - Conduct and Performance (SCP) was the method used in marketing studies which mostly used cross sectional data across industries. Subsequently to overcome limitations associated with SCP methodology viz; (i) inability to capture heterogeneity in industries (ii) endogeneity of structural variables (iii) problems in classification of industries and (iv) usage of accounting cost data which represent average cost but not marginal cost, new methods of analysis were developed (Kadiyala etal, 2001). Among these, New Empirical Industrial Organization approach (NEIO) is one. Several positive features are associated with the approach. It can be used for theory testing. The NEIO approach is explicitly linked to behavioral theory and provides options to perform " what -if analysis". NEIO also enables decomposition of the determinants of market power and profitability ((Kadiyala etal,2001; Einav and Levin, 2010). There are different NEIO methods, the most widely used methods are Conjectural Variation (CV) approach and Menu approach (Roy et al, 2006). Using these approaches, several studies focusing on analysis of competition in agricultural and food industry were carried out in the past. These studies were surveyed and compared by Perekhozhuk and Glauben (2017). In the current study CV approach with some modifications is used. The CV approach is pioneered by Iwata(1974). In this model it is postulated that firms will have conjectures about how competitors will react to changes in their quantity/price strategy and incorporate these conjectures into their decisions.

In the present study, underlying theoretical model for analyzing existence of market power is based on competition in terms of quantity (i.e Cournot model) and is based on the assumptions: (i) profit maximizing is the objective of the firms (ii) n (indexed i= 1, 2….n) pulp manufacturing firms in the industry are producing a homogeneous product, i.e mango pulp and (iii) the firms are using a quasi-fixed proportions technology in which there is a fixed proportional relationship between the material input (mango) and the output (mango pulp), but the firms use other non-material inputs in variable proportions. This assumption facilitates the representation of both the firm (q_i) and industry ($Q = \sum q_i$) level quantities of the material input and output with the same variable.

Let the mango supply curve faced by pulp industry be given by,

$$Q = h(W_m, Z) \qquad \text{---- Eq .1}$$

Where $Q = \sum q_i$ is the industry quantity of the material input and output, W_m is the mango price and Z is a vector of exogenous variables that shift supply.

Solving equation 1 for W_m yields the inverse mango supply curve,

$$W_m = g(Q, Z) \qquad \text{---- Eq .2}$$

Assuming competitive behavior in output and nonmaterial input markets, pulp producing firms face the following profit maximization problem

$$Max_{q_i} \pi_i = Pq_i - W_m q_i - C_i(q_i, W) \qquad \text{---- Eq .3}$$

Subject to constraint of Equation 2

Where,

q_i = Output of the i^{th} firm

P = Parametric prices of output i.e. mango pulp

C_i = Total processing cost of the i^{th} firm and

W = Parametric prices of non-material inputs (prices of inputs other than mango).

Differentiating Equation 3 with respect to q_i and assuming the second order necessary conditions for a unique maximum are satisfied, yields equation

$$\partial \pi_i / \partial q_i = P - W_m - q_i(\partial g / \partial Q)(\partial Q / \partial q_i) - \partial C_i / \partial q_i = 0 \qquad \text{---- Eq .4}$$

Where $\partial g / \partial Q$ is the slope of the inverse industry mango supply curve

$\partial Q / \partial q_i$ is the change in industry quantity with respect to a change in the quantity of the ith firm

$\partial C_i / \partial q_i$ is firm specific marginal processing cost .

Letting $\lambda_i = \partial Q / \partial q_i$ and rearranging equation 4 yields

$$W_m + \lambda_i q_i (\partial g / \partial Q) = P - \partial C_i / \partial q_i \quad \text{---- Eq .5}$$

The equation 5 indicates that in equilibrium canning firms equate their perceived marginal mango expenditure to the value marginal product (VMP) of output net marginal processing cost. Solving equation 5 for W_m yields equation

$$W_m = P - \partial C_i / \partial q_i - \lambda_i q_i (\partial g / \partial Q) \quad \text{---- Eq .6}$$

Equation 1 and 6 constitutes the model. Empirical implementation requires choosing functional forms for mango supply curve.

To estimate the model at Industry level, the counterpart to equation 6 can be obtained by multiplying the equation with Q/Q and taking the sum over all firms. This yields the industry level equation as

$$W_m = P - \partial C / \partial Q - \lambda Q (\partial g / \partial Q) \quad \text{---- Eq .7}$$

The derivation of industry level derived demand equation is dependent on the assumption that the conditions for consistent aggregation over firms are satisfied.

The λ in the equation 7 is a weighted average of λ_i , where the weights are each firm's share of material input usage.

In the earlier studies the model is solved either by (i) estimation using simultaneous equations or individual equations or (ii) calibration by drawing necessary parameter values from previous studies. In the present study, equation 1 is estimated. Using supply elasticity estimates resulting from estimation of equation .1 together with marginal processing cost resulting from cost function is used in calibration, for analyzing market power.

Estimation of mango supply function:

In the present study supply function of mango is estimated using two methods thereby accounting for perennial nature of mango crop and consequent age/yield dynamics. Given the limited data availability regarding new plantings, removals,

replanting and age-wise distribution of perennial crops area, more frequently used approach in modeling supply response of perennial crops is the distributed lag model. In several studies area response and yield response are estimated separately using lagged price and lagged area as explanatory variables. Drawing on this model in the present study supply relation is estimated using equation

$$Q_t = \gamma_0 + \gamma_1 P_{t-k} + \gamma_2 P_{t-k-1} + \gamma_3 Q_{t-1} + \gamma_4 R_t + e_i \quad \text{---- Eq .8}$$

Where

Q_t = Mango production in the year t

k = Gestation period of the perennial crop

P = Price of the output of the crop.

R_t = rainfall in the year t

In the present study one more version of supply model is estimated. This model is formulated drawing on the model of Elnagheeb and Florkowski (1993). In the model total potential output (Q_t^*) is the summation of the product of yield per (tree) acre for trees in the age group i (Y_{it}) and number of (trees) acres in age group i at time t (I_{it}).

$$Q_t^* = \sum_{i=0}^{n} Y_{it} I_{it} \quad \text{---- Eq.9}$$

Actual production is a function of potential output, climatic variables, price and lagged output.

$$Q_t = \gamma_0 + \gamma_1 Q_t^* + \sum_{i=1}^{m} \beta_i P_{t-i} + \upsilon W_t + \theta Q_{t-1} + u_t \quad \text{---- Eq .10}$$

To overcome the problem of infinite horizon, the first difference equation is used

$$\Delta Q_t = \gamma Q_t^* + \sum_{i=1}^{m} \beta_i \Delta P_{t-i} + \upsilon \Delta W_t + \theta \Delta Q_{t-1} + \Delta u_t \quad \text{---- Eq .11}$$

For computing potential output, data on tree age-wise mango yield in different years and age-wise number of acres in different years is required. For computing age

wise yield the method of Lagrangian interpolation is used. Suppose information is available regarding age –wise yield of a perennial crop at discrete points such as yield at 5 years age, yield at 10 years age, yield at 20 years age and yield at 40 years age, then age-wise yield can be computed using Lagrangian interpolation formula

$$Y = \frac{(x-x1)(x-x2)(x-x3)}{(x0-x1)(x0-x2)(x0-x3)}y0 + \frac{(x-x0)(x-x2)(x-x3)}{(x1-x0)(x1-x2)(x1-x3)}y1 + \frac{(x-x0)(x-x1)(x-x3)}{(x2-x0)(x2-x1)(x2-x3)}y2 + \frac{(x-x0)(x-x1)(x-x2)}{(x3-x0)(x3-x1)(x3-x2)}y3 \quad \text{----------Eq.12}$$

Where x0,x1,x2 and, x3 are the age of trees for which yield data is available, y0, y1,y2 and y3 are yield at the ages of x0,x1,x2 and x3, x is the age for which we want to estimate yield(y) using interpolation method.

The available information regarding mango bearing and yield pattern is as follows. Mango starts bearing from fifth year onwards. At the start of bearing the yield may be as low as 10-15 fruits (2-3kg) per tree, rising to 50-70 fruits (10-15kg) in subsequent years and to about 500 fruits (100 kg) in its 10 th year. In the age group 20-40 years, a tree bears 1000-3000 fruits (200-600kg) in an ‘on ‘year (source: Ikisan). Based on farmer’s survey it was identified that the in general practice, number of trees per hectare is 150. Using this information yield per hectare of 5 years age mango trees is computed as 0.375 tonnes. Similarly yield per hectare of 10, 20, and 40 years old trees are computed as 15, 30 and 90 tonnes respectively. Using these discrete values of ages x0,x1,x2 and x3 (5,10,20,and 40) and yields y0,y1,y2 and y3 (0.375,15,30 and 90 tonnes), y_i values are computed using Lagrangian method of interpolation. From the computed y_i values yield index is constructed taking yield per hectare of 5 years tree as base. Using this index, together with annual average yield data, Y_{it} values are computed.

For computing age wise area distribution in the present study, it is assumed that there are no removals and difference in area between successive years (i.e year t-1 and t) constitutes new planting with the age one (in year t). In the next year (t+1), this area

constitutes acreage of 2 years age trees. Likewise age-wise distribution of area is computed. Further as the first mango-pulp manufacturing firm started in 1970, whatever acreage of mango is there in the district in the year 1980-81, is assumed as 10 years old. Starting from this year new additions are computed and age dynamics of these new additions are captured over years up to 2005-06. Then change in potential yield in each year is computed as summation of product of change in yield of trees (5 years and above 5 years) and change in respective acreages. In deciding about the lag length of price, the criteria of change in sign of coefficient of at least one variable (contrary to expected sign based on theory) is adopted in the present study.

Estimation of Cost function

For computing marginal processing cost, cost function is estimated in the present study. Cost function is estimated for pooled data. The empirical model for cost function for pooled data is specified as

$$C = \alpha_0 + \alpha_1 Q + \alpha_2 Q_{Y_{d1}} + \alpha_3 Q_{Y_{d2}} + \alpha_4 Q_{Y_{d3}} + \alpha_5 Q_{Y_{d4}} + \alpha_6 Q_{Y_{d5}} + \alpha_7 Q_{Y_{d6}} + ei \quad \text{---- Eq .13}$$

As analyzing cost efficiency is one of the objective in the study, besides pooled cost function, cost function for aseptic pulp units and conventional pulp units were estimated separately. Further cost function was estimated separately for own operated pulp units and units working under job work system.

Trade-off between market power and efficiency

According to Azzam and Schroeter (1995) model, V is the initial (pre-consolidation) oligopsony distortion indicating the proportional gap between the value of the marginal product of the raw material input (P) net of marginal processing cost (c) and the price of the raw material input (W).

$$V = \frac{P - c - W}{W} \quad \text{---- Eq .14}$$

Assuming that consumer demand and raw material input supply functions take the constant elasticity forms, and setting pre-consolidation output (Q) as 100 units,

pre-consolidation price of input (W) as equal to one, the authors formulated the trade-off model in terms of the following equations.

$$Q = AP^{\eta} \qquad \text{---- Eq.15}$$

'Consumer demand for final product'

$$Q = BW^{e} \qquad \text{---- Eq .16}$$

'Raw material input supply function'

$$P = (1+V+c)100^{-1/\eta}Q^{1/\eta} \qquad \text{---- Eq .17}$$

'Inverse consumer demand function'

$$W = 100^{-1/e}Q^{1/e} \qquad \text{---- Eq .18}$$

'Inverse raw material input supply function'

Where A and B are constants, η is the price elasticity of demand and e is the price elasticity of raw material supply. The height of the pre-consolidation derived demand curve for the raw material at a given quantity is its price net of marginal processing cost.

$$W = (1+V+c)100^{-1/\eta}Q^{1/\eta} - c \qquad \text{---- Eq .19}$$

With drastic reconfiguration of the industry, that results in lower marginal processing cost due to plant scale economies or multi-plant economies, 0<s<1 denotes the proportionate cost reduction. Accordingly the post-consolidation marginal cost is (1-s) c. Assuming that consolidation leaves the industry with greater concentration and correspondingly greater market power resulting in a post-consolidation distortion $V^{*}>V$, and post-consolidation output as Q*, input price W* and output price P* the following equations of welfare change are derived.

$$\Delta CS = \frac{1}{(1+\eta)}(1+V+c)(100-100^{-1/\eta}Q^{*\frac{(1+\eta)}{\eta}}) \qquad \text{---- Eq. 20}$$

$$\Delta PS = \frac{1}{1+e}(100^{-1/e}Q^{*(1+e)/e} - 100) \qquad \text{---- Eq .21}$$

$$\Delta\pi = \{(1+V+c)100^{-1/\eta}Q^{*1/\eta} - (1-s)c - 100^{-1/e}Q^{*1/e}\}Q^{*} - 100V$$

Change in oligopsony rents **---- Eq .22**

$$\Delta SW = scQ^{*} - \frac{\eta}{1+\eta}(1+V+c)(100 - 100^{-1/\eta}Q^{*(1+\eta)/\eta}) - cQ^{*} + 100c + \frac{e}{1+e}(100 - 100^{-1/e}Q^{*(1+e)/e})$$ **---- Eq .23**

'Net change in social welfare'

In the Equation 23, the term scQ* represents the value of the post consolidation cost savings for Q* units and the rest of the terms together represent the additional "deadweight loss" associated with the oligopsony. The cost reduction necessary to offset the deadweight loss is found by setting the net change in social welfare equation to zero and solving for s. But doing this requires knowledge of Q*. For determining Q*, post consolidation distortion equation is rewritten as

$$V^{*} = \frac{P^{*} - (1-s)c - W^{*}}{W^{*}}$$

$$= \frac{(1+V+c)100^{-1/\eta}Q^{*1/\eta} - 100^{-1/e}Q^{*1/e} - (1-s)c}{100^{-1/e}Q^{*1/e}}$$ **---- Eq .24**

Given estimates of the pre-consolidation distortion V, the post-consolidation distortion V*, marginal processing cost c, the price elasticity of consumer demand and price elasticity of raw material (input) supply, equations 23 and 24 can be solved simultaneously (by using numerical method) by setting ΔSW equation to zero, for finding out two unknowns Q* and s. In the present study pre AEZ situation and post-AEZ situations are considered. As number of processing units are higher in post-AEZ situation compared to pre-AEZ situation , it is hypothesized that the marginal processing cost is higher in post-AEZ situation as the quantity processed by each processing unit declines (because of hypothesized inelastic supply of mango). It is also hypothesized that market power is lower under post-AEZ situation. For this, empirical facts were analyzed

in the study and accordingly the trade-off model is modified in the present study.

Data: For analyzing mango processing cost efficiency and market power in mango processing, data from 20 pulp producing units were collected. From each mango pulp producing unit data was collected for 7 years i.e from 2000-2006. Other necessary data regarding mango area in Chittoor district was taken from "Season and Crop report of Andhra Pradesh" in different years. Data on mango price was collected from regulated markets of Chittoor district, in which mango was notified commodity. Data on Mango pulp exports and mango pulp export price were collected from APEDA website. Data on per capita GDP of importing countries were obtained from IMF/World bank Website.

IV. Results and Discussion:

1. Cost efficiency:

Results of estimation of cost function are presented in the table.1. Using the coefficients of estimated pooled cost function, marginal cost was derived for various years and compared with the average cost (Table.2). The comparison shows that in all the years marginal cost is less than average cost indicating economies of scale (costs increase less than proportionately with output).

Table .1. Mango pulp cost function (pooled)

Variables	Coefficients	t Stat	P-value
Intercept	2203679.12	2.60	0.01
Q	7546.36	24.66	2.23695E-53
$Q_{Y_{d1}}$	1004.11	0.77	0.44
$Q_{Y_{d2}}$	2033.30	1.90	0.06
$Q_{Y_{d3}}$	1386.25	1.14	0.26
$Q_{Y_{d4}}$	747.99	0.76	0.45
$Q_{Y_{d5}}$	277.72	0.49	0.62
$Q_{Y_{d6}}$	-77.72	-0.16	0.87

R Square =0.8867 Adjusted R Square =0.8812

Scale Economies Index (SCI) is computed to measure the economies of scale effect using formula SCI= 1- E_c Where E_c is cost-output elasticity = Marginal cost/Average cost, E_c is the per cent change in the average cost of production resulting from a one per cent increase in output. From the table.2 it can be observed that cost-output elasticity ranged from 0.81 to 0.94 in various years, and average pulp production ranged from 995 to 4288 tonnes.

Table.2. Cost - output elasticity and SCI of mango pulp units (Pooled)

Year	Average quantity of pulp produced (tonnes)	Marginal cost (Rs)	Average cost (Rs)	Cost-output elasticity	SCI
2000	1114.03	8550.47	9784.38	0.87	0.13
2001	1205.65	9579.66	10625.30	0.90	0.10
2002	995.41	8932.61	9974.35	0.90	0.10
2003	1300.84	8294.35	10025.20	0.83	0.17
2004	1955.84	7824.09	9346.35	0.84	0.16
2005	2453.02	7468.64	9130.93	0.82	0.18
2006	4288.13	7546.36	8002.13	0.94	0.06

Table.3 Cost - output elasticity and scale economies index of pulp production in aseptic units and conventional units.

Year	Average quantity of pulp produced (tonnes)	Average cost (Rs)	Marginal cost (Rs)	Cost output elasticity	Scale economies index
		Aseptic technology			
2003	3400.00	8036.27	-3208.61	-0.40	1.40
2004	6373.42	8320.32	2270.10	0.27	0.73
2005	10739.95	8028.40	3607.46	0.45	0.55
2006	14202.24	7713.21	4961.95	0.64	0.36
		Conventional technology			
2000	1114.03	9784.38	10899.78	1.11	-0.11
2001	1205.65	10625.35	9834.73	0.93	0.07
2002	995.41	9974.35	10563.61	1.06	-0.06
2003	1118.31	10551.04	10091.25	0.96	0.04
2004	1219.58	10240.01	10570.56	1.03	-0.03
2005	1209.98	10598.86	10414.12	0.98	0.02
2006	570.34	10700.07	10829.62	1.01	-0.01

Table.4 Cost - output elasticity and SCI for job-work and own processing

Year	Technology	Average quantity of pulp produced (tonnes)	Average cost (Rs)	Marginal cost (Rs)	Cost output elasticity	SCI
			Job work			
2003		2000.00	12712.00	13171.98	1.04	-0.04
2004	**Aseptic**	2700.00	12939.00	13279.73	1.03	-0.03
2000		1292.65	10168.05	9737.46	0.96	0.04
2001		1530.94	10529.70	9981.23	0.95	0.05
2002		2339.80	10794.52	10424.66	0.97	0.03
2003	**Conventional**	1448.66	10711.12	10253.87	0.96	0.04
2004		1618.60	10852.93	10361.62	0.95	0.04
2005		1661.34	10839.80	10610.72	0.98	0.02
2006		714.18	10732.46	9923.38	0.92	0.08
			Own processing			
2003		4800.00	6088.04	-6545.13	-1.07	2.07
2004		7597.89	7773.21	-186.21	-0.02	1.02
2005	**Aseptic**	10739.94	8028.39	1681.36	0.21	0.79
2006		14202.23	7713.21	3512.13	0.45	0.54
2000		782.29	8607.00	9247.45	1.07	-0.07
2001		555.07	11153.02	14923.16	1.34	-0.34
2002		593.99	7282.05	8442.15	1.16	-0.16
2003	**Conventional**	363.22	9091.78	3005.77	0.33	0.67
2004		554.56	7258.47	9364.69	1.29	-0.29
2005		371.73	8599.13	11232.27	1.31	-0.31
2006		185.06	10200.13	13063.04	1.28	-0.28

In order to estimate SCI of aseptic units and firms using conventional technology, separate cost functions were estimated, SCI was computed and results are presented in the table.3. It can be observed that SCI was always positive in the case of aseptic units. When analysis was carried out separately for aseptic units and conventional units according to system of operation i.e job work and owned processing. It is observed that in job-work processing, firms using aseptic-technologies experienced diseconomies of scale and firms using conventional technologies were having positive economies of scale (Table.4). This might be due difference in conversion charge (job-work charge). The conversion charge in the case of conventional technology was Rs 2200 per tonne of pulp and in the case of aseptic processing; the charge was Rs 4500 per tonne of pulp in the year 2005. In the own-processing, firms using aseptic technology are having economies of scale but conventional units are facing diseconomies of scale. This in-turn is due to

lower time for sterilization in aseptic processing, thereby saving time and heating material. This inturn facilitates more per day processing of pulp in aseptic units. Further lower labor cost in case of aseptic technology contributes to scale economy. Thus cost efficiency in mango pulp production varied with both technology and system of operation.

2. Mango Supply response:

As discussed in methodology section various versions of supply response models were estimated accounting for perennial nature of the crop and dynamics of yield. These models yielded price elasticity ranging from 0.48 to 0.76. Islam (1990) estimated price elasticity of fresh tropical fruit supply to be 0.48 for all countries. Jedele *et al.*(2003) in their study analyzing the world market for mangoes, assumed that the three major mango producing regions Africa, Latin America and mango-producing Asia have supply elasticities of 0.58 because they tend to have a greater impact with changes in production and supply than the other regions. Having these facts from literature in backdrop, price elasticity of supply of 0.48 is considered in further calculations in the study.

3. Market Power

As indicated in methodology section calibration method is used in evaluating market power in the present study. Calibration is a method of identifying parameter values as theoretically required "residuals" by assuming that the necessary equilibrium conditions hold in the system. The advantage with this method in the present context is that, it facilitates measurement of time varying market power. The equation for testing industry level market power in mango industry is

$$W_m = P - \partial C / \partial Q - \lambda Q(\partial g / \partial Q)$$

Where W_m = mango price

Q = total pulp production

$\partial g / \partial Q$ = inverse supply elasticity of mango

$\partial C / \partial Q$ = marginal cost of processing

λ = degree of market power

Having the above equation as base, using (i) supply elasticity figure of 0.48 (ii) marginal costs from pooled cost function (iii) mango price and mango pulp price in various years and (iv) total mango pulp production in various years, industry level

oligopsony power measures are obtained. Further using Azzam and Schroeter (1991) demonstration that,

$$\frac{P - MC - W_m}{W_m} = \frac{[\alpha - H(\alpha - 1)]}{Es}$$ = Price distortion

Where H = Herfindahl index and

Es = supply elasticity of mango and

α = firms' implicit coordination in input market

Price distortion and level of implicit coordination in input market (mango market in the present context) is measured for various years and is presented in the Table 5.

Table 5. Industry level oligopsony market power, price distortion and firms' coordination in mango market

Year	Market power	Price distortion	Level of firms' coordination in mango market
2003	0.0640	0.80	0.3628
2004	0.0299	0.56	0.2385
2005	0.0226	0.39	0.1374

If the market power equals zero, it indicates perfect market. On the other hand, if it equals to unity, it indicates monopsony. The measured market power in the present context is in between, indicating oligopsony. But the oligopsony power is declining over the years indicating movement towards perfect competition. Thus price distortion is also declining over years. Price distortion value varies with both concentration level and level of coordination among firms. Zero value of level of coordination indicates Cournot conduct implying non-cooperative behavior and unity indicates perfect collusion. In the present context the level of firm's coordination is falling in-between one and zero, and is declining over the period 2003-05 moving towards zero value (non-cooperative behavior). It is observed that Herfindahl index increased over the period 2003-05. These two factors together interactively resulted in the observed price distortion values. Hence the behavioral model yielded results which are contrary to expectation based on structural

indices like n firm concentration ratio, Herfindahl index and Gini ratio (for the period 2003 to 05).

Table 6. Simulation of market power and level of coordination under different values of estimated supply elasticity

Supply elasticity	Period		
	2003	2004	2005
	Market power		
0.48	0.064	0.030	0.023
0.61	0.082	0.038	0.029
0.68	0.091	0.042	0.032
0.76	0.102	0.047	0.036
	Level of firms coordination		
0.48	0.363	0.238	0.138
0.61	0.473	0.315	0.192
0.68	0.532	0.356	0.221
0.76	0.598	0.402	0.254

To analyze the extent of market power under different supply response estimates obtained in four versions of supply response model, simulations have been carried out and the results are presented in Table 6. The results indicate that market power is increasing with supply elasticity. Using estimated price distortions, actual Herfindahl index value for different years and different estimated supply elasticity values, level of firms' coordination values are derived. The results indicate that level of firms' coordination is increasing with increasing supply elasticity. This increasing coordination (collusion) can be the underlying factor for increasing market power with increasing supply elasticity.

The results of present study are in line with Stigert *et al*. (1993) reporting. They reported that in beef packing industry as anticipated supply decreases, the mark down decreases due to aggressive bidding, and during periods of anticipated supply increase, the markdown increases due to less aggressive bidding. Ji and Chung (2011) also reported that seasonality and cattle cycle affected market power in U.S cattle market. The key finding from the present analysis is that irrespective of supply elasticity estimate used, over the period 2003-05, market power is declining.

Is there any market power exertion by top most firm? To examine this aspect, market power of top most firm is evaluated using the equation

$$W_m = P - \partial C_i / \partial q_i - \lambda_i q_i (\partial g / \partial Q)$$

The equation differs from industry level market power equation in that here firm specific output quantity and firm specific marginal cost variables are used. The results are presented in Table.7

It can be observed from the Table.7 that, market power of top most firm is higher compared to industry level market power, but also declining over the period 2003-05. This effect could be due to the fact that, to reap the benefits of scale economy, the firms are having objective function of maximizing their share in market, rather than having the objective function of profit maximization. Higaki (1997), in the context of analysis of competition (oligopoly) in Japanese potato market, made similar observation.

Table 7. Market power and price distortion at the top most firm level

Year	Technology used by the top most firm	Quantity of pulp produced by the top most firm (tonnes)	Share of the top most unit in total pulp production (per cent)	Market power	Price distortion
2003	Conventional	3200	7.00	0.647	0.56
2004	Aseptic	11000	13.50	0.460	1.17
2005	Aseptic	19000	19.92	0.211	0.73

4. Complementarity /trade-off between market power and marginal cost

What are the changes in consumer surplus, producer surplus and oligopsony rents in post AEZ situation compared to pre-AEZ situation. In order to analyses these issues using Azzam and Schroeter (1995) model, parameter of demand elasticity for mango pulp is needed. Mango pulp is consumed both domestically and also exported. Time series

data on India's mango pulp exports is available (APEDA) but total pulp production data is not published. APITCO reported that during 1998-99 mango pulp exports from Chittoor cluster was 27075 tonnes accounting for 71.20 per cent of mango pulp production indicating export demand is major demand compared to domestic demand. Hence using data from 1990-91 to 2005-06 on India's mango pulp exports, unit value of exports and GDP of major 14 importers of mango pulp from India (Imports of these 14 countries accounted for 86 to 89 per cent of India's mango exports during 2002-05), mango pulp demand function is estimated and the results are presented in the Table .8

Table .8 Mango pulp demand function

	Coefficients	t Stat	P-value
Intercept	-112396.00	-6.60	1.69E-05
Price	-0.29	-0.63	0.54
Imp GDP	8.72	9.26	4.33E-07

R Square = 0.89, Adjusted R Square = 0.88,
Price elasticity = -0.14, Income elasticity = 3.10

Using the estimated mango pulp demand elasticity and mango supply elasticity (from different versions of supply model), together with base parameters of pre-AEZ situation (data of year 1999) and test case parameters of post-AEZ situation (data of year 2005), welfare changes are projected for post-AEZ situation and the results are presented in the Table 9. Here for pre-AEZ situation, data of 1999 is considered because data on firm-wise pulp production data for the years 2000-02 (needed for computing Herfindahl index) were not available. Further, as cost function is estimated using data from year 2000 only, in the present study an assumption is made that marginal cost in year 1999 is same as that of year 2000.

From Table.9 it can be observed that as supply elasticity increases, decline in oligopsony rent is also increasing under welfare neutralizing situation. Further the negative value of welfare neutralizing cost reduction indicates that marginal cost has to

increase for neutralizing change in welfare. Comparison of actual realized situation with projections indicates that marginal cost declined by 12.6 per cent in post-AEZ situation compared to pre-AEZ situation, thereby increasing consumer surplus, producer surplus, and decreasing oligopsony rent. The net change in social welfare is negative (-371.74).

Table 9.Projections of welfare changes under different supply elasticity conditions

	Supply elasticity				
	0.48	0.61	0.68	0.76	0.48
	Base line parameters				
Distortion	1.24	1.24	1.24	1.24	1.24
Output price	4.08	4.08	4.08	4.08	4.08
Raw-material price	1.00	1.00	1.00	1.00	1.00
Quantity	100.00	100.00	100.00	100.00	100.00
Conduct	0.5708	0.5708	0.5708	0.5708	0.5708
Concentration	0.0601	0.0601	0.0601	0.0601	0.0601
Demand elasticity	-0.14	-0.14	-0.14	-0.14	-0.14
	Test case parameters				
Conduct (alpha)	0.1380	0.1380	0.1380	0.1380	0.1380
Concentration (HI)	0.0577	0.0577	0.0577	0.0577	0.0577
					Actual realized values
	Projections				
Distortion	0.39	0.39	0.39	0.39	0.39
Output price	3.33	3.32	3.31	3.30	5.04
Raw-material price	1.06	1.05	1.04	1.04	2.47
Quantity	102.86	102.93	102.96	102.98	209.49
Change in Consumer surplus	75.47	77.14	77.80	78.40	469.14
Change in Producer surplus	6.14	4.92	4.45	4.01	593.11
Change in oligopsony rent	-81.61	-82.06	-82.25	-82.41	-1062.25 (-1433.99)*
Welfare neutralizing cost reduction	-0.012	-0.013	-0.013	-0.013	-0.091 (0.126)*

* Figures in parentheses indicate actual realized values of change in oligopsony rent and cost reduction and the other figures represent welfare neutralizing change in oligopsony rent and welfare neutralizing cost reduction.

Simulations have been carried out to analyse implications of increased concentration (doubling HI) under different levels of coordination and the results are presented in Table 10.

Table.10. Simulation of welfare changes under different conduct and concentration situations

Component /Parameters	**Scenarios**				
	1	**2**	**3**	**4**	**5**
	Base line parameters				
Distortion	1.24	1.24	1.24	1.24	1.24
Output price	4.08	4.08	4.08	4.08	4.08
Raw-material price	1.00	1.00	1.00	1.00	1.00
Quantity	100.00	100.00	100.00	100.00	100.00
Supply elasticity	0.48	0.48	0.48	0.48	0.48
Demand elasticity	-0.14	-0.14	-0.14	-0.14	-0.14
Conduct	0.5708	0.5708	0.5708	0.5708	0.5708
Concentration	0.0601	0.0601	0.0601	0.0601	0.0601
	Test case parameters				
Conduct (alpha)	0.0000	1.0000	0.0000	0.1380	1.0000
Concentration (HI)	0.0577	0.0577	0.1200	0.1200	0.1200
	Projections				
Distortion	0.12	2.08	0.25	0.50	2.08
Output price	3.08	4.75	3.20	3.44	4.75
Raw-material price	1.09	0.96	1.08	1.05	0.96
Quantity	104.02	97.89	103.44	102.43	97.89
Change in Consumer surplus	101.97	-66.45	89.09	64.94	-66.45
Change in Producer surplus	8.73	-4.30	7.44	5.18	-4.30
Change in oligopsony rent	-110.70	70.75	-96.53	-70.12	70.75
Welfare neutralizing cost reduction	-0.014	0.019	-0.014	-0.011	0.019

From the table .10 it can be observed that, irrespective of level of concentration, under conditions of perfect collusion, price distortion is attaining it maximum limit value (of 1/supply elasticity) and is resulting in decline of producer surplus and consumer surplus(scenarios 2 and 5). Under this situation welfare neutralizing cost reduction is positive, indicating that cost reduction is needed to offset deadweight loss. When concentration is almost same (0.0601 and 0.0577), moving towards non-cooperative behavior is leading to decline in price distortion (scenario 1). Under non-cooperative condition, increase in concentration is leading to increased price distortion (scenario 3). Thus interaction of firm level coordination and industry concentration is the determinant of welfare changes under situations where there is decreasing coordination level and increasing concentration and vise versa (scenario 4). When price distortion is increasing change in oligopsony rent is positive. When price distortion is decreasing, change in oligopsony rent is negative, necessitating increase in marginal costs to nullify this effect. When both level of coordination and concentration are declining price distortion declined, oligopsony rent declined necessitating once again cost increase for offsetting the deadweight loss. But the realized decline in oligopsony rent is more than the realized increase of consumer surplus and producer surplus. This, in turn, is due to decline in marginal cost and increase in SCI in post-AEZ situation compared to pre-AEZ situation.

Conclusions:

The study results indicates that for monitoring competition in an agro-processing industry, it is not enough to look into concentration alone, but attention need to paid on other determinants viz: coordination level and supply response of raw material from agriculture. Market power analysis at the top most firm level showed greater market power compared to industry. This can have effect on performance of other firms in the industry and social welfare. This is an important issue in the context of absence of any policy regulating procurement price of mango by the mango pulp units. Hence market power at top most firm need to be monitored constantly.

From review of literature it is observed that diverse hypotheses are there regarding determinants of market power and diverse methods for measuring market power. It is the data availability that dictated the methodology in the present study. More

data availability regarding the industry in future will facilitate more realistic assessment of market power in the sector through application of diverse methods.

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On the economics of cartel investigation: the case of cement in India

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Short abstract:

This paper contributes to the ongoing debate about cartelization in the Indian cement industry. The issue sprang up with the 2010 complaint by the Builders Association of India with the CCI and is currently resonating in anti-trust forums with the recent order of the Commission (29 of 2010), which finds the conduct of 11 cement firms and the CMA in contravention of the provisions of Section 3(3) (a) and 3(3)(b). We focus on cartel-induced overcharges. Depending on the econometric method (dummy variable technique and Dynamic Treatment Effects), our estimates indicate potential overcharges attributable to cartelization.

Keywords: Cement cartels, Cartel-induced overcharges, Dummy variable technique,Dynamic Treatment Effects (DTE) method

JEL classification codes: L40, L61, C54, C31

I. Introduction

"The first thing for any new competition regulator is to go out and find the cement cartel. My experience of this subject is, it is always there, somewhere, the only countries in which I had been unable to find the cement cartel is where there is a national state-owned monopoly for cement." -Richard Whish

In competition law parlance, one of the most extensively studied and discussed is the problem of cartel detection. Most competition authorities have strict provisions for cartels, and in some countries, are part of criminal law. Received wisdom suggests most cartels harm the economy as it eats into the consumer surplus, by raising prices above the equilibrium level. If firms in an industry compete, then this competition drives down the prices which eventually benefit the consumers. This fall in prices will lead to reduced inflation and hence enhancing economic growth. Cartels allow firms to enter soft competition and are thus used to keep prices high. The participating firms act as near monopoly extracting the entire surplus from the consumers. Collusive practices that aim at fixing either prices or market shares are considered as damaging per se as firms get an opportunity to block the entry of new rivals or to overcharge for their products or services.

The theme of our paper is to investigate the impact on prices due to alleged cartelization of the Indian cement industry. Cement is an important input into the construction sector of the economy and any artificial price rise (due to collusion among cement firms) will spill over to the macroeconomy. Anecdotally, The Economist (29 March 2014) notes that cartels are robbing poor countries' consumers of tens of billions of dollars a year: if so, negating all the aid that rich countries' governments send them. Additionally, as the quotation of Dr. Whish in the beginning of this section indicates, cement is a peculiar industry which has a cartel in almost every country.

Authorities have been successful in proving cement cartels in many countries, with the help of leniency programs, circumstantial and economic evidence. The table below show some of the countries where cartels in the cement industry have been found.

Table I.1: Worldwide Cement Cartels

Period of Cartel	Country
1981-1999	Argentina
1986-2007	Brazil
1990—2002	Germany
1995-2009	South Africa
1997-2005	Taiwan
1998-2009	Poland
2002-2003	South Korea
2002-2004	Turkey (Aegean region)
2002-2006	Australia
2003-2006	Egypt
2005-2007	Hungary
2006-2010	Colombia
2008-2009	Pakistan
n/a-2009	Indonesia

Source: Author's own calculations

Based on respective country's anti-trust authorities

It is interesting to study cartel dynamics in country-specific context, given the presence of country-specific anti-trust legislation, leniency programs in particular.

The Indian cement cartel case has been resonating in anti-trust forums from the day when a complaint was filed by Builders Association of India on 26 July 2010 against 11 cement companies & the Cement Manufacturers Association accusing them of restricting the supply of cement despite the available capacity to control cement prices. Builders Association of India (BAI) claimed that prices of cement have been increasing continuously at alarming rates and have adversely impacted the construction sector. The Informant i.e. BAI, alleged that the Cement Manufacturer's Association (CMA) was complicit in aiding collusive practices among the 11 companies, two of whom (ACC Cements & Gujrat Ambuja Cements) had withdrawn as members from CMA due to a widespread belief that the CMA is party to collusive and anti-competitive practices in the cement industry in India. The Informant opined that the forces of demand & supply were not at play behind the price increase. The subsequent order of the Commission was challenged at the COMPAT leading to the recent revised order of the Commission (29 of 2010), which finds the conduct of 11 cement firms and the CMA in contravention of the provisions of Section 3(3) (a) and 3(3)(b) of the Competition Act.

The empirical exercises in our paper is primarily to enrich the analysis of the competition authority, by investigating some collusive markers (for tacit collusion) suggested by theory, in the hope that Commission considers these measures for future cartel analysis. Our intention is not to question the choice of colluding firms as well as the collusive phase. We take the regulator's choice as given (for this paper) and attempt to understand the nature of competition and the extent of cartel-induced overcharge. The final objective is to understand the rationale for the penalty imposed by the regulator on the colludingfirms.

We formulate our research agenda in three stages, in the form of the following three testable hypotheses:

Hypothesis 1 (Market structure and nature of competition in cement industry in India):There is fringe competition in the market, with stability in market shares of the collusive firms between June 2009 to March 2011.

Hypothesis 2 (Testing for the stability in tacit collusion among 11 firms in the industry):There is no significant difference between the set of colluding and non-colluding firms.

Hypothesis 3 (Testing for the ex-post impact on wholesale price of cement): The overcharges created by the cartel are positive and significant.

The rationale for our hypothesis follows from the rich theoretical literature on cartels (summarized in a later section), which gives us some standard collusive markers that are present in most cartelized industries. Our first hypothesis is motivated by the fact that collusion tends to yield static market shares of colluding firms. Theory suggests that firm-level homogeneity aids collusion, by reducing the incentives to break away from the cartel. While complete homogeneity is rare, cartel members try to reduce incentives to deviate from collusive pricing by ensuring stability in market shares (for instance, using buy-backs to compensate cartel members (Harrington, 2006)). Stability in market shares also helps detect deviation by any member firm in the cartel. Our second hypothesis is motivated by the observation that at the time of the investigation of the Directorate General (DG), 49 cement companies were functional in the industry, out of which 11 were alleged by the BAI to be members of a cartel. It is easier establish the existence of an industry-wide cartel with less than 10 firms. However, investigating the possibility of a cartel with 11 insiders and 38 outsiders immediately raises the question about the incentive of the outsiders to destabilize the cartel. A counter to this line of reasoning is that there are positive spillovers for the outsiders, if a few firms have successfully cartelized, as they benefit from higher prices without running the risk of being investigated. An indirect test of this is to check for the degree of homogeneity among the alleged cartel insiders and outsiders. A higher degree of homogeneity is indicative of less incentives for outsiders to destabilize the cartel (possibly due to high positive spillovers in prices for all industry players).

Our third hypothesis investigates the effectiveness of the alleged cartel in raising prices and to formulate a theory of harm due to collusive actions. While ex-post cartel analysis is limited by the availability of secondary data, it informs anti-trust authorities about patterns in the data that can be exploited to watch out for potential collusive behavior among firms in any industry. At the same time, identification of collusive markers from such studies

are complementary aids for the regulator. The primary action in cartel detection relies on leniency programs, which reduce the incentive to collude among firms in any industry.

This paper is structured as follows. Section II presents a short literature review on cartels in general and cement cartels in particular, and draws out common collusive markers that enlighten anti-trust analysis. Section III provides a brief review of the cement cartel analysis conducted by the Competition Commission of India (CCI) and pronounces additional plus factors that can enrich the analysis. Section IV presents our results on the three hypotheses discussed earlier. Section V concludes with a discussion on leniency programs.

II. Literature Review

II.1 Theoretical foundation on the formation and sustainability of cartels

Economic literature treats cartel as a result of a particularly unique conduct among a set of/all firms in a particular industry. This typically results in pricing very different from competitive prices, mostly higher than the latter benchmark. Two main kinds of collusive conduct is discussed in the economic literature: tacit and explicit collusion. In the former, firms do not resort to agreements to enforce collusion. All that is needed to support tacit collusion is a meeting of minds between the firms and the understanding of the fact if firms deviate then punishments will be meted out that will affect all the firms, regardless of who deviated. On the contrary, explicit collusion is the case where firms engage in direct communication regarding the setting of prices, capturing market share etc. While economic theory does not dwell much on the fine differences between the two modes of collusion, anti-trust practice does.

From a legal perspective, different countries have defined cartel through the provisions of their competition regulation. In India, where cartelization is a civil offence, the Competition Act (2002) in Section 2 (c) defines cartel as follows: "Cartel" includes an association of producers, sellers, distributors, traders or service providers who, by agreement amongst themselves, limit, control or attempt to control the production, distribution, sale or price of, or, trade in goods or provision of services". These arrangements can take various forms like increasing prices by creating artificial scarcity, division of markets among various firms so they can create a monopoly in a particular area etc. These agreements help them exert market power and extract higher consumer surplus than what they would get if they did not act in concert. The general consensus is that such arrangements are welfare reducing and should be punished.

There is an extensive body of theoretical literature on cartels, generalizing the nature of collusive markers across industries. One branch of theory investigates collusive actions and their relationship with changes in business cycles, particularly whether the behaviour of

collusive prices are countercyclical or procyclical. The much cited Green and Porter (1984) model discusses cartel formation in the presence of demand uncertainty. Specifically, firms do not observe rivals' demand conditions and are uncertain the reason behind a low demand state in their own operations. It might be due to deviation by a rival from the collusive high price determined by all firms (undercutting this firm and reducing its demand) or it might be due to low demand for all players. The model assumes that firms use a "trigger price" strategy, which is a benchmark price to which they compare the market price when they set their production. Whenever the market price dips below the trigger price during the collusive phase, they revert to Cournot quantity competition for some fixed amount of time before resuming monopolistic conduct again. The result in this paper is that it is a rational response for plays to participate in a reversionary episode as they cannot observe the reason for demand fluctuations. Reversionary episodes play an essential role in maintaining collusive outcomes and do not signal the breakdown of a cartel agreement. Hence, episodes with low demand see competitive pricing, whereas collusive pricing is more likely during a business upswing and high demand condition. In sharp contrast, Rotemberg and Saloner (1986) have theoretically argued that colluding oligopolies behave competitively in periods of high demand. They point out that it is the boom period and not the recession period that will see the breakdown of cartels arguing on the grounds that firms will then have a major incentive to deviate. If price is the strategic variable of choice and demand is relatively high, the benefit to a single firm from undercutting the price that maximizes joint profits is larger. This result holds under the assumptions of no capacity constraints and that industry demand is observable. Haltiwanger and Harrington (1991) investigate these results in the presence of correlation in present and future demand, specifically assuming that a strong demand today signals a strong demand tomorrow. If one firm cheats during period of high demand that will mean giving up on more profits in future. Therefore, a high demand condition at present will not make collusion difficult instead it will help collusive outcomes. They conclude on the note that firms find it difficult to collude during recession as the foregone future profits will be relatively lower that the current gain from deviation. Investigation in cement (Rotemberg and Saloner (1986)) indicates that cement price tends to move countercyclically.

II.2 Institutions and collusion: trade associations and leniency programs

Trade associations are known to provide a convenient platform for firms to share important information on price, quantity, capacity etc. A discussion on these associations is relevant due to the alleged role of CMA in the Indian cement cartel case. Exchange of information reduces the possibility of a scenario akin to Green and Porter (1984), where cartels are forced into reversionary competitive phases. At the same time, such associations help new entrants access industry information at a low cost. In fact, regulation of associations might be counterproductive as demonstrated in McCutcheon (1997). This paper analyses Sherman Act which is thought to operate in public interest, whereas the paper finds the self-same Act may actually serve to benefit firms rather than consumers. An examination of the interpretation and enforcement of section 1 of the Sherman Act reveals that firms find it costly, but not very costly, to meet to discuss prices. Making meetings somewhat costly benefits firms when they design collusive agreements that rely on marketplace punishments that harm all firms in the agreement when one firm cheats. Because all firms find punishment an undesirable outcome when punishment is called for, they would rationally choose to meet again and renegotiate the original agreement when they find themselves punishing a cheater. Therefore, there is no conclusive view regarding the role associations play.

A different strand of literature explores the role of leniency programs on cartel detection. In essence, such programs offer firms involved in a cartel either total immunity from fines or a reduction of fines which the commission would have otherwise imposed on them if they report and hand over the evidence to the authority. It also benefits the Commission, allowing it not only to pierce the cloak of secrecy in which cartels operate but also to obtain insider evidence of the cartel infringement.[1]The leniency policy also has a large deterrent effect on cartel formation and it destabilizes the operation of existing cartels as it seeds distrust and suspicion among cartel members.

Recently, in the cement cartel case in South Africa, South Africa's Competition Commission has reached a settlement agreement with AfriSam, where the latter has admitted that it took part in a cement cartel. Nonetheless, consensus regarding the effectiveness of leniency

[1]http://ec.europa.eu/competition/cartels/leniency/leniency.html

programs is yet to come forth. A strand in the literature indicates that leniency might induce collusion, since they decrease the expected cost of misbehavior.

II.3 Empirical literature: Cartel induced overcharges

A lot of empirical studies have been conducted by applying different variety of available approaches in quantifying the damages faced by the society due to the operations of cartel, mostly in relation to cartel-induced overcharges. Price overcharge refers to the increase in prices during cartel period over some benchmark prices. Thus, calculating the overcharge often involves comparing the price actually paid by buyers during the anticompetitive period ("cartel period") to estimates of the price that would have prevailed in the absence of such conduct but where conditions are otherwise the same (the "counterfactual" condition). (Govinda, Khumalo and Mkhwanazi, 2001).

Empirical evidence suggests that cartel-induced overcharges vary based on duration, legal environment; organizational characteristics of the cartel and to a lesser extent, method of overcharge calculation (Connor and Bolotova, 2006). Posner (2001) reviewed overcharges for 12 cases and found a median overcharge of 28%. Similarly, Werden (2003) reviewed 13 studies and arrived at a median of 15%. A study by the OECD (Organisation for Economic Cooperation and Development) surveyed cartel cases of its members and found a median overcharge of 13% to 16% (OECD, 2002). Mncube (2014) studies the South African flour cartel (active from 1999 to 2007). The paper concludes that the overcharges to independent bakeries range from 7 per cent to 42 per cent and that the cartel profits were approximately two times higher during the cartel than the price war year 2002 or the post collusion year 2008. For the precast concrete products cartel, Khumalo et al (2012) estimate the cartel overcharge to be in the range of 16.5 per cent to 28 per cent for the Gauteng region and 51per cent to 57 per cent for the KwaZulu-Natal region.

The common belief is that collusive conduct generally leads to higher prices generating welfare loss. However, contrary to this, some economists argue that cartels can be cost-reducing. By cooperating on areas such as research or advertising, colluding firms can obtain cost advantages that ultimately can result in lower prices (Bork, 1978). Bolotova, Connor and Miller (2008) shows that the minimum value of overcharge is -5.26 percent and the

maximum is 81.82 percent. Hence, empirical evidence on cartel-induced overcharges is indicates a wide range for overcharges. However, there is some consensus about standard collusive markers in cartelized markets, as summarized in Harrington (2006), which uses case law of 20 European Commission decisions between 2000-2004. Among these are:

i. increased product standardization
ii. increased uniformity across firms in product price, quality, and the prices for ancillary service
iii. higher list prices and reduced variation in prices across customers
iv. **dynamic stability in market shares**
v. **industry-wide price increases** and reduced imports

Other than these, several authors have theorized increased possibilities of collusion with less number of competitors, higher barriers to entry, repeated and multi-market interactions, trade association memberships (Motta, 2004). Of these collusive markers, we focus on the emboldened ones in our analysis in section IV.

III. Cement Cartel in India: A Brief

Some of the salient facts of the cartel case that require attention are:

I. The Informant, BAI, is a society registered under the Societies Registration Act, 1860. It is an association of builders and other entities involved in the business of construction. The members of BAI are one of the largest consumers of cement in the Indian market and are directly affected by high cement prices. Given the upstream-downstream nature of the relationship between the Opposite Parties and the Informant, the latter is likely to be privy to inside information about the nature of competition in

the upstream cement market.

II. BAI provided evidence from secondary data[2] about potential collusion among 11 cement firms, namely: Associated Cement Co. Ltd. (OP-2/ ACC), Gujarat Ambuja Cement Ltd. (OP-3/ ACL), Grasim Cement (OP-4/Grasim), UltraTech Cement Ltd. (OP-5/ UltraTech), Jaypee Cement (OP-6/ Jaypee), The India Cements Ltd. (OP-7/ India Cements), J. K. Cement (OP-8/ JK Cement),Century Cement (OP-9/ Century), Madras Cements Ltd. (OP-10/ Madras Cements/ Ramco), Binani Cement Ltd. (OP-11/ Binani) and Lafarge India Pvt. Ltd. (OP-12/ Lafarge) out of a population of 49 functional cement firms in the industry. Few mechanisms mentioned by the BAI in its allegation of collusion are:

   i. complicity of the CMA (OP-1/CMA[3]): in particular, withdrawal of ACC Cements and Ambuja Cements Ltd. from its membership
   ii. underutilization of capacity despite the growth of the sector in 2009-10
   iii. division of the Indian Territory into 5 zones in order to limit the supply easily

[2]In the wake of financial crises of 2008, government announced various stimulus packages in the form of reduction in excise duties, coal, petrol etc but the price per bag of cement increased between December 2008 –February 2009 by Rs 5.

[3]The meetings of High Powered Committee of CMA were held on 3.01.2011, 24.02.2011 and 4.03.2011 after which price of top companies increased.

III. Independent investigation by the DG revealed the following facts about competition in this sector in India:

i. The industry constituted 49 companies operating with more than 173 large plants.

ii. Of these, the DG investigated 12 players with around 75 per cent market share, i.e. ACC Ltd., Ambuja Cement Ltd., Ultratech Cement Ltd., Jaypee Cement Ltd., India Cement Ltd, Shree Cements Ltd., Madras Cement Ltd., Century Cement Ltd., J.K. Cements, J.K. Lakshmi Cements Ltd., Binani Cement Ltd., Lafarge India Pvt. Ltd.

iii. The DG commented on the oligopolistic nature of competition along with market concentration. For the alleged colluders, the DG found evidence of low capacity utilization (73 per cent in 2010-11), parallelism in price, production and dispatch.

iv. Almost all the cement manufacturers were operating at a profit margin of around 25 per cent and prices are higher than competitive levels.

v. Price of cement has been independent of cost of sales and there has been a continuous divergence between the cement price index and index price of inputs. Between 2004-11, whereas cost of sales increased about 30 per cent, the price of bag of cement increased by 100 per cent.

IV. The DG conducted various tests including price, dispatch and production parallelism. The order stated that price of all the companies moved in the same direction, coefficient of correlation of change in prices of all companies was positive and close to each other (more than 0.5 per cent). The correlation coefficient of dispatch data among the largest companies exhibited a very strong correlation, indicating a situation of meeting of minds. DG also brought out the spatial nature of the market. The market has been divided in 5 zones and market strategies are planned zone wise as transportation costs are high.

V. The CCI observed the following:

i. Abuse of dominance by any player: the Indian cement market was found to be characterized by several players with no single firm or group was in a position to operate independently of competitive forces.

ii. Relying on international practice and the clandestine nature of cartels, the Commission noted that circumstantial evidence is of no less value than direct

evidence to prove cartelization. For instance, in the two months of November and December 2010, the dispatch was lower than the actual consumption for the corresponding months of 2009. The CCI contends that even though the market could absorb the supplies, lower dispatches coupled with lower utilization establishes that the cement companies indulged in controlling and limiting the supply of cement in the market.

iii. In view of the evidence the contraventions of sections 3(3) (a) and (b) stood established and a penalty of approximately six thousand crores was imposed in an order dated 20.06.2012 against the colluding firms (ACC Ltd., Ultratech Cement Ltd., India Cements Ltd., Ramco Cements Ltd, J K Cement Ltd.., Binani Cement Ltd., Lafarge India Pvt. Ltd. Jaypee Cement Corpn. Ltd., Ambuja Cements, Grasim Cements and Century Cements).

VI. The cement manufacturers appealed against this decision of the CCI before the COMPAT. The COMPAT in its order dated 11 December 2015, set aside the matter on the ground of violation of the legal principle that 'only one who hears can decide'.

The CCI has revisited the original order via its final ruling (case no. 29 of 2010) on 31 August 2016 and has announced a fine of INR 6700 crore based on 0.5 per cent of net profits for 2009-10 (from 20.05.2009) and 2010-11 for cement manufacturers named as Opposite Parties in this case.

IV. Empirical Analysis: Market structure and Cartel-induced Overcharges

The investigation of the Commission rests crucially on the argument that despite a healthy growth rate of the construction industry (measured at factor cost) at 7 per cent and 8.1 per cent over the years 2009-10 and 2010-11 respectively[4], growth in cement production and dispatches had been to the tune of only 4.74 per cent and 4.75 per cent in 2009-10 and 2010-11 respectively. Going into the year 2010-11 in detail, the final order of the Commission states "the third and fourth quarter of 2010-11 witnessed a GDP growth rate of 8.3 per cent and 7.8 per cent at factor cost respectively and the construction industry witnessed a growth of 9.7 per cent and 8.2 per cent in Q3 and Q4 of 2010-11 respectively. However, the cement industry registered a negative growth rate of 5.43 per cent and 3.41 per cent in cement production in November and December of 2010-11, respectively. Even in case of cement dispatches, a negative growth rate of 6.33 per cent and 4.90 per cent was observed in the months of November and December 2010, respectively, over the corresponding months in the previous year. Even in January, 2010-11, the growth rate in cement production and dispatches was very low." Additionally, capacity utilization was observed to have fallen significantly in 2010-11 "even though certain Opposite Parties including Lafarge India Pvt. Ltd. and Century Cements have stated that some of their plants were working with a capacity utilization of 98-100%."

Without satisfactory demand condition factors explaining the low rate of growth of the cement industry, the Commission stood by its original finding of cartelization by the 11 alleged firms in the cement industry. In arriving at this conclusion, the statistical tools employed are price correlation analysis[5] and a mention of the low rates capacity

[4]These growth rates are higher at 11.1 per cent in 2009-10 and 18 per cent in 2010-11 if measured at current prices.

[5]To correct for the confusion arising from different sets of prices used by the DG for conducting this analysis, the Commission independently conducted state-wise correlation analysis for the period January 2007 to February 2011 using the data submitted by the Opposite Parties to the DG. The Commission has used data for the same/ common city as a representative of the price at the state level for each company wherever such data was available. In all other cases, a representative city has been used to reflect the prices at the state level for a company.

utilization[6] coupled with evidence of production and dispatch parallelism and a noting of the company-wise state-wise price per bag of cement for the months of September and November in year 2010 and January-February in 2011.

While it is a fair contention by the Commission to state that usage of "high level econometrics or statistical tools" is irrelevant for the analysis of price parallelism among the potential colluders, a more sophisticated ex-post data analysis can strengthen the economic arguments which explores the incentives for the firms to collude in the first place.

To further this cause, we consider our three hypotheses and use secondary data to examine them. For cement prices, we use the latest monthly wholesale price index for cement with base year 2004-05 released on 14 September 2010 by the Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce. Monthly cement consumption data is taken from Indiastat[7] which provides secondary level socio-economic statistical information about India, its states, regions and sectors. For analyzing, we use the CMIE database (ProwessIQ) which provides audited annual financial reports of companies. It is by far the most comprehensive and reliable source of data on the Indian economy.

IV. 1. Hypothesis 1 (Market structure and nature of competition in cement industry in India)

The Herfindahl-Hirschman index (HHI) is a commonly accepted measure of market concentration. It is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. It is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers. HHI is commonly used in US merger cases, its application in cartel cases has been very less.

Interpretation: An HHI below 0.01 (or 100) indicates a highly competitive industry.

[6]The final order of the Commission considered the capacity utilization of 75 per cent rather than 73 per cent reported by the DG (excluding the data pertaining to ACC Ltd. and ACL) as given in CMA report which is calculated on the basis of available capacity of 224.41 MT of the remaining cement companies as on 31.03.2011.

[7]It is a cluster of 56 associate websites wherein 19 websites are sector-specific, 6 are regional websites and 31 websites are state-specific.

An HHI below 0.15 (or 1,500) indicates an unconcentrated industry, while an HHI between 0.15 to 0.25 (or 1,500 to 2,500) indicates moderate concentration. An HHI above 0.25 (above 2,500) indicates high concentration. Higher the value of the index, lower is the level of competition and higher is market concentration in the industry.

We calculate the HHI for the cement industry from 1998-2014 using the metric of sales of goods in the ProwessIQ database. Table IV.1 reveals that the cement industry has been quite unconcentrated, even in the period when cartel was functional, which means that collusive market is not easy to sustain.

Table IV.1 Herfindahl-Hirschman Index for the Indian Cement Industry (1998-2014)

Year	Index	HHI points	Interpretation
1998	0.080496	804.9648386	Unconcentrated Index
1999	0.068271	682.71091	Unconcentrated Index
2000	0.070525	705.2500813	Unconcentrated Index
2001	0.072972	729.716901	Unconcentrated Index
2002	0.072773	727.7343974	Unconcentrated Index
2003	0.071713	717.1271482	Unconcentrated Index
2004	0.070022	700.215191	Unconcentrated Index
2005	0.087036	870.3621726	Unconcentrated Index
2006	0.079459	794.585736	Unconcentrated Index
2007	0.074214	742.1361141	Unconcentrated Index
2008	0.07172	717.2043082	Unconcentrated Index
2009	0.066094	660.942503	Unconcentrated Index
2010	0.078262	782.6245228	Unconcentrated Index
2011	0.085898	858.9780754	Unconcentrated Index
2012	0.086035	860.3536724	Unconcentrated Index
2013	0.086942	869.4165445	Unconcentrated Index
2014	0.092855	928.5516623	Unconcentrated Index

Source: Authors' own calculations based on ProwessIQ data

A low HHI in itself does not necessarily rule out collusion. We investigate the concentration scenario using the concentration ratio for the top eight firms (CR_8) i.e. the market share of top eight firms in the industry for the same period. Unlike the HHI, this measure shows that around 60 per cent of the entire market belonged to just the top 8 firms, despite 149 operational firms as per ProwessIQ.

Table IV.2 CR_8 for the Indian Cement Industry (1998-2014)

Year	CR_8	Interpretation
1998	65.52875781	Medium Concentration- Oligopolistic Market
1999	60.99295565	Medium Concentration- Oligopolistic Market
2000	62.08465208	Medium Concentration- Oligopolistic Market
2001	61.03203024	Medium Concentration- Oligopolistic Market
2002	60.52876734	Medium Concentration- Oligopolistic Market
2003	62.71965402	Medium Concentration- Oligopolistic Market
2004	61.37760145	Medium Concentration- Oligopolistic Market
2005	64.56755452	Medium Concentration- Oligopolistic Market
2006	65.47679678	Medium Concentration- Oligopolistic Market
2007	65.06451113	Medium Concentration- Oligopolistic Market
2008	63.86488858	Medium Concentration- Oligopolistic Market
2009	63.17818732	Medium Concentration- Oligopolistic Market
2010	64.82938942	Medium Concentration- Oligopolistic Market
2011	65.78314604	Medium Concentration- Oligopolistic Market
2012	65.22533372	Medium Concentration- Oligopolistic Market
2013	65.82576688	Medium Concentration- Oligopolistic Market
2014	68.70535772	Medium Concentration- Oligopolistic Market

Source: Authors' own calculations

Our analysis corroborates the DG's finding that the market is oligopolistic in nature, with significant concentration in market shares among the top eight firms. However, we can qualify this statement further.

Table IV.3 shows the descriptive statistics for the market shares of the top eight firms. Note the extremely low variance in market shares, indicating dynamic stability in this variable which we noted earlier as an important collusive marker.

Table IV.3 Descriptive Statistics for Market Shares of Top Eight Firms (1998-2014)

	ACC	Ultratech	India	Ramco	Binani	Lafarge	Jaypee	Gujarat
Mean	0.15	0.11	0.06	0.04	0.02	0.02	0.00	0.01
Max	0.21	0.22	0.11	0.05	0.03	0.05	0.02	0.01
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standard Deviation	0.05	0.09	0.02	0.01	0.01	0.02	0.01	0.00
Skewness	-1.04	-0.11	-0.12	-2.68	-1.95	0.69	1.35	-0.59
Kurtosis	4.56	1.61	4.23	10.85	7.67	1.80	2.87	2.48
Observations	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Variance	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00

Source: Authors' own calculations

Table IV.4 shows the Spearman's rank correlation coefficient for market shares of these firms. Our results indicate a high degree of positive and statistically significant correlation among market shares of these firms.

Table IV.4 Spearman's Rank Correlation for Market Shares ofTop Eight Firms

Spearman's Rank Correlation *(1998-2014)*								
	ACC	Ultratech	India Cements	Ramco	Binani	Lafarge	Jaypee	Gujarat
ACC	1							
Ultratech	-0.5907*							
India Cements	0.8308*	-0.6223*	1					
Ramco	0.4303	0.0168	0.4262	1				
Binani	0.4469	-0.2996	0.5707*	0.5769*	1			
Lafarge	0.6888*	-0.4097	0.4452	0.1643	0.0091	1		
Jaypee	-0.5810*	0.7783*	-0.5623*	0.1326	0.1232	-0.6495*	1	
Gujarat	0.7193*	-0.5088*	0.9257*	0.5583*	0.5728*	0.3727	-0.459	1
*** 5% level of significance**								

Source: Authors' own calculations

In order to examine our first hypothesis, we construct the mobility matrix of market shares based on share of sale of goods. The matrix helps us in analyzing the nature of concentration in the market. It has been formed in the following manner:

We take the pre-cartel period as 2006-2009, following the CCI order the cartel period was 20.5.2009-31.3.2011, as we have yearly data on sales.[8] We first calculate the market share for each firm for the period 2006-2011 based on sale of goods. Next, a simple average of market share is taken for the two periods i.e. pre-cartel & cartel. Finally, we classify firms as per their market share in 4 categories. The selection of these four categories is based on CR_8 accounting for almost 60 per cent of total market share.[9]

[8]A robustness check was done by taking the cartel period as 2009-2010 and the results did not change significantly.

[9]The data was available for a total of 145 firms but those have been removed for which the value was zero for both the pre-cartel & cartel period. The firms for which value was zero for only 1 period have been kept. The value zero not always mean share was zero, it also indicates that data was not available.

Table IV.5 Mobility Matrix for Market Shares

Cartel Period						
			2009-2011			
			Top 20% Firms (By market share)	**30-50% Firms (By Market Share)**	**50-80% Firms (By Market Share)**	**Bottom 20% Firms (By Market Share)**
Pre Cartel Period	**2006-2008**	**Top 20% Firms (By market share)**	**A C C Ltd., Ambuja Cements Ltd., Ultratech Cement Ltd., India Cements Ltd.,**Shree Cement Ltd**., Ramco Cements Ltd.**[10], Birla Corporation Ltd., **J K Cement Ltd.,** J K Lakshmi Cement Ltd**., Binani Cement Ltd.,** Penna Cement Inds. Ltd., Chettinad Cement Corpn. Ltd., O C L India Ltd., Prism Cement Ltd.	Sanghi Industries Ltd., My Home Inds. Pvt. Ltd.,		**Lafarge India Pvt. Ltd.**
		30-50% Firms (By Market Share)	Zuari Cement Ltd.	Rain Cements Ltd., Heidelberg Cement India Ltd.,Saurashtra Cement Ltd., Mangalam Cement Ltd., Gujarat Sidhee Cement Ltd., Cement Corpn. Of India Ltd., K C P Ltd., Shree Digvijay Cement Co. Ltd., Malabar Cements Ltd., N C L Industries Ltd., Cement Manufacturing Co. Ltd., Meghalaya Cement Ltd., Sagar Cements Ltd., Kalyanpur Cements Ltd., Panyam Cements & Mineral Inds. Ltd., Anjani Portland Cement Ltd., Srichakra Cements Ltd., Megha Technical & Engineers Pvt. Ltd., Keerthi Industries Ltd., Deccan Cements Ltd.	Tamil Nadu Cements Corpn. Ltd.	Visaka Cement Industry Ltd. [Merged], Sri Vishnu Cement Ltd. [Merged], Indorama Cement Ltd. [Merged]
		50-80% Firms (By Market Share)		**Jaypee Cement Corpn. Ltd.**	Bheema Cements Ltd., Barak Valley Cements Ltd., Hemadri Cements Ltd., Vinay Cements Ltd. Travancore Cements Ltd., Cochin Cements Ltd., Burnpur Cement Ltd., Greygold Cements Ltd., Cement International Ltd., Sri Mata Infratech Ltd., Shri Keshav Cements & Infra Ltd., Khalari Cements Ltd., Sorabh Cement Ltd., Deva Drill Tech (India) Ltd., Balaram Cements Ltd., Necem Cements Ltd., P R Cements Ltd., Virgo Cements Ltd., Shaktiman Cements Ltd., Namo Cements Ltd.,	Alcon Cement Co. Pvt. Ltd., Cheran Cement Ltd., Nirman Cements Ltd., Rajapalayam Cement & Chemicals Ltd., K J S Cement Ltd.,
		Bottom 20% Firms (By Market Share)	Samruddhi Cement Ltd. [Merged], Dalmia Cement (Bharat) Ltd.	BhilaiJaypee Cement Ltd., Trinetra Cement Ltd.	Bharathi Cement Corpn. Pvt. Ltd., Bhavya Cements Ltd., Dalmia Cement East Ltd., Calcom Cement India Ltd., Encore Cement & Additives Pvt. Ltd. [Merged]	Sanjay Intra Ltd., Rishi Cement Co. Ltd., Chenab Cement Ltd., Saurabh Cement Ltd., Varun Cements Ltd., Gangotri Cement Ltd., Someswara Cements & Chemicals Ltd., S C L Cements Ltd.
Source: Author's own calculations						

[10] Madras Cement has been renamed as Ramco Cements. The data for 2 colluding firms i.e. Century Cements Ltd & Grasim Cements is not available on prowess.

The matrix can be read as follows: If a firm was in top 20% in both the periods it is in the first cell of the matrix. If its share has changed between the periods, then it will lie in the non-diagonal cells of the matrix. As most of the firms lie on the diagonal elements of the matrix, we have evidence of stickiness in market shares. Firm names in red are the allegedly colluding firms. Of the nine alleged colluders on which we found secondary data from ProwessIQ on market shares, note that seven are in the first cell of this table. One firm has retained its position in the 30 to 50 per cent range, while only one firm (Lafarge India Pvt. Ltd.) has moved down the ranks from top 20 per cent to bottom 20 per cent. Majority of the alleged colluders retained their position in the top 20 per cent market share. The following table provides the figures on average market shares for firms in each of the cells, the first number being that for the row category for market share and the second being that for the column value for the market share.

Table IV.6 Mobility Matrix for Average Market Shares

			2009-2011			
			Top 20%	**30-50%**	**50-80%**	**Bottom 20%**
PreCartel Period	**2006-2008**	**Top 20%**	*78.09413*, *76.6309*	3.491177, 2.509548	-	2.145079719, 0
		30-50%	1.199711606, 1.691837891	12.7995, 10.5071	0.4386227, 0.098925893	0.810203, 0
		50-80%	-	0.016092959, 0.656909732	0.952002, 0.792794	0.046113, 0.008383
		Bottom 20%	0,6.143688	0, 0.635001	0, 0.317851	0.007366, 0.00711

Source: Authors' own calculations

Tables IV. 6 clearly shows how small the average market shares of the bottom firms in this industry was and the stickiness in relative market share ranks in the Indian cement market prior to and during the cartel period. This indicates that we cannot reject our first hypothesis:

Hypothesis 1: There is fringe competition in the market, with stability in market shares of the collusive firms between June 2009 to March 2011.

Fringe competition is said to arise when there a few small firms in the market, that capture a large market share and many small sellers. Due to unchanging market share dynamics despite the presenceof a large number of firms in the market, one of the collusive markers is corroborated: fringe firms cannot pose potential threats to the top firms and if anything, would benefit from positive price spillovers arising due to collusion among the top entities.

IV. 2. Hypothesis 2 (Testing for the stability in tacit collusion among 11 firms in the industry)

If we compare the average profits of the 11 firms against that of the remaining 38 firms from the period 2005 to 2011, we find that there is a clear positive correlation in these figures, though in absolute value terms, the average profit of the former group is about 9 times higher than that of the latter for most of these years. There is a slightly higher variation in average profits of the colluding set of firms than that of the non-colluding firms. Nonetheless, the upward movement in average profits is the same for all the firms, indicating some form of 'umbrella pricing' present in the industry.

While this is not a strong test of similarity between the groups of firms, it is a preliminary exercise that we conducted given some data limitations.

Hence, we find weak support for our second hypothesis[11]:

Hypothesis 2: There is no significant difference between the set of colluding and non-colluding firms.

This establishes that there was a possibility of stability in collusion as the non-colluding set of firms were also making positive and increasing profits in the cartel period (presumably due to positive spillovers in pricing for all firms softening *overallcompetition in the industry).*

IV.3. Hypothesis 3 (Testing for the ex-post impact on wholesale price of cement)

IV.3.1. Methodology

Literature suggests that three types of approaches are available for estimating the harm caused by cartels. They are i) Comparator based, ii) Financial analysis based, iii) Market-structure based.

Comparator based approaches try to look at what would have happened had the cartel not been there by looking at time periods before or after infringement or by looking at a

[11] A co-movement in profits matters more for this hypothesis, as collusion among a set of firms in the industry then creates positive externalities for all players in the market, reducing the possibility of a break-down of collusion or using complicated trigger strategies to sustain collusion.

similar market in which a cartel did not exist. This can be applied using three ways: i) cross-sectional analysis i.e. comparing different geographic or product markets, ii) time-series comparisons by analyzing prices before, during and/or after an infringement); and iii) combining the above two in 'difference-in-differences' models. Financial approaches use financial information such as rate of return, costs on comparator firms and industries to estimate the counterfactual scenario. There are two types of approach that use this information. First are the ones examining financial performance. These include assessing the profitability and comparing this against a benchmark. For example, event studies of how stock markets react to information. The second type is a group of financial tools, such as discounting, multiples etc.

Market structure based approaches use theory as their base to set up a suitable model depending upon the market structure and reaching a counter factual situation. The models can be calibrated using the econometrics techniques described under the comparator-based approaches.

We employ the comparator-based method to look at the dynamics of pricing in the cement industry. We focus on the before-and-after effect of cartelization on wholesale cement prices. The choice of this approach is informed by the data at disposal and due to the fact that there is no credible comparator to allow for the use of difference-in-difference (DiD) approach. In essence, while our method compares price during the cartel period with the price in the same market before and/or after the cartel period, the DiD method evaluates price developments at different points in time across different markets, exploring the price effects of a cartel from both a time perspective and a geographic perspective.

There are two ways by which before-and- after approach can be applied. One is simply comparing the price averages between these periods. Alternatively, the price overcharge can be estimated by multivariate models that take into account relevant control variables. The ability to measure the overcharge accurately depends upon how reliably and precisely the analysis can distinguish the collusive effect on prices from other influences that are unrelated to the anticompetitive conduct (Nieberding, 2006). Thus, the attractive feature of multivariate models is that they allow for the inclusion of other determinants

of price in the cartel and non-cartel periods, such as seasonal effects, technological effects or structural changes. Again, for conducting multivariate comparison, two approaches exist. The dummy variable approach involves calculation of cartel overcharge through coefficient parameter by introducing indicator variable for the cartel period with value 1 during cartel. The forecasting approach (Dynamic Treatment Effects (DTE)) involves predicting the price during the cartel period on the basis of the prices in the non-cartel period given the structural changes in the market. (Govinda, Khumalo and Mkhwanazi, 2001). As most of our variables are non-stationary, the simple OLS regression for implementing the dummy variable technique is not reliable. Hence, we present results from the estimation of the DTE model for cartel-induced overcharges.

The "before-and-after" method has certain key advantages that explain its frequent application in overcharge estimations. First, data requirements are limited to time series of the cartelized product. Second, an estimation of the overcharge is technically relatively easy to implement and therefore suitable for implementation in a relatively short time window for the analysis. Third, it is not necessary to make any assumptions on industry conduct absent the cartel (Hüschelrath et al, 2013). However, the performance of this approach relies on the extent to which the period before or after the cartel provides a good approximation of the competitive price. One reason why this might not be the case is the possible persistence of cartel prices after the cartel has been uncovered. This is the transition period, in which prices continue to follow the cartel period price trend. Residual collusion is one of the factors that provide an explanation for transition period. Therefore, ignoring the transition period is likely to lead to biased estimates of the price overcharge of the cartel.

IV.3.2. Variable Measurement

The main dependent variable for us is the monthly Wholesale Price Index[12] (WPI) of Grey Cement. It is also known as Ordinary Portland Cement (OPC). The reason

[12] The selection of data sources for the manufactured products is done on the basis of sampling. Also, a list of top manufacturers is considered for a regular supply of price quotations from them. This ensures that the wholesale prices are appropriate for usage here in the calculation of overcharges.

for choosing OPC is that it accounts for 70 per cent of the total domestic consumption.

Independent variables include:

The main independent variable:

1. **Cartel period:** It is a dummy variable for cartel. The coefficient of this willcapture the impact of cartel on the WPI of grey cement. In other words, the overcharges created by the cartel. It takes value 1 for the period June 2009 – March 2011 and 0 otherwise.

Supply side controls (input prices):

2. **Wholesale Price Index of Limestone:** Limestone is a major input used in theproduction of cement. About 1.5 tonnes of limestone is used in the manufacture of 1 tonne of cement. Limestone is available in large quantities in Rajasthan, Madhya Pradesh, Gujarat, Andhra Pradesh, Karnataka, Tamil Nadu, and parts of Bihar.
3. **Wholesale Price Index of Power:** Power and Fuel accounts for 8 per centof cost of sales of OPC.

Demand side control:

4. **Consumption:** Consumption of cement is taken as a proxy for demand due tothe unavailability of monthly demand of cement data. It is likely to increase the price of cement, as explained by the normal demand supply forces.

Other controls:

5. **Seasonality:** The main demand of cement comes from the construction sector.It can be further decomposed into housing construction (accounting for 64 per cent of total demand), industrial construction, Infrastructure and commercial & institutional. The construction sector is known for having seasonal trends as construction booms during summer season. Therefore, it is important to capture those trends by using monthly dummies.

6. **Index of Industrial Production:** This is taken as a relevant businesscycle control variable. Basic goods IIP has been taken as among used based indices, cement is classified under basic goods.

IV.3.3. Results and Discussion

I. The Dummy Variable Technique

The impact of the cartel is estimated through a simple Ordinary Least Squares regression of the form:

$$WPI\_Cement_t = \beta_0 + \beta_1 WPI\_Limestone_t + \beta_2 WPI\_Power_t + \beta_3 Consumption_t + \beta_4 IIP_t + \beta_5 D^c + \sum_{i=1}^{11} h_i M_i + e_t$$

Note here that is a set of monthly controls, e_t is the random error term and the coefficient of interest is β_5, which measures the effect of the cartel period (measured by the dummy variable Dc) on the WPI of OPC. The coefficient of the cartel dummy captures the ceteris paribus effect of the cartel on price.

Table IV.7: Dummy Variable Model for the WPI of Cement, January2004 – December 2011

Log (Variable)	**Model (1)**
$WPI\_Limestone_t$	0.203374 (.091947)**
WPI_Power_t	-0.598713 (.095357)***
$Consumption_t$	0.214725 (0.078806)***
IIP_t	1.437284 (0.115327)***
Cartel Period Dummy	.019757 (.011625)*
Constant	-0.769439 (0.229205)***
Number of observations R-squared Adjusted R-squared	84 0.9587 0.9489
Monthly dummies	Yes
Notes: ***, ** and * indicate significance at 1, 5 and 10%, respectively. Standard errors in parenthesis below coefficients.	
Source: Author's own calculations	

The cartel period as stated in the order is 20.05.2009-31.03.2011. So we take the period to be June 2009- March 2011. The table IV.7 shows the estimation results for the case of natural logarithm of the respective variables. It can be inferred from the dummy coefficient that the price difference between the cartel period and the non-cartel period i.e. the avoided price is exp(0.019756) – 1 = 1.99%, statistically significant at 1%. Apart from the specification mentioned here, three other models have also been tried – a model without the natural logs of the variables, another specification including a time trend and a third variant with lags of the variable. The specification with the of the logarithms of the variables presented below provided the best fit.The results of other three specifications are presented in Appendix 1.

A naïve reading of this result indicates that there was a significant effect of the cartel period on prices. However, we should note the possibility of a spurious result here as some of the independent variables (WPI _Cement, WPI_ Power and IIP) are non-stationary, as Table IV.8 shows.[13]

Table IV.8 Unit Root Tests

(AIC Criteria, Max Lag Length=10)

Variable	ADF_t-statistic	p-value
WPI _Cement	-1.797453	0.6911
WPI _Limestone	-3.624167	0.0382
WPI_ Power	-2.690152	0.2455
Consumption	-6.826471	0.0001
IIP	-0.271903	0.9890

Notes: ADF_t-statistic indicates the t-value with both intercept and trend. MacKinnon (1996) one sided p-values are noted.

Source: Authors' own calculations

II. Dynamic Treatment Effects (DTE)

We investigate whether a co-integrating relationship exists among these variables. Despite non-stationarity in individual variable time series, a co-integrating relationship is a combination of these variables which is stationary

[13]Despite the spurious nature of a naïve OLS regression in this context, the empirical literature has routinely reported these results upfront, for example in Notaro (2014).

and we can comment on long-run dynamic patterns in the data. The Autoregressive Distributive Lag Model (ARDL) bound test (we have two I(0) variables and three I(1) variables) to test for the existence of a cointegrating relationship among the variables. As we find that the value of the f-statistic of this test is higher than the critical upper value bounds at even 1 per cent level of significance, we reject the null hypothesis of no cointegration.

Table IV.9 ARDL Bound Test for Cointegration

Test Statistic	**Value**	**K**
F-statistic	9.558818	4
	Critical Value Bounds	
Significance	I0 Bound	I1 Bound
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Source: Authors' own calculations

Accepting that there is a cointegrating relationship among the variables of interest, we estimate the ARDL model, with WPI_Cement as the dependent variable as shown in Table IV.10. The cointegrating relationship is shown in the equation below:
WPIC = (-0.7773*WPIL + 0.0874*WPIPR + 10.4169*CONS + 0.3593*IIP + 34.3167)

Table IV.10. Long Run Relationship – ARDL Model (January 2005- May 2009)[14]

Variable	Model (1)	Probability
WPI _Limestone	-0.777317 (0.575488)	0.1876
WPI _Power	0.087361 (0.463673)	0.8519
Consumption	10.416912 (6.456068)	0.1178
IIP	0.359304 (0.783266)	0.6500
Constant	34.316693 (44.6563)	0.4486

Notes: Standard errors in parenthesis.

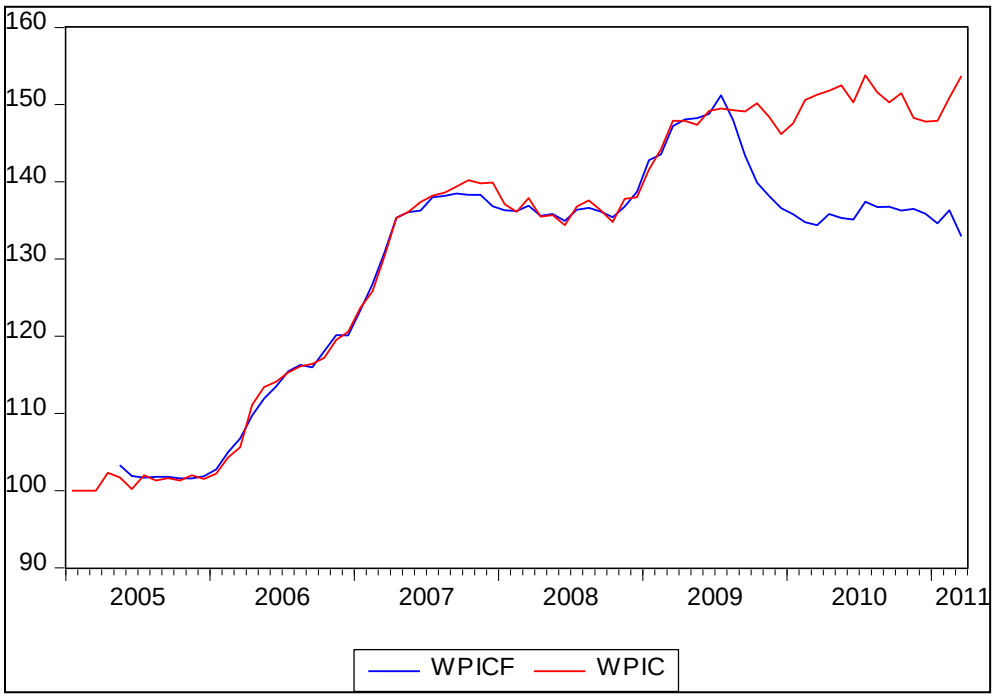
Source: Authors' own calculations

Standard diagnostic tests for normality, heteroscedasticity and auto correlation were conducted for the ARDL specification. The results, reported in Appendix 2 prove that none of these problems show up with our specification. There is no evidence of structural break in the ARDL specification (in our CUSUM plots). The but-for or counterfactual scenario is now created by using the price of cement predicted by this model and forecasting future prices (from June 2009 to March 2011). This is the price that would prevail in the absence of any potential cartelization between June 2009 to March 2011. The following graph contrasts the price path of cement as predicted by the model (in blue) and actual cement prices (in red).It should be noted that the actual price path is within ± 2 S.E. (Standard Error) band of the prediction [15].

Figure IV. 1. Comparing ARDL forecasted cement price with actual cement price

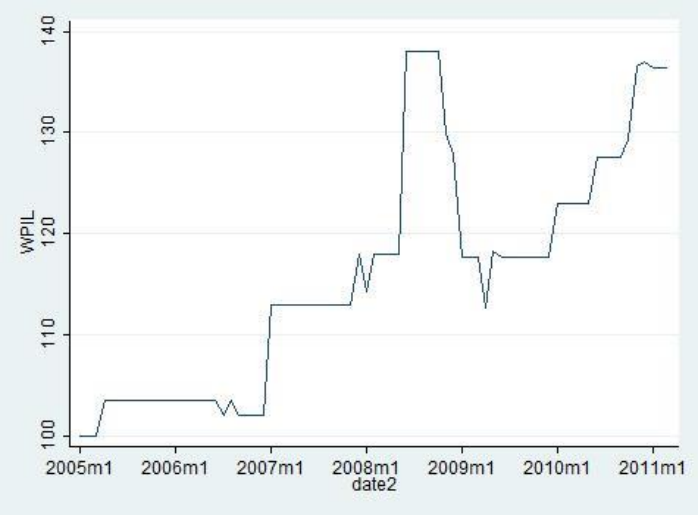
[14]The cartel overcharge calculation tables (Table IV.7 and Table IV.10) are notable for negative sign of Power (by the OLS method) and Limestone (by the ARDL approach) indicating the limitations of the approaches. However, it is observed that some of the papers aimed at calculating cartel overcharges have faced similar problems. For instance, in Notaro, G. (2014). Methods for Quantifying Antitrust Damages: The Pasta Cartel in Italy. *Journal of Competition Law and Economics*, *10*(1), 87-106. – A pasta cartel overcharge calculation shows negative sign of energy. Also, in Govinda, H., Khumalo, J., &Mkhwanazi, S. "On measuring the economic impact: savings to the consumer post cement cartel burst." In *Competition Law,Economics and Policy Conference* (Vol. 4). the coefficients of limestone and oil were negative and were which taken as proof for some amount of inconsistency in the data.

[15]The error band for the prediction is shown in Appendix 3.



However, caveats is due about our ARDL specification: the sign of the coefficient of WPI_limestone in our estimated model is negative. This result of wrongly signed inputs is common to the empirical literature on price-related overcharges arising due to collusion. A potential possibility is that distorted market competition exists in the entire supply chain for cement, resulting in such anomalies. Investigating this is part of future work.Second, other than the constant term, none of the regressors are significant in our ARDL specification.

Figure IV. 2. Wholesale Price of Limestone from 2005 to 2011[16]



Source: Authors' own calculations based on DIPP data

Following Bolotova, Connor and Miller (2008), we measure overcharges from our model as the following rate:

$$\text{Overcharge rate} = \frac{P_{\text{predicted}} - P_{\text{forecast}}}{P_{\text{predicted}}}$$

These results are summarized in table IV.11, which gives us an average overcharge rate of around **8.73 per cent.**This rate of overcharge, while on the low side, is part of the observed range for cartel -induced overcharges. As the forecast price falls within the predicted band for the predicted price, we should not expect very large overcharge rates, as we find only a weak evidence for collusion through our empirical analysis in this section.

[16]The time series movements of other variables are presented in Appendix 4.

Table IV.11. Overcharge calculation from ARDL model

Year	WPI	Cement Forecast	Overcharge (%)
Jun-09	149.2	148.79	0.28
Jul-09	149.5	151.21	-1.13
Aug-09	149.3	148.01	0.87
Sep-09	149.1	143.42	3.96
Oct-09	150.2	139.9	7.36
Nov-09	148.4	138.14	7.43
Dec-09	146.2	136.58	7.04
Jan-10	147.6	135.81	8.68
Feb-10	150.6	134.76	11.75
Mar-10	151.3	134.39	12.58
Apr-10	151.8	135.83	11.76
May-10	152.5	135.3	12.71
Jun-10	150.3	135.1	11.25
Jul-10	153.8	137.42	11.92
Aug-10	151.6	136.72	10.88
Sep-10	150.3	136.76	9.90
Oct-10	151.5	136.28	11.17
Nov-10	148.3	136.5	8.64
Dec-10	147.8	135.85	8.80
Jan-11	147.9	134.61	9.87
Feb-11	150.9	136.32	10.70
Mar-11	153.7	132.94	15.62

Source: Authors' own calculations

With an average overcharge rate which is less than 10 per cent and the fact that the actual price path (though higher than the predicted price path) has not crossed the accepted error bounds for prediction, the final test is on the calculation of penalties. While the CCI has concluded that there is enough evidence of collusion and has imposed a penalty based on 0.5 per cent of net profits in 2009-10 (20 May 2009 onward) and 2010-11, our analysis does not provide direct evidence for such penalty calculation to remedy potential harm.

Going forward, the limitations of ex-post analysis using publicly available data of the kind we found available to comment on overcharges and potential harm should alert the Competition Authority that other methods such as its Leniency Programme might be better alternatives to detect collusion in industries with distorted competition, such as cement. However, such programmes, unless well

designed might help colluding firms achieve better coordination (McCutcheon 1997). Extending the analysis to sub-regional competition issues, keeping in mind the regional fragmentation of the cement market is limited by the availability of publicly available data, but is part of our longer run research agenda.

V. Conclusion

The discussion on the Indian cement cartel case is interesting as well as academically challenging, given that the Commission has not reversed its original conclusion that the Opposite Parties are guilty of cartelization of the cement industry between June 2009 to March 2011. Worldwide, successful cartel investigation rests on a clever usage of the leniency and whistleblower programs that provide direct evidence of cartelization. Our first hypothesis clearly indicates the difficulty of creating a but-for counterfactual as the cement market is clearly oligopolistic in nature, with some fringe competition. Ex-post cartel analysis might consider employing some of the statistical techniques that we discuss to elucidate on the extent of harm and cartel-induced overcharges. While the selection of firms in the collusive set and the cartel period are open to debate, what is undeniably established is the stability of market shares of the alleged colluding firms. *Wecontrasted the market shares of these firms against market shares of a Polish cement cartel case in 2009 (Bejger, 2011), where two of the colluders (one of thembeing Lafarge confessed to cartelization under the Polish leniency program. Given the homogeneous nature of cement and oligopolistic competition across countries, we contrasted the market share volatility of alleged colluders in India with the Polish case. Hearteningly, we find that market share volatility is lower for the allegedly colluding Indian firms than for the Polish conspirators.*

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VII. Appendix

Appendix 1: Various OLS specifications

Model 2: The specification without logs

Dependent Variable: WPIC
Method: Least Squares
Date: 05/01/16 Time: 10:37
Sample: 2005M01 2011M12
Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CARTEL	2.436935	1.663002	1.465383	0.1475
WPIL	0.209752	0.109371	1.917809	0.0594
WPIPR	-0.539691	0.104018	-5.188423	0.0000
CONS	1.894667	0.810558	2.337485	0.0224
IIP	1.455042	0.131031	11.10456	0.0000
@SEAS(2)	11.65804	2.630728	4.431486	0.0000
@SEAS(3)	-7.755717	2.683347	-2.890314	0.0052
@SEAS(4)	16.00878	2.643028	6.056984	0.0000
@SEAS(5)	11.66191	2.600353	4.484742	0.0000
@SEAS(6)	16.55690	2.722081	6.082443	0.0000
@SEAS(7)	18.52118	2.783121	6.654823	0.0000
@SEAS(8)	20.25109	2.913426	6.950953	0.0000
@SEAS(9)	23.57692	2.974807	7.925529	0.0000
@SEAS(10)	13.30128	2.707807	4.912196	0.0000
@SEAS(11)	17.98231	2.819460	6.377928	0.0000
@SEAS(12)	3.745541	2.579941	1.451793	0.1512
C	-42.09775	6.040759	-6.968950	0.0000

R-squared	0.949138	Mean dependent var	134.0929
Adjusted R-squared	0.936992	S.D. dependent var	18.99098
S.E. of regression	4.766984	Akaike info criterion	6.139943
Sum squared resid	1522.517	Schwarz criterion	6.631894
Log likelihood	-240.8776	Hannan-Quinn criter.	6.337703
F-statistic	78.14387	Durbin-Watson stat	1.346283
Prob(F-statistic)	0.000000		

Model 3: The specification with time trend

Dependent Variable: WPIC
Method: Least Squares
Date: 02/19/17 Time: 10:53
Sample: 2005M01 2011M12
Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	146.6497	15.12291	9.697185	0.0000
WPIPR	-0.723294	0.108044	-6.694461	0.0000
WPIL	0.175535	0.106448	1.649017	0.1032
CONS	0.249363	0.691240	0.360748	0.7193
IIP	0.110381	0.144191	0.765517	0.4463
@TREND	1.102155	0.098637	11.17388	0.0000
@DURING("2009M06 2011M03")	-4.857860	1.760649	-2.759130	0.0072

R-squared	0.942404	Mean dependent var	134.0929
Adjusted R-squared	0.937916	S.D. dependent var	18.99098
S.E. of regression	4.731913	Akaike info criterion	6.026191
Sum squared resid	1724.107	Schwarz criterion	6.228759
Log likelihood	-246.1000	Hannan-Quinn criter.	6.107622
F-statistic	209.9836	Durbin-Watson stat	0.316379
Prob(F-statistic)	0.000000		

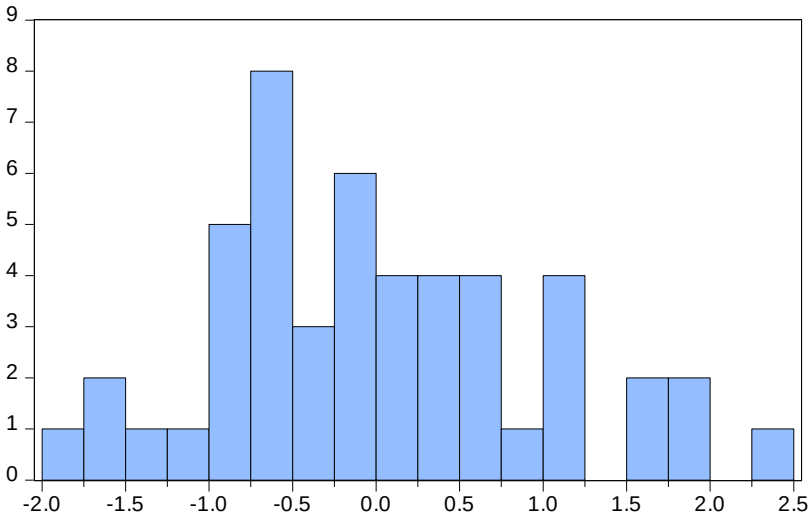
Model 4: The specification with lags

Dependent Variable: WPIC
Method: Least Squares
Date: 02/19/17 Time: 11:00
Sample (adjusted): 2005M05 2011M12
Included observations: 80 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-14.38409	7.349097	-1.957260	0.0541
@DURING("2009M06 2011M03")	7.481617	1.780702	4.201498	0.0001
WPIPR(-4)	0.117961	0.116844	1.009563	0.3160
WPIL(-4)	0.164605	0.137862	1.193989	0.2363
CONS(-4)	2.612704	0.590759	4.422624	0.0000
IIP(-3)	0.626448	0.102293	6.124039	0.0000

R-squared	0.885639	Mean dependent var	135.7687
Adjusted R-squared	0.877912	S.D. dependent var	17.86451
S.E. of regression	6.242057	Akaike info criterion	6.572535
Sum squared resid	2883.283	Schwarz criterion	6.751187
Log likelihood	-256.9014	Hannan-Quinn criter.	6.644162
F-statistic	114.6147	Durbin-Watson stat	0.579134
Prob(F-statistic)	0.000000		

Appendix 2: Results of tests of normality, serial auto-correlation and heteroscedasticity



Series: Residuals
Sample 2005M05 2009M05
Observations 49

Mean	-1.04e-14
Median	-0.118058
Maximum	2.380565
Minimum	-1.881939
Std. Dev.	0.950491
Skewness	0.403783
Kurtosis	2.757772
Jarque-Bera	1.451294
Probability	0.484011

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.237866	Prob. F(4,24)	0.0949
Obs*R-squared	13.31114	Prob. Chi-Square(4)	0.0099

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 02/18/17 Time: 18:28
Sample: 2005M05 2009M05
Included observations: 49
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WPIC(-1)	0.020391	0.057119	0.356985	0.7242
WPIL	-0.004115	0.064632	-0.063662	0.9498
WPIL(-1)	0.019005	0.081632	0.232816	0.8179
WPIL(-2)	-0.014416	0.081739	-0.176371	0.8615
WPIL(-3)	0.008238	0.086898	0.094806	0.9253
WPIL(-4)	-0.004109	0.068665	-0.059845	0.9528
WPIPR	0.019552	0.160362	0.121926	0.9040
WPIPR(-1)	-0.024084	0.193428	-0.124511	0.9019
WPIPR(-2)	-0.012873	0.182428	-0.070564	0.9443
WPIPR(-3)	-0.015488	0.157989	-0.098035	0.9227
WPIPR(-4)	0.029014	0.138211	0.209927	0.8355
CONS	-0.190966	0.443329	-0.430755	0.6705
CONS(-1)	-0.038681	0.537457	-0.071970	0.9432
CONS(-2)	-0.173424	0.455310	-0.380893	0.7066
CONS(-3)	0.082526	0.434120	0.190100	0.8508
CONS(-4)	-0.030289	0.440307	-0.068791	0.9457
IIP	0.017114	0.073298	0.233491	0.8174
IIP(-1)	0.001787	0.089256	0.020023	0.9842
IIP(-2)	0.012923	0.084756	0.152475	0.8801
IIP(-3)	-0.009413	0.076171	-0.123572	0.9027
C	-0.637566	4.510928	-0.141338	0.8888
RESID(-1)	-0.484675	0.215121	-2.253036	0.0337
RESID(-2)	-0.628869	0.243306	-2.584682	0.0163
RESID(-3)	-0.276723	0.253482	-1.091687	0.2858
RESID(-4)	-0.158399	0.234917	-0.674278	0.5066

R-squared	0.271656	Mean dependent var	-1.04E-14
Adjusted R-squared	-0.456688	S.D. dependent var	0.950491
S.E. of regression	1.147180	Akaike info criterion	3.419132
Sum squared resid	31.58451	Schwarz criterion	4.384346
Log likelihood	-58.76873	Hannan-Quinn criter.	3.785333
F-statistic	0.372978	Durbin-Watson stat	1.977550
Prob(F-statistic)	0.990493		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

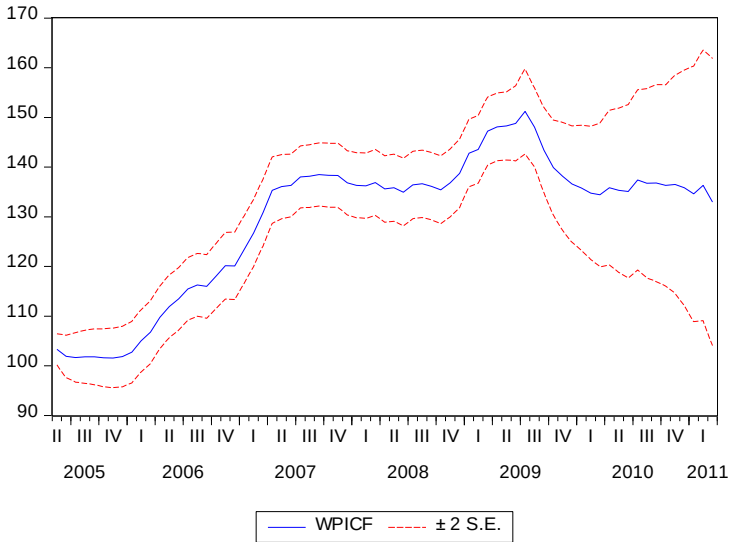
F-statistic	0.588341	Prob. F(20,28)	0.8887
Obs*R-squared	14.49888	Prob. Chi-Square(20)	0.8043
Scaled explained SS	4.160935	Prob. Chi-Square(20)	0.9999

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/18/17 Time: 18:14
Sample: 2005M05 2009M05
Included observations: 49

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.418881	4.935442	0.490104	0.6279
WPIC(-1)	-0.026608	0.064174	-0.414629	0.6816
WPIL	0.012871	0.072106	0.178500	0.8596
WPIL(-1)	-0.015153	0.090683	-0.167100	0.8685
WPIL(-2)	0.044430	0.090752	0.489575	0.6282
WPIL(-3)	-0.125171	0.097327	-1.286083	0.2089
WPIL(-4)	0.115195	0.077628	1.483923	0.1490
WPIPR	-0.244473	0.170853	-1.430895	0.1635
WPIPR(-1)	0.312355	0.207800	1.503154	0.1440
WPIPR(-2)	-0.161914	0.201990	-0.801594	0.4295
WPIPR(-3)	0.202969	0.176001	1.153228	0.2586
WPIPR(-4)	-0.196357	0.152704	-1.285865	0.2090
CONS	0.682324	0.487563	1.399457	0.1727
CONS(-1)	-0.517225	0.598770	-0.863813	0.3950
CONS(-2)	0.063026	0.509849	0.123616	0.9025
CONS(-3)	0.178167	0.489644	0.363870	0.7187
CONS(-4)	0.130258	0.497370	0.261893	0.7953
IIP	-0.052573	0.082449	-0.637643	0.5289
IIP(-1)	0.132805	0.100635	1.319672	0.1976
IIP(-2)	-0.053461	0.094825	-0.563784	0.5774
IIP(-3)	-0.011100	0.085799	-0.129373	0.8980

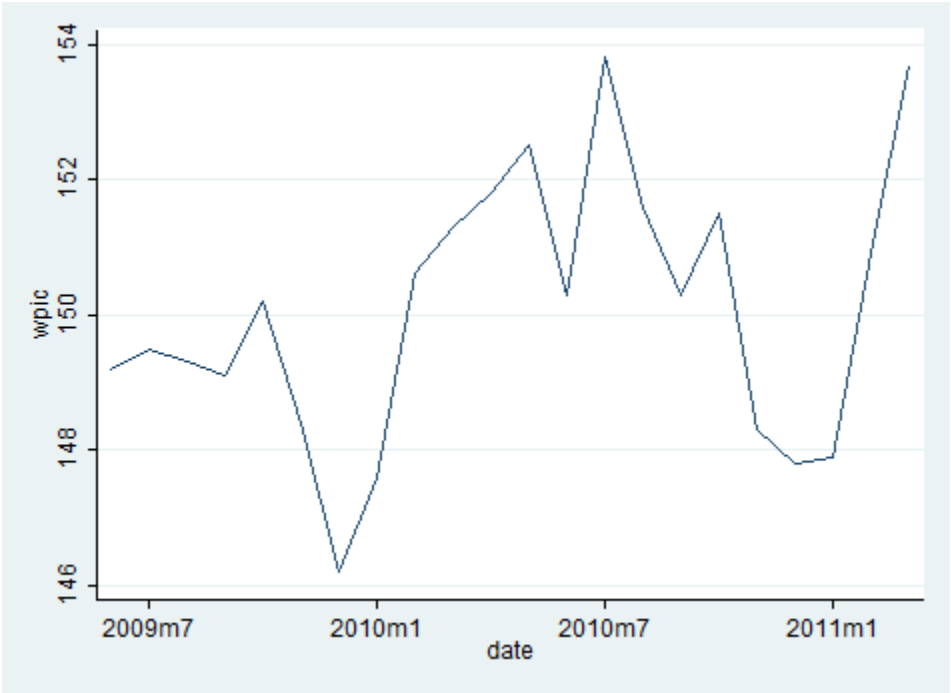
R-squared	0.295895	Mean dependent var	0.884996
Adjusted R-squared	-0.207036	S.D. dependent var	1.185496
S.E. of regression	1.302448	Akaike info criterion	3.663895
Sum squared resid	47.49839	Schwarz criterion	4.474675
Log likelihood	-68.76544	Hannan-Quinn criter.	3.971504
F-statistic	0.588341	Durbin-Watson stat	2.246857
Prob(F-statistic)	0.888691		

Appendix 3: Prediction band of the ARDL model



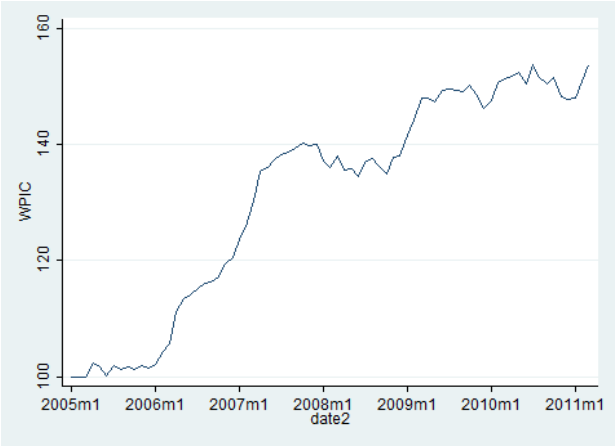
Forecast: WPICF	
Actual: WPIC	
Forecast sample: 2005M01 2011M03	
Adjusted sample: 2005M05 2011M03	
Included observations: 71	
Root Mean Squared Error	7.358138
Mean Absolute Error	4.217383
Mean Abs. Percent Error	2.871213
Theil Inequality Coefficient	0.027803
Bias Proportion	0.260145
Variance Proportion	0.161104
Covariance Proportion	0.578752

Appendix 4: Wholesale Price of Cement (June 2009 – March 2011)

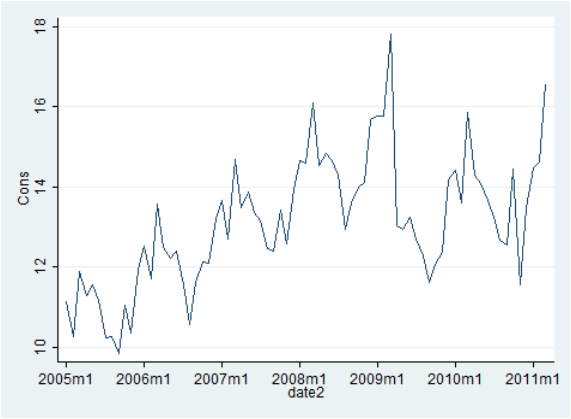


Appendix 5: Time series movements of variables (dependent and independent)

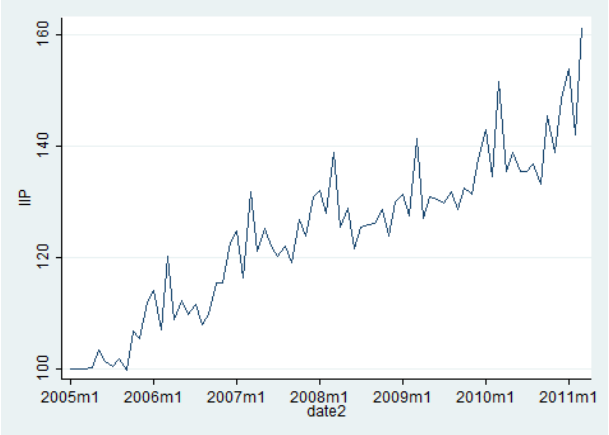
Wholesale Price Index of Cement



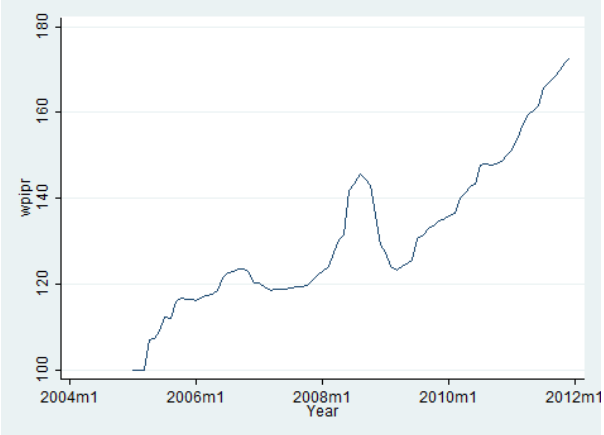
Consumption of Cement



Index of Industrial Production



Wholesale Price Index of Power



Applicability of Stated Preference Techniques in defining Relevant Markets

National Conference on Economics of Competition Law, Competition Commission of India

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Contents

Short Abstract

Determining the relevant market is the keystone of most antitrust cases as it is the first stage of analyzing competitive effects of a merger or a particular business practice under anti-trust investigation. Defining the boundaries of the relevant market entails conducting a substitutability exercise based on a comparison of the product characteristics of potentially competing products and the applicable geographic boundaries for the product. Incorporation of "consumer preferences" to demonstrate actual substitutability patterns is a pivotal aspect of this exercise. Consumer preferences can be studied with the help of two techniques of economic analysis, viz., Revealed Preference and Stated Preference. Revealed Preference analysis requires real world evidence, which may not be readily available all the time. In such a situation, dedicated consumer surveys may be used to represent specific preferences of consumers. In most jurisdictions, such an analysis qualifies as permissible economic evidence in support of the market definition exercise. In this paper we assess the applicability of consumer surveys[1] in representing consumer preferences using Stated Preference techniques (including Discrete Choice and Contingent Valuation models). Additionally, we evaluate the potential applicability of Stated Preference techniques to some past Indian anti-trust cases and examine whether such techniques can aid in performing economic analysis (such as the small but significant and non-transitory increase in price (SSNIP) test).

[1] Stated Preference techniques are essentially survey-based techniques. Therefore, in the context of this paper Stated Preference technique and consumer surveys are used interchangeably.

Extended Paper

Introduction

Relevant market assessment is a critical aspect of all competition law matters as it is a means to identify those substitute products or services, which exert an effective competitive constraint on the product(s) and/or the services under evaluation. Defining relevant markets entails substitutability analysis, based on a comparison of the product characteristics of potentially competing products (relevant product market) and the applicable geographic boundaries (relevant geographic market) for the product. Several factors are considered and assessed in order to identify the area of effective competition and competitive constraints that an undertaking involved may face.

One of the important tenets of defining relevant market in an anti-trust case—is the evaluation of consumer preferences—and the incorporation of these preferences in the relevant market definition. The Indian Competition Act of 2002 also regards consumer preferences amongst one of the many factors considered while defining relevant markets.[2] According to economic literature, consumer preferences can be assessed primarily through two types of techniques viz., Revealed Preference ("RP") and Stated Preference ("SP").

RP techniques use actual consumer choice data to assess consumer perception and preferences regarding alternative products. RP techniques require information to be collected on actual consumer switching behavior in response to a price increase or new product coming into the market. However, in the Indian context, such quantitative data required to implement RP techniques may not always be available, or if available, may not be sufficient to conduct economic analysis. Moreover, in situations where the potential impact on competition caused by a proposed merger or a combination has to be assessed, real world evidence on how consumers may respond would not be available. In such scenarios, a well-designed consumer survey that measures hypothetical preferences of consumers across products and alternatives can be used to assess the nature of consumer demand and in turn delineate the boundaries of relevant market.

Consumer surveys qualify as permissible and accepted economic evidence in many jurisdictions. Anti-trust regulators including, the Office of Fair Trading[3] ("OFT"), UK, the European Commission and the Competition Authority of Kenya have undertaken consumer surveys in the past to ascertain consumer preferences and evidence from these surveys has formed an important component of their findings on the delineation of relevant market. In particular, the OFT promotes the use of consumer surveys and states that "*use of statistically-robust consumer survey research can help in informed decision making*".[4] This is demonstrated by the fact that the OFT has used consumer surveys in almost half of the 31 merger enquiries they completed between 2003 and 2006.[5]

In light of the rising acceptance of consumer surveys as a form of economic evidence in various jurisdictions, this paper discusses the methodologies for implementing SP techniques. Starting with a brief recapitulation of RP and SP techniques, this paper then reviews some specific SP techniques (Contingent Valuation and Discrete choice models) demonstrated through case examples. We further discuss the application of SP techniques in other international jurisdictions and demonstrate the application of SP techniques to some past Indian anti-trust cases.

Revealed Preference and Stated Preference

A key area in defining relevant markets is substitutability analysis, which entails the assessment of consumer perception about the following aspects:

i. Price sensitiveness and willingness to pay ("WTP");
ii. Importance and value of the product/service attributes that are being consumed ; and,

[2] The Competition Act, 2002, Chapter 4 (Section 19(7)).
[3] From 1 April 2014 Competition Markets Authority (CMA) took over many of the functions of the Competition Commission (CC) and the Office of Fair Trading (OFT).
[4] Good practice in the design and presentation of consumer survey evidence in merger enquiries, Office of Fair Trading and Competition Commission, UK.
[5] Customer surveys and critical loss analysis for market definition, Oxera.

iii. Change in consumer behavior if alternatives (with respect to the good under consumption) available were to change

Consumer preferences about these particular aspects can be represented through RP or SP Techniques. In the case of RP, consumer preferences are revealed through consumer actions in real markets. RP techniques represent real-world evidence on the choices that consumers exercise and are revealed by consumers' decisions in actual market situations. Consumer preferences can be measured through a study on actual purchase patterns of consumers revealed through historical sales and purchase data maintained by organizations. As against this, SP techniques are survey based techniques used to elicit consumer valuations and preferences. Specifically, SP techniques are of two types - Contingent Valuation Technique ("CVT") and Discrete Choice Experiments ("DCE"). SP techniques can be used for both market and non-market goods as it measures hypothetical preferences as well. In the subsequent section, we provide a brief comparison of SP and RP techniques based on few key differentiating characteristics.

Comparison of Revealed Preference and Stated Preference techniques

RP techniques represent the use-value of the good, viz., the direct value of consuming the goods. Conversely, SP Techniques represent the economic value of the good (use and non-use value[6]), viz., the extent to which consumers would be willing to sacrifice something else in order to obtain the good under consideration. Use value is direct value derived by consuming the good (e.g. visiting an amusement park) or indirectly securing some benefit from the good (e.g. saving funds for children's future education also referred as options value). Non-use values, also referred to as passive values, arise in situations in which an individual is willing to pay for provision of the goods even though he is not directly consuming the good currently or in the future. For example, individual willing to pay for conservation of an imperiled World Heritage Site. As SP techniques can express option and non-use values as well, they can be used for valuing potential future or hypothetical goods, whereas RP techniques are restricted to real goods only. This characteristic of SP technique has a far reaching potential; these techniques can prove to be a very useful tool in evaluating the potential impact of a proposed merger or a combination.

RP techniques draw inferences about consumer preferences from the actual choices that consumers have exercised over goods that are available at a given point in time. However, in imperfect markets, some goods may not be available at a given point due to imperfections such as existence of supply side constraints. In such a scenario, actual choices exercised by the consumer cannot be considered to be representative, as the consumer did not have access to the full choice set while making the decision. SP techniques overcome these problems associated with imperfect markets as they draw inferences based on hypothetical questions. However, there are certain issues that need to be kept in mind while implementing SP techniques.

SP techniques may be subject to biases arising from the hypothetical nature of the technique. For example, there could be potential problems associated with hypothetical responses such as strategic responses or a failure to properly consider behavioral constraints. Furthermore, since SP techniques are primarily survey techniques, they could suffer from issues of sampling bias if the sample is non-random and does not accurately represent the underlying population under study.

In table 1, we briefly summarize the key features of the two techniques.

Table 1: Revealed and Stated Preference Techniques

	Revealed Preference	Stated Preference
Underlying principle	Consumer preferences revealed through real world evidence	Consumer preferences are captured using survey techniques
Methodology	Competitive Price Analysis	Contingent Valuation Discrete Choice Method

[6] Non-use value refers to the value not arising due to the direct consumption of the good. For instance: a consumer may be willing to pay for a good that he is conserving for future value (options value).

	Revealed Preference	Stated Preference
	Travel Cost Method[7] Hedonic Pricing method[8]	
Applicable goods	Real goods	Real and hypothetical goods
Advantages	Reliance on actual choices reduces the potential problems associated with hypothetical responses	Preferences that cannot be evaluated with real world evidence can be captured through survey techniques
Disadvantages	• Data on actual consumption patterns may not be readily available • Presence of market imperfections reduce the choice set for consumers • Analysis is limited to observable state of the world	• Problems associated with hypothetical responses such as strategic responses or a failure to properly consider behavioral constraints (such as consumers overstating their likely reaction to a change in the market) • Sampling bias and non-response error[9]

Owing to the advantages and disadvantages emanating from RP and SP techniques, researchers suggest that these two techniques should be used in conjunction. Combination of the two techniques can help in addressing the inherent weakness of both methodologies.

RP techniques can be a useful tool to gain insight into actual consumer behavior as the analysis is based on real market observations, however, their use is limited in situations that involve new products or services. Conversely, SP techniques can be used to ascertain consumer responses with respect to new products, particularly, in merger assessments that are forward looking and involve assessment of consumer response to hypothetical situations. Since SP techniques remain hypothetical in nature, combining them with RP techniques can help in mitigating the hypothetical bias as well as assess the validity and reliability of SP data.

Furthermore, RP data can exhibit high degree of multicollinearity, i.e., attributes (independent variables) may be correlated with each other or there may be endogeneity, i.e. attributes are correlated with the error term. These issues make it difficult to assess the causal impact of attributes on the outcome of interest. Combination of RP and SP techniques under appropriate experimental design can help control for multicollinearity and endogeneity issues[10].

In the Indian context, data required for implementing RP techniques is limited. Additionally, in prospective merger and combination scenarios, capturing preferences through RP technique is not possible as appropriate proxy markets do not exist. SP Techniques can predict consumer choices in both these scenarios – when the required data is not available and when the real market for goods does not exist. Therefore, in this paper, we discuss few specific survey based stated preference techniques that can used to model consumer behavior in real life scenarios.

Stated Preference techniques: Discrete Choice and Contingent Valuation Technique

Significant literature has been developed around designing SP techniques in the absence of data required for RP techniques. Stated Preference Techniques are primarily of two types - (i) Contingent Valuation Technique ("CVT") and (ii) choice modelling techniques including Discrete Choice Experiments ("DCE").

[7] It is a non-market valuation technique by using consumption behavior in the market, where travel cost is a measure of the preferences for the good.
[8] The hedonic pricing approach considers the values of a good as a function of each attribute of that good and value of an attribute is the implicit price (hedonic price) as it cannot be observed in the real market.
[9] Nonresponse error occurs when sampling units selected for a sample are not interviewed. Sampled units typically do not respond because they are unable, unavailable, or unwilling to do so
[10] Multicollinearity may arise in situations where there is correlation between explanatory variables. For e.g., correlation between vehicle efficiency and vehicle type when regression specification is estimating the impact of vehicle efficiency on the price of the vehicle. Endogeneity may arise if any of the explanatory variable is correlated with the error term. For e.g., when estimating the impact of fuel efficiency on price we have an omitted explanatory variable such as vehicle type. This omitted explanatory variable will be captured in the error term. Consequently, the error term will be correlated with the explanatory variable and this phenomena may lead to endogeneity.

CVT elicits preferences regarding the economic or the monetary value of the product as a whole. In other words, it measures consumer's maximum willingness to pay for a product or a service. For example; to ascertain the substitutability between different modes of transport, consumers are asked the following question: what is the maximum journey cost that you are willing to accept to travel by Metro between Delhi and Gurgaon before you stop using the mode of transport (Metro in this case).

It is evident from the CVT technique example above that it does not provide any information about the value placed by consumers on the different attributes that comprise that good. In the above question, CVT approach assumed that only one attribute (price) varied while other attributes (frequency, travel time) remained the same. DCE technique on the other hand do not ask for monetary valuations, but rather asks for consumers to choose between alternatives based on a comparison of all the attributes of the considered good. All choice modelling techniques assume that goods and services can be described in terms of their product attributes and characteristics. For example, if we apply the DCE technique to the transportation problem discussed above, we see how Discrete Choice Modelling Approach (table 2) highlights the trade-offs between different attributes of various modes of transport available for commuting between Delhi and Gurgaon.

Table 2: Modes of Transport

	Bus	**Metro**	**Radio Taxi**
Frequency of service	5-10 minutes	2-3 minutes	4-7 minutes
Travel Time	60-80 minutes	60 minutes	60-80 minutes
Reliability	Moderate	High	High
Number of interchanges	1	1	0
Price	INR 20-30	INR 40-50	INR 100-250

Source: Deloitte Analysis

DCE techniques are more suitable in situations where the focus is on the economic value of different characteristics of the good – for instance, in the above example, trade-off between characteristics of different modes of transport, viz., frequency, travel time and reliability could be evaluated using DCE. However, it is important to note that these characteristics or attributes of the good should not be correlated and there should be a clear trade-off between them. Additionally, DCE can be used to measure the value of the whole good – as the approach inherently assumes that the economic value is the sum of the attributes of the good.

As demonstrated above, DCE provides for a more direct evaluation of product characteristics and attributes as compared to CVT; therefore DCE appear to be in ascendancy to CVT.

Applicability of Stated Preference Technique in other jurisdictions

In this section, we review the application of SP Techniques by competition regulators in other jurisdictions. Competition agencies and regulators from other jurisdictions such as the European Union ("EU") and United Kingdom ("UK"), routinely use SP techniques for merger assessments and market definition analysis to conduct competition assessments. As the implementation of actual Small but significant non transitory increase in price ("SSNIP") test has rigorous and extensive data requirements, regulators often use SP techniques for implementing SSNIP. Critical Loss Analysis is a tool used to implement SSNIP and the estimation of demand responsiveness for the purpose of delineating relevant markets.[11] Beginning with a brief recap of SSNIP and the critical loss analysis, we turn to the review of the application of SP techniques in the context of market definition by other Competition Regulators (OFT and other European competition regulators).

[11] In order to implement the actual SSNIP, robust estimates of own and cross price elasticities for all the possible substitute products are required.

Implementation of SSNIP using the Critical Loss Analysis

Relevant Markets are commonly defined on the basis of the SSNIP test. SSNIP or the Hypothetical Monopolist test aims to find the narrowest product market in which it is possible for the hypothetical monopolist to exert monopoly power. The hypothetical monopolist test attempts to answer the question – if all the products in the proposed market were controlled by the hypothetical monopolist, would the monopolist still find it profitable to exert a SSNIP in the proposed market? In order to ascertain whether a SSNIP will be profitable for the hypothetical monopolist, critical loss analysis is undertaken.

The hypothetical monopolist's incentive to raise price (impose SSNIP) depends on the extent of likely substitution away from monopolist's products in the candidate market[12] and on the quantum of profit margins earned on those products. The data on likely substitution away from monopolist's products ("actual loss of sales") can be obtained through SP techniques such as a consumer survey. On the other hand, "critical loss"[13] can be estimated using the gross margin estimates for the hypothetical monopolist. The "actual loss" is then compared with the "critical loss". If the actual loss of sales is less than the critical loss benchmark,[14] the SSNIP is profitable and therefore the relevant market definition is considered to be close to the candidate market considered at the beginning of the analysis. However, if the actual loss exceeds the critical loss, the SSNIP is unprofitable and the relevant market to be considered needs to be expanded to include the products to which consumers switch to and therefore is likely to be wider than the original candidate market.

Application of SP Techniques in the context of market definition

Use of Consumer Surveys to implement Critical Loss Analysis, Office of Fair Trading (OFT)

The OFT routinely uses the above discussed methodology to determine the boundaries of relevant market in the case of merger assessments. LOVEFiLM International Limited, an online DVD and games rental ("ODR") provider was seeking to acquire Amazon's online DVD Rental subscription service.[15] The issue under consideration was – whether the relevant product market to be considered for the acquisition was limited to the online DVD rental market, or it included other differentiated channels available for accessing video content such as the bricks-and-mortar DVD rental providers and other digital delivery channels for video content. The OFT examined this issue by instructing the parties to commission a consumer survey, which facilitated the implementation of critical loss analysis and in turn SSNIP. The hypothetical monopolist with regards to this case was – the hypothetical monopolist of online DVD rental services. The involved parties undertook an online survey of more than 2000 ODR consumers and asked the consumers – what would they do if all ODR prices increased by 10%. Approximately, 30-40%[16] of the consumers said that they would shift to a non-ODR providers – this figure represents the actual loss for the hypothetical monopolist.[17] The estimate of critical loss based on certain gross margin assumptions was 20-30%. Therefore, since the actual loss to the hypothetical monopolist exceeded the critical loss in this case, the analysis indicated that the market was wider than just online DVD rentals. Based on consumer survey results along with other factors that were examined to assess the closeness of competition between the merging parties, the OFT cleared the merger unconditionally.

Use of Consumer Surveys to assess Consumer preferences, Austrian Regulatory Authority (RTR)

Evidence from consumer surveys from the perspective of market definition analysis has also found application by other European regulators. Below is an example from the telecom sector. European Commission expressed concerns over the market definition of broadband access, which was considered by the Austrian Regulatory Authority for Broadcasting and Communication ("RTR"). The issue under evaluation was – whether residential customers regard mobile broadband access as an adequate substitute for fixed broadband access. Austrian Regulator asserted that in Austria the residential retail market for broadband access included both mobile and fixed line broadband connections. In support of their decision regarding this market definition, RTR submitted additional evidence garnered using consumer surveys. The results of the consumer survey revealed that 76% of residential mobile broadband customers use their connection on a standalone basis thereby suggesting that

12 Hypothetical Monopolist's market considered at the beginning of the evaluation is the candidate market
13 It measures the maximum amount by which sales of the products in the candidate market can fall following the hypothesized price increase and still endure that the profits of hypothetical monopolist do not fall. .i.e. the point at which the two effects exactly offset each other. It provides a benchmark to assess "actual loss of sales" gathered through consumer surveys and switching analysis
14 Critical Loss benchmark measures lowest sales volume that the hypothetical monopolist will lose as a result of SSNIP for the price increase to be unprofitable.
15 https://assets.publishing.service.gov.uk/media/555de389ed915d7ae2000093/lovefilm.pdf
16 These numbers are different from the actual numbers. The actual numbers were not available in public domain due to commercial reasons. Lovefilm International Limited and Amazon Inc. Office of Fair Trading, 15th April, 2008
17 Hypothetical monopolist in this case is the market for all ODR providers together.

mobile broadband services are a substitute rather than a complement to fixed broadband. RTR submitted the evidence from the consumer survey to support their decision of a broader market definition[18].

It is apparent from the above examples that regulators often use SP Techniques to implement the SSNIP test and gauge consumer's price sensitivity in the absence of rigorous data that is needed for the actual implementation of the SSNIP test. In the subsequent section, we discuss how these SP techniques can be replicated in the Indian Anti-Trust scenario.

Applicability of Stated Preference Technique in the Indian Anti-trust scenario

While consumer surveys are useful in assessing consumer behavior, the application of consumer survey techniques is feasible in sectors that have a large and a direct consumer base. This is because the availability of a large consumer base gives an opportunity to select a random unbiased sample. In the light of this observation, we discuss which sectors in India display the potential of utilizing these survey techniques.

Indian scenario has the potential of utilizing consumer surveys as a form of empirical evidence that can aid in the assessment of relevant market definition and competitive analysis. Of the 586 information requests received by the Competition Commission of India ("CCI") up to March, 2015, 30%[19] pertain to sectors such as pharmaceuticals, real estate and automobiles that have a large direct consumer base. Moreover, the pharmaceutical sector also recorded the highest number of combination requests in the FY 2014-15. Prominence of pharmaceutical sector in combination cases, presents an opportunity to commission consumer surveys to ascertain the closeness of competition between the products provided by the merging parties.

Design and Analysis of Consumer Surveys

Case in point - Hiranandani Hospital

In this section, we highlight the key considerations that need to be taken into account while commissioning a Stated Preference Study. It highlights the various stages of design and analysis that such studies require. We demonstrate the application of the SP Technique through a practical case study example of Hiranandani Hospital, Mumbai.

Background to the case

CCI imposed a penalty on Hiranandani Hospital, Mumbai for entering into anti-competitive agreements and abusing its dominant position in the relevant market thereby violating Section 3 and 4 of the Competition Act. The informant to the case alleged that Hiranandani Hospital entered into an exclusive supply agreement with Cryobank International – a stem cell banking service provider and did not allow the stem cells to be collected by any other service provider except Cryobank. Director General's ("DG") investigation concluded that Hiranandani Hospital was dominant in the relevant market i.e. "*Provision of maternity services by super specialty and high-end hospitals within a distance of 12 kilometers from the Hiranandani Hospital*".[20] While arriving at the relevant market definition, DG considered several factors including the economic and social strata of the patient, services provided by super specialty hospital (according to National Accreditation Board for Hospitals and Health Care Hospitals classification) and the catchment area defined on the basis of sample data.[21] Dr. Geeta Gouri, former member of the Competition Commission of India (CCI), in her dissent order raised concerns over DG's market definition and highlighted that the market definition failed to identify nuances of the healthcare industry where price versus quality trade-off plays a significant role in determining consumer's choices.[22] The dissent order further stated that the non-price factors such as the choice of gynecologist and family traditions, which influence consumer's actual choice were not given due consideration.[23] Preferences in healthcare industry are likely to be driven by strict consumer preferences in terms of doctors to consult, the hospitals to use, etc. and hence distance alone may not adequately capture the competitive constraints that play out in this industry. It is in such instances that use of consumer surveys can be considered informative about consumer preferences. Below we briefly talk about few essential features that should be kept in mind while designing and commissioning consumer surveys.

18 Case number 39, 2012, Ramakant Kini vs. Hiranandani Hospital, Geeta Gouri, CCI

19 CCI Annual Report, 2014-15

20 Case number 39, 2012, Ramakant Kini vs. Hiranandani Hospital, Geeta Gouri, CCI, paragraph 29

21 Sample data of 252 patients who had availed both maternity services and stem cell banking services at Hiranandani Hospital According to National Accreditation Board for Hospitals and Health Care Providers

22 Case number 39, 2012, Ramakant Kini vs. Hiranandani Hospital, Geeta Gouri, CCI, paragraph 34

23 Case number 39, 2012, Ramakant Kini vs. Hiranandani Hospital, Geeta Gouri, CCI, paragraph 35

Implementing a stated preference study – Hiranandani Case

I. **Outline the research question/problem (Transparency of Objectives[24]):** The first step in any Stated Preference Study is to outline the research question and the objective of the exercise. For example, with respect to the Hiranandani case example, the SP exercise should be focused on assessing the:
   - the drivers of consumer's choice regarding maternity services including price and non-price factors; and,
   - the extent to which hospitals located around Hiranandani hospital (including maternity care centers) compete with each other and Hiranandani Hospital.

II. **Choice of the valuation technique and survey method (reliability of the valuation method)–**The choice of the SP technique to be employed in the study is contingent on the level of detail required on the characteristics of the product or the service. In the present case the focus is on evaluating the economic value consumers attach to non-price factors such as choice of gynecologist and family traditions while taking a decision about maternity services at a hospital. Therefore, a discrete choice modelling technique that values characteristics associated with the service would be ideal. Once the valuation technique is decided, the next step is to choose a survey method. The type of survey methodology (e.g., face to face interviews, telephone survey, and email surveys) depends on the time and the resources that are available for the study. The subject matter of this SP exercise is complex as it involves evaluating consumer preferences regarding choice of hospital for maternity services. Therefore, it would be preferred to conduct face to face surveys as they would enable probing and clarification that may be needed from the interviewers.

III. **Determining the population and sampling technique (Representativeness of the Sample):** Choosing a sample from the population involves identifying a target population and then selecting a representative sample from the target population. The target population in relation to the Hiranandani Case would comprise of women in child bearing age group (20-50 years) and their associated family members in Mumbai city. Consequently, one would be required to draw a random sample from the identified target population using probability sampling techniques. In order to ensure precision and accuracy of the results we usually determine the sample size according to widely used benchmark— 95% confidence level. Additionally, variance in the underlying population should also be examined to ensure that if the variance in the population is larger, a bigger sample size should be selected.

IV. **Structure and Design of the survey questionnaire:** The structure and the design of the questionnaire plays a very important role in eliciting responses from consumers. A survey should be designed in such a way that it encourages survey respondents to re-live their purchasing decisions. Keeping into consideration the Hiranandani case discussed above, below we list the key aspects that the design of a discrete choice valuation questionnaire should include (Table 3).

Table 3: Stated Preference Technique - Hiranandani Hospital

Area	Particulars
Purpose of the questionnaire	Understand the factors driving consumer choice with respect to maternity services at hospitals for the purpose of defining relevant market for Hiranandani Hospital
Socio economic characteristics	Capture some basic socio-economic characteristics such as age, sex, interests, income and education. This information is useful to test if consumer's choice regarding the choice of hospital varies with level of income, education, etc.
Matters of Fact (i.e. simple factual details about the use of the service and the context in which the service is used)	Understand whether the consumer will be a direct consumer of the service or is an indirect consumer, *i.e.*, a family member

[24] Good practice in design and presentation of consumer survey evidence in merger enquiries, OFT and Competition Commission, UK

Matters of behavior (*i.e.*, which other alternatives are considered)	List down other alternative hospitals that the consumers are willing to conside for availing the maternity care services
Matters of choice (i.e. which factor influence the particular choice among the alternatives)	List down factors, which are significant determinants of consumer's choice and ask the consumers to rank these factors according to the order of importance/desirability (contingent ranking). Some of these factors include: • Proximity to the hospital • Family traditions • Choice of gynecologist • Health insurance
Attitudinal questions (i.e. what respondents would do under different circumstances)	• Ask the consumers what would they do if their preferred hospital raised prices by 5% or 10%? • Ask the consumers what would they do if Hiranandani hospital raised prices by 5% or 10%? • Ask the consumers what would they do if all hospitals in a certain region raised their prices by 5% or 10%?

V. **Pilot survey –** In order to test the efficacy and design of the questionnaire, the survey should be implemented on a smaller group of respondents. Adequate piloting before the full survey is implemented is essential to ensure the credibility of results. The size of the pilot sample may vary from 25-100 people depending on the size of the full sample considered. The draft questionnaire may be revised based on the responses received during the pilot stage.

VI. **Commissioning the main survey –** Once the questionnaire is finalized (after the incorporation of inputs from the pilot stage), the final version of the survey should be administered to the full sample. The implantation of the survey should be conducted by trained professionals, particularly trained for implementing SP techniques.

VII. **Data analysis –** Once the survey data has been tabulated in electric format and cross checked for input errors, the analysis of the data can be carried out. The analysis stage of the SP study is the stage at which data collected in the survey is transformed into useable output. With respect to the relevant market definition for Hiranandani Hospital, the focus should be on– questions on matters of choice and attitudinal questions.

- **Questions on matter of choice –** the responses to these questions can provide insight on which characteristics or attributes do consumers actually consider while selecting a hospital for maternity service. In particular, it can help us in evaluating the hypothesis –does price play a significant role in determining consumer choice in this case. These responses will aid in evaluating if a low priced hospital constraints a high end competitor in providing maternity services. Additionally, the questionnaire will assist in evaluating whether non-price factors influence consumer's choice of hospital with respect to provision of maternity services.
- **Attitudinal questions –** These questions will help in delineating the boundaries of the relevant market for Hiranandani Hospital. A SSNIP can be implemented using the Critical Loss Methodology discussed in the previous section. The "actual loss" to the consumers can be estimated and it can be compared with the "critical loss" benchmark. If the actual loss is greater than the critical loss, then the relevant market is wider than the candidate market considered at first.

The above mentioned case study clearly highlights out that SP techniques can be used to gather insight into consumer preferences and factors determining consumer choice. However, certain design elements such as the sampling technique, design of the questionnaire, and choice of valuation technique should be given due consideration to before commissioning a consumer survey.

Conclusion

This paper discusses the methodologies for assessing consumer preferences viz., Revealed Preference ("RP") and Stated Preference ("SP"). The paper further highlights the importance of use of consumer surveys in eliciting consumer perception and their acceptance as a form of economic evidence for conducting relevant market assessment by various competition authorities. In particular, it reveals that consumer surveys can be a valuable source of information to implement complex economic tests such as the SSNIP. While consumer surveys can fill in gaps in knowledge regarding consumer preferences, they should be designed and implemented in such a manner that it elicits respondents to re-experience their purchasing decisions. An effective consumer survey research should respect four general principles, viz., transparency of objectives, representativeness of the sample, reliability of the valuation method, and full disclosure of results.[25] The research question or the hypothesis of the study should be clearly stated and the sample drawn should be representative of the underlying population. In order to ensure more reliable responses from consumers, questions on matters of fact, behavior and choice should be asked before questions on matters of attitude. Finally, the results of the survey should be reported in full, with entire supporting data made available to allow for the replication of results. In order to enhance the evidential value of consumer surveys, it is essential that the implementation agencies adhere to the four general principles outlined above. It is important to note that the application of survey based techniques is not only limited to defining relevant markets; these techniques can serve as a useful tool in developing optimal pricing strategies and forecasting response to price changes.

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Market definition through SSNIP Tests applied to consumption expenditure data

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Abstract

The definition of the relevant antitrust market is a critical first step in a competition economics investigation. It is often based on a SSNIP Test that compares demand elasticity in the relevant market to a benchmark critical elasticity. The demand elasticity is estimated from actual data and is the empirical driver of the SSNIP Test and indeed the entire market definition exercise. This paper shows that, for certain products, publicly available data in the form of the large sample Household Consumption Expenditure ("HCE") survey, conducted every five years by the National Sample Survey Office ("NSSO"), can be used to implement SSNIP Tests. This is a large data set that can be used to estimate demand elasticities for a range of goods at different levels of geographic aggregation. However, working with sample data poses empirical challenges, which can lead to biased elasticity estimates and erroneously defined markets. The Heckman sample selection model corrects for sample selection biases and specification errors. The empirical component of this paper consists of an application of this model to HCE data to yield bias-corrected elasticity estimates for a set of consumption goods. Ordinary least squares ("OLS") estimates are also presented. Comparison of the Heckman and OLS results provides inference on the bias that results from simplistic analysis of survey data. The impact of this bias on the market definition exercise is also discussed.

Keywords: Antitrust, competition policy, econometrics, Heckman model, market definition, sample selection, SSNIP

JEL Class: C34, C36, C55, K21, L41, L42, L66,

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Competition economics is concerned with the determination and measurement of market abuse. Practitioners identify and measure market abuse by considering factors on both the demand and supply sides of the market. On the demand side, the key question is whether consumers will switch away from the alleged market abusing firm(s) if they raise prices or engage in other anti-competitive behavior. On the supply side, the key question is whether competitors, upstream and downstream commercial relationships, legal and administrative rules and other conditions constrain anti-competitive behavior. Diverse methods are used to answer both key questions: price analysis, own- and cross-price elasticity estimation, customer and competitor surveys, qualitative evidence and so on.

However, this methodological arsenal can only be brought to bear once the market has been defined. Without market definition, an antitrust investigation cannot proceed. Market definition is therefore a necessary and critical first step in any evaluation of market power and the anti-competitive effects of business conduct (Baker, 2007). It is an initial discrete exercise to determine whether a given product or service lies within a given market or not (Amelio & Donath, 2009).

The starting point of a market definition exercise, and therefore the starting point of an antitrust investigation, is typically the SSNIP Test (Harbord & von Graevenitz, 2000), where the SSNIP is defined as a Small but Significant and Non-transitory Increase in Price. It is standard practice to assume that a 5-10 percent price increase is small, but significant.[2] The SSNIP Test was first defined in the 1982 Merger Guidelines promulgated by the US Department of Justice ("DOJ") and has since found broad acceptance among practitioners around the world. The European Union, for example, accepted the SSNIP concept in 1997 (European Commission, 1997).

The Indian Competition Act[3] does not explicitly mention either market definition or the SSNIP Test, but perusal of orders from the Competition Commission of India ("CCI") indicates that both concepts are accepted by practitioners and the CCI itself. Indeed, market definition is always a matter of careful consideration; the starting point in published orders. In these orders, markets were not defined through explicit application of SSNIP Tests, but the underlying factors motivating such Tests – prices, demand and the potential for their

[2] *Five percent was originally considered appropriate in the US 1982 Merger Guidelines and reconfirmed in the US 1992 Horizontal Merger Guidelines, but ten percent is more commonly used by practitioners and law enforcement; a 5-10 percent range was endorsed by the more recent US 2010 Horizontal Merger Guidelines and is used as a standard benchmark in other jurisdictions.*

[3] *As downloaded from the website of the Competition Commission of India on 14 November 2016: http://www.cci.gov.in/competition-act*

manipulation by market-dominant entities – were always salient factors. We infer that SSNIP Tests are acceptable in India and their lack of use may be ascribed to challenges in implementation. The obvious challenge to implementation is data scarcity: price and quantity data are needed to estimate elasticities in the candidate relevant market.

The main idea behind this paper is that obstacles posed by data scarcity are surmountable through recourse to reliable third party data, which may be collected for purposes other than competition analysis. Such data, when they contain demand and expenditure information on products within the candidate antitrust market, can be used in SSNIP Test analysis. Indeed, because these data sets often contain supplementary information on demographic and other variables, they allow better inference than data that were directly obtained from industry sources. Demand estimation requires data on consumer demand, i.e. retail data. However, firms often have sales data only at the wholesale level: detailed records of sale to wholesalers and shops, but less on sales to end-consumers. They also do not have demographic and other data that improve the statistical properties of demand estimates.

Third party data well suited to demand estimation and SSNIP Tests are retail consumption records and surveys of consumption expenditure. Retail consumption records are often obtained from supermarket scanner data. But such analysis is better suited to countries with mature retail markets, where scanner data cover a preponderance of all retail transactions. In countries like India, with large unorganized sectors, such data would not cover most of the population, particularly economically weaker sections. Any inference would be biased. Resulting SSNIP Tests would apply to a wealthy minority only.

A more promising approach would be to use surveys of consumption expenditure with pan-India coverage. The most comprehensive of such efforts is the Household Consumption Expenditure ("HCE") survey by the National Sample Survey Office ("NSSO"). This survey samples every district in the country, covers all income groups, and records consumption behavior for hundreds of goods. It is the Government's primary data source on consumption by different population segments at state and national levels (NSSO, 2012). HCE data is used by policy makers and academics to design policy and study microeconomic behavior.

In this paper, we show how HCE data can be used for SSNIP Tests for consumer products. We also show that reliable inference from survey data such as the HCE survey is complex. Analyses based on conventional estimators like ordinary least squares ("OLS") lead to biased demand elasticity estimates because of sample selection problems. Bias-correcting estimators like the Heckman estimator should be used instead.

The structure of this paper is as follows: Section 1 looks into the question of market definition and, in this context, defines the SSNIP Test. Section 2 describes the HCE data set and the estimation strategy. Section 3 covers the empirical results and Section 4 concludes.

1. Understanding SSNIP Tests

The SSNIP Test is applied by implementing an algorithm set out in the 1992 US Horizontal Merger Guidelines and is predicated upon the behavior of a Hypothetical Monopolist. The algorithm starts with a narrowly defined product market and considers whether a Hypothetical Monopolist could impose a SSNIP in this market. Factors to consider when making this deliberation include substitute products, competitors, and the timing and cost of switching products (DOJ & Federal Trade Commission, 1992). If a SSNIP is feasible, then the relevant antitrust market is defined and the market abuse investigation begins. If not, then product market is expanded to include close substitutes and the SSNIP question posed again, i.e. can a Hypothetical Monopolist impose a SSNIP on the expanded product market? These steps iterate until the relevant antitrust product market is defined. Then, the SSNIP Test is applied on the geographic dimension, moving from a small market region outwards. Overall, the SSNIP Test identifies the smallest market over which a Hypothetical Monopolist could implement a SSNIP (Massey, 2000).

The SSNIP Test, as defined above, is conceptual. In its implementation, it is empirical. A common empirical method is Critical Elasticity Analysis ("CEA"), where actual demand elasticities in the candidate relevant market are compared to a critical elasticity of demand. This critical elasticity is a threshold value, equal to the highest demand elasticity that is consistent with SSNIP profitability. If the demand elasticity were above this threshold then, because of price-sensitivity, customers would reduce consumption to an extent that the attendant fall in revenues would render the SSNIP unprofitable. The relevant antitrust market becomes a set of products within a specified region within which elasticities are high, but outside which elasticities are low (Kamerschen & Kohler, 1993).

A related method is Critical Loss Analysis ("CLA"), developed by Harris & Simons (1989). Under this method, the actual loss in quantity sold by the Hypothetical Monopolist is compared to a critical loss in quantity. If the actual quantity loss exceeds the critical loss, then SSNIP is unprofitable and vice versa (Hueschelrath, 2009). Critical elasticity and critical loss are related concepts and share a common derivation.

Formally, the critical elasticity of demand (ε_D) is defined as the inverse of the sum of the price-cost margin (m) and the SSNIP (t) (Massey, 2000), as shown in equation (1).

$$\varepsilon_D = \frac{1}{m+t} \tag{1}$$

Equation (1) is derived from the definition of profit π, which is the difference between price p and unit cost c multiplied by the quantity sold q, $\pi = (p - c)q$. The derivation proceeds by totally differentiating the profit equation with respect to p and q and recognizing that, at the optimum, marginal profit is zero, $\Delta\pi = 0$. Equation (1) follows by defining the price-cost margin as $m = (p - c)/p$ and the SSNIP as $t = \Delta p/p$ and rearranging terms.

The critical loss l_D, which is the marginal change in demand $\Delta q/q$, is defined as

$$l_D = \frac{m}{m+t} \tag{2}$$

The derivation is analogous to that for ε_D. Interested readers may refer to Hueschelrath (2009) or O'Brien & Wickelgren (2003) for details. From equations (1) and (2), we see that $l_D = \varepsilon_D m$, or the critical loss is the product of the critical elasticity and the price-cost margin.

Practitioners use both CEA and CLA when applying SSNIP Tests and there is no conceptual contradiction between the two. Differences arise in practice because of data availability. When it is more feasible to estimate actual losses [elasticities], CLA [CEA] is used. Given the HCE survey data, elasticity estimation is feasible. This paper applies SSNIP Tests by using CEA. Application of CEA requires definition of reference critical elasticities. Four critical elasticities are defined in Table 1, assuming SSNIPs of 5 and 10 percent and price-cost margins of 10 and 50 percent.

Table 1: Critical elasticities under SSNIP and price-cost margin assumptions

		Price-cost margin	
		10%	**50%**
SSNIP	**5%**	6.67	1.82
	10%	5.00	1.67

Source: own calculations

A price-cost margin of 10 percent is consistent with a competitive market with easy entry and exit conditions. The 50 percent price-cost margin is consistent with oligopolistic markets, where the market structure allows incumbent firms to defend high profit margins. Such markets that are more likely to face market abuse. The critical elasticity for a 10 percent

SSNIP for a firm with a 50 percent price-cost margin is 1.67 and will be used as the benchmark in the analysis in Section 3.

2. Data Notes & Estimation Strategy

The NSSO has conducted a large sample HCE survey every five years since the 27th survey Round in 1972-73. There have been nine large sample HCE surveys to date, with the latest being held during the 68th Round in July 2011 – June 2012. The HCE surveys play an important role in Indian policy design (NSSO, 2012). One of the core statistics computed from the data is monthly per capita expenditure. The distribution of this variable and its components across states and socio-economic groups provides information on poverty, inequality, food consumption and nutrition. The HCE surveys are also used to estimate budget shares for commodity bundles, which are then used to estimate consumer price indices. Given the prominence and use of this survey in the Indian policy landscape, there is no reason to doubt its suitability in the estimation of demand elasticities and SSNIP Tests.

This paper uses the 68th Round HCE Survey for demand elasticity and SSNIP Test analysis.[4] In this Round, 101,651 households across 7,469 villages and 5,268 urban frame survey ("UFS") blocks were surveyed. Geographical coverage extended across the entire country except for remote parts of Nagaland and the Andaman & Nicobar islands. All population groups were considered for sampling except residents of institutions like orphanages, prisons, hospitals, *ashrams* and barracks. The sample was collected using a stratified multi-stage design. Sampling details, including discussion of how the stratified design was implemented, are found in NSSO (2011).

Survey data were collected on the consumption and expenditure of about 350 consumption goods. For the purposes of this paper, it is not necessary to use the entire data set: own- and cross-price elasticities are only calculated for three consumption goods. The three consumption goods are the alcohol types covered by the HCE. These are beer; country spirits including toddy (collectively country liquor or "CL"); and wine and Indian-made and foreign-made foreign liquors (collectively "FL"). One of the aims of this analysis is to show

[4] *One may suppose that the use of 2011-12 data may lead to dated inference on demand elasticity. This would be true only if consumer preferences were unstable. Such an assumption is troublesome for two reasons. First, it runs counter to standard microeconomic theory. As shown by Becker (1962), stable preferences are a sufficient condition for downward sloping demand curves. Second, the assumption contradicts an intuitive understanding of consumer preferences: how many vegetarians are likely to switch to meat? This is not to suppose that preferences are wholly static: changes may occur, but gradually, particularly when aggregated across an entire economy. Changes in societal preferences would be small over a five-year period. In any case, preference instability does not contradict the broader thesis of this paper, which is that reliable third party data is suitable for the implementation of SSNIP Tests. Neither does it exclude the use of NSSO data: the NSSO also conducts annual thin sample HCE surveys, which can be used for more recent elasticity estimates. The caveat is that smaller samples may yield less precise estimates.*

that HCE data is granular enough to allow estimation of demand elasticities at different levels of aggregation. Accordingly, demand elasticities are estimated at the national level as well as for two states, Maharashtra ("MH") and Tamil Nadu ("TN").

Along with price and quantity data on the goods mentioned above, additional data – to be used in the regression equations to estimate the demand elasticities – were also extracted from the HCE data set. Table 2 contains country-level descriptive statistics of the continuous variables used in the regression analysis. Respondents to HCE surveys do not report the prices of goods purchased. Instead, they report expenditures and quantities purchased. Unit value is estimated as expenditure divided by quantity and is highly correlated to actual prices, making it a suitable proxy for price (Deaton & Edmonds, 1996). In the discussion that follows, unit value and price are used interchangeably. The final column in Table 2 records the proportion of households that report consumption of the given good.

Table 2: Descriptive statistics of variables used in demand elasticity estimations

		Quantity		Unit Value (INR)		Consumer proportion
Variable	**Qty. Units**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	
Tobacco	dummy	1.00	0.00	230.02	422.97	49.02%
Country liquor	litres	4.00	2.51	152.14	87.18	7.66%
Beer	litres	4.02	1.86	167.47	59.27	1.67%
Wine, foreign liquor	litres	2.09	1.49	460.49	180.08	4.28%
Other intoxicants	dummy	1.00	1.00	513.94	464.04	1.15%
Wheat	kg.	3.77	1.99	64.87	39.26	87.62%
Other cereal	kg.	2.16	1.23	54.63	34.81	21.81%
Monthly expenses				8652.37	6380.47	
Land holdings	hectares	0.45	0.84			
Respondent age	years	47.55	13.52			

Source: HCE Survey, 68th Round; own calculations

Hence, Table 2 shows that 7.66 percent of survey households report CL consumption. They consume 4.00 liters a month on average, bought at an average of INR 152 per liter. There is variation in consumption and unit values across households, as indicated by the standard deviations. The differences in prices or unit values are partly attributable to quality differentials and differential tax treatments across states. The descriptive statistics for the beer and CL are analogously interpreted. Tobacco is a dummy variable that indicates whether the respondent household consumes tobacco. The tobacco may be consumed in diverse forms, including *bidis*, cigarettes, chewing tobacco and *zarda*. CL, beer and FL are the alcohol types for which elasticities will be estimated, and their consumption is reported in liters. 'Other intoxicants' is a dummy variable indicating whether household members consume intoxicants

other than those specifically listed in the HCE survey questionnaire. It largely refers to drug consumption. Land holdings is a proxy for wealth and, along with age, is used as a control variable. Monthly household expenses are INR 8652 with high variance.

Along with the variables in Table 2, data is also collected on factor variables, which are used as fixed effects in the regressions. The factor variables are states, regions within states (as defined in the HCE survey), cooking fuel type, and social group. The fixed effects capture unmeasured variations in household characteristics, thereby improving estimator properties. The "State" fixed effect, for example, captures state-level heterogeneity in household consumption. Households in Maharashtra and Tamil Nadu are embedded in different social and cultural milieus, which leads to differences in their consumption patterns. These socio-cultural factors are not recorded in the data, but are captured through the use of fixed effects. Some statistics on fixed effects are shown in Appendix A.

To estimate demand elasticities from the HCE data, the Heckman sample selection model (Heckman, 1979) is applied. This model corrects for a common statistical sampling problem referred to as the sample selection or incidental truncation problem. It appears when the sample of interest (e.g. beer consumers in the HCE data) has different underlying characteristics and is therefore not representative of the overall population (Heckman & MaCurdy, 1986). This obscures the "true" causal effect between the outcome (e.g. beer demand) and the causal factor (e.g. beer price). It becomes infeasible to determine which part of the outcome is attributable to causal factor and which part to differences between the sample and the general population (Toomet & Henningsen, 2008). This leads to problems with the statistical properties of conventional estimators such as least squares (Greene, 2002). An empirical strategy like the Heckman sample selection model is needed to separate these two effects. This model is described in Appendix B.

The Heckman strategy models the sample selection problem as a two-step decision making process. The first step consists of "selecting" whether to take an action or not (e.g. to drink beer). The second step, which is contingent on the first, requires actions that lead to the observed "outcome" (actual beer consumption). Both steps are modeled through two regression equations: the selection and outcome equations.

In practice, most explanatory variables for the selection equation are also needed for the outcome equation. This can introduce multicollinearity into the model, which leads to inflated variances for parameter estimates. The estimates become inefficient. To control for multicollinearity in Heckman sample selection models, instrumental variables are used

(Sousa, 2014; Toomet & Henningsen, 2008). Strong candidates for instrumental variables are those that are correlated with the selection decision, but are uncorrelated with the error in the outcome equation. In other words, these are variables that correlate with the decision to drink or not drink beer, but once the beer-drinking decision has been made, do not affect the quantity of beer consumed. Our selected instruments are the decisions to consume other alcohol types. This is because consumers of beer are also likely consume other types of alcohol and vice versa. Hence, beer selection will be correlated with FL and CL selection. At the same time, selection of FL and CL does not affect the quantity of beer consumed by an individual (i.e. the beer outcome). The alcohol selection decision is captured by a dummy variable that is constructed from the HCE data.

Along with the instrumental variables, the regression analysis also uses control variables. If these variables were not considered, then the model would suffer from omitted variable bias. The selected control variables are state or region-level fixed effects, fixed effects for cooking fuel type and social group, age, land ownership, and some dietary elements. Age refers to the age of the primary householder. The dietary controls account for household level heterogeneity as well as some household expenses.

3. Empirical Results

Table 3 presents regression results under an OLS estimation. Nine OLS estimations were run in total. In each regression, the dependent variable was the log of quantity consumed. The relevant explanatory variables are listed in the left-most column. d_{tob} is a dummy variable indicating whether one or more members of the household consumes tobacco and p_{tob} is the monthly expenditure on tobacco. p_{CL}, p_{beer} and p_{FL} are monthly household expenditures on country liquor, beer and foreign liquor respectively and MHE is the total monthly household expenditure. Logs of prices and expenditure are used because this allows their coefficients to be interpreted as elasticities or semi-elasticities. The regression also includes control variables whose coefficients are not reported for brevity. The control variables and their use are discussed in Section 2.

Table 3: Elasticity estimates under OLS

	Country liquor			Beer			Wine & foreign liquor		
	IN	**MH**	**TN**	**IN**	**MH**	**TN**	**IN**	**MH**	**TN**
$Intercept$	-0.027	1.438	11.620*	-0.260	-1.561	0.650	-1.615**	0.340	-3.164**
d_{tob}	-0.103**	-0.030	-0.081	-0.006	-0.011	-0.107	0.015	-0.111	0.171**
$log(p_{tob})$	0.119**	-	0.121	0.076**	0.164*	0.040	0.102**	-	0.129**
$log(p_{CL})$	-0.423**	-0.557**	-0.449**	-0.067**	0.143	-0.097	0.017	0.614†	-0.074

	Country liquor			Beer			Wine & foreign liquor		
	IN	**MH**	**TN**	**IN**	**MH**	**TN**	**IN**	**MH**	**TN**
$log(p_{beer})$	-0.023	-0.134	-0.335	-0.073**	-0.348**	-0.402**	-0.016	-0.276	-0.016
$log(p_{FL})$	-0.047**	-0.120	-1.591†	-0.122**	-0.063	-0.041	-0.518**	-0.745**	-0.122
$log(MHE)$	0.333**	0.489**	0.267†	0.296**	0.347**	0.359**	0.499**	0.360**	0.433**
Observations	7785	480	67	1694	110	152	4349	94	695
F Statistic	271.77**	10.81**	2.70*	25.89**	3.35**	4.66**	177.88**	5.39**	20.90**
Adjusted R^2	0.28	0.27	0.15	0.16	0.13	0.18	0.25	0.32	0.17

*Note: **, * and † indicate significance at the 1%, 5% and 10% levels.*
Source: own calculations

The second to fourth columns from the left contain the results for CL, the next three columns contain the beer results and the three right-most columns contain the results for FL. Results are estimated for India as a whole, and for the states of Maharashtra and Tamil Nadu. All own-price elasticities are highlighted in yellow.

All own-price elasticities are negative and significant (with the exception of FL in TN) at the one percent level. The significant own-price elasticities hover around -0.50 across geographies and alcohol types and never exceed -0.75. The OLS results therefore indicate that consumers are own-price inelastic in their demand for alcohol. This is particularly true for beer consumption at the all-India level: demand appears almost completely inelastic. Own-price elasticity indicates the percentage change in demand because of a one percent change in price. An elasticity of -0.50 therefore indicates that demand falls by 2.5% and 5% for 5% and 10% SSNIPs respectively. The own-price elasticities in Table 3 are below the reference critical elasticities in Table 1, which indicates that a Hypothetical Monopolist would be able to implement a SSNIP in these markets. These markets could therefore be defined as relevant antitrust markets.

Once the relevant market has been defined, the competitiveness analysis can begin. One method for assessing market power is to consider cross-price elasticities with substitute products. Table 3 shows that cross-price elasticities are either low or not significant, indicating limited substitution across alcohol types. The remaining coefficients reported in Table 3 pertain to smoking and monthly household expenditure. The tobacco dummy and price are included are control variables because of the correlation between tobacco and alcohol consumption (Sousa, 2014). The coefficients for $log(MHE)$ indicate that consumers are income-inelastic with respect to alcohol consumption. A one percent increase in income only increases alcohol demand by 0.27 – 0.50 percent, depending on alcohol type and region.

Table 4 presents regression results under the Heckman sample selection model. The same products and regions were considered as in the OLS regressions. The dependent variable in the selection equation is, as indicated in equation (5), a consumption dummy. The dependent variable in the outcome equation is the log of quantity consumed. The outcome equation and the OLS regressions have the same dependent variables. Covariance parameters (ρ) are significant for all regressions, indicating correlation between errors in the selection and outcome equations. One may infer that the OLS results are significantly biased.

Table 4: Elasticity estimates under the Heckman sample selection model

	Country liquor			Beer			Wine & foreign liquor		
	IN	**MH**	**TN**	**IN**	**MH**	**TN**	**IN**	**MH**	**TN**
Selection equation									
$Intercept$	-0.269	-0.771	-3.157	-4.744**	-6.977**	2.406	-5.247**	-10.144**	-1.416
d_{tob}	0.789**	0.997**	0.817**	0.454**	0.443**	0.525**	0.730**	0.594**	1.044**
d_{CL}	-	-	-	-0.315**	-0.601*	-0.553	-0.508**	-0.873**	-0.926**
d_{beer}	-0.406**	-0.769*	-0.603	-	-	-	-0.296**	-0.596	-1.107**
d_{FL}	-0.613**	-0.803**	-0.748**	-0.253**	-0.600	-0.992**	-	-	-
$log(p_{tob})$	0.039**	0.105**	-0.122	0.112**	0.279**	0.1	0.106**	-	0.186**
$log(p_{CL})$	-0.453**	-0.526**	-0.402**	-0.181**	0.045	-0.01	-0.056**	0.362	0.221**
$log(p_{beer})$	-0.042*	0.255*	0.329†	-0.385**	-0.467*	-0.518**	0.028	0.126	0.074
$log(p_{FL})$	0.040†	-0.071	0.318	0.026	0.052	-0.848*	-0.469**	-0.343†	-0.660**
$log(MHE)$	0.062**	0.009	0.232*	0.476**	0.559**	0.482**	0.562**	0.764**	0.336**
Outcome equation									
$Intercept$	0.117	1.590	12.945**	-0.076	-5.931	0.015	-1.813**	-10.124*	-5.031**
d_{tob}	-0.158**	-0.201	0.144	-0.038†	0.170	-0.202*	0.039†	0.429†	1.176**
$log(p_{tob})$	0.115**	-	0.093	0.054**	0.273*	0.023	0.109**	-	0.268**
$log(p_{CL})$	-0.391**	-0.474**	-0.573**	-0.033†	0.212	-0.120	0.022	0.955*	0.193**
$log(p_{beer})$	-0.018	-0.183	-0.316	-0.018	-0.543*	-0.303**	-0.013	0.034	0.049
$log(p_{FL})$	-0.054**	-0.097	-1.832*	-0.093**	0.068	0.118	-0.530**	-1.043**	-0.690**
$log(MHE)$	0.328**	0.496**	0.257†	0.254**	0.596*	0.343**	0.508**	0.968**	0.483**
Variance-covariance parameters									
ρ	-0.181**	-0.288†	0.534*	-0.348**	0.751*	-0.483*	0.080*	0.939**	0.991**
σ	0.604**	0.689**	0.639**	0.454**	0.635*	0.445**	0.618**	1.120**	1.165**
Observations	101,651	8,044	6,646	101,651	8,044	6,646	101,651	8,044	6,646

*Note: **, * and † indicate significance at the 1%, 5% and 10% levels.*
Source: own calculations

As discussed in Appendix B, the selection equation is estimated by probit. The coefficients in a probit regression are log-odds, which can be used to estimate the marginal effects that have a direct economic interpretation. Marginal effects are estimated and reported in the selection equation results in Table 4, instead of log odds. The coefficients for continuous explanatory

variables, such as log price, are thereby interpreted as the percentage change in the number of consumers because of a one percent change in the explanatory variable defined at the mean.

The Heckman model is identified by using consumption dummies for other alcohol types (d_{CL}, d_{FL}, d_{beer}) as instruments in the selection equation. These dummies are significant, which indicates that they are appropriate instruments. A tobacco consumption dummy and tobacco price are also included as control variables, along with fixed effects and demographic variables mentioned in Table 2 and Appendix A.

The selection equation variables relevant to CEA are the logs of the prices of CL, beer and FL. The own-price effects on the decision to consume (highlighted in light yellow) are negative and significant. Thus, a significant proportion of consumers stop consuming a given alcohol type when the price of that alcohol type increases marginally. This effect is wholly uncaptured by an OLS regression framework. The cross-price coefficients are positive and negative, depending on the region and alcohol type, indicating substitutability as well as complementarity among alcohol types.

The outcome equation results are analogous to the OLS results in Table 3 and are similarly interpreted. Own-price elasticities are negative and significant, and differ from the OLS equivalents. The differences exist because of the sample selection bias in the OLS estimates. In some cases, the bias has a large impact on the elasticity estimates. Own-price elasticity for FL in Maharashtra, for example, goes from inelasticity under OLS (-0.75) to unit elasticity after selection bias is accounted for (-1.04).

The results in Table 3 and Table 4 can be used in CEA, but since OLS is biased, the Table 3 results would lead to incorrect market definition. As estimated in Table 1, the critical elasticity under a 10 percent SSNIP and a 50 percent price-cost margin is 1.67. The actual elasticity under OLS is less than this for all region-product market combinations, indicating that the relevant antitrust market is defined. The actual elasticity under the Heckman model is also less than the critical elasticity (as shown by the outcome equation results in Table 4). However, this elasticity estimate only accounts for customers who reduce demand in response to the SSNIP. It does not account for customers who stop consumption completely in response to the SSNIP (i.e. the selection equation results). By using the definition of elasticity and the functional form of the selection equation, an adjusted elasticity estimate can be calculated, which account for both selection and outcome effects. A comparison of all elasticity estimates is found in Table 5.

Table 5: Comparison of actual and critical elasticities

	Country Liquor			Beer			Wine/IMFL/FMFL		
	IN	MH	TN	IN	MH	TN	IN	MH	TN
ε_{crit}	-1.667	-1.667	-1.667	-1.667	-1.667	-1.667	-1.667	-1.667	-1.667
ε_{OLS}	-0.423	-0.557	-0.449	-0.073	-0.348	-0.402	-0.518	-0.745	-0.122
ε_{HK}	-0.391	-0.474	-0.573	-0.018	-0.543	-0.303	-0.530	-1.043	-0.690
Adjusted ε_{HK}	-0.474	-0.564	-0.639	-0.090	-0.622	-0.395	-0.599	-1.088	-0.786
$Bias_{OLS}$	-0.051	-0.007	-0.190	-0.017	-0.274	0.007	-0.081	-0.343	-0.664
$Bias_{OLS}$ / adj. ε_{HK}	10.67%	1.28%	29.70%	18.46%	44.06%	-1.72%	13.53%	31.52%	84.47%

Source: own calculations

When both selection and outcome effects in the Heckman sample selection model are considered, then the elasticity of demand is consistently higher than under OLS. But even this higher adjusted Heckman elasticity of demand (adjusted ε_{HK}) is always less than the critical elasticity (ε_{crit}). Thus, both OLS and the Heckman methods show that the relevant antitrust market can be defined at the state level in MH and TN. Further analysis may reveal that actual elasticities exceed the critical elasticity in other states. In these cases, a state-level market definition is too narrow. The pan-India market would then be the relevant market.

Table 5 shows that the OLS bias, defined as (adjusted $\varepsilon_{HK} - \varepsilon_{OLS}$) tends to be negative. The sole positive bias, for beer in TN, is very small. The size of the bias varies substantially from 0.007 to -0.664. In percentage terms, the bias varies from -1.7 percent (beer in TN) to 84 percent (wine in TN). Not accounting for sample selection bias can therefore lead to severe problems in elasticity estimation.

4. Conclusions

Indian practitioners of competition economics seldom use CEA and SSNIP Tests when defining relevant antitrust markets. In this paper, we demonstrate that large sample, third party data sets, which may have been collected for other reasons, like the HCE data collected by the NSSO, contain the depth of information necessary for the implementation of SSNIP Tests for a range of consumer goods. Apart from implementing SSNIP Tests, the HCE data is also suitable for cross-elasticity analysis, which can be used as a quantitative element of the competition analysis subsequent to market definition.

We also show that the application of conventional estimators like OLS can lead to biased estimates and incorrect market definition, because these estimators do not control for sample selection or incidental truncation problems. To get rid of the bias in OLS and other conventional estimators, estimators like those designed in Heckman (1979) can be used.

Our comparison of the OLS and Heckman results shows that the OLS tends to bias demand elasticity estimates towards zero, thereby leading the competition economist to narrower market definition than might actually be warranted. In some cases, the amount of bias is substantial. In the nine candidate markets considered by us, the size of the bias ranged from 1.7 percent to 84 percent of the bias-corrected Heckman demand elasticity estimate.

One can see how biased elasticity estimates can lead to incorrect market definition by considering an example. Consider, a case where critical elasticity is 1.67, OLS elasticity is 1.50 and the true elasticity is 1.80. If only OLS was used, then the competition economist would come to the incorrect conclusion that the market was defined. In actuality, the market would have to be expanded to find the relevant market.

This paper represents a preliminary attempt at surmounting challenges in market definition in India. Further avenues of research could look at alternate third party data sources; or design or identify alternate estimation strategies for market definition and other quantitative exercises relevant to the economics of competition law in India.

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Appendix A Descriptive statistics for fixed effects

Demand elasticity estimation using HCE survey data requires the use of factor variables, which are used as fixed effects. The factor variables are cooking fuel, social group, states (for the nation-level estimation) and regions within states (for the state-level estimations). The regions within states have been defined by the NSSO. Table 6 shows the distribution of the sample population by the type of cooking fuel used. Most households in the sample – and by inference in India – use either firewood, liquefied petroleum gas ("LPG") or electricity when cooking food. These categories account for 87% of all households. Cow dung or *gobar* is the preferred cooking fuel for five percent of households. The remaining households use coal or kerosene, or do not cook at home.

Table 6: Distribution of sample households by cooking fuel type

Type of cooking fuel	Frequency	Proportion
No cooking	1,873	1.84%
Coal / Charcoal	1,711	1.68%
Firewood	44,893	44.16%
LPG / Electricity	43,796	43.08%
Cow dung	4,870	4.79%
Kerosene	2,526	2.48%
Other (unspecified)	1,982	1.95%
Total	101,651	100%

Source: HCE Survey, 68th Round; own calculations

Table 7 shows the distribution of sample households by social group. The social groups considered in the HCE survey are Scheduled Tribes ("ST"), Scheduled Castes ("SCs"), Other Backward Classes ("OBCs") and an Others or general category. The greatest proportion of the sample is drawn from the OBC category and smaller proportions from the SC and ST categories. To the extent that the HCE sample is representative of the overall population, the proportions in Table 7 would apply to India as a whole.

Table 7: Distribution of sample households by social group

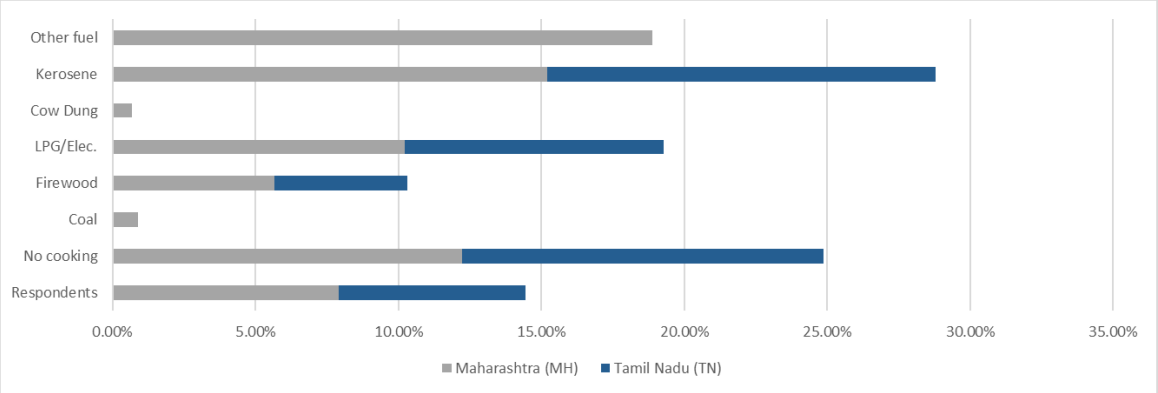
Social Group	Frequency	Proportion
Unspecified	15	0.01%
Scheduled Tribes	13566	13.35%
Scheduled Castes	15757	15.50%
Other Backward Classes	39677	39.03%
Others	32636	32.11%
Total	101651	100.00%

Source: HCE Survey, 68th Round; own calculations

Figure 1 presents data on the distribution of the sample population and cooking fuel types across the states selected for demand elasticity estimation. The lowest bar (Respondents) indicates the percentage of the total sample drawn from a given state. It indicates that the two selected states account for almost 15% the 100,000+ sample. MH accounts for 7.9% of all sampled households, while TN accounts for 6.5%. These proportions are commensurate with the states' populations.

The other bars in Figure 1 show the contributions of the states to the total number of users of the different cooking fuel types. By comparing the sizes of the color bars to the Respondents color bar, one may determine whether a given state is over- or under-represented in the use of a given cooking fuel. Compare, for example, the bars for cow dung and coal to that for Respondents. The grey bar for MH for cow dung and coal is smaller than for Respondents. There is no blue bar for TN for cow dung and coal. This indicates that MH and TN have proportionately lesser representation among households who use cow dung or coal for cooking, when compared to the national average. These results are consistent with the hypothesis that cow dung and coal use is proportionately greater among the rural poor. Since MH and TN are less rural and have higher monthly per capital expenditures than the average they have a proportionately lesser presence among cow dung users.

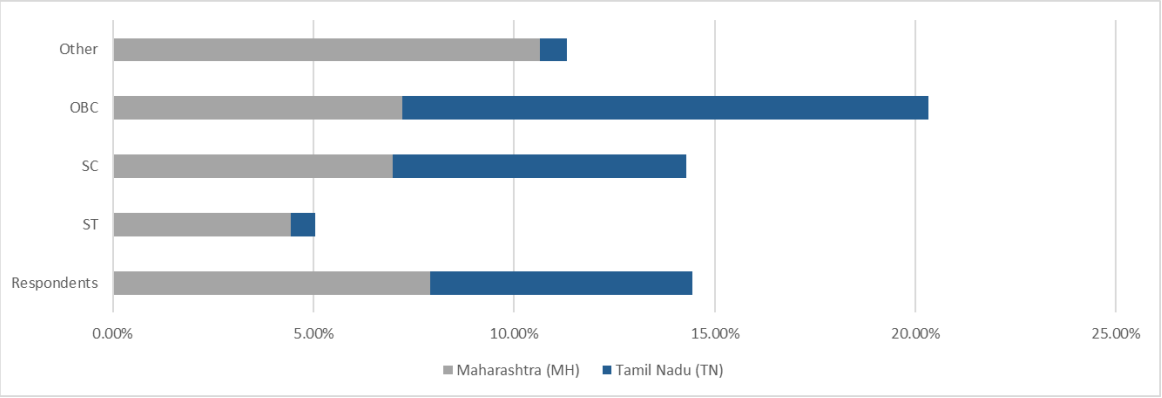
Figure 1: Proportions of cooking fuel types in selected states



Source: HCE Survey 68th Round; own calculations

Figure 2 replicates the analysis in Figure 1, but for social groups. One sees, for example, that OBCs are over-represented when TN and MH are considered together. But, by comparing the OBC row and the Respondents row, one sees that this over-representation is wholly attributed to TN. MH slightly under-represented. The other social groups are underrepresented slightly. It is interesting to note that the majority of the TN sample is drawn from the SC and OBC categories. To the extent that this sample represents the TN population, it indicates that the vast majority of the TN population self-selects into these social groups. It would be interesting to research the correlation between this self-selection and the political and reservation structures in the state. MH, by contrast, has a less distorted distribution across social groups.

Figure 2: Proportions of social group types in selected states



Source: HCE Survey 68th Round; own calculations

Appendix B The Heckman sample selection model

Our elucidation of the Heckman sample selection model is drawn from Toomet & Henningsen, (2008). Other resources include Greene (2002), Woolridge (2003) and Cameron & Trivedi (2005). The model begins with the assumption of an unobserved structural process, which is characterized by the selection and outcome equations [(3) and (4)] below.

$$y_i^{S*} = x_i^S \beta^S + \varepsilon_i^S \tag{3}$$

$$y_i^{O*} = x_i^O \beta^O + \varepsilon_i^O \tag{4}$$

The structural process models a two-step choice decision process. The first step consists of a selection choice. The second step consists of a follow-on choice contingent on the earlier selection, which leads to the outcome. y_i^{S*} is the latent or unobserved selection decision by individual i and y_i^{O*} is the latent outcome. x_i^S and x_i^O are the explanatory variables for the selection and outcome equations respectively. Although y_i^{S*} and y_i^{O*} are not observed, two indicator variables y_i^S and y_i^O are, where

$$y_i^S = \begin{cases} 0 & if\ y_i^{S*} < 0 \\ 1 & otherwise \end{cases} \tag{5}$$

$$y_i^O = \begin{cases} 0 & if\ y_i^S = 0 \\ y_i^{O*} & otherwise \end{cases} \tag{6}$$

Coming back to our beer example, the model in equations (3)-(6) describes a decision process where individual i first selects whether or not to drink beer. This decision is affected by explanatory variables x^S and unmeasured factors and random error ε^S. If he decides not to drink, then $y_i^S = 0$, otherwise $y_i^S = 1$. If i selects to drink beer, his follow-on decision is about how much beer (y_i^{O*}) to drink, which is affected by x^O and ε^O. The contingency of the second decision on the first is shown by equation (6), which tracks observed beer consumption. Because of the structure of the decision process, y^O is observed only when $y^{S*} > 0$. The dependence of y^O and x^O can thereby be written as

$$E[y^O | x^O = x_i^O, x^S = x_i^S; y^S = 1] = x_i^O \beta^O + E[\varepsilon^O | \varepsilon^S \geq -x_i^S \beta^S] \tag{7}$$

Let $E[\varepsilon^O | \varepsilon^S \geq -x_i^S \beta^S]$ be defined as the control function. Since the control function is non-zero unless ε^O and ε^S are independent, conventional estimators of y^O, like OLS, are biased. The Heckman model assumes that ε^S and ε^O are distributed bivariate normal with correlation ρ (see equation (8)). When $\rho > 0$, then ε^S and ε^O are positively correlated, and vice versa.

$$\begin{pmatrix} \varepsilon^S \\ \varepsilon^O \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & \sigma^2 \end{pmatrix} \right) \tag{8}$$

Given this assumption, the Heckman strategy proceeds by first estimating the control function from equations (3) and (5) by probit, and then inserting this estimate into the outcome equation (4) as additional covariates. Using the properties of a bivariate normal distribution one obtains the outcome estimation equation (9)

$$y_i^O = x_i^O \beta^O + E[\varepsilon^O | \varepsilon^S \geq -x_i^S \beta^S] \equiv x_i^O \beta^O + \rho\sigma\lambda(x_i^S \beta^S) + \nu_i \tag{9}$$

where $\lambda(\cdot) = \phi(\cdot)/\Phi(\cdot)$ is the inverse Mills ratio, $\phi(\cdot)$ and $\Phi(\cdot)$ are probability and cumulative distribution functions of a standard normal distribution, and ν is an independent and identically distributed error term. As noted by Toomet & Henningsen (2008), the Heckman method repurposes sample selection problem as an omitted variable problem, where $\lambda(\cdot)$ is the omitted variable that is estimated by probit as a first step.

The sign on ρ indicates the direction of bias when conventional estimators like OLS are used because it affects the sign of the control function (see (9)). This is known because σ and $\lambda(\cdot)$ are positive by definition. $\rho > 0$ implies a positive control function, which in turn implies that observable outcomes have positive realizations of ε^O in the mean; a phenomenon referred to as "positive selection". The observed outcomes y_i^{O*} are higher than they would be if ε^S and ε^O were not positively correlated. Further details, including those related to consistent estimation of the variance covariance matrix are not provided.

Application of Economic Tools for Relevant Market Definition: The Experience in India

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Abstract

Relevant market definition is an important tool in competition assessment. Economic analysis enables relevant markets to be defined in a scientific and robust manner. However, there exist certain practical challenges related to data availability and applicability of the tools that need to be considered while applying these tools. Over the years, in India, economic tools (such as catchment area analysis and Elzinga Hogarty test) have been increasingly used to define the relevant market. This paper discusses India's experience in applying economic tools for relevant market definition, including areas for potential improvement.

Introduction

Relevant market comprises of two components – relevant product market[1] and relevant geographic market.[2] It includes "*all reasonably substitutable products or services, and all nearby competitors, to which consumers could turn in the near term"* if the price increased by a small but significant amount.[3]

Despite recent discussion in the antitrust community regarding the significance of market definition in competition assessment, defining the relevant market continues to be an important step in assessing the extent of competitive constraint in abuse of dominance investigations and merger control.[4]

Appropriate definition of the relevant market is extremely important because an incorrectly defined relevant market can result in wrong conclusions about market power and, therefore, effect on competition. On the one hand, a relevant market defined too narrowly can result in the incorrect conclusion that a firm possesses market power (when in reality it does not). On the other hand, a relevant market defined too broadly can result in the wrong inference that a firm does not possess market power (although in the correctly defined relevant market it may be dominant).

This paper provides an overview of the various economic tools that can be used to define the relevant market (with practical examples from advanced jurisdictions), highlights key practical points that need to be considered while applying these tools, and discusses India's experience with the application of such tools.

Economic tools used to delineate the relevant market

To ensure that the relevant market defined for competition assessment is robust and scientific (and therefore reliable), antitrust practitioners often use a wide variety of economic tools. In this section, we discuss some of the commonly used tools.

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[1] The Competition Act, 2002, defines the relevant product market as "*a market comprising all those products or services which are regarded as interchangeable or substitutable by the consumer, by reason of characteristics of the products or services, their prices and intended use*". Source: Section 2(t) of Competition Act, 2002.

[2] According to the Competition Act, 2002, the relevant geographic market comprises "*the area in which the conditions of competition for supply of goods or provision of services or demand of goods or services are distinctly homogenous and can be distinguished from the conditions prevailing in the neighbouring areas*." Source: Section 2(s) of Competition Act, 2002

[3] *Continued Work on the Elaboration of a Model Law or Laws on Restrictive Business Practices* (20 February 1998). UNCTAD, TD/B/RBP/81/Rev.5

[4] Market Definition (11 October 2012). OECD Policy Roundtables. Directorate For Financial And Enterprise Affairs Competition Committee. DAF/COMP(2012)19. Retrieved from <http://www.oecd.org/daf/competition/Marketdefinition2012.pdf>

i. Small but Significant and Non-transitory Increase in Price (SSNIP) Test

This test (also known as the hypothetical monopolist test) is based on the concept of demand substitution and can be used to define the relevant product or geographic market. The SSNIP test starts with the narrowest possible market and assesses whether a hypothetical monopolist can profitably increase the price of the product in the particular area by 5-10%.[5] If consumers respond to the price increase by switching to an alternate product (or supplier from a different area) making the price increase unprofitable, then the relevant market is expanded to include the substitute product or area.[6]

This test was used to define the relevant market in *Nestlé/Perrier*. Nestlé submitted that there is no separate market for bottled source water and that the relevant product market should include all non-alcoholic refreshment beverages, including both bottled source water and soft drinks.[7] However, the European Commission (EC) concluded that "*it cannot be reasonably expected that an appreciable non-transitory increase in the price of source waters compared with that of soft drinks would lead to a significant shift of demand from source waters to soft drinks for reasons of price only*".[8] The EC arrived at this conclusion based on the following factors: (a) there was a significant difference in the absolute prices of bottled water and soft drinks (the price ratio was between 2 and 3); (b) bottled water is advertised as natural, pure and healthy, which affects substitution of bottled water with soft drinks for daily use at home; and (c) the prices of the two products moved differently over the last five years (the price of bottled water increased in both absolute and real terms, despite the price of soft drinks declining during this period).[9]

The SSNIP test may be applied using different economic analysis.[10] For instance, the critical loss analysis assesses how the actual loss in sales borne by a firm from a price increase

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[5] *Horizontal Merger Guidelines* (19 August 2010). U.S. Department of Justice and Federal Trade Commission. Retrieved from < https://www.justice.gov/atr/horizontal-merger-guidelines-08192010>

[6] *Ibid*

[7] *92/553/EEC: Commission Decision of 22 July 1992 relating to a proceeding under Council Regulation (EEC) No 4064/89* (Case No IV/M.190 - Nestlé/Perrier); Official Journal L 356 , 05/12/1992 P. 0001 – 0031 <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31992D0553>

[8] *Ibid*

[9] *Ibid*

[10] '*Could' or 'Would'? The Difference between Two Hypothetical Monopolists* (November 2008). Oxera. Retrieved from < http://www.oxera.com/Oxera/media/Oxera/downloads/Agenda/Hypothetical-monopolists.pdf>

Diversion Ratios: Why Does It Matter Where Customers Go If A Shop Is Closed (February 2009). Oxera. Retrieved from < http://www.oxera.com/Oxera/media/Oxera/downloads/Agenda/Diversion-ratios.pdf?ext=.pdf>

compares to the "critical loss" benchmark (where the fall in sales due to certain consumers not buying the firm's product anymore is offset by the rise in profits from the higher price being paid by consumers who continue to buy the product).[11] If the actual loss in sales is greater than the critical loss benchmark, it implies that the price increase will be unprofitable. Another analysis that is used as part of the SSNIP test to identify closest substitutes is diversion ratios, which "*measure the proportion of sales captured by different substitute products when the price of a product is increased*".[12] When the hypothetical monopolist increases price by 5-10%, the substitute to which a larger proportion of consumers shift is the closest substitute for the product, and is therefore included in the relevant market.[13] Diversion ratios are particularly useful in identifying the closest substitute in the case of differentiated products.[14] It may be estimated from data collected by businesses using demand estimation techniques, or through consumer surveys.[15]

ii. *Price Analysis*

Price analysis can be used to define the relevant product or geographic market. The most commonly used price analysis to define the relevant market is price correlation analysis. Correlation analysis is a statistical tool used to assess the extent to which two or more variables move together. The rationale behind using price correlation analysis to define the relevant market is that if two products/areas are part of the same relevant market, their prices tend to move similarly because of the competitive pressure exerted by one on the other.[16] However, it is important to note that strong correlation between prices could also be due to various other factors such as similarity in costs, general economic condition, or seasonal factors. Therefore, more rigorous techniques of price analysis such as correlation between price differences,[17] stationarity analysis,[18] and assessment of a long run co-integrating relationship between the prices[19] may be more appropriate.

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[11] '*Could' or 'Would'? The Difference between Two Hypothetical Monopolists* (November 2008). Oxera, Retrieved from < http://www.oxera.com/Oxera/media/Oxera/downloads/Agenda/Hypothetical-monopolists.pdf>

[12] *Diversion Ratios: Why Does It Matter Where Customers Go If A Shop Is Closed* (February 2009). Oxera. Retrieved from < http://www.oxera.com/Oxera/media/Oxera/downloads/Agenda/Diversion-ratios.pdf?ext=.pdf>

[13] *Ibid*

[14] *Ibid*

[15] *Ibid*

[16] Katsoulacos Y., Konstantakopoulou K., Metsiou E. and Tsionas E. G. (2013). *Quantitative Price Tests in Antitrust Market Definition with an Application to the Savory Snacks Markets*. Working Paper Series. Athens University of Economics and Business.

[17] "It is customary to compute the correlation coefficient using the natural logarithm (log) of the price series, both due to efficiency reasons and because the first log difference is an approximation of the growth rate.

In *Arsenal/DSP*, the EC used transaction-level data using invoices to undertake both price correlation and stationarity analyses to define the relevant geographic market as the European Economic Area (EEA).[20] According to the EC's analysis, "*DSP's and Velsicol's prices of benzoic acid in the EEA, Asia and North America have been diverging over time, and there does not appear to be any close relationship between them. This finding is not consistent with a hypothesis that DSP and Velsicol set prices in such a way that there is a global market and instead points to an EEA-wide geographic market definition.*"[21]

iii. Catchment Area Analysis

Competition authorities often use catchment areas analysis to define the relevant geographic market using the distance (or time) that a consumer is willing to travel to consume the product (or service). Catchment area refers to the area around a firm or a business that accounts for a large proportion (80-90%)[22] of its customers.[23]

In the anticipated acquisition by Travis Perkins plc of the BSS Group plc, the Office of Fair Trade (OFT) defined the relevant geographic market using catchment area analysis (based on time).[24] The OFT's assessment showed that 15 to 20 minutes' drive time (which is around 10 miles) captures around 80 percent of the sales of plumbing and heating specialists.[25]

While the catchment area of a firm provides useful evidence of competition in the market, it may underestimate the degree of competition when there are firms located at the edge or just outside the catchment area of the firm under consideration. In such situations, there is an overlap in the firms' catchment areas, implying that the relevant geographic market may not be just the catchment area of the firm under consideration but might include the catchment

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Equal changes in the log represent equal percentage changes in price. Correlations should always be computed both between levels and differences in the log prices." Source: *Quantitative techniques in competition analysis (*October 1999), Research Paper 17, Office of Fair Trading

[18] Stationarity analysis assesses whether the relative price of two products or regions tends to a constant value over time.

[19] Co-integration primarily refers to the existence of a long run relationship between pairs of variables.

[20] *Commission Decision of 9 January 2009 declaring a concentration to be compatible with the common market and the EEA Agreement* (Case No COMP/M.5153 - ARSENAL/ DSP) <http://ec.europa.eu/competition/mergers/cases/decisions/m5153_20090109_20600_en.pdf>

[21] *Ibid*

[22] *Techniques For Defining Markets For Private Healthcare In The UK* (November 2011). Oxera. Retrieved from <https://assets.digital.cabinet-office.gov.uk/media/53315caded915d0e5d0003a5/Oxera_Market_definition.pdf>

[23] *Shop 'Till You Drop: Retail Mergers and the U.K. Competition Review Process* (October 2012) Competition Policy International. Retrieved from <http://www.cliffordchance.com/content/dam/cliffordchance/PDF/Article_shop_til_drop.pdf >

[24] *Anticipated acquisition by Travis Perkins plc of the BSS Group plc. ME/4609/10* (26 October 2010). The OFT's decision on reference under section 33(1). Retrieved from <https://assets.publishing.service.gov.uk/media/55702bd1ed915d15be000016/travis-perkins_FTD.pdf>

[25] *Ibid*

areas of the other firms in the periphery as well. This is because, for consumers located in the area of overlap between the two firms' catchment areas, products of both firms are substitutes. Based on this possibility of chains of substitution across the overlapping catchment areas, the relevant geographic market may in fact be broader. This is in line with literature on market definition, which states that *"[w]ithin a relevant market, it is not necessary that all products or services (or regions) are substitutes for each other: it might be sufficient for some products to be indirect substitutes to other products to be included in the same market*".[26]

iv. Shipment Data Analysis

Reliance on analysis of shipment data to determine the relevant geographic market is based on the understanding that regions that are significantly engaged in trade in the relevant product with each other, exert a competitive constraint on each other. Elzinga-Hogarty (E-H) test is a commonly used technique to define the relevant geographic market using shipment data**.** Under the E-H test, the relevant geographic market for a product (or service) is determined based on quantitative analysis of the product's trade to and from an area. Specifically, the E-H test assesses if there is significant inflow (measured by the proportion of imports in the region's consumption) and outflow (measured by the proportion of exports in the region's production). If the area under consideration has significant trade (inflow or outflow) in a product, then the relevant geographic market is expanded to include the region(s) with which the trade in the product (or service) is higher than a certain threshold.[27]

In *United States v. Oracle Corp,* based on the E-H test, the US Federal Court concluded that the relevant geographic market for the market for enterprise resource planning software was global.[28] Based on this relevant market definition, Oracle was allowed to proceed with its acquisition of PeopleSoft.[29]

[26] Aproskie, J and Lynch. S (August 2010).T*he Chain of Substitution in Market Definition. Pitfalls in Application* (August 2012). Retrieved from <http://www.compcom.co.za/assets/Uploads/events/SIxth-Annual-Competition-Law-Economics-and-Policy-Conference-in-South-Africa-2012/NewFolder-4/Aproskie-and-Lynch-Chain-of-substitution-in-market-definition-Competition-Conference-2012.pdf>

[27] Willem H. Boshoff (3 May 2006). *Quantitative Techniques in Competition Policy – The Elzinga-Hogarty Test*, Econex, Research Note.

[28] U*.S. and Plaintiff States v. Oracle Corp* (9 September 2004). No C 04-0807 VRW Findings of Fact, Conclusions of Law and Order Thereon. Retrieved from <https://www.justice.gov/atr/case-document/findings-fact-conclusions-law-and-order-thereon>

[29] *Ibid*

Practical challenges to the application of economic tools for relevant market definition

While there are various economic tools that can be used to define the relevant market, certain practical issues may limit their applicability. One such issue is data paucity – application of the economic tools requires extensive amounts of data, which is often unavailable. For instance, in the case of the SSNIP test, to determine whether a price change is likely to be profitable or not, one may have to estimate how much quantity demanded by the consumers changes in response to a change in price (elasticity of demand). This would require developing a well-specified demand model that can be estimated through relevant data on demand for the product, price of the product and its substitutes, and other factors influencing demand such as income, seasonal factors, etc. Unfortunately, such data may often not be available.

In advanced jurisdictions like the European Union (EU) and the United States (US), when the information required to conduct a relevant market analysis (for instance information on substitution by consumers) is unavailable, it is common to rely on surveys to collect this information. However, in doing so, it is critical to ensure that the methodology relied on for the survey is scientifically accurate. For instance, in the US, the Federal Judicial Center has a Reference Manual on Scientific Evidence, which discusses various practical points that one needs to be careful about when conducting a survey (so that the authenticity and results of the survey can be defended). Specifically, according to the reference guide, following are some points to consider when using surveys to collect evidence:[30]

- The survey must be designed to address the relevant question(s) and be administered and interpreted to ensure objectivity of the survey;
- The survey should be designed, conducted and analysed by skilled and experienced experts; and,
- The survey should not be biased due to improper sampling, non-response, or questions being biased or unclear.

In certain cases, reliance on economic tools to define the relevant market is also hindered by the fact that these tests may not be applicable in the case of certain non-traditional markets.[31]

[30] Diamond S. S. (2011) *Reference Guide on Survey Research*. Reference Manual on Scientific Evidence. Third Edition. Federal Judicial Center and National Research Council of the National Academies.

[31] *Roundtable on Market Definition -- Note by the Delegation of the European Union* (June 2012). Retrieved from <http://ec.europa.eu/competition/international/multilateral/2012_jun_market_definition_en.pdf>

For instance, in a two-sided market[32] (say television or newspapers), application of traditional tools such as the SSNIP test may result in an incorrect definition of the relevant market.[33] Specifically, a price increase on one side of a two-sided platform market influences demand on the other side as well. For instance, increase in newspaper subscription price may result in lower subscription by readers, which in turn may result in lower advertising in the paper as well (since demand for advertising is dependent on popularity of the paper among subscribers). Thus, given the interdependence between demand on both sides of such markets, relying on the standard SSNIP test may result in the relevant market being defined too narrowly.[34] Specifically, price increase may be profitable in one side of the market, but not profitable when the impact on both sides of the market is considered. Therefore, to correctly define the relevant market in a two-sided market (such that all competitive constraints are identified), the SSNIP test should take into account effects on both sides of the market.[35]

Economic tools in their traditional form may also not be applicable in the case of markets with differentiated products.[36] Competition in such markets is based not just on price but also on the differentiating attributes of the product/service. Since economic tools such as SSNIP test and price correlation analysis focus on just price and ignore competition based on non-price factors, the relevant market defined using such tools in the case of markets with differentiated products, may be incorrect.[37] Similarly, the E-H test is also not applicable in the case of industries with differentiated products and services.[38] For instance, while the E-H test was used to define the relevant geographic market in the case of hospital services in the

[32] Two-sided platform markets are markets with two distinct sets of users who interact with each other through a common platform and the value of joining the platform depends on their expectations about the network size.

[33] *Ibid*

[34] *Ibid.*

Market Definition (11 October 2012). OECD Policy Roundtables. Directorate For Financial and Enterprise Affairs Competition Committee. DAF/COMP(2012)19. Retrieved from <http://www.oecd.org/daf/competition/Marketdefinition2012.pdf>

[35] Market Definition (11 October 2012). OECD Policy Roundtables. Directorate For Financial and Enterprise Affairs Competition Committee. DAF/COMP(2012)19. Retrieved from <http://www.oecd.org/daf/competition/Marketdefinition2012.pdf>

[36] Differentiated products/services refer to products/services that are intended for similar uses, but have different characteristics (the difference could be based on intrinsic quality differences (e.g. fuel efficiency in cars, size of the hard drive in computers, after-sales services) or perceived quality differences (e.g. reputation of a brand in consumer goods).

[37] *Roundtable on Market Definition -- Note by the Delegation of the European Union* (June 2012). Retrieved from <http://ec.europa.eu/competition/international/multilateral/2012_jun_market_definition_en.pdf>. Diversion ratios are commonly used to identify the intensity of competition between various differentiated products.

[38] *Competition Law: Hospitals* (July 2004). Improving Health Care: A Dose of Competition - A Report by the Federal Trade Commission and the Department of Justice. Retrieved from <https://www.justice.gov/atr/chapter-4-competition-law-hospitals#2a1>

United States, its applicability and relevance for hospitals is widely debated. This is because the products and services provided by hospitals are not homogenous; and decision of consumers to travel or not for healthcare depends on various other factors such as difference in the perceived and actual quality of service, insurance coverage, out-of-pocket cost, family connections, etc.[39]

Further, one also needs to be prudent while defining the relevant market in the case of high innovation technology markets.[40] Substitutes in such markets keep changing with technological developments including introduction of new products, integration of previously separate functionalities into one product, and easier entry due to process innovation.[41] As a result, the boundaries of the relevant market in such high innovation markets are unstable – they may shift rapidly.[42] Therefore, application of economic tools to define the relevant market in such cases may not be as straightforward. For instance, the SSNIP test considers the currently available substitutes to the product in question, implying that it is based on the static concept of demand substitution.[43] However, in dynamic high-innovation markets, new substitutes can emerge due to rapid technological change or previously unviable substitutes may become stronger substitutes due to lower cost of production resulting from process innovation.[44] According to competition law commentators, relevant market definition in such markets "*should not focus only on short-term demand substitution but also on long term supply-side substitution and potential entry*".[45] Applying traditional tests such as SSNIP, which focuses on existing substitutes and does not consider substitutes that may become available in the future, may result in the relevant market being defined too narrowly.[46]

In the case of some markets, for instance price discrimination markets, economic tools such as SSNIP test may not be applicable in their traditional form and may have to be adapted to the market characteristics.[47] In markets categorized by price discrimination, there are various

[39] *Ibid*
[40] *Roundtable on Market Definition -- Note by the Delegation of the European Union* (June 2012). Retrieved from <http://ec.europa.eu/competition/international/multilateral/2012_jun_market_definition_en.pdf>.
[41] Market Definition (11 October 2012). OECD Policy Roundtables. Directorate For Financial and Enterprise Affairs Competition Committee. DAF/COMP(2012)19. Retrieved from <http://www.oecd.org/daf/competition/Marketdefinition2012.pdf>
[42] Ibid
[43] Ibid
[44] Ibid
[45] *Merger and Antitrust Analysis in High-Technology Markets: Current Issues* (July 2010). Skadden, Arps, Slate, Meagher & Flom LLP.
[46] Ibid
[47] Market Definition (11 October 2012). OECD Policy Roundtables. Directorate For Financial and Enterprise Affairs Competition Committee. DAF/COMP(2012)19. Retrieved from <http://www.oecd.org/daf/competition/Marketdefinition2012.pdf>

groups of consumers who are charged different prices. Therefore, in addition to a product and geographic component, the relevant market will also have a consumer group component.[48] Specifically, the SSNIP test should assess whether the hypothetical monopolist can profitably increase price of a product in a particular geography by 5-10% for a particular group of consumers, and not all consumers considered together.[49]

One also needs to be cautious while applying the SSNIP test in the case of aftermarkets - products that are used only in combination with another good (for instance printers and their cartridges). The complementary nature of use of aftermarket products implies that their price (cartridges) may influence consumer's demand in the primary market (for printers), particularly if the consumers take into consideration the price in the aftermarket when making consumption choice in the primary market.[50] In such a situation, one needs to determine whether the relevant market should be defined separately for the primary product (printer) and the secondary product (cartridge), or whether both the products should be considered together (as a system) as part of the same relevant market.[51] If the supplier of the primary product cannot exercise any market power in the aftermarket, then it implies that there is no distinct relevant market for the secondary product – the relevant market is in fact a systems market.[52] In such a situation, the SSNIP test should be applied to the whole system and not the primary and secondary product separately.[53]

Thus, while relying on economic tools to define the relevant market, it is pertinent to first determine the applicability of the test in the specific case. For instance, the SSNIP test and the related critical loss analysis may result in flawed conclusions when price charged by an already dominant firm is considered.[54] According to economists, in such a scenario, price may be set so high in the beginning that a further increase in price will definitely lead to

[48] Ibid
[49] Ibid
[50] Ibid
[51] Ibid
[52] Ibid.
There are situations when a separate relevant market for the aftermarket may be defined. For instance, in markets with several primary and secondary products, where the secondary products are compatible with the primary products, a separate aftermarket may be defined for the secondary products. This is because consumers are free to choose any combination of primary and secondary products.
[53] Ibid
[54] Katsoulacos K., Konstantakopoulou I., Metsiou E. and Tsionas E. G. (2013). *Quantitative Price Tests in Antitrust Market Definition with an Application to the Savory Snacks Markets*. Working Paper Series. Athens University Of Economics And Business

lower profits despite close substitutes at competitive price not being available (this is commonly referred to as the cellophane fallacy).[55]

India's experience with relevant market definition

In the initial years of competition law enforcement in India, the Competition Commission of India (CCI) and other stakeholders (businesses, lawyers, and economists) relied extensively on qualitative analysis to define the relevant market. In other words, relevant market definition was based on qualitative factors such as consumer preference, transport cost, product characteristics and its end use, etc., which were used to assess the extent of substitutability between two products/geographies.

However, delineation of the relevant market based on qualitative factors alone may be subject to differing opinions by different stakeholders thereby resulting in conflicting relevant market definitions. For instance, in a case related to the real estate sector where the relevant market was defined qualitatively, the Informant and the Opposite Party disagreed with the relevant market defined by the Director General, CCI (DG). In fact, in this case, even the DG revised its definition of the relevant market in a supplementary report.[56] In its initial report, the DG defined the relevant market as the market for "*the provision of services for development and sale of* ***residential apartments*** *in Noida and Greater Noida*", but in its supplementary report, the definition was changed to "*provision of services for development of* ***integrated township*** *in the territory of Noida and Greater Noida".*[57] The CCI, in its order, defined the relevant market as that identified by the DG in its initial report - provision of services for development and sale of residential apartments in Noida and Greater Noida regions.[58] Thus, since everyone's perception of what is substitutable and what is not may differ, relevant market definition based on qualitative factors is subject to ambiguity.

Over the years, driven by increasing reliance on economists for analysis, application of economic tools to define the relevant market has increased in India. For instance, catchment area analysis and E-H test are being increasingly used to determine the relevant markets (some examples being Ultratech's acquisition of Jaypee Cement and Lafarge-Holcim

[55] Ibid
[56] *CCI Order on Case Nos. 72 of 2011; 16, 34 & 53 of 2012; and 45 of 2013* (26 October 2015). Retrieved from <http://www.cci.gov.in/sites/default/files/722011_0.pdf>
[57] *Ibid.* The CCI however went with the relevant market delineated by the DG in its initial report.
[58] *Ibid*

merger).[59] Reliance on such economic tools highlights the need for data-based evidence to define the relevant market while providing clarity to the stakeholders on the possible approaches that can be used to define the relevant market, allowing them to rely on such empirical analysis in the future. Increasing reliance on such economic tools for competition assessment implies that competition law in India is moving in the right direction.

However, there is still a lot of ground that needs to be covered by the CCI, especially with respect to clarity on thresholds. For instance, in the global merger between Holcim Ltd and Lafarge S.A. (*Holcim-Lafarge*), while applying empirical tests, the CCI did not rely on specific thresholds, and stated that "*regardless of the choice of the threshold level for the purpose of EH Test and catchment area tests, there should be sufficient cause in terms of the competitive constraints for inclusion of an additional state/area in the relevant geographic market*".[60] The fact that the CCI did not endorse any clear threshold and left scope for discretion in determining whether a region should be included in the relevant market or not, results in ambiguity in the application of such tests in the future. Also, the CCI's inability to provide valid economic justifications for the open-ended approach of defining the relevant market in the said case, creates uncertainty for stakeholders.

Ambiguity in the CCI's approach towards relevant market definition is also highlighted by its varying application of the concept of chains of substitution in competition cases. In the combination between IndusInd Bank and Royal Bank of Scotland (*IndusInd-RBS*) involving the market for provision of banking services to commercial enterprises by scheduled commercial banks, the CCI defined the relevant market on the basis of chains of substitution. In its order in *IndusInd-RBS*, the CCI, while recognizing that the primary service area is a radius of about [15-20] kilometres, stated that "*in view of a chain reaction sequence, there could also be a possibility that even those competitors, who do not have a direct overlap in the primary service area of the Parties, will also be a part of the relevant geographic market, since the customers forming part of all areas covered by the chain reaction sequence could be sensitive to a small but significant increase in the service charges and/or credit rates by their respective banks. Given the well-established connectivity between the districts of Mumbai and Mumbai sub-urban (collectively "Mumbai"), it may be presumed that the said*

[59] CCI orders on Combination Registration No. C-2013/10/135 (20 December 2013); Combination Registration No. C-2015/02/246 (10 April 2015); Combination Registration No. C-2014/07/190 (30 March 2015); and Combination Registration No. C-2016/04/394 (4 August 2016).

[60] Notice u/s 6 (2) of the Competition Act, 2002 given by Holcim Limited and Lafarge SA (30 March 2015). Combination Registration No. C-2014/07/190. Retrieved form <http://www.cci.gov.in/May2011/OrderOfCommission/CombinationOrders/C-2014-07-190.pdf>

districts will at least form part of the chain reaction sequence. Therefore, in the present case, the relevant geographic market may be considered as comprising of at least the said districts which form part of Mumbai."[61]

The CCI, however, failed to apply this same logic of chains of substitution in the recent acquisition of DT Cinemas by PVR (*PVR-DT)*. Despite the Parties having highlighted the application of chains of substitution in *IndusInd-RBS,* in their submission to the CCI, the CCI simply denied its applicability in this case citing "*difference in characteristics of the relevant market in the two cases*" as the reason.[62] If the CCI had clarified the exact difference in nature between the two cases that deterred the applicability of chains of substitution in *PVR-DT,* it would have provided clarity to stakeholders with respect to when chain of substitution is applicable and when it is not.

Thus, while the CCI has been taking steps in the right direction in relation to relevant market definition, there is still a long way ahead with respect to the application of economic tools, particularly related to mitigating ambiguity in the CCI's approach. The CCI needs to draw from the experience of advanced jurisdictions, while at the same time ensuring that its approach is in line with the conditions in India. Clarity in its approach, especially with respect to thresholds, through guidelines can contribute to taking competition assessment in India forward. A key step in this direction is that the CCI and other stakeholders recognize the role of economists and economic analysis in competition assessment, which can play a pivotal role in promoting the application of robust economic tools in competition analysis in India.

A major factor limiting the reliance on economic tools for relevant market definition in India is the paucity of reliable data. Competition authorities in advanced jurisdictions frequently rely on consumer surveys, market studies, transactional data, and secondary market and industry level data for economic analysis to determine the relevant market. However in India, availability of reliable primary and secondary data for analysis is a key constraint. For instance, in the case of Ultratech Cement's acquisition of certain assets of Jaypee Cement (which was notified to the CCI in October 2013), the data used to assess shipment of cement

[61] Notice under Section 6 (2) of the Competition Act, 2002 given by IndusInd Bank Limited. CCI Order (15 June 2015). Combination Registration No. C-2015/04/268

[62] Combination Registration No. C-2015/07/288 (4 May 2016). Retrieved from <http://www.cci.gov.in/sites/default/files/event%20document/C-2015-07-288.pdf>

across states was for the year 2011-12 since similar data since then was not available.[63] Unavailability of data may thus in certain cases limit the applicability of economic tools for relevant market definition.

As mentioned previously, in advanced jurisdictions such as the US and EU, when data required for relevant market analysis is unavailable, it is common practice for the competition authorities to undertake surveys to collect relevant data, particularly in relation to the perception of consumers/competitors about substitutes.[64] However, the CCI is yet to adopt this approach. For instance, in *PVR-DT*, the key determining factor for defining the relevant geographic market was the distance travelled by consumers to watch movies. Despite recognizing this, the CCI failed to undertake a proper consumer survey to determine this distance, and instead relied on the information provided by competing theatres to identify the distance that consumers generally travel to watch movies. Moreover, in instances when data is unavailable and the client conducts consumer survey to collect data for economic analysis, the genuineness of the information may be questioned by the CCI, which further limits the economic analysis provided by the parties in their submissions to the regulator.

Conclusion

Defining the relevant market correctly is key for competition assessment in abuse of dominance investigations and merger control. This paper aims to assist stakeholders in defining the relevant market correctly by discussing the commonly used economic tools to determine the relevant product and geographic market, along with examples from advanced jurisdictions. These include the SSNIP test, price analysis, catchment area analysis, and E-H test. Reliance on such economic tools to define the relevant market highlights the need for data-based evidence to determine the relevant market, provides clarity to the stakeholders on the possible approaches that can be used to define the relevant market, and enables them to rely on such empirical analysis in the future.

Further, the paper also highlights key points that need to be considered by stakeholders before relying on these tests to define the relevant market. Specifically, one needs to ascertain whether these tools are applicable or not in the given instance (given data availability and industry characteristics) and whether the methodology adopted is scientific such that it does not result in biased results.

[63] CCI Order for Combination Registration No. C-2013/10/135 (20 December 2013). Retrieved from <http://www.cci.gov.in/sites/default/files/C-2013-10-135%20Main%20Order.pdf>

[64] *Roundtable on Market Definition -- Note by the Delegation of the European Union* (June 2012). Retrieved from <http://ec.europa.eu/competition/international/multilateral/2012_jun_market_definition_en.pdf>

This paper also discusses in detail India's experience with the adoption of economic tools for relevant market definition. While the application of economic tools in competition assessment has increased in India over the years, there are still challenges related to data availability and clarity on thresholds for the applicability of economic tests that restrict stakeholders' reliance on economic analyses while defining the relevant market. Over the years, relevant market definition in India has evolved from being extensively reliant on qualitative analysis (which may be subject to discrepancy with different stakeholders arriving at different relevant market definitions) to more scientifically defined markets using economic tools.

However, there is still a long way ahead with respect to the application of economic tools to determine the relevant market in India. To improve on this, the CCI and other stakeholders need to increasingly recognize the role of economic analysis in competition assessment. Additionally, it is important to identify how data can be collected (including through surveys) that can then be relied on for economic analysis. The CCI also needs to mitigate ambiguity in relation to thresholds and analyses used so that stakeholders have better clarity – this can be achieved by developing guidelines for stakeholders. These steps are important because market definition based on economic tools and strong analysis will build a consistent body of case law and avoid the pitfalls of over enforcement and under enforcement that come along with an erroneous definition of the relevant market.

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Making Indian Pharmaceuticals Competitive: The Dilemma for Regulation

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INDIAN COUNCIL FOR RESEARCH ON INTERNATIONAL ECONOMIC RELATIONS

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1. Introduction

The Indian pharmaceutical market is large and fragmented. The industry has expanded rapidly with more than 20,000 registered units recorded recently. About 250 large units and 8000 small scale units form the core of the pharmaceutical industry in India[1]. In June 2016, the industry was valued at Rs 107,019 crores on a Moving Annual Turnover (MAT) basis. The top 10 players in the industry contribute to 43% of overall sales, and those ranked from 11-20 contribute about 21%[2]. India is the largest provider of generics drugs globally. Drug prices in India driven by intense competition in generics are among the lowest in the world. The Indian pharmaceutical industry is also the third largest in terms of volume of sales and tenth in terms of value. From a preferred destination for multinational drug manufacturing, India is now becoming the hub for other outsourcing activities such as discovery research and clinical trials. However, domestic companies continue to dominate the industry with a market share of close to 78%[3].

Public health objectives drive the host of regulations that govern this industry. Out-of-pocket health care expenditure by households in India is estimated at almost 69%[4], of which expenditure on medicines is significant. Affordability and universal access to health care are leading objectives of government policy, which include price regulations, research and development, insurance, drug procurement, patenting, drug promotion and advertising, drug safety, etc. Regulations have played a key role in how the market structure for pharmaceutical industries has evolved in India. In fact, early growth of the industry is attributed to the patent policy adopted by the government in the 1970s. Competition authorities work within this regulatory backdrop to achieve the twin objectives of promoting drug innovation and consumer welfare.

Competitive forces work uniquely in the pharmaceutical industry. The prescription drug market creates information asymmetries since the patient (consumer) who pays for the drug is not the one who selects it. Physicians, acting as agents, are the primary decision makers for the final consumer. This phenomenon intensifies the market dominance that is laid down by product patenting. Moreover, the abuse of market power is not always observable in prices. Unethical marketing, collusion along retail distribution and other exploitative practices for drug promotion are also approaches resulting in anti-competitive outcomes. Despite the large number of manufacturers, such market failures result in monopolistic and/or oligopolistic outcomes. On the other hand, excessive regulation runs the risk of limiting competition. The recent increase in price controls intended to achieve universal access may have the unintended adverse impact on viability of the industry. The estimated investment loss attributed to drug price regulation in India is USD 20 billion by 2020. Thus regulation aimed

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1 ASA & Associates LLP, July 2015, "A Brief Report on Pharmaceutical Industry in India"

2 IMS Health Market Reflect Report for June 2016

3 *Ibid*

4 National Health Accounts, 2014

at correcting for the alleged lack of competition needs careful thought. For example, regulated prices are often set higher than those achieved by free markets. Another commonly cited anti-competitive policy pursued by the Indian government is the imposition of anti-dumping duties on the import of certain bulk drugs[5].

A cross-country study on the impact of price regulation in pharmaceutical markets found that price competition between generic manufacturers was significant in relatively unregulated markets, and that regulation sometimes undermines competition in regimes where it is stringent.[6] On balance, regulatory stringency is associated with growth slowdown in the pharmaceutical sector. Evidence points to the negative impact of regulations on drug safety and quality on innovation including in developed countries. The rate of R&D productivity declined in UK due to the negative effects of increased regulation[7]. At the same time, policy makers constantly struggle to strike a balance between the cost and benefits of intervention in complex markets like pharmaceuticals where safety, access and affordability are prime drivers of regulation. The paper attempts to explore some aspects of this dilemma.

We centre our analysis around key policy changes in drug price regulation and patenting to understand its impact on market structure and prices in the industry. Section 2 briefly outlines the state of competition within the industry. Section 3 illustrates the evolution of drug price control order and the impact it has on competition and sale of drugs in the industry. In this section we also provide a comparison of drug price control regulations for India and other select countries. Section 4 briefly maps the history of patenting in India's pharmaceutical industry and evaluates the impact of policy with respect to two significant regulatory events. Section 5 concludes and offers some policy recommendations.

2. Competition in India's Pharmaceutical Industry

Drugs are divided into therapy groups, in addition to a list of unclassified formulations. Anti-infectives, cardiac and gastrointestinal are among the largest therapy groups. Therapy groups are further divided into super groups, which are subdivided into classes, followed by further reclassification into sub groups and finally formulations. Since pharmaceuticals are a large and complex industry, competition analysis at the industry level does not yield meaningful results. In an analysis from 2014, we find that the level of market concentration increases with the degree of disaggregation[8]. Illustration 1 provides the direction of disaggregation and the associated levels of market concentration at each level. Therefore, an industry that appears competitive may not in fact be, if the *relevant market* is defined correctly. Market

[5] Bhattacharjea and Sindhwani, 2014, "Competition Issues in the Indian Pharmaceutical Sector" Project Sponsored by CUTS-CIRC

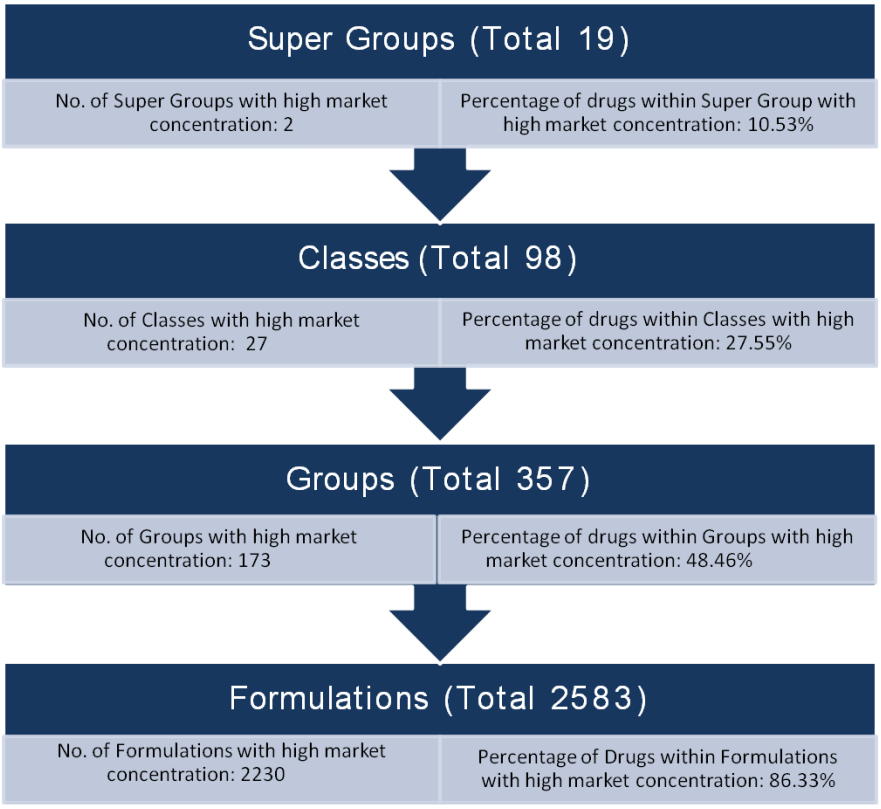
[6] Danzon and Chao, 2000, "Does Regulation Drive Out Competition in Pharmaceutical Markets?" Journal of Law and Economics, Vol 43, No 2 (October 2000), pp 311- 358

[7] Grabowski Vernon and Thomas, 1978, "Estimating the Effects of Regulation on Innovation: An International Comparative Analysis of the Pharmaceutical Industry", The Journal of Law & Economics, Vol 21, No. 1 (Apr 1978), pp 133-163

[8] Presentation by Sakthivel Selvaraj on NPPA Foundation Day Conference on Affordable Medicines for All, New Delhi , August 2016

definition is therefore at the core of competition analysis. While competition law and court decisions across jurisdictions provide the basis for defining thresholds, experience suggests that in non-merger cases, competition authorities and private plaintiffs generally argue in favour of narrow markets[9].

Illustration 1: Levels of high market concentration at each level of disaggregation within the pharmaceutical industry



In an extensive analysis on competition issues in the pharmaceutical market, Bhattacharjea and Sindhwani (2014)[10], compute measures of market concentration (price cost margins, four firm concentration, HHI, etc.) and find evidence of extreme fragmentation and concentration at the top. However, the authors assert that the measures of concentration are likely to be underestimates given that the analysis is at the industry level. The study also uses a linear regression model, employing panel data techniques to measure the impact of market share on price cost margins. The results show that higher market shares are associated with higher price cost margins. Some of the other explanatory variables driving price cost margins are export intensity, assets of the firm and R&D intensity.

Evaluation of mergers and acquisitions that accelerated post 2000 in the pharmaceutical sector is also very significant to competition analysis. The regulatory basis for merger control is that it potentially lessens competition. Companies buy out other firms to gain market power

9 Competition Law and Indian Pharmaceutical Industry, 2010, Centre for Trade and Development (CENTAD), New Delhi

10 Bhattacharjea and Sindhwani, 2014, "Competition Issues in the Indian Pharmaceutical Sector" Project Sponsored by CUTS-CIRC

or to work out strategic positioning as a global player. With the opening of FDI in the sector, multi-national corporations are increasing investments to expand presence in India. In an analysis on the impact of mergers & acquisitions (M&A)in the industry, it was established that in some cases it helped bring down prices in certain therapeutic groups, but not necessarily for selected molecules of the acquired company. In terms of product availability, the analysis suggested an increased focus on exports and launch of new products in the portfolio of the merged entity[11]. According to a recent survey of 100 companies by Grant Thorton, India will see the largest number of M&A deals in the near future. One fourth of the respondents were optimistic about acquisitions in the pharmaceutical sector. Competition authorities thus have their work cut out to ensure positive outcomes for "Access to Medicines" in the future.

In the following sections we analyse secondary data to build evidence on the effects of the drug price control order and patent policy on competition, prices and access to drugs in the Indian pharmaceutical market.

3. Impact of Drug Price Control on Prices and Competition

Drug Price Control in India was introduced with the Drugs (Display of Prices) Order, 1962 and the Drugs (Control of Prices) Order, 1963 under the Defence of India Act. This was followed by a series of Orders on price controls with different objectives and outcomes. Drug Price Control Order (DPCO) 1995 was revolutionary in that the price controls were decided on the basis of market share where only drugs manufactured by companies whose turnover or market share met the threshold limit were subject to price control.[12] The Drug Price Control Policy, 2002 revised the turnover and market share thresholds in line with increased FDI limit for greenfield investments, upto 100% under the automatic route.[13]

The Ministry of Health in 2011 introduced the new National List of Essential Medicines (NLEM 2011)[14] where drugs were divided into Scheduled and Non-Scheduled categories. Scheduled drugs were subject to price ceiling as defined in the Order, while non-scheduled drugs operated in a free market, though monitored for overcharging. The government thereafter introduced the National Pharmaceuticals Pricing Policy 2012 (NPPP 2012) to replace the Drug Policy enunciated in September 1994.

The NPPP 2012 was introduced with an objective of promulgating the principles for pricing of Essential Drugs as laid down in NLEM 2011. The NPPP 2012, proposed to regulate prices on the *principles of essentiality of drugs*. This was a departure from the market share

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[11] "Impact of Merger & Acquisitions in Indian Pharma on Production, Access and Pricing of Drug", Knowledge Partnership Programme, IPE Global. Available at http://www.ipekpp.com/admin/upload_files/Knowledge_2_39_Impact_2575324832.pdf

[12] *Ibid.*

[13] Pharmaceutical Policy-2002, February 15, 2002. Available at http://nppaindia.nic.in/may-2002/policy-02.html; Cumulative FDI in the pharmaceutical sector accounts for 5% of total FDI in India until September 2016.

[14] The earlier version of the National List of Medicines were introduced in 1996 and 2003

principle adopted in the earlier policy[15]. Regulating prices of formulations only, under the NPPP 2012 was also a shift from the earlier practice of regulating prices of specified bulk drugs. Regulation of bulk drug manufacturing hindered the entry of new companies as well as formulations into the price-controlled sector, leading to a decline in competition. It was understood that price control on formulations guaranteed price control only of specific medicines prescribed by medical practitioners.

Another change brought under NPPP 2012, was Market Based Pricing (MBP) principles for determination of ceiling prices.[16] The annual increase in price of drugs listed under NLEM 2011 is tied to changes in the Wholesale Price Index (WPI). NLEM 2015 contains a total of 376 medicines and 799 formulations. From a list of 348 medicines in NLEM 2011, 106 medicines were added, and 70 medicines were deleted[17]. NPPA started the exercise of determining ceiling prices of medicines listed in NLEM 2015 and notified the ceiling price of 464 formulations as on September, 2016[18].

3.1 Impact of Drug Price Control on Prices and Competition

There have been many critics of the new regime alleging escalation of ceiling prices under market based pricing of essential medicines or exclusion of life saving drugs under the principles of essentiality. Price controls, whether cost based or market based have their own limitations with respect to promoting competition. We compare data on scheduled and non-scheduled drugs to evaluate the impact of drug price control on the market for cardiovascular drugs in India. We measure change in volume and value of sales, prices and levels of market concentration over a five-year period from the date of notification of NPPP 2012\. We use data from AIOCD Pharmasoftech AWACS Pvt Ltd. This data captures the market for retailers/ stockists that in turn sell medicines to final consumers/ patients. Since the market structure of different therapeutic drugs varies, we cannot extend the findings of our analysis in this paper to the industry in general. However, the results from our analysis in the paper indicate the need for a detailed analysis on the efficacy of a price control policy for pharmaceuticals in India.

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[15] There was an imminent need to break away from the economic criteria/market share principle. Out of 348 medicines listed in NLEM 2011, only 34 drugs were included amongst the 74 drugs listed in the First Schedule of the DPCO, 1995. This "essentiality" criterion is met through the NLEM, which is revised from time to time in consultation with the World Health Organization's (WHO) model list of essential medicines, essential lists of medicines in various states, medicines used in various National Health Programmes and emergency care drugs

[16] Ceiling price of a drug, listed in the NLEM, is the simple average of prices of all brands having a market share of more than or equal to 1 per cent of that drug, calculated for six months prior to the date of the new Policy taking effect. The calculations are based on IMS Health's readily monitored data verified through surveys by National Pharmaceutical Pricing Authority (NPPA). The IMS price is increased by 16 per cent (as margin to the retailer) to arrive at the ceiling for retail prices.

[17] Report of the Core-Committee for Revision of National List of Essential Medicines, November 2015. Available at http://cdsco.nic.in/WriteReadData/NLEM-2015/Recommendations.pdf

[18] http://pib.nic.in/newsite/PrintRelease.aspx?relid=151146

Cardiovascular diseases (CVD) are one of the leading causes of deaths in India. The World Health Rankings on Coronary Heart Diseases ranks India at 39 out of 172 countries (higher ranks imply higher risk[19]). According to another recent report, a quarter of all mortality in the country is attributed to cardiovascular diseases[20]. Given the intensity of incidence of CVDs in India, the analysis on impact of drug price control on prices and levels of competition is significant for this therapeutic category.

From the available data we have a set of 1957 and 4134 formulations falling under the scheduled and non-scheduled[21] category of cardiovascular drugs respectively. Using Moving Annual Turnovers (MAT) from November 2012 to November 2016, we find that the market share of scheduled drugs has been declining. In terms of value of sales, scheduled drugs comprised 42.4% of the market for cardiovascular drugs in 2012 as compared to 30.7% in 2016. The average annual growth rate for quantity of sales in the non-scheduled category was 8.2% compared to 1% in the scheduled drugs category. The average annual growth rate in terms of value of sales was 16% and 2.8% for non-scheduled and scheduled drugs respectively[22].

We compute market concentration under the two categories using the Herfindahl Hirschman Index (HHI). HHI is a very common concentration measure used in competition analysis and is measured using the formula

$$\mathbf{HHI = s1\text{^}2 + s2\text{^}2 + s3\text{^}2 + ... + sn\text{^}2}$$

(where *si* is the market share of the *i*th firm, where *i* goes from 1 to n)

Estimates of annual HHI from 2012 to 2016 find that the market for non-scheduled drugs is more competitive than that for scheduled drugs, both in terms of volume and value of sales[23]. (Refer Table 1). While HHI has marginally increased within the scheduled category in the last two years of analysis, it remains more or less unchanged in the non-scheduled category[24]. Under the traditional understanding of market structure and competition we would expect prices in the market with higher concentration to be higher than that with lower market concentration. The results for price estimates in the cardiovascular therapeutic group are in fact the opposite.

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19 http://www.worldlifeexpectancy.com/cause-of-death/coronary-heart-disease/by-country/

20 Prabhakaran, Jeemon and Roy, 2016, "Cardiovascular Diseases in India: Current Epidemiology and Future Directions"Available at http://circ.ahajournals.org/content/133/16/1605

21 The scheduled and non-scheduled categorizations are based on NLEM 2015AND NLEM 2011. These do not necessarily include all formulations listed under Paragraph 19, DPCO 2013. Non-Scheduled drugs are as of 2015.

22 Refer Appendix 1 for data on sales of cardio vascular drugs

23 HHI Calculations are based on 222 companies and 1957 formulations in the scheduled category and 283 companied and 4134 formulations in the non-scheduled category.

24 A similar analysis using only 1099 formulations added under NLEM 2015, also finds the difference between HHIs for scheduled and non-scheduled drugs significant, non-scheduled drugs being the more competitive market

Using data on value and volume of sales we have computed the price of each formulation under both categories. While computing average prices we have finessed the problems of aggregation across dissimilar drugs assuming that any errors would cancel out between the two groups, scheduled and non-scheduled. The average price of all non-scheduled drugs is consistently higher than that for scheduled drugs over the five-year period. The difference in prices between the two categories ranges from 29% in 2013 to 51% in 2016 (Refer Table 1). A two sample t-test finds the means for the two groups to be significantly[25] different for each of the five years.

Market distortion created by regulatory intervention can partly explain these results. We hypothesize that firms manufacturing drugs under the scheduled category may have been forced to exit the market, finding business increasingly unprofitable. On the other hand the market for non-scheduled drugs having become more attractive could have witnessed an upsurge in the manufacturers. This also explains the steady increase in sales of drugs in the non-scheduled category vis-à-vis the scheduled category.

Table 1: Comparison of HHI in the Scheduled and Non-Scheduled Drugs within the Cardio Vascular Therapeutic Group

	HHI By Quantity		HHI By Value	
Year	**Scheduled**	**Non-Scheduled**	**Scheduled**	**Non-Scheduled**
2012	0.038	.039	0.042	.037
2013	0.039	.039	0.042	.037
2014	0.039	.04	0.042	.037
2015	0.04	.04	0.044	.037
2016	0.04	.04	0.043	.037

Source: Author's estimates based on AWACS data

Table 2: Comparison of Prices for Scheduled and Non-Scheduled Drugs within the Cardio Vascular Therapeutic Group

Year	Average Price (in Rs)		Difference in price between the two categories (in %)
	Scheduled	**Non-Scheduled**	
2012	56	74	31.9
2013	59	76	28.5
2014	57	77	35.2
2015	58	81	39.98
2016	57	86	51.1

Source: Author's estimates based on AWACS data

A preliminary analysis of market structure for the cardiovascular therapeutic category does not conclusively reflect if the access and affordability objectives of price control have been achieved. There could be drivers other than price control explaining why demand and competition are higher in the non-scheduled category. These include consumer preferences, marketing strategy of pharmaceutical companies, exploitation of lacunae in the price control regime (such as use of irrational combinations to circumvent price ceilings), etc. Moreover,

[25] Two –tailed significance level of 0.05. Refer Appendix 2 for test results

HHIs are one of the many measures used in competition analysis. Besides market concentration ratios, comparisons of price cost margins of different manufacturers also facilitate a strengthened understanding of market structures. The scope of this study is limited in that way.

We conduct the same analysis at the class and group level within the cardio vascular therapeutic group to identify reasons for existing consumption patterns despite the exercise of an extensive price control regime.

Within the cardiovascular therapeutic group, *Agents acting on the renin- angiotensin system* is the largest class of formulations (with respect to number of formulations) with 637 and 1099 drugs under the scheduled and non-scheduled category. Within this class, the sale (by volume) of non-scheduled drugs has increased annually at a rate double than that for scheduled drugs on average. For sale in terms of value, this ratio is about three times[26]. The HHI estimates[27] for the market of *agents acting on the renin-angiotensis system* also reflect outcomes that are similar to that for the overall market of cardiovascular drugs. In fact, the non-scheduled market in this class of drugs is much more competitive than the scheduled category (Refer Table 3). At the same time, price difference between scheduled and non-scheduled drugs of this class is more pronounced than that for the super category of cardiovascular drugs. Price within the non-scheduled category has steadily increased, while that for scheduled drugs has remained range bound (Refer Table 4).

Table 3: Comparison of HHI in the Scheduled and Non-Scheduled Drugs within the Agents Acting on the Renin-Angiotensis System Class

	HHI By Quantity		HHI By Value	
Year	**Scheduled**	**Non-Scheduled**	**Scheduled**	**Non-Scheduled**
2012	.051	.03	.071	.032
2013	.048	.025	.072	.031
2014	.049	.023	.073	.029
2015	.051	.023	.073	.029
2016	.054	.023	.076	.031

Source: Author's estimates based on AWACS data

Table 4: Comparison of Prices for Scheduled and Non-Scheduled Drugs within the Agents Acting on the Renin-Angiotensis System Class

Year	**Average Price (in Rs)**		**Difference in price between the two categories (in %)**
	Scheduled	**Non-Scheduled**	
2012	44	71	59.9
2013	46	74	60.04
2014	46	76	65.4
2015	47	80	70.8
2016	46	84	83.3

Source: Author's estimates based on AWACS data

[26] Refer Appendix 3 for data on sales of drugs within this class

[27] The HHI estimates are based on 408 companies and 1099 formulations within the non-scheduled category and 143 companies and 637 drugs in the scheduled category

We finally move to the level of the Group, which is the second most disaggregated level of drug categories[28]. We use the second largest group *Angiotensin II Antagonists, Plain* to make comparisons between the scheduled and non-scheduled markets. The *Angiotensin II Antagonists, Plain* group includes 497 scheduled and 57 non-scheduled drugs. Tables 5 and 6, use the same format as that for the broader category of drugs to offer some analysis.

Angiotensin II Antagonists, Plain is a group dominated by scheduled drugs. However, the growth rate in sales continues to be higher for the non-scheduled category[29]. The HHI[30] comparisons are reversed within this group. The scheduled category shows a higher degree of competition. This may be because the group includes a larger variety of scheduled drugs and also because drugs within the non-scheduled category sub-groups such as Candesartan, Valsartan and Olmesartan are served by few manufacturers including Micro Labs, Ranbaxy, Zydus Cadila and Indus Cadila. The average price within the non-scheduled category remains higher as in most other cases. However the difference is smaller than that in the broader categories of analysis that are well represented by both scheduled and non-scheduled drugs. This is the only case where our theoretical understanding of competition analysis holds true (markets with higher concentration exhibit higher prices), but does not adequately explain outcomes of a price control regime in the absence of a large sample of non-scheduled drugs.

Table 5: Comparison of HHI in the Scheduled and Non-Scheduled Drugs within the Angiotensin II Antagonists, Plain Group

	HHI By Quantity		HHI By Value	
Year	**Scheduled**	**Non-Scheduled**	**Scheduled**	**Non-Scheduled**
2012	.067	.186	.091	.209
2013	.06	.173	.0896	.185
2014	.061	.175	.0897	.187
2015	.064	.173	.0904	.186
2016	.066	.174	.0971	.178

Source: Author's estimates based on AWACS data

Table 6: Comparison of Prices for Scheduled and Non-Scheduled Drugs within the Angiotensin II Antagonists, Plain Group

Year	**Average Price (in Rs 10,000)**		**Difference in price between the two categories (in %)**
	Scheduled	**Non-Scheduled**	
2012	46	51	10.8
2013	48	50	4.2
2014	49	56	14.3
2015	49	57	16.3
2016	48	59	22.9

Source: Author's estimates based on AWACS data

[28] We do not use the group Angiotensin II Antagonists + Diuretics with 582 formulations for analysis since 579 drugs within this group fall under the non-scheduled category and do not offer scope for comparison.

[29] Refer to Appendix 4 for data on sales within this group

[30] The HHI estimates are based on 27 companies and 57 formulations within the non-scheduled category and 132 companies and 497 drugs in the scheduled category

The basic elements of the Structure- Conduct- Performance paradigm, would suggest that our results of higher market concentration from HHIs, point towards cases of market abuse that is an increased entry barrier and higher price cost margins of leading firms in the defined market. Our results on the contrary, reflect that in categories where both scheduled and non-scheduled drugs are adequately represented, the usual outcomes do not hold true. This, as suggested above, could be a result of market distortions created by regulatory intervention. We hypothesize that price regulations drive out competition from India's pharmaceutical markets resulting in higher HHIs within the scheduled category when compared to the non-scheduled category. Companies finding business unviable under the price control order may eventually exit the market or shift to manufacturing of formulations that fall outside the price regime. The policy outcome, as is true for some other countries, may be counterproductive, completely failing its objective to facilitate affordable access to medicines. Over the five-year period, scheduled drugs, at least under the cardiovascular category, have not shown a comparable increase in sale to the unregulated category, which by virtue of market-based competition have grown in volume and value.

Analysis of the cardiovascular therapeutic category is by no means sufficient to draw conclusions on the efficacy of the overall price control regime in India. The fragmented nature of the industry limits the scope of a broad-brush analysis on the state of competition. While the paper attempts to drill down to disaggregated levels of the market, abuse of market power could arise from exploitative practices of a manufacturer in a very small segment of the market. Lower HHIs do not rule out the possibility of abuse of dominance. We often find competition authorities dealing with issues on a case-to-case basis to overcome this problem. Defining the relevant market ex-ante is particularly restrictive in its capacity to determine the level of market competition or abuse of dominance.

While absence of regulation is not a proposal that follows from the analysis, for an industry with serious implications on health and safety of citizens, drug price control ought to be rigorous and evidence based. In recent times price control has led to a wide-range of legal disputes thus resulting in suboptimal resource allocation that eventually detracts from the twin objectives of affordability and access. Litigation on issues of overcharging has led to increased demands on administrative resources and regulatory costs. We discuss this issue in more detail in Section 3.4 of the paper. The next section provides a few illustrations from the experience of other countries in drug price control. There are several challenges related to identification of essential drugs, determination of reference prices/ ceiling prices, etc. which price control regulations must invest in. Whether or not price control will benefit pharmaceutical manufacturing and its consumption in India is a question that requires deeper investigation at different levels of disaggregation within the industry. Policy makers must recognize the resultant trade-offs from such interventions.

3.2 Benchmarking and Comparison of Drug Price Regulations

In every country across the globe, it is almost safe to state that healthcare objectives remain uniform. Drug price control by governments is a way of plugging unnecessary healthcare costs and achieving the objective of universal access to healthcare. This is a process wherein

instead of relying on market demand to determine the price of a drug, the government intervenes to set the price of a drug in whatever manner deemed fit.

A report by the U.S. International Trade Administration found that at least 11 Organization for Economic Cooperation and Development (OECD) member countries adopt some form of price control for drugs. In the report it was observed that the aggregate prices for popular patented drugs were almost 18 to 67 per cent lower in the OCED member countries with price control mechanisms than in the unregulated market of the United States.[31]

While there is ample support and also evidence towards government price controls enabling access and affordability of drugs, the policy is oftentimes perceived as a threat to innovation and competition. However, a closer look at the structure of pharmaceutical markets reveals that this complex market is built through provisional monopolies facilitated by patent protection. In the absence of regulation, the pharmaceutical companies are empowered to arbitrarily set a price at the cost of patients. This is especially unfair in the case of exploitative pricing for life saving and other essential medicines where patients have to endure massive costs. Thus it becomes imperative for the price control regimes to balance the interests of pharmaceutical companies and the consumer while facilitating profits for the former and containing costs for the latter. As regards innovation, the governments once again have to incentivize innovation through various policies and also subsidize research in pharmaceuticals wherever possible.

Both developed and developing economies have adopted price regulation policies to prevent pharmaceutical companies from over charging. The most popular methods include reference pricing,[32] approval delays and procedural barriers, restrictions on dispensing and prescribing, and reimbursement. Of these, the straight forward of them all is where the government decides the sale price of drugs and penalizes any sale in violation of such price.[33]

From Table 7 below, it becomes clear that China and U.S. are the only major economies, which do not regulate drug pricing. The U.S. however is also a glaring example where the prices of prescription drugs are immoderate and exorbitant. China's latest move to deregulate drug pricing also met with severe criticism. It is not always that price control policies achieve their intended objectives, but health as a public good demands careful implementation of such policies that severely impact innovation, access and pricing.

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31 US Department of Commerce, International Trade Administration- *Pharmaceutical Price Controls in OECD Countries, Implications for US Consumers, Pricing, Research Development and Innovation.* Available at http://www.trade.gov/td/health/drugpricingstudy.pdf

32 Reference pricing (as seen from Table 7) is the most popular method adopted by countries to determine the price of drugs. It is a practice of using the price(s) of medicine in one or more countries or a therapeutic group to arrive at a standard that is further used in setting or negotiating the price of a medicine in a given country or a given therapeutic group. Legislations in some countries also provide for price monitoring in time intervals ranging between three months to five years.

33 In some of the countries reimbursement price being the de facto market price, for new drugs, is set well below the market prices and any charge above the regulated price is borne by consumers. There are also some countries where prices of drugs already on the market are subject to regular cuts by the government.

Table 7: Comparison of Drug Price Regulations across Countries

Country	Control Prices at Launch	Control Reimbursement Prices	Prescription Drugs	Patented Drugs	Reference Pricing	Financial/Profit Controls	Value based pricing	Free Pricing	Pharmacy Selling Price	Wholesaler selling price
Belgium	✓				✓				✓	
Denmark			✓					✓	✓	
Finland		✓			✓				✓	✓
France		✓			✓	✓			✓	
Germany		✓			✓				✓	✓
Ireland		✓			✓	✓			✓	✓
Italy		✓				✓			✓	✓
Luxembourg	✓				✓	✓			✓	✓
Netherlands			✓		✓					✓
Norway	✓		✓		✓				✓	✓
Spain	✓	✓	✓			✓			✓	✓
Sweden		✓					✓		✓	
Switzerland		✓			✓	✓			✓	
Turkey	✓		✓		✓	✓			✓	✓
United Kingdom	✓		✓			✓	✓		✓	✓
Canada				✓	✓		✓			
United States of America								✓		
Japan	✓				✓	✓			✓	
China								✓		
South Africa	✓				✓				✓	✓
Brazil	✓				✓					

Source: See Appendix 5

3.3 Overcharging and Legal Disputes

As stated above, NPPA, the drug price regulator currently fixes ceiling price, based on average price of all brands in a specified drug category with a market share of 1 per cent or more. In its authority to regulate drug prices, NPPA also penalizes any violation of prescribed price controls. Non-compliance with the notified ceiling price tantamount to overcharging and is liable to be recovered along with interest thereon from the date of overcharging.

In an attempt to study the price movement of medicines, during the month of August 2015, NPPA found that the prices of 4724 (829 scheduled and 3895 unscheduled) pharma Stock Keeping Units (SKUs) out of the 101,418 (12,213 scheduled and 88,811 unscheduled) SKUs studied were beyond permissible limits under DPCO 2013.[34] The remaining complied with the Order - prices of 17,226 SKUs rose within permissible limits[35], prices of 18,104 SKUs declined and there was no change in 60,998 SKUs.[36] Table 8 lists the extent of overcharging under DPCO 1995 and DPCO 2013.

Table 8: Cases of overcharging under DPCO 1995 and DPCO 2013

DPCO 1995			
Year	**Number of cases**	**Overcharge amount demanded including interest**	**Amount realised in percentage**
Upto March 2009	653	2636.3	15.23
2009-10	87	71.23	33.41
2010-11	42	107.11	19
2011-12	40	60.81	14.6
2012-13	103	129.22	8.02
2013-14	88	415.9	13.23
2014-15	91	526.06	2.26
2015-16	160	907.43	0.54
2016-17 (Upto October 2016)	19	23.72	

DPCO 2013			
Year	**Number of cases**	**Overcharge amount demanded including interest**	**Amount realised in percentage**
2013-14	2	0	
2014-15	39	53.99	100%
2015-16	103	20.45	25.53%
2016-17 (Upto October 2016)	40	6.57	11.72%

Source: NPPA

[34] Monitoring price movements of medicines under DPCO, 2013 http://www.nppaindia.nic.in/order/webisteSheetsPharmaTrac19022016.pdf

[35] *Ibid.*

[36] *Ibid.*

The Indian judiciary has also frequently reiterated and adjudged on the importance of price control and upheld price caps on drugs in various cases. The highlight is Supreme Court upholding NPPA's notification to control prices of some non-essential medicines. The Court dismissed the plea by the Indian Pharmaceutical Alliance against the 2014 NPPA notification seeking to regulate prices of 108 diabetic and cardiovascular drugs which were not included in the list of NLEM. The 2014 notification sought to regulate the prices of non-scheduled drugs. The notification was challenged on the ground that NPPA in issuing such notification had exceeded its authority.[37]

Further, the NPPA has issued internal guidelines for identifying cases and initiating action against overcharging by manufacturers and/or marketers under DPCO, 2013, 1995 and 1987. Under the guidelines, the Monitoring and Examination (M&E) division will scrutinize and identify cases of overpricing from different sources. The M&E division relies on data furnished by manufacturers or data available on the Indian Pharmaceutical Database Management System (IPDMS or Pharma Data Bank).[38] Since NPPA is itself struggling with manufacturers not submitting data online[39], the operation of these guidelines is dubitable.

NPPA issues orders and revisions in ceiling prices from time to time. The DPCO gives NPPA the power to fix ceiling prices of drugs as and when NLEM is revised. The NPPA thus recently revised ceiling prices of essential drugs twice within a matter of few months. Such multiplicity in regulations results in increasing compliance cost for manufacturers and deters submission of data and pricing in accordance with the DPCO. The increasing number of overcharging cases can be attributed to the lack of clarity in regulations and the inability of manufacturers to keep up with recurring changes in price ceilings. A robust yet clear regulatory ecosystem can improve compliance by both Indian and foreign manufacturers.

The sector is also crowded with other regulators controlling standards, pricing and quality of drugs. The Central Drugs Standard Control Organization (CDSCO) is responsible for approval of new drugs, clinical trials, quality management of imported drugs, etc. Patent authorities determine future use and market potential of a new drug. The continuous changes in regulatory requirements coupled with administrative complexities in dealing with multiple regulatory bodies, definitely impacts the ease of doing business in the Indian pharmaceutical industry.[40]

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37 *Drug pricing: Supreme Court upholds capping of prices of 108 anti-diabetes, cardiovascular drugs,* The Financial Express, 25 October, 2016. Available at http://www.financialexpress.com/economy/supreme-court-upholds-capping-of-prices-of-108-drugs/428872/

38 *NPPA issues guidelines to expedite monitoring & recovery in overcharging cases*, Pharmabiz.com, *August 29, 2016.* Available at http://www.pharmabiz.com/NewsDetails.aspx?aid=97135&sid=1

39 NPPA notice regarding submission of information through IPDMS dated 10.06.2016
Available at http://www.nppaindia.nic.in/order/ipdms10062016.pdf

40 Paul Howard, *To Lower Drug Prices, Innovate, Don't Regulate*, The New York Times, 23 September 2016. Available at http://www.nytimes.com/roomfordebate/2015/09/23/should-the-government-impose-drug-price-controls/to-lower-drug-prices-innovate-dont-regulate

While the industry has pushed for abolition of the NPPA to remove "unnecessary hurdles" and to facilitate "ease of doing business", any step in altering the regulatory framework has to be considered alongside the costs and the ensuing outcomes namely industry growth, public health, and innovation.[41]

4. Patenting Law and Impact on Market

In the absence of product patents, until before India's accession to the WTO, pharmaceutical companies were able to produce innumerable generic drugs. This helped establish India as one of the leading generic drug manufacturers in the world. In an attempt to balance access to affordable drugs alongside effective intellectual property protection, the Indian government created a law that extended intellectual property right protection to pharmaceuticals only if they constituted brand new chemical substances or enhanced the therapeutic "efficacy" of known substances - Section 3(d). This has attracted fierce criticism from industry players worldwide especially in the context of innovation.

Recent landmark decisions of the Supreme Court of India on drug patenting are illustrated below. We analyze the impact of such decisions if any, on the market of the affected drug

4.1 Novartis AG vs. Union of India[42]:

Novartis challenged the validity of Section 3(d) and contested its compatibility with the WTO TRIPS Agreement, which was dismissed by the High Court of Madras in 2007. Novartis in 2013 approached the Supreme Court in an appeal against rejection by the India Patent Office of a product patent application for the beta crystalline form of *Imatinib mesylate*. Imatinib mesylate is said to be used in treating myeloid leukemia and is marketed by Novartis as "Glivec" or "Gleevec". Upholding the rejection, the Supreme Court confirmed that the beta crystalline form of imatinib mesylate did not fulfill the test prescribed by Section 3(d). The Court also clarified that efficacy as contemplated under Section 3(d) is therapeutic efficacy.

Critics have condemned the Supreme Court decision that it is halts the progress of innovation and R&D in India.[43] But a closer look at the judgment divulges more than a plain attempt to fit the requirements of Section 3(d). Section 3(d) was proposed to address concerns that introduction of pharmaceutical product patent protection would substantially constrain the availability of medicines for the population of India and also many developing countries. The legislature sought to limit practices that might result in the grant of patents for insubstantial technological contributions.

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41 *As SC Tries Case on Drug Price Ceiling, Government Mulls Dismantling Price Control Body*, The Wire, 09 November 2016. Available at https://thewire.in/78965/as-sc-tries-case-on-drug-price-ceiling-government-mulls-dismantling-price-control-body/

42 Novartis AG vs. Union of India, Civil Appeal 2706-2716 of 2013, Supreme Court of India. Available at http://judis.nic.in/supremecourt/imgs1.aspx?filename=40212

43 *Supra note at 42.*

It is pertinent that several licenses have been granted by the Drug Controller General of India for various crystal forms of imatinib mesylate to other manufacturers, including Cipla, Sun Pharmaceutical Industries etc. Natco Pharma, one such licensee had filed an opposition to the patent claim made by Novartis India Ltd. Novartis obtained exclusive marketing rights (EMRs) for imatinib mesylate and Natco challenged the grant of EMRs for the drug to Novartis. However, in this challenge it seems like the Apex Court missed the dominant position of Natco Pharma before and post the pronouncement of the decision. During the period 2012- 2016 Natco Pharma accounted for an average 70% market share of Imatinib Mesylate. Refer to *Appendix 6* for market concentration estimates in this market.

Thus refusal to grant patent protection to Novartis by Supreme Court no doubt fulfills the mandate of Section 3(d), but does not explain how market concentration by Natco Pharma continues to remain unchallenged and of its impact on pricing. Do high HHI levels not translate into abuse of dominance or has the ethos of access and affordability failed to meet the judicial eye?

4.2 Compulsory Licensing and Bayer:

Section 84 of the Indian Patents Act provides commercial utilization of the patented invention. Any individual/ company can make a request for grant of Compulsory License after three years from the date of grant of a patent. Under a compulsory license, an individual or company seeking to use another's intellectual property can do so without seeking the rights holder's consent, and pays the rights holder a set fee for the license.

In 2011 Natco Pharma Ltd. filed a compulsory license application for Bayer’s anti-cancer drug, Nexavar. Bayer was selling the drug at 2.8 lakh for a monthly course, while Natco agreed to make the same available at about 3 per cent of Bayer’s price. The Controller of Patent decided against Bayer on grounds of not meeting reasonable requirement of the public at a reasonable price and patented invention not being worked in India. In the order granting the license, the Patent Controller had noted that as against the demand of 8842 patients in the year 2011, Bayer had supplied the drug to less than 200 patients after more than three years of the grant of the patent. The Patent Controller granted the license to Natco with royalty rate of 6% further increased to 7% on appeal. On approaching the Apex Court, in what came to be a landmark judgment, the Supreme Court of India, refused to entertain Bayer’s plea to set aside the compulsory license on Sorafenib (Nexavar).

Yet again, Bayer’s failure to have the compulsory license set aside on Nexavar, did not have a significant impact on the market structure. It is clear that the price of Bayer’s Nexavar was exorbitant and that Natco Pharma sought to manufacture the same drug at a much lesser price through a compulsory license. However, Cipla has for long now manufactured and sold the drug at about the same price claimed by Natco Pharma under the compulsory licensing

proceedings (Refer Table 9). It is also said that Cipla was selling "at risk" in the absence of a compulsory license[44].

Judicial interventions through two landmark precedents have left market conditions unchanged. The courts in anticipation of market abuse, have delivered appropriate judgments but their impact on market outcomes are still to be witnessed. It is concerning as the costs to such procedures are high. However, one can hope that such judgments prevent the market from exploitations driven by similar approaches in the future. At a time when the policy makers are grappling with the issue of drug pricing, it is more imminent than ever to rethink the mandate and objective of price control vis-à-vis patenting in the India's pharmaceutical context.[45]

Table 9: Market for Bayer's Nexavar drug before and after the compulsory licensing order

Drug Name	Company	Quantity (in '000)					Price (in Rs)				
		MAT Nov 2012	MAT Nov 2013	MAT Nov 2014	MAT Nov 2015	MAT Nov 2016	MAT Nov 2012	MAT Nov 2013	MAT Nov 2014	MAT Nov 2015	MAT Nov 2016
NEXAVAR 200 MG TABLET 60	BAYER PHARMACEUTICALS PVT. LTD.	0	0	0.1	0.09	0.06			116986	116986	116986
SORAFENAT 200 MG TABLET 120	NATCO PHARMA LTD	0	0	0	38.59	53.64				6766	6766
SORANIB 200 MG TABLET 120	CIPLA LTD.					0.01					6840
SORANIB 200 MG TABLET 20	CIPLA LTD.	3.11	6.49	17.34	5.44	20.77	4824	1653	1475	1638	1578

Source: Author's estimates based on AWACS data

5. Conclusions

In the recent past, rapid developments in the pharmaceutical sector have led to the creation of novel drugs thus facilitating better health and saving lives. In India with its income disparities and limited access to health care, the pharmaceutical industry has a pivotal role to play in ensuring fundamental rights and welfare of citizens. The state facilitates achievement of these objectives that are enshrined in the Constitution of India.

As a largest provider of generics medicines globally, with a 20 per cent share in global generics exports, the Indian pharmaceutical industry is poised to be the third largest

[44] Shamnad Basheer and Rupali Samuel, *Bayer's Nexavar and the "working" of Compulsory Licensing: Mind The Patent (Information) Gap!*, Spicy IP. Available at https://spicyip.com/wp-content/uploads/2015/04/Report-on-Bayer-for-writ-Finalized.pdf

[45] *Govt seeks views on pricing patented drugs*, Live Mint, September 23, 2016. Available at http://www.livemint.com/Politics/kVTTeIKZsy3xLYlNYeKCWO/Govt-seeks-views-on-pricing-patented-drugs.html

pharmaceutical market by 2020. While India's pharmaceutical industry boasts of a relatively lower cost of production than that of U.S. and Europe, it is also important to have a supportive enabling and comprehensive regulatory framework. Although the industry shows great potential and progress, backed by a comprehensive regulatory framework, it is bound to witness not only more competition but also facilitate accomplishment of primary health policy objectives.

The absence of national healthcare system, reimbursement schemes and rising costs of medicines coupled with out of pocket expenditure for medicines and drugs by consumers make India's pharmaceutical sector further unique. Although initiatives like Pradhan Mantri Jan Aushadi Yojana, increase availability of generic drugs at lower prices, there is need to widen the scope of existing policies to address the demand for these drugs in India and also worldwide.

Generics are no doubt available for prices lower than in most other countries, but India's pharmaceutical industry has come under scrutiny for the poor patent protecting standards affecting not only innovation in drugs but also the cost for many multinational manufacturers.

Thus, there has been a need more than ever to study the interaction of innovation, profits, access and regulation in the context of India's pharmaceutical industry. Through this paper, we have thus attempted to understand the impact of regulation on market structures and competition in the industry while analysing data on pricing, sales, etc. The main focus of our inquiry is drug price control regulation and patenting policies in India. However, other factors in enabling competition and the objective of universal healthcare cannot be ignored. The results of the study should be viewed as interim and aimed at initiating further discourse on the regulation competition interface in the pharmaceutical industry. As explained earlier, the pharmaceutical market is highly fragmented and the results are not easily generalisable given that the study focuses on one amongst the many therapeutic groups and two amongst the many crucial regulations concerning the industry.

Our analysis shows that the intended objective of price regulation, i.e., affordable access has not been realized in full. A cautionary word is on order though. At best of times it is difficult to achieve competitive outcomes in regulated markets due to well known reasons. The interplay of regulation and competition should be examined empirically by expanding this analysis to other therapeutic groups to strengthen the hands of policy makers. Thus it is critical to measure the costs and benefits of regulating price and innovation in the pharmaceutical industry. While deregulation and free markets may not be the road ahead, but time is ripe to test the effectiveness of alternative policies to achieve similar objectives. Any step forward should be taken with a detailed understanding of the market in its entirety, purchasing power, insurance, procurement schemes and the like.

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Appendix 1: Sale of Drugs in the Scheduled and Non-Scheduled categories of Cardiovascular Drugs

Year	Quantity (in '000)		Value (Rs Crore)	
	Scheduled	Non-Scheduled	Scheduled	Non-Scheduled
2012	660433	777097	2522	3415
2013	662993	835839	2605	3917
2014	668210	907408	2586	4551
2015	680129	1014992	2832	5446
2016	688825	1064448	2801	6312

Source: Authors estimates from AWACS

Appendix 2: Results from a Two-Sample t test with equal variance to measure the difference in average price of scheduled and non-scheduled drugs in the Cardiovascular Therapeutic Group

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------------------------------------------------------------------------------------------------
   Group    |        Obs       Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
------------+-----------------------------------------------------------------------------------
       0    |       1375    .00557    .000505    .018726    .0045793    .0065606
       1    |       2454   .0073872   .0002189   .0108421    .006958    .0078164
------------+-----------------------------------------------------------------------------------
combined    |       3829   .0067346   .0002297    .014211    .0062844    .0071849
------------+-----------------------------------------------------------------------------------
    diff    |                -.0018173   .0004779               -.0027542   -.0008803
------------------------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -3.8028
    Ho: diff = 0                                     degrees of freedom =     3827

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0001         Pr(|T| > |t|) = 0.0001          Pr(T > t) = 0.9999
```

Appendix 3: Sale of Drugs in the Scheduled and Non-Scheduled categories of Agents Acting on the Renin-Angiotensin Class of Cardiovascular Drugs

Year	Quantity (in '000)		Value (Rs Crore)	
	Scheduled	Non-Scheduled	Scheduled	Non-Scheduled
2012	159987	142719	717	888
2013	162675	153938	761	1021
2014	165593	166929	776	1167
2015	180814	189327	860	1391
2016	187074	196761	882	1568

Appendix 4: Sale of Drugs in the Scheduled and Non-Scheduled categories of Angiotensin II Antagonists, Plan Group of Cardiovascular Drugs

	Quantity (in '000)		Value (Rs Crore)	
Year	**Scheduled**	**Non-Scheduled**	**Scheduled**	**Non-Scheduled**
2012	119715	2919	530	22.04
2013	121710	3264	569	18.48
2014	128428	3569	597	14.87
2015	145610	4125	702	13.23
2016	152097	4527	733	11.61

Appendix 5[46]

Country	Drug Price Controls
Belgium	ERP on the basis of average price of reference country or alternatively the price in the country of origin is used as supportive guide. Price cuts were introduced in 2013 on the basis of international prices for reimbursed patented medicines, which are prevalent in the market for at least five years. Requires a price to be negotiated with national authorities before a prescription medicine can be marketed.
Denmark	ERP acts as a price ceiling for new medicines in the hospital sector and contribute to cost containment. Medicinal products used in public hospitals are available free of charge for patients. In the out-patient sector, prices are set by the manufacturers (free-pricing). There have been instances where Market authorization holders (MAH) have lowered the prices to maintain general reimbursement status for a drug. Prescription only drugs are partly reimbursed upon being granted an automatic or conditional reimbursement status upon application from the MAH.
Finland	No requirement on MAH/distributor or local representative to obtain approval of the price or reimbursement status for drugs before they are placed on the market. But reimbursement available only when the MAH has applied for, along with a reasonable wholesale price and the Pharmaceutical Pricing Board has confirmed these. A drug can be thus be marketed without a confirmed reasonable wholesale price but the same is not eligible for reimbursement under the Health Insurance Act. Reasonable wholesale price is the price of the drug in countries situated in the European Economic Area. Reference pricing is adopted where drugs are divided in reference groups by substances. Reference prices are determined based on MAH's price notifications.
France	A manufacturer is free to decide whether or not to be a part of the reimbursement regime. Price negotiations are key to the reimbursement regime. Pharmaceutical companies based on the quantities of drugs sold pay a tax called "remises". Each year, market is divided into therapeutic groups of products and allows a level of

[46] *Pricing and Reimbursement Questions*-Conference Bleue--European Lawyers' Conference on Pharmaceutical and Healthcare Affairs; Available at http://www.arthurcox.com/wp-content/uploads/2015/06/Pricing-and-Reimbursement-Questions.pdf; European Commission, *Study on enhanced cross-country coordination in the area of pharmaceutical product pricing;* Available at http://ec.europa.eu/health//sites/health/files/systems_performance_assessment/docs/pharmaproductpricing_frep_en.pdf; *A Kaleidoscope of Drug Price Control Spanning Across the World and Its Relevance to India-http://www.tapanray.in/a-kaleidoscope-of-drug-price-control-spanning-across-the-world-and-its-relevance-to-india/*

	increase in the quantity of drugs sold for each of these groups. If the increase is beyond the authorized level, a percentage of the income has to be paid by the company selling products within the said group. There is also remise on the turn over of the company if the yearly turnover exceeds the fixed percentage. The price of a generic drug is at least 60 per cent less than the price of the innovator product. The price of innovator drug however has to decrease gradually to the price of the 1st generic drug within a 5 year period. The first reduction of price of the innovator drug is 20 per cent at the launch of the 1st generic drug.
Germany	Combination of free pricing, EPR and VBP. An early benefit assessment is conducted for medicines with a new active ingredient based on the remuneration calculation model. MAH are empowered to set prices which are reimbursed entirely and a year later, the price are renegotiated taking into account the results of the assessment. Considering the added therapeutic benefit, the Federal Joint Committee decides on the added value and price negotiations, taking into account also the international prices. Laws provide for EPR but not used in practice. Reference price groups often drive the reimbursement price once generics enter the market. The doctors are required by law to prescribe the cheapest of the therapeutically equivalent drugs and this often means generics become a favourite eventually.
Ireland	EPR is a supportive guide to set prices for new single source on-patient medicines while it is the guiding point for re-alignment of existing prices. Maximum Retail Price for prescription drugs are determined in relation to the price of the same product in the neighbouring countries using a published formula. Upon entry of a generic, the price of the patented drug is reduced to 70% of the original price with a further reduction to 50% of the original price twelve months following the initial price reduction.
Italy	Average European price for old drugs and a contractual model derived price for new. For prices outside the reimbursement scheme, the manufacturer freely sets the prices. Mostly ex factory prices is the maximum sale price to the public hospitals but in within the public procurement, discounts are manufacturer's individual discretion. In order to maintain competition, the offered prices ought to consider the reference average price for the concerned category of drugs and significant deviations from the average price is not considered appropriate. The drugs in the non-reimbursed category are subject to a statutory 50% price cut when sold to public hospitals. Generics and bio-similar are placed in the same category as the parent referenced product. The price is deemed to be "clearly convenient" when it is lower than the price of the patented drug according to the prescribed reduction percentage (20% or lower). The rebate of this nature is dependent on the price of the original drug and the average national health expenditure over the last 3 year period on the original drug.
Luxembourg	The Ministry of Social Security controls all products registered as "medicines" under its "national number". The price is the ex factory price which refers to the price charged by the manufacturer. The Health Ministry established a list of groups of products called generic groups containing the same API no longer protected by patent. EPR is applied for reimbursed, prescription only and innovative drugs with the price calculated based on the lowest price in basket of referenced countries.
Norway	The Norwegian Medicine Agency regulates maximum pharmacy purchasing price and the pharmacy mark up for prescription only drugs irrespective of their patent protection. The prices of over the counter (OTC) drugs are not regulated. The prices of generic prescription only drugs cannot exceed the maximum market price of the original product. Under the stepped price model introduced in 2005, a maximum reimbursement price is set for affected medicines (branded and generics included), and this price level is reduced in steps following the patent expiry. The size of price cuts depends on annual sales before establishment of generic competition and the time since competition was established. Stable generic competition is a precursor to

	application of stepped price model and happens when the products are placed on the substitution list and no delivery issues are recorded. The price reduces by 30% when stable generic competition takes place and 55% six months after this.
Sweden	Although there is no traditional price control for drugs, the pharmaceutical companies experience difficulties in selling their products (other than OTC) without being a part of the reimbursement regime. VBP, decided on the basis of 1) societal perspective- principles of human value, need and solidarity and cost effectiveness. 2) Threshold value- based on the individuals' willingness to pay for a quality adjusted life year gained. 3) Marginal decreasing utility of treatments- that the benefits of a treatment vary by indication or by degree of severity.
Switzerland	To ensure cost effectiveness, in case of a high priced drug, whose sales are not estimated at the time of launch, the authority is empowered to fix a sales cap and the company is then obliged to transfer sales above such cap to a general account of the health insurances. Following ERP, the ex factory price cannot be higher than the average ex factory price in the referenced countries. In addition to the price comparison, there is also a therapeutic cross comparison conducted if the product is unavailable in the foreign market. No explicit legal requirement to lower the price upon entry of a generic into the market, but the competent authority is empowered to assess the price of the branded drug upon expiry of patent and the price is lowered by this time.
Turkey	Using the reference pricing method for originator products, the price is arrived according to the lowest ex-factory price among the selected five EU countries. In case of non-availability of ex-factory price, the price is calculated by deducting mark ups and VAT from the retail price.
United Kingdom	MAH are empowered to freely determine the prices of branded medicines with a new active ingredient subject to the Pharmaceutical Pricing Regulation Scheme (PPRS) that regulates the maximum profit of manufacturers. This freedom to fix prices is subject to the prior approval of prices by the Department of Health. With respect to the new branded medicines by companies who are members of the PPRS, the Secretary of State is empowered to specify the maximum price at which the product can be brought to the National Health Service (NHS). Products not subject to NHS are not regulated. Although there is no requirement for the manufacturer to comply with the price of a new non-branded generic with the Health Department, the Department under its voluntary price regulation scheme with the generic manufacturers has established that the generics can be priced freely except that the price cannot exceed that of the branded product. VBP is followed based on the Quality Adjusted Life Year (QALY) gains in relation to costs (innovation, burden of illness, rare diseases, wider societal benefits etc., are considered)
Canada	Only the patented drugs are subject to price control. These prices are regulated in a manner that the price is along the lines of the cost of therapy for existing drugs sold in Canada used to treat the same disease. The existing patented drug prices cannot increase by more than the Consumer Price Index. The Canadian prices of patented medicines can never be the highest in the world. Public drug plans control drug prices through listing of drugs on their respective formulations for reimbursement. A maximum ex-factory price is determined at the federal level by reference to prices in other countries for most innovative products and with reference to existing prices in Canada for less innovative ones.
United States of America	Free market pricing is observed in pharmaceutical companies for three apparent reasons: 1)Direct advertisements by manufacturers to patients has ensured sustained demand. 2) Price increases have been largely invisible to both patients and their doctors, because of the health-insurance plans. 3) Medicare, the public-health programme for those aged 65 and older, is the largest drug customer, but is not allowed to negotiate prices with drug companies.
Mexico	Price caps on patented medicines based on international referencing on the average

	ex-factory price in six largest markets for a given product globally. Reimbursement methods exist but are limited to generics based on health technology assessment. MRP capped for private sector.
Japan	Ever drug needs to obtain regulatory approval prior to marketing. For a new drug to be brought under health insurance, the NHI price listing procedure is needed. Reference pricing method is adopted where price of a drug is decided based on the price of a similar comparable drug on the market. A comparable drug is identified from existing, reimbursed drugs based on similarities in indication, action, molecular formula, manner of administration, and dosage. The daily price of the new drug is set as the same daily cost of the comparable drug to ensure competition in the market. Premiums are at times added to the calculated price innovativeness/usefulness, support for small market size, and support for a pediatric indication. In the absence of comparable drug, price is calculated in the cost accounting method with profit percentage adjusted depending on the novelty, efficacy, and safety of the drug in comparison with existing therapies. The price is compared with the average price in other countries and also adjusted in case of substantial difference.
China	Prior to 2015, Chinese government set the maximum price of drugs in the country. In a 2015 policy, the government deregulated these prices allowing the market competition to determine the prices. The government would be present in a supervisory, advisory capacity to monitor prices and penalize unreasonable pricing. Under the same policy however, anesthetics and grade one psychiatric medications were still be subject to price caps.

Appendix 6: Market Share and HHI estimates for Imatinib Mesylate

	Market Share in Terms of Volume					Market Share in Terms of Value				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
ALKEM LABORATORIES LTD.	0.006	0.011	0.010	0.006	0.003	0.005	0.010	0.009	0.007	0.004
CADILA PHARMACEUTICALS LTD	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.000
CELON LABS	0.000	0.012	0.013	0.005	0.012	0.000	0.005	0.006	0.003	0.007
NEON LABORATORIES LTD	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.001
NOVARTIS INDIA LTD	0.000	0.000	0.000	0.003	0.005	0.000	0.000	0.001	0.004	0.009
ZUVENTUS HEALTHCARE LTD	0.000	0.000	0.006	0.014	0.014	0.000	0.000	0.007	0.017	0.018
SUN PHARMA LABORATORIES LTD.	0.014	0.012	0.014	0.004	0.005	0.007	0.006	0.007	0.002	0.003
INTAS PHARMACEUTICALS LTD	0.040	0.040	0.043	0.043	0.042	0.036	0.035	0.051	0.070	0.058
ZYDUS CADILA	0.031	0.086	0.136	0.048	0.036	0.009	0.027	0.064	0.028	0.026
HETERO HEALTHCARE LTD	0.001	0.001	0.001	0.002	0.000	0.000	0.000	0.001	0.001	0.000

CIPLA LTD.	0.015	0.017	0.031	0.008	0.012	0.009	0.010	0.021	0.006	0.007
RELIANCE LIFE SCIENCE	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
FRESENIUS KABI INDIA PVT LTD	0.003	0.001	0.002	0.000	0.000	0.003	0.001	0.002	0.000	0.000
UNIMARK REMEDIES LTD	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DR. REDDYS LABORATORIES LTD	0.035	0.033	0.032	0.022	0.017	0.035	0.028	0.025	0.023	0.025
LUPIN LTD	0.013	0.009	0.011	0.009	0.007	0.006	0.005	0.007	0.007	0.006
GLENMARK PHARMACEUTICALS LTD.	0.006	0.003	0.003	0.002	0.006	0.003	0.001	0.002	0.001	0.004
SAMARTH LIFE SCIENCES PVT LTD	0.000	0.000	0.000	0.005	0.003	0.000	0.000	0.000	0.000	0.000
RPG LIFE SCIENCES LTD.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NATCO PHARMA LTD	**0.830**	**0.776**	**0.694**	**0.826**	**0.834**	**0.884**	**0.871**	**0.797**	**0.811**	**0.832**
RANBAXY LABORATORIES LTD	0.006	0.000	0.002	0.002	0.000	0.003	0.000	0.002	0.003	0.000
HHI ESTIMATES	**0.693**	**0.613**	**0.505**	**0.687**	**0.699**	**0.785**	**0.762**	**0.643**	**0.664**	**0.698**

Studying Competitiveness of Indian Industry:
A Methodological Exploration

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National Conference on Competition Economics

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ABSTRACT*

This research paper aims at assessing the competitiveness of Indian industries with the ultimate objective of identifying industries with higher possibilities of collusion. In order to complement the competition enforcement toolkits of the Competition Commission of India (CCI), this paper has also made an attempt to develop a suitable competition index using firm level data of Indian industries. The methodology is based on a weighted average score against key economic indicators identified on the basis of the theoretical underpinnings from industrial organisation literature as well as the intrinsic characteristics of the industry subject to certain limitations related to aggregation and availability of the data. The results presented in the paper may provide useful inferences to the CCI in identifying and screening industries which are exposed to higher possibilities for collusion.

JEL Classification: L13, L22, L50, L70

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Studying Competitiveness of Indian Industry

A Methodological Exploration

I

Background and Introduction

Deterrence and detection of anti-competitive practices remain the most important enforcement priorities of competition authorities around the world. More than ever, competition authorities have been proactively screening the sectors by using sophisticated economic tools in their efforts to detect suspicious instances of anti-competitive practices across industries. Antitrust literature suggests that these tools have been quite effective in especially those competition jurisdictions where other competition enforcement measures such as leniency, complaints have not gained traction in triggering and reporting competition issues.

In order to complement the competition enforcement toolkits of the CCI, we have made an attempt to develop an economic detection instrument: the Competition Index (CI). This instrument has been methodologically developed through assessing the level of competition of around 66 industries[1] of the Indian economy. In developing the instrument, we have used similar approaches that have been utilized by the other competition authorities and have enhanced those approaches by using additional techniques in our analysis. For instance, apart from simple average weighting and weighted average system, we have used Principal Component Analysis to allocate weights to economic indicators and verifying the results. The tool may help the CCI in proactively monitoring the industries for seeking out cartels and launching *suo moto* investigations in a wide range of sectors. The toolkit may also add significant value in combination investigations as it will provide a macro overview of the level of competition of the industry pertaining to the case.

[1] Complete list of industries analyzed is attached in Annexure 3

The paper is divided into ten sections. Section II reviews the related antitrust literature on empirical techniques of assessing competition in the markets. Section III discusses the indicators chosen for the construction of the index. Section IV describes the data collection process along with summary statistics. Section V presents the consistency check on the data collected. The standardization process and the weighting approaches are discussed in sections VI and VII respectively. Section VIII highlights the results of the model. In section IX, we have conducted the robustness check for the model and present the findings. Finally, section X provides the conclusion along with the limitations and caveats of the study.

II

Literature Review

Over the years, quantitative methodologies of assessing competitiveness have garnered considerable attention from antitrust authorities around the world. Competition authorities have been applying quantitative methodologies using industry level data to measure competitiveness across the levels of the industries. In the following paragraphs we will review antitrust literature which is pertinent to this study. Specifically, we shall discuss the key economic indicators that have been quite effective in assessing competitiveness across industries/sectors. In similar previous studies, number of economic indicators have been explored, developed and tested in order to measure the degree of competition or its absence. On the basis of previously conducted studies, we have discussed the implications of several economic indicators on competition or collusion including barriers to entry and exit, capital intensity, concentration, demand, interaction, product characteristics, profits and market stability. Based on the antitrust literature available, we have also briefly highlighted the empirical relationship of competition with key economic indicators.

A report by Paul A Grout and Silvia Sonderegger (2005) on "Predicting Cartels", found that higher entry barriers have a negative impact on competition and facilitate collusion. Higher entry barriers encourage formation of cartels as they decrease the competitiveness in the markets. If prices become higher in sectors with low entry barriers then it attracts more competitors in the future and will increase competitiveness in the markets. On the contrary, high entry barrier will decrease competition as the number of competitors will remain the same. The study concludes that entry and potential entry is damaging in two ways. Firstly, it destabilizes the existing cartels and also

their future probabilities due to disagreements between them. Secondly, it enhances the cartel members need to coordinate their activities, thereby making their collusive agreement more explicit and easy to prove. This argument corroborates the theoretical view that an increase in the number of market participants, either in the present or in the future, renders collusion harder to sustain.

In another study, George Symeonidis (2003) uses capital intensity and advertising intensity to measure competition. According to the research, high capital intensity has a negative impact on competition, as it decreases the competitiveness in the industry. In contrast, high advertising intensity has a positive impact on competition and increases the competitiveness in the market. The author used a comprehensive data set on the incidence of price-fixing across UK manufacturing industries in the 1950s. The econometric results suggest that collusion is more likely in industries with higher degree of capital intensity and less likely in high advertising industries.

Another indicator that has been most commonly used by researchers to measure competition is concentration. Concentration within industries has been studied and researched extensively in the past. Various quantitative techniques have been established in order to capture the magnitude of industrial concentration (Bikker & Haaf, 2012). Despite the variety of techniques, the general format of a concentration index remains as follows:

$$CI = \sum_{i=1}^{n} s_i w_i$$

Where CI is concentration index, s_i is the market share, w_i is the weight attached to the market share and n is the number of firms

Most indices use the above form as a base. The K firm concentration ratio for instance essentially sums up the market share of the largest k number of firms. The simplicity of the ratio as well as limited data requirements make it a frequently used measure of concentration. The most widely used concentration index is the Hirschman- Herfindahl index. The HHI is basically the summation of squared market shares of all firms in the industry. The squaring of market shares ensures greater weightage to larger firms. Another index is the comprehensive industrial competition index. This is the sum of the proportional share of the leading firm and the summation of the squares of the

proportional sizes of each firm, weighted by a multiplier reflecting the proportional size of the rest of the industry. There are other indicators which are being used in the industrial Organization literature as well as by practitioners are Hall Tideman index (where the market share is weighted by the firm's rank), the U index centered on the concept of inequality, the Hause index (based on interpretations of the Cournot model) etc.

Another economic linkage that has been extensively studied by the antitrust economists is the relation between competition and demand. In his paper "Competition Policy, Theory and Practice", Massimo Motta (2004) used indicators like demand elasticity and stability of demand to study linkages between demand and competition. The paper establishes that high demand elasticity has a positive impact on competition. On the contrary, stability of demand has a negative impact on competition.

Interaction is also an important indicator through which competition in an industry or market can be measured. To measure the interaction in an industry, indicators like communication, industry associations and multi-market contact were used. In a paper by Robert Porter (2005), "Detecting Collusion", the author has used communication as an indicator to measure the competition and likelihood of cartelization in an industry. He observed that communication is negatively related to competition. In another report prepared for the Office of Fair Trading, by Paul A Grout and Silvia Sonderegger, number of industry associations and competitiveness of the industry were found to be inversely related.

Other indicators that are used to measure competition in a market are innovation, productivity and prices. Innovation fosters competition as the innovation leads to lower prices or better quality products which ultimately increases the demand of the product. NERA also found that low productivity has a negative impact on competition as it is inefficient and hence will result in lower output due to which the firm will not be able to compete successfully in a market. Hence, low productivity reduces the competitiveness in the industry. The costs and pricing of goods and services are also an important factor in measuring competition. Reports and papers by NERA, Motta and Grout & Sonderegger validate the linkage between competition and the cost, as well as pricing of products. High prices have a negative effect on competition as it thwarts demand of

the product to increase. The cost of a product also impact the pricing of goods. Higher employee costs and manufacturing costs will result in higher prices which will have a negative effect on the competitiveness of the industry.

Factors that impact the competition in an industry can also be associated with the characteristics of the product. Product homogeneity and symmetry have a negative effect on competition (Motta, 2004). Motta also observed that excess capacity and inventories decrease the competition in the market. Lorenz (2008) noticed that that low capacity utilization, dysfunctional growth of capacities and low volatility of market shares have a negative effect on market shares. These indicators are related to the symmetry and stability of markets in the industry.

Profits have also been used as an indicator to measure competition. Typically, high and stable profits are linked with anticompetitive markets. Price cost margins are frequently analyzed in order to determine the nature of competition in an industry. Higher margins suggest prevalence of anticompetitive tendencies. For instance, if competition is intensified through a reduction in entry barriers, the incumbents are forced to lower prices to compete with the entrants. A rise in competition is then associated with a reduction in price-cost margins.

Profit elasticity is a new concept that has been used in this area (Boone, 2008). Essentially, this requires measuring the percentage fall in a firm's profit in response to a 1% fall in the firm's efficiency. A fall in efficiency would lead to a fall in profits for all types of firms (including monopolists). However, in more competitive markets, the fall would be steeper. Hence, it can provide a fair idea with regards to the nature of the industry.

Market stability is another economic criteria that has been frequently used as a proxy to assess the competition in an industry. Markets with high levels of anticompetitive practices generally display a stable trend. For instance, prices do not fluctuate much in these markets as they are fixed within a range. Market growth is also generally on the balanced side. Many other concepts of stability have been identified recently. For instance, Lorenz 2008 uses indicators like technical innovation and variance of market shares as proxies for market dynamism. Stability of the number of firms, output, demand and costs are also useful indicators for measuring competition.

III

Objective, Approach and Methodology

The objective of this paper is to assess the competitiveness of 66 industries (division level) and subsequently develop a competition index which can be used by the CCI to monitor the industries and pre-empt any damaging anti-competitive behaviour. While the data presented here shows the ex-post scenario, this index can be updated on a regular basis so that a concurrent monitoring could be done. Industries displaying less anti-competitive characteristics might not attract the attention of competition authority today, however, the index if updated and monitored at a regular intervals can provide useful inferences regarding market dynamics and competitiveness of the industry. While in a free market economy, infringement by competition authorities in normal business activity can be damaging, at the same time remaining vigilant can act as a deterrent towards building up of sectoral anti-competitive character.

In the following paragraphs, we show the selection of specific indicators for this study. The first step in the construction of the index was towards selection of the indicators for developing the index. We have conducted an antitrust literature review covering economic detection instruments and various other screening methods. Based on the antitrust literature and availability of the data, we have selected nine indictors for assessing the competitiveness of the industry and subsequently developing the competition index.

HHI: The Hirschman-Herfindahl index (HHI) was selected as a proxy for concentration within industries. HHI is considered to be the best and most widely used indices among all concentration indices. Antitrust literature suggest that a higher HHI value indicates a less competitive industry. Few studies also suggest that HHI is positively related with market asymmetry. Thus, if the industry has a skewed market share distribution (i.e. a few firms enjoy the majority of the market share) then the HHI will be higher. Furthermore, the HHI is negatively related with the number of firms existing in an industry. Based on HHI, the U.S. Federal Trade Commission and U.S. Department of Justice have classified markets into three types. Markets in which the HHI is below than 1500 are characterised as ‘unconcentrated’ markets. HHIs between 1500 and 2500 indicate ‘moderately concentrated’ markets, which may or may not raise competition concerns. Markets with HHIs over 2500 are ‘highly concentrated’ and are more likely to pose competition concerns.

Number of firms: Antitrust literature indicates that an industry with more number of firms tends to be more competitive than an industry with lesser number of firms. This is because a reduction in the number of firms essentially means a direct reduction in the number of competitor.

Effective Churn Rate: The churn rate is used as a proxy to measure the degree of dynamics of an industry. It is defined as the number of firms entering or exiting an industry compared to the number of existing firms. Thus it reflects how actively the competition landscape of an industry is changing. It also provides a signal regarding entry and exit barriers. Higher barriers would mean a lower churn rate.

Survival Rate: The survival rate reflects the degree of stability of a market. It is defined as the number of firms that have been active for at least the previous five years, in relation to the average existing number of firms for those years. A high survival rate implies repeated interaction among firms. If, for instance, all of the existing companies were the only ones present in the market, for the previous five years, that might suggest possible communication, or at least mutual knowledge of the firms' strategic decisions (and therefore effortless anticipation of each other's behavior). Furthermore, the survival rate can also serve as a proxy for the entry and exit barriers. The absence of entrants or leavers (i.e. a survival rate of 1) suggests high barriers and may impede effective competition. The survival rate and the churn rate are, to some extent, similar. This aspect is incorporated in the weighting schemes.

Volatility in market shares: Markets with anticompetitive tendencies display stable market shares. Lorenz, 2008, in his paper "Screening markets for cartel detection" discussed that if the industry is open to competition then the market shares tend to fluctuate rapidly.

Market Growth: A stable market growth typically reflects an environment conducive for collusive behavior. On the other hand, collusion attempts will fail in declining market growth due to economic problem and in booming markets due to ease of market entry in such markets.

Labour Unions: Over the years, a large and rapidly expanding body of literature on implications of trade unions on competition has emerged. The economic literature suggests that inherent

functioning of the market is negatively impacted by the number of Labour unions existing in the industry and thus making the market difficult from reaching a competitive equilibrium. In our study, industries with higher number of labour unions has been assumed to represent higher anticompetitive tendencies.

Profits: As per the traditional industrial organizational theories, in a perfectly competitive market, price equals the marginal cost and thus no supernormal profits exist in such economic scenarios. On the contrary, high and stable profits are representative of imperfect markets with higher probabilities of anti-competitive activities.

R&D rate: Economic literature suggests that highly innovative markets are less prone to anticompetitive practices. Firms with high R&D expenses are assumed to be mutually competitive, whereas, the absence or avoidance of R&D expenses might point to possible collusive behavior.

IV

Data Description and Sources

For the purpose of our analysis we have used division level data from Capitaline. Out of total industries, data was available for 83 industries. However, for our study, 66 of these industries were finalized as they had data for all the 9 indicators. Besides Capitaline, we have obtained the trade union information from the labor bureau. The summary statistics for the data are provided in appendix 5.

Table 1 explains the construction of the index:

Table 1: Construction of the Index

Indicator	Process
Number of Firms	We first obtained the gross sales for all the companies for the last five years (2012-2016). Based on this, for each industry we calculated the average number of firms for those years.
Average Market Growth	Using total sales we calculated the average market growth for each industry (year on year growth in total sales).
Volatility of Market Shares	Market Shares for each company were calculated using sales figures. The volatility of market shares was estimated using the coefficient of variance (by dividing the standard deviation of each firm's market share by the

	average market share across the time period). We then took the average coefficient of variance for each firm to arrive at the volatility of market shares by industry.
Hirschman Herfindahl Index	The Hirschman Herfindahl Index for each industry was calculated by squaring and summing market shares of each firm in that industry.
Effective Churn Rate	To calculate the churn rate we identified the total entry and exit in each industry for each year[2]. This was divided by the average number of firms for each industry to get the corresponding churn rate.
Survival Rate	The survival rate was calculated by dividing the number of active firms in the last five years by the average number of firms in the same time period for each industry. Active firms were defined as those whose gross sales were greater than zero in all the five years.
Research and Development	To measure research and development, we used expenditure on research and development as a percentage of net turnover as a proxy. This figure was obtained for each company and then the average was taken to get expenditure on research and development by industry.
Profits	To measure profit margin we obtained the net profit before tax for each company for each year and divided it by the total sales. Then we calculated the median net profit ratio for each company. Industry wise net profit ratio was calculated by taking the average within each industry.
Number of Trade Unions	The number of trade unions in each industry were obtained from the Labour bureau.

V

Data Consistency

Prior to standardization, we checked for the consistency of the data. The results are presented in the figure below.

The upper triangular matrix displays the Pearson's correlation values between variables while the lower triangular matrix displays pairwise scatter plot along with the corresponding regression lines. The diagonal presents the density plot for all the nine variables.

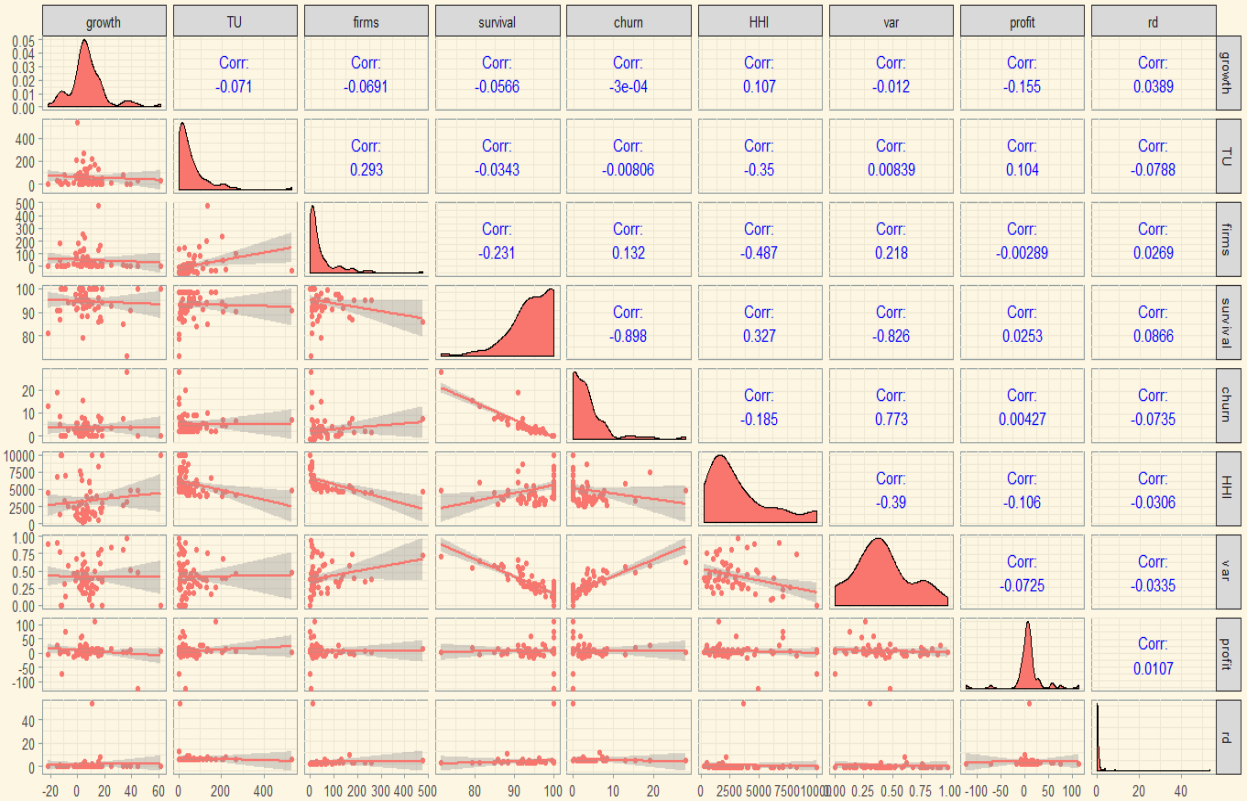
As we can see, the correlation signs reaffirm the theoretical hypothesis that we presented above. Variables like HHI, survival rate and profits which have an adverse impact on competition are positively correlated with each other while the remaining variables are negatively correlated amongst themselves.

[2] Calculation of entry/ exit of a firm is based on whether the firm had positive sales or not. This might lead to inaccurate results if there are reporting issues.

Out of 36 correlation values only 7 are above 0.3 (or below -0.3) thus signifying that the variables are not very highly correlated. These weak correlations suggest that all the variables actually add information to the model.

The density plots reveal the distributions of these variables. Market growth, variance in market share and profits before taxes display a bell curve distribution. Number of trade unions, number of firms, churn rate and R&D are skewed to the right, while survival rate is skewed to the left.

Figure 1: Pairwise Plot



VI

Standardization of Data: Using Fuzzy Logic

In mathematics, a set is a collection of things that belong to some definition. For example, let's say there is a set of tall people X. An individual belongs to set X if and only if his height is greater than six feet. If his height is less than six feet then he belongs to the set X' (not tall). Thus, an individual is either tall (belongs to X) or not tall (does not belong to X). There is nothing in between. This sharp edged membership functions works nicely for binary operations and mathematics, but it does not work as nicely in describing the real world. The regular set theory makes no distinction between somebody who is 6'1" and someone who is 7'1", they are both simply tall. In contrast, Fuzzy sets are those sets whose elements have degrees of membership. Formally:

Let X be a nonempty set. A fuzzy set A in X is characterized by its membership function $\mu A : X \rightarrow [0, 1]$ *and* $\mu A(x)$ *is interpreted as the degree of membership of element x in fuzzy set A for each* $x \in X$.[3]

Hence, the membership is defined over the *interval* of 0 to 1, instead of just two possible values of 0 and 1.

For the purpose of our analysis, we have used fuzzy sets or membership functions for all the variables. **Essentially, we have standardized all the indicators on a scale of 0 to 1, with 0 being the least anticompetitive and 1 being the most anticompetitive.** The slopes of these functions is based on competition theory. The range of all these membership functions is the minimum and maximum values of the respective indicator. Here, we will briefly comment on each indicator's slope of the membership function.

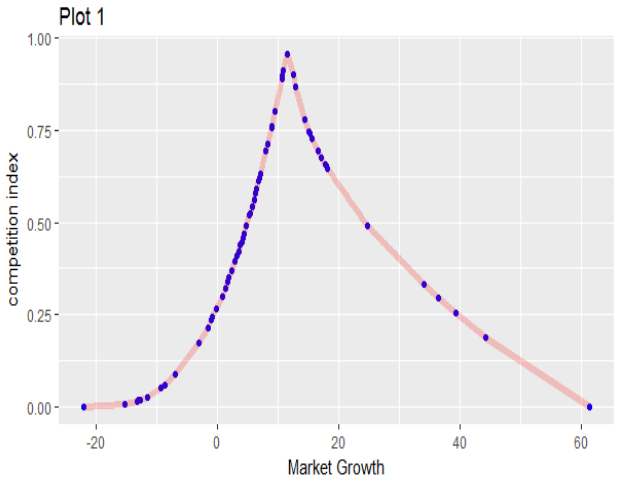
[3] (Ragin, 2000)

Figure 2 displays the market growth curve. As we can see, the curve is shaped like an inverted V. This is because we assume that anticompetitive practices are most rampant when market growth is stable and positive. It is difficult to collude in volatile markets. The functional form for Market growth is as follows:

CI=X^2 If X<12

=$1 - X^{1/2}$ If X>=12

Figure 2: Market Growth



The second variable was number of trade unions. In our analysis, we found that the number of trade unions had a positive correlation with the number of firms. This is rational since larger industries tend to have more trade unions. Hence to disentangle the impact and normalize this variable we have divided the number of trade unions by the number of firms. After that we used a membership function for standardization. Figure 3 refers to trade unions membership function (tuf). This is an upward sloping curve since higher number of trade unions would have an adverse impact on competition. The curve is concave because the marginal effect of additional number of trade unions is less. The functional form for Trade Unions is given as:

CI=$X^{1/2}$

Figure 3: Number of Trade Unions

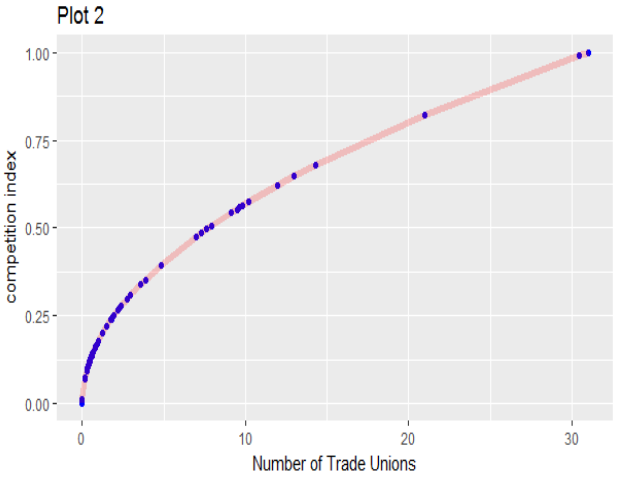


Figure 4 refers to the number of firms in the industry. This is a downward sloping curve since higher number of firms would have a positive impact on competition. The curve is steep initially and then flattens. This is because once again the marginal impact of the additional number of firms declines as the number of firms increases. For example, let's say industry X is a monopoly. Now if another firm enters the market the positive competition impact will be massive. On the other hand, let's say industry X had 500 firms. In this case, adding another firm will have negligible impact on competition. The functional form for Number of Firms is given as:

$CI = 1 - X^{1/4}$

Figure 4: Number of Firms

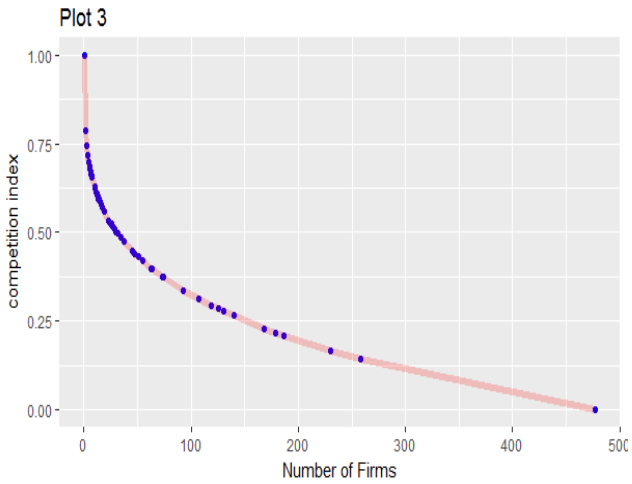


Figure 5 displays the curve for survival rate. It's an upward sloping straight line since every one percent increase in survival rate is assumed to have a constant negative impact on competition. The functional form for Survival Rate is defined as:

CI=X

Figure 5: Survival Rate

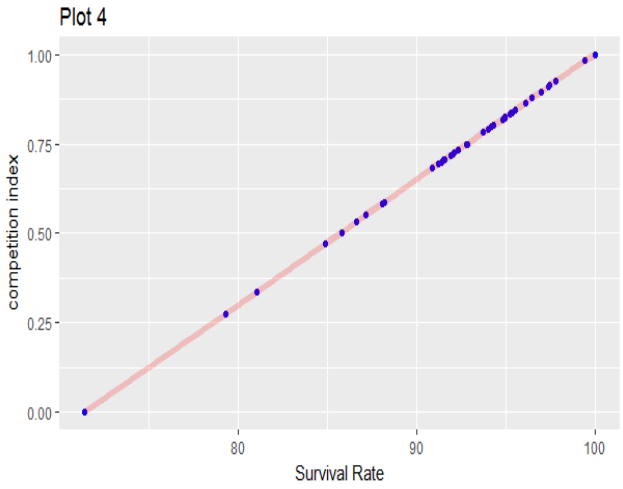


Figure 6 displays the curve for churn rate. Like the curve for number of firms, this is also a downward sloping convex curve. The reasoning is the same. The functional form for Churn Rate is given as:

CI =$1 - X^{1/4}$

Figure 6: Churn Rate

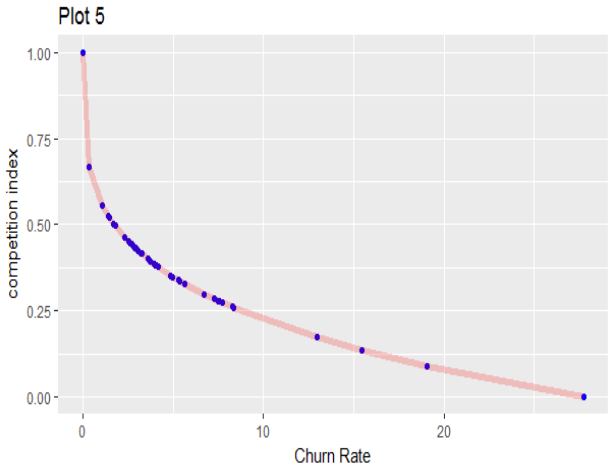


Figure 7 displays the curve for HHI. It's an upward sloping curve since higher HHI would have an adverse impact on competition. The first part of the curve is concave whereas the curve becomes convex after the 2000 mark. This is because it is after this mark that higher HHI becomes increasingly problematic. The functional form for HHI is defined as:

CI= Beta distribution with parameters 1/5 and 1/10

Figure 7: Hirschman Herfindahl Index

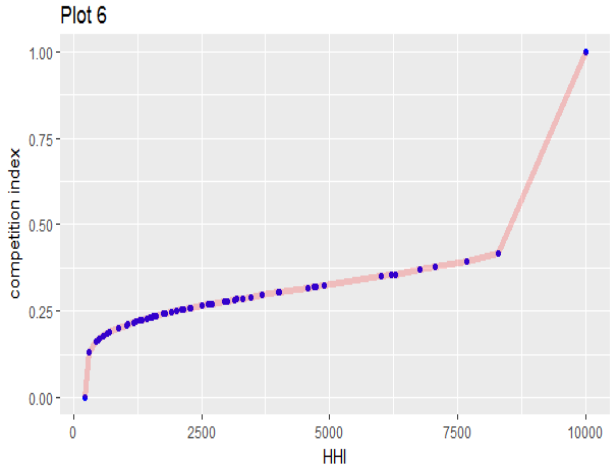


Figure 8 refers to the curve for variance of market share. Like the curve for number of firms and churn rate, this is also a downward sloping convex curve. The reasoning is the same. The functional form for Variance in Market Share is given as:

CI $=1-X^{1/4}$

Figure 8: Variance of Market Share

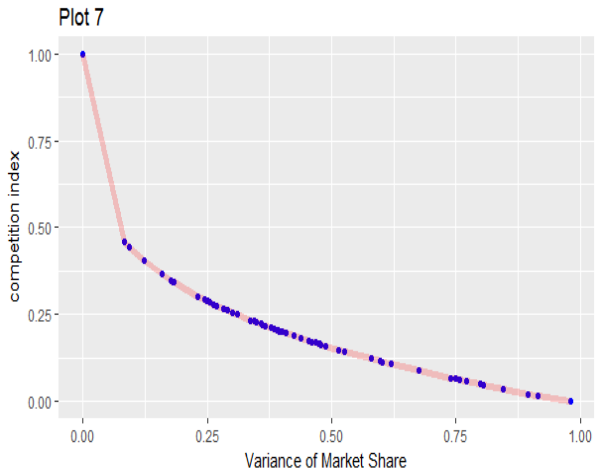


Figure 9 displays the curve for profit before taxes. It's an upward sloping curve since higher PBT would have an adverse impact on competition. The first part of the curve is concave whereas the curve becomes convex once profits become positive. The functional form for Profit before tax is defined as:

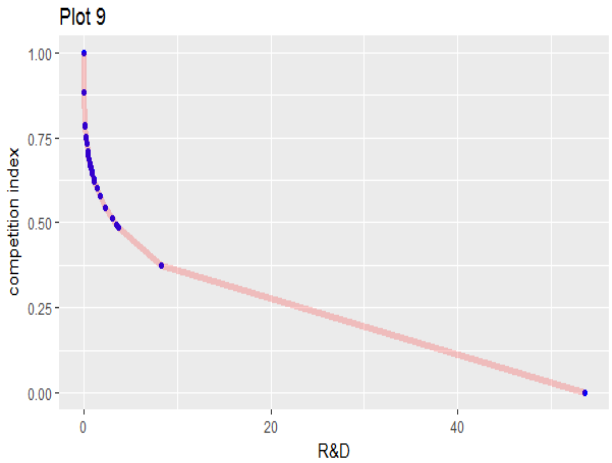
CI= Beta distribution with parameters 1/5 and 1/10

Figure 9: Profit before tax

Figure 10 refers to the curve for Research and Development. Like the curve for number of firms and churn rate, this is also a downward sloping convex curve. The functional form for Research and Development is given as:

CI $=1-X^{1/4}$

Figure 10: Research and Development



VII

Weighting Scheme

For the purpose of our analysis we have used three different weighting systems.

Table 2: Vector of Weights

Indicator	Method 1	Method 2	Method 3
Market Growth	11%	10%	1%
Number of Trade Unions	11%	15%	11%
Number of Firms	11%	5%	15%
Survival Rate	11%	5%	13%
Churn Rate	11%	5%	24%
HHI	11%	20%	14%
Variance in Market Share	11%	10%	17%
Profit Before Tax	11%	15%	1%
Research and Development	11%	15%	6%

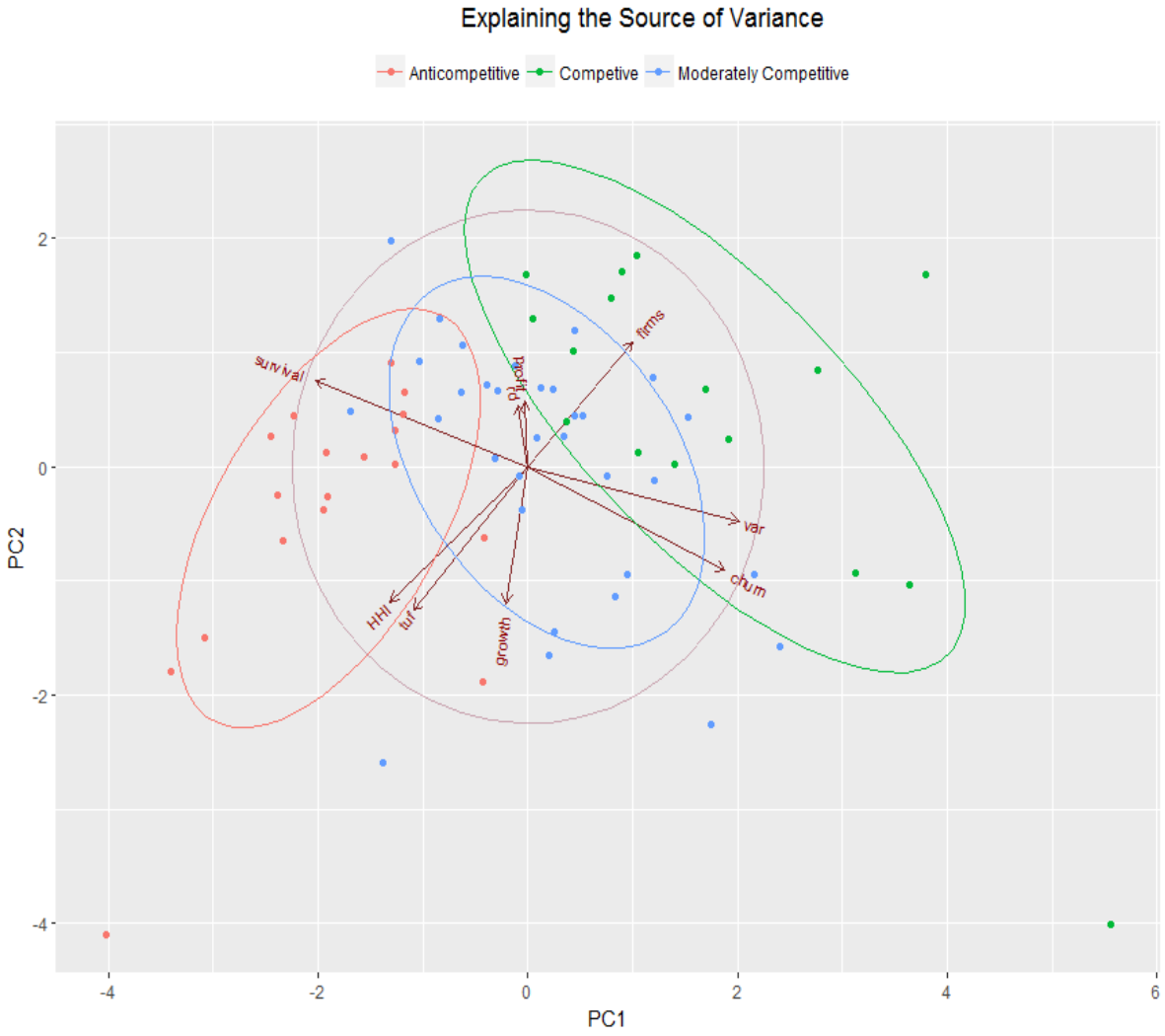
Method 1 is a simple average weighting system. Each indicator is thus assigned 11% weight. **Method 2** is a weighted average system. Here, the maximum weight has been assigned to HHI since it is the most widely used measure for anticompetitive tendencies. Since 20% weight is assigned to this, only 5% is assigned to the number of firms as both of them essentially indicate the degree of concentration. Similarly, survival rate, churn rate, variance in market share and market growth get 10% weightage each as they jointly refer to the dynamism of the market. The remaining variables namely number of trade unions, profits and research and development all get 15% weightage. **Method 3** weights are obtained by conducting a principal component analysis[4]. For this we first standardized the variables as mentioned in the previous section. Then we created a correlation matrix. Based on the correlation matrix, we identified the principal components and arrived at the weights. These weights are provided in Table 2.

Figure *11* elaborates on the principal component analysis. The points correspond to the PCA scores received by each industry. They have been categorized into anticompetitive, moderately competitive and competitive based on the competition index scores received using the weighted average approach. The nine indicators become 9 axis of measurement. As we can see, HHI and

[4] **Principal component analysis** (**PCA**) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called **principal components**

number of firms are almost exactly in the opposite direction thus showing that these two indicators are highly correlated. Similarly, survival and churn rate are also pointing in the opposite direction. In *Figure 11* , we can see that the industries which appear competitive on the index have certain features. For instance, all competitive industries (green dots) are in the direction of "firms", "var" and "churn". In other words, they have a large number of firms, along with high variance of market share and a high churn rate. Less competitive industries (red dots) are in the direction of "survival", "HHI" and "tuf". In other words they have a high survival rate, HHI and a large number of trade unions. The horizontal length of the arrows depicts the weightage assigned to each indicator (since we are considering only the first Principal component (PC1). As we can see, the PCA assigns very little weightage to market growth, profits and research and development.

Figure 11: Source of Variance in the Competition Index



VIII

Results of the Study

Annexure 1 presents the top 10 and bottom 10 industries based on the PCA analysis, simple average as well as the weighted average. It is important to note that we have excluded a few industries from the final results since we did not have enough information and the companies were not adequately representative of their industry.[5]

[5] Since a large proportion of the Indian economy belongs to the informal sector, data is neither recorded not reported for most of these companies in such sectors. Hence it would be incorrect to display their results.

The index is on a scale of 0 to 1 with 0 being the most competitive and 1 being the least competitive. Based on the results we can see that the average PCA score is 0.43. The table mentioned in the aforesaid annexure also presents standardized scores for all the indictors.

Air transport, manufacture of beverages and manufacture of tobacco products are the top three industries displaying the most anticompetitive tendencies. As we can see, in air transport, barring profitability all other indicators are above economy average. Variance of market share in particular contributes a lot to the score for this sector (market shares are very stable in this sector). For beverages, high and stable growth (around 10%) is one of the major factors. For manufacture of tobacco products, the HHI is extremely high. This is because one company owns almost 80% of the market share in this industry.

Furthermore, we can see that the survival and churn rate are 1 for most of the highly anticompetitive industries (this means 100% survival rate and 0% churn rate). This might seem to suggest that those industries which have high standardized survival and churn rate scores are the ones who will by default be at the top of this table. However, even in the weighted average scenario where we give only 5% weightage to survival and churn rate, the same industries top the table. Thus, it only corroborates the fact that highly anticompetitive industries by their very nature have high standardized scores in survival and churn rate (in other words high survival rate and low churn rate).

The bottom half of the table displays the highly competitive industries. Manufacture of computer and electronics gets the PCA score of 0.32. A major reason for this industry getting the low PCA score is that it has the low HHI, few trade unions and High variance of market shares in comparison to the other industries. Manufacturing of textiles is the other sector which is placed right at the bottom of the table with a score of 0.33. The reason for this is that this industry displays extremely low concentration (low HHI and high number of firms), low TU score, high churn rate, low survival rate and high variance in market share.

IX

Robustness Check

In this section, we test the robustness of the model. The first test relates to impact of changing the weights assigned to the indicators. As mentioned above, the industries were ranked using three different vector of weights. A Spearman Rank correlation was conducted on these three different rank outputs. The correlations are as follows:

Between Method 1 & 2	**0.966**
Between Method 1 & 3	**0.961**
Between Method 2 & 3	**0.904**

As we can see, the correlation is extremely high thus indicating that changing weights does not have a significant impact on the results of the model.

The second test pertains to a consistency check on the standardized data. The figure below explains the consistency check. The lower triangular matrix displays the Pearson's correlation values between variables. As we can see almost all the standardized variables have a positive correlation, thus reaffirming the fact that they are moving in the same direction and an increase in all the standardized variables increases the value of the composite index and vice versa. Even more importantly, the last three rows explain the correlation between the three ranking scores and the nine indicators. It is clear that all the correlations are positive thus highlighting the fact that the variables are in sync with the final scores and there is no conflict.

Table 3: Correlation Matrix of Standardized Variables

	MG	*TU*	*Firms*	*SR*	*CR*	*HHI*	*Var*	*Profits*	*R&D*	*SA*	*WA*	*PCA*
Market Growth Average												
Number of Trade Unions	0.01											
Number of Firms	-0.14	0.47										
Survival Rate	0.15	0.31	0.32									
Churn Rate	0.13	0.36	0.56	0.85								
HHI	-0.18	0.39	0.79	0.30	0.47							
Variance in Market Share	-0.01	0.40	0.62	0.57	0.64	0.87						
Profits	0.22	0.09	-0.05	0.06	0.08	-0.08	0.01					
R&D	-0.28	0.33	0.54	-0.03	0.14	0.32	0.18	0.03				
Average score	0.20	0.63	0.78	0.70	0.83	0.74	0.82	0.16	0.39			
Weighted Average 1	0.13	0.69	0.80	0.55	0.70	0.80	0.82	0.18	0.49	0.97		
PCA	0.01	0.57	0.80	0.74	0.88	0.78	0.86	0.04	0.34	0.97	0.92	

We also conducted a robustness check for the functional forms used in the standardization process. For each indicator, functional forms of the membership functions were changed and then Pearson correlation values were calculated for the standardized variables with the initial and new functional forms. Table 4 highlights the results of this robustness check. As we can see, there is very high positive correlation between the initial and new standardized variables even when we tweak the slopes of the membership functions for the indicators. Thus, it is evident that the model is robust against changes made in the functional forms of membership functions.

Table 4: Robustness check for functional form

Indicator	Initial Functional Form	New Functional Form	Correlation
Market Growth	CI=X^2 If X<12 =$1-X^{1/2}$ If X>=12	CI=X^4 If X<12 =$1-X^{1/4}$ If X>=12	0.95
Number of Trade Unions	CI=$X^{1/2}$	CI=$X^{1/4}$	0.95
Number of Firms	CI =$1-X^{1/4}$	CI =$1-X^{1/2}$	0.94
Survival Rate	CI=X	CI=$X^{1/2}$	0.95
Churn Rate	CI =$1-X^{1/4}$	CI =$1-X^{1/2}$	0.95
HHI	CI= Beta distribution with parameters 1/5 and 1/10	CI= Beta distribution with parameters 1/2 and 1/5	0.99
Variance in Market Share	CI =$1-X^{1/4}$	CI =$1-X^{1/2}$	0.95
Profit Before Tax	CI= Beta distribution with parameters 1/5 and 1/10	CI= Beta distribution with parameters 1/2 and 1/5	0.98
Research and Development	CI =$1-X^{1/4}$	CI =$1-X^{1/2}$	0.87

X

Conclusion of the study along with Caveats

This paper attempts to develop a comprehensive index which measures anticompetitive tendencies across industries. We have covered around 66 industries for our analysis. However, some of them had to be dropped as they were not adequately representative of their sector. The primary reason for this is because a large number of such industries (especially in the agriculture sector for instance) belong to the informal sector. These companies in such sectors do not record or report any data to databases like Capitaline.

In spite of this caveat, the study has a wide coverage amongst other sectors. More than 3500 companies have been analyzed while constructing the index. Data was collected on nine indicators for these 3500+ companies over a period of five years (2012-2016) thus providing for more than 1.5 lakh data points. This makes the study adequately robust and reliable.

The main findings of the study include a high level of anticompetitive tendencies in industries such as air transport, beverages and tobacco products. These industries display low dynamism (high survival rate, low churn rate and low variance of market share) and high concentration (low number of firms and high Hirschman Herfindahl index). In air transport and beverages, the market growth too is ideal for collusive attempts as it is high and stable (8.37% and 9.58% respectively).

Industries, specifically in the manufacturing sector, viz. Manufacture of textiles, manufacture of computer and electronics and manufacture of food products appear to be highly competitive primarily because of higher activity and lesser concentration. All three of them display low HHI, high activities and few number of trade unions in the industry.

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Annexure 1:

PCA Results

Industry	PCA (Final Scores)	Standardized Scores on a scale of 0 to 1								
		Growth	TU	Firms	Survival	Churn	HHI	Variance	Profits	R&D
Economy Average	0.43	0.48	0.25	0.51	0.81	0.56	0.26	0.20	0.35	0.80
Less Competitive Industries										
Air transport	0.73	0.71	0.62	0.75	1.00	1.00	0.36	0.44	0.33	1.00
Manufacture of beverages	0.67	0.80	0.57	0.59	1.00	1.00	0.32	0.37	0.34	0.79
Manufacture of tobacco products	0.67	0.35	0.49	0.68	1.00	1.00	0.40	0.29	0.34	0.70
Broadcasting and programming activities	0.65	0.87	0.54	0.56	1.00	1.00	0.23	0.28	0.23	1.00
Extraction of crude petroleum and natural gas	0.64	0.37	0.20	0.72	1.00	1.00	0.38	0.30	0.39	0.69
Manufacture of leather and related products	0.62	0.96	0.27	0.59	1.00	1.00	0.24	0.34	0.34	0.75
Water transport	0.62	0.32	0.10	0.63	1.00	1.00	0.27	0.29	0.34	1.00
Warehousing and support activities	0.49	0.59	0.47	0.61	0.82	0.46	0.30	0.18	0.32	1.00
Manufacture of motor vehicles	0.49	0.44	0.17	0.37	0.98	0.67	0.24	0.35	0.34	0.58
Highly Competitive Industries										
Manufacture of basic metals	0.36	0.30	0.13	0.21	0.82	0.45	0.19	0.20	0.33	0.71
Manufacture of chemicals and chemical products	0.34	0.52	0.13	0.17	0.82	0.42	0.13	0.22	0.34	0.65
Manufacture of food products	0.34	0.47	0.25	0.27	0.70	0.35	0.19	0.17	0.34	0.70
Manufacture of textiles	0.33	0.44	0.16	0.14	0.83	0.43	0.00	0.20	0.34	0.70
Manufacture of computer and electronics	0.32	0.52	0.14	0.40	0.72	0.28	0.24	0.11	0.33	0.50

Weighted Average Results

Industry	WA (Final Scores)	Standardized Scores on a scale of 0 to 1								
		Growth	TU	Firms	Survival	Churn	HHI	Variance	Profits	R&D
Economy Average	0.41	0.48	0.25	0.51	0.81	0.56	0.26	0.20	0.35	0.80
Less Competitive Industries										

Air transport	0.62	0.71	0.62	0.75	1.00	1.00	0.36	0.44	0.33	1.00
Manufacture of beverages	0.57	0.80	0.57	0.59	1.00	1.00	0.32	0.37	0.34	0.79
Broadcasting and programming activities	0.56	0.87	0.54	0.56	1.00	1.00	0.23	0.28	0.32	1.00
Manufacture of leather and related products	0.51	0.96	0.27	0.59	1.00	1.00	0.24	0.34	0.34	0.75
Manufacture of tobacco products	0.51	0.35	0.49	0.68	1.00	1.00	0.40	0.29	0.34	0.70
Warehousing and support activities	0.50	0.59	0.47	0.61	0.82	0.46	0.30	0.18	0.32	1.00
Information service activities	0.49	0.66	0.12	0.60	1.00	1.00	0.26	0.23	0.35	1.00
Extraction of crude petroleum and natural gas	0.47	0.37	0.20	0.72	1.00	1.00	0.38	0.30	0.39	0.69
Water transport	0.46	0.32	0.10	0.63	1.00	1.00	0.27	0.29	0.34	1.00
Manufacture of wearing apparel	0.46	0.90	0.20	0.53	0.69	0.39	0.22	0.16	0.34	1.00
Highly Competitive Industries										
Manufacture of rubber and plastics products	0.36	0.49	0.14	0.28	0.84	0.43	0.18	0.23	0.34	0.66
Manufacture of chemicals and chemical products	0.34	0.52	0.13	0.17	0.82	0.42	0.13	0.22	0.34	0.65
Manufacture of electrical equipment	0.34	0.22	0.14	0.31	0.91	0.53	0.22	0.22	0.32	0.62
Manufacture of basic metals	0.34	0.30	0.13	0.21	0.82	0.45	0.19	0.20	0.33	0.71
Manufacture of computer and electronic products	0.33	0.52	0.14	0.40	0.72	0.28	0.24	0.11	0.33	0.50
Manufacture of textiles	0.31	0.44	0.16	0.14	0.83	0.43	0.00	0.20	0.34	0.70

Simple Average Results

Industry	SA (Final Scores)	Standardized Scores on a scale of 0 to 1								
		Growth	TU	Firms	Survival	Churn	HHI	Variance	Profits	R&D
Economy Average	0.45	0.48	0.25	0.51	0.81	0.56	0.26	0.20	0.35	0.80
Less Competitive Industries										
Air transport	0.69	0.71	0.62	0.75	1.00	1.00	0.36	0.44	0.33	1.00
Manufacture of beverages	0.64	0.80	0.57	0.59	1.00	1.00	0.32	0.37	0.34	0.79
Manufacture of leather and related products	0.61	0.96	0.27	0.59	1.00	1.00	0.24	0.34	0.34	0.75
Manufacture of tobacco products	0.58	0.35	0.49	0.68	1.00	1.00	0.40	0.29	0.34	0.70
Information service activities	0.58	0.66	0.12	0.60	1.00	1.00	0.26	0.23	0.35	1.00

Extraction of crude petroleum and natural gas	0.56	0.37	0.20	0.72	1.00	1.00	0.38	0.30	0.39	0.69
Water transport	0.55	0.32	0.10	0.63	1.00	1.00	0.27	0.29	0.34	1.00
Warehousing and support activities	0.53	0.59	0.47	0.61	0.82	0.46	0.30	0.18	0.32	1.00
Manufacture of motor vehicles	0.46	0.44	0.17	0.37	0.98	0.67	0.24	0.35	0.34	0.58
Manufacture of other non-metallic mineral products	0.46	0.63	0.24	0.38	0.84	0.50	0.20	0.29	0.34	0.71
Highly Competitive Industries										
Manufacture of electrical equipment	0.39	0.22	0.14	0.31	0.91	0.53	0.22	0.22	0.32	0.62
Manufacture of food products	0.38	0.47	0.25	0.27	0.70	0.35	0.19	0.17	0.34	0.70
Manufacture of chemicals and chemical products	0.38	0.52	0.13	0.17	0.82	0.42	0.13	0.22	0.34	0.65
Manufacture of basic metals	0.37	0.30	0.13	0.21	0.82	0.45	0.19	0.20	0.33	0.71
Manufacture of textiles	0.36	0.44	0.16	0.14	0.83	0.43	0.00	0.20	0.34	0.70
Manufacture of computer and electronics	0.36	0.52	0.14	0.40	0.72	0.28	0.24	0.11	0.33	0.50
Real estate activities	0.33	0.46	0.00	0.45	0.28	0.14	0.23	0.07	0.35	1.00
Computer programming and consultancy	0.32	0.69	0.01	0.23	0.58	0.30	0.26	0.11	0.33	0.37
Financial services, except insurance and pension funding	0.30	0.73	0.10	0.00	0.50	0.26	0.17	0.06	0.35	0.51
Wholesale trade	0.27	0.02	0.07	0.22	0.55	0.26	0.22	0.06	0.33	0.67

Annexure 2: PCA output[6]

```
Rotation:
                PC1         PC2         PC3         PC4         PC5         PC6
growth   -0.003091442 -0.74443549  0.59122902 -0.19085310  0.21792007 -0.02500902
tuf      -0.278282884  0.10301788  0.51298357  0.40486776 -0.68830487  0.04956079
firms    -0.364318337  0.23319376  0.21176612 -0.08478123  0.27310246  0.63343249
survival -0.322406556 -0.26812261 -0.30734711  0.24074735 -0.09916805 -0.26699806
churn    -0.589823212 -0.30826451 -0.32859677  0.31371006  0.20883943  0.18459473
HHI      -0.350612885  0.23172725  0.08719641 -0.51060573 -0.03669564  0.03889731
var      -0.437518543  0.03596124 -0.03305408 -0.50015105 -0.16916085 -0.46935508
profit   -0.007867824 -0.06221858  0.07326108  0.06033194  0.01729494 -0.18884889
rd       -0.153525391  0.39375775  0.35489459  0.34869302  0.56608569 -0.48254252
                PC7          PC8         PC9
growth   -9.806194e-02 -0.007270254 -0.04523250
tuf      -1.007711e-02  0.091116137 -0.01588550
firms     3.680138e-03 -0.414219433  0.33681912
survival -2.994581e-01 -0.687358954 -0.16876906
churn     1.730549e-01  0.489946488 -0.05483667
HHI       2.097302e-02  0.019601220 -0.74254159
var      -9.507521e-05  0.103896344  0.54436810
profit    9.251604e-01 -0.305731164 -0.04127254
rd       -1.195153e-01  0.053918067 -0.05793475
> summary(fa.pca)
Importance of components:
                          PC1    PC2    PC3     PC4     PC5     PC6     PC7     PC8
Standard deviation     0.4667 0.3082 0.2231 0.19719 0.17443 0.11596 0.09034 0.07628
Proportion of Variance 0.4722 0.2059 0.1079 0.08431 0.06597 0.02915 0.01769 0.01262
Cumulative Proportion  0.4722 0.6781 0.7860 0.87029 0.93626 0.96541 0.98311 0.99573
                          PC9
Standard deviation     0.04440
Proportion of Variance 0.00427
Cumulative Proportion  1.00000
```

[6] For the purpose of choosing weights we have selected the first Principal Component PC1. As is clear from the summary command, the first principal component explains around 47% of the variance of the data set.

Annexure 3: List of Industries Covered

Industry Name
Division 01 Crop and animal production, hunting and related service activities
Division 03 Fishing and aquaculture
Division 05 Mining of coal and lignite
Division 06 Extraction of crude petroleum and natural gas
Division 07 Mining of metal ores
Division 08 Other mining and quarrying
Division 09 Mining support service activities
Division 10 Manufacture of food products
Division 11 Manufacture of beverages
Division 12 Manufacture of tobacco products
Division 13 Manufacture of textiles
Division 14 Manufacture of wearing apparel
Division 15 Manufacture of leather and related products
Division 16 Manufacture of wood and products of wood and cork, except furniture; (manufacture of articles of straw and plaiting materials)
Division 17 Manufacture of paper and paper products
Division 18 Printing and reproduction of recorded media
Division 19 Manufacture of coke and refined petroleum products
Division 20 Manufacture of chemicals and chemical products
Division 21 Manufacture of pharmaceuticals, medicinal chemical and botanical products
Division 22 Manufacture of rubber and plastics products
Division 23 Manufacture of other non-metallic mineral products
Division 24 Manufacture of basic metals
Division 25 Manufacture of fabricated metal products, except machinery and equipment
Division 26 Manufacture of computer, electronic and optical products
Division 27 Manufacture of electrical equipment
Division 28 Manufacture of machinery and equipment n.e.c.
Division 29 Manufacture of motor vehicles, trailers and semi-trailers
Division 30 Manufacture of other transport equipment
Division 31 Manufacture of furniture
Division 32 Other manufacturing
Division 35 Electricity, gas, steam and air conditioning supply
Division 36 Water collection, treatment and supply
Division 37 Sewerage

Division 38 Waste collection, treatment and disposal activities; materials recovery
Division 41 Construction of buildings
Division 42 Civil engineering
Division 43 Specialized construction activities
Division 45 Wholesale and retail trade and repair of motor vehicles and motorcycles
Division 46 Wholesale trade
Division 47 Retail trade
Division 49 Land transport and transport via pipelines
Division 50 Water transport
Division 51 Air transport
Division 52 Warehousing and support activities for transportation
Division 55 Accommodation
Division 56 Food and beverage service activities
Division 58 Publishing activities
Division 59 Motion picture, video and television programme production, sound recording
Division 60 Broadcasting and programming activities
Division 61 Telecommunications
Division 62 Computer programming, consultancy and related activities
Division 63 Information service activities
Division 64 Financial services, except insurance and pension funding
Division 66 Other financial activities
Division 68 Real estate activities
Division 71 Architecture and engineering activities; technical testing and analysis
Division 72 Scientific research and development
Division 77 Rental and leasing activities
Division 79 Travel agency, tour operator and other reservation service activities
Division 80 Security and investigation activities
Division 82 Office administrative, office support and other business support activities
Division 85 Education
Division 86 Human health activities
Division 90 Creative, arts and entertainment activities
Division 93 Sports activities and amusement and recreation activities
Division 95 Repair of computers and personal and household goods

Annexure 4: Summary Statistics of the raw data[7]

Measure	Growth	Trade Unions	No. of Firms	survival	churn
Mean	7.56	59.95	49.89	94.57	3.49
Standard Error	1.70	10.36	9.73	0.71	0.59
Median	5.88	32.00	15.40	95.26	2.63
Standard Deviation	13.83	84.19	79.07	5.80	4.82
Kurtosis	3.51	14.58	12.92	3.15	10.55
Skewness	1.22	3.25	3.16	-1.49	2.85
Range	83.22	530.00	475.60	28.57	27.74
Minimum	-21.94	0.00	1.00	71.43	0.00
Maximum	61.28	530.00	476.60	100.00	27.74

Measure	HHI	Variance of Market Share	Profit	R&D
Mean	3275.90	0.41	7.10	1.36
Standard Error	339.11	0.03	3.40	0.82
Median	2275.31	0.39	6.63	0.01
Standard Deviation	2754.98	0.24	27.63	6.64
Kurtosis	0.61	-0.33	10.92	61.23
Skewness	1.24	0.37	-0.69	7.71
Range	9774.36	0.98	235.92	53.56
Minimum	225.64	0.00	-22.79	0.00
Maximum	10000.00	0.98	113.13	53.56

[7] The summary statistics provided here are for the raw data including all the industries analyzed for the study. The final result includes only those industries for which we could gather substantially representative data.

How have Mergers and Acquisitions Affected Firms' Business Performance? Empirical Evidence of Indian Manufacturing Sector

Pulak Mishra[1]

Abstract

Given the significant increase in the number of mergers and acquisitions (M&A) during the last two and half decades of economic reforms in India, the present paper attempts to examine how such strategic combinations have affected firms' financial performance. Using secondary data collected from the *Prowess IQ* database of the Centre for Monitoring Indian Economy (CMIE) and applying Arellano-Bond dynamic panel data estimation techniques, the paper finds that M&A do not cause any significant influence on firms' financial performance due to the multidirectional structure-conduct-performance relationships. Findings of the present paper, therefore, suggest for relook at the policies and regulations relating to M&A, international trade and intellectual property as they are expected to influence the market structure, firms' business strategies, efficiency and competitiveness, and hence their financial performance.

Keywords: Economic Reforms, Mergers and Acquisitions, Financial Performance, Competition Policy, India

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How have Mergers and Acquisitions Affected Firms' Business Performance? Empirical Evidence of Indian Manufacturing Sector

Introduction:

Policy initiatives and regulatory changes made during the last two and half decades of economic reforms have led to considerable changes in the basic environment and functioning of Indian manufacturing sector. Although the pace of economic reforms has slowed down in recent years, the policy changes and regulatory measures in general continue to aim at strengthening market disciplines and enhancing competition. It is expected that greater market competition would bring in efficiency and competitiveness and thus facilitate achieving optimality in allocation of resources and distribution of goods and services.

While the domestic firms have responded to the policy and regulatory changes in a variety of ways, many of them have relied largely on mergers and acquisitions (M&A) as strategies to restructure their business for existence and growth under the new business conditions[2]. As a result, there has been significant increase in number of M&A during the post-reform period (Beena, 2014; Basant and Mishra, 2016). Given the policy induced flexibilities, domestic private firms, especially those from the same business groups, have taken the route of mergers to consolidate their business. A large number of them have also used the opportunities to raise monopoly power. The foreign firms, on the other hand, have relied mainly on acquisitions to enter into specific markets and raising control therein.

It is observed that involvement of the multinational corporations (MNCs) in M&A has been substantially high and acquisition of shares of the incumbents has become a predominant channel of foreign investment inflows into the country during the post-reform period[3]. The share of acquisitions in equity inflows has increased from 11 percent during 1995-2000 to 27 percent during 2000-2012 (ISID, 2014). Hence, although the liberal policy and regulatory measures have resulted in a significant increase in foreign investment inflows, high share of acquisition is likely to have important implications for overall development of the economy in general and market structure and firms' performance in particular.

Given this backdrop and findings of the existing studies, one may expect that M&A in Indian manufacturing sector would help the firms to improve their financial performance through either larger market power and/or greater efficiency[4]. The structure-conduct-performance framework of

[2]Although mergers and acquisitions are different in definitions and statutory procedures, the present paper makes no distinction between the two as their economic effects are by and large the same.
[3]The share of cross-border deals was as high as 34 percent during 2000-2008 (Saraswathy, 2015).
[4]Thus, the impact of M&A on financial performance can be considered as the balance of the anti-competitive market

Bain (1956) suggests that, given the market structure, M&A as business strategies influence firms' financial performance. Many of the existing studies (e.g., Healy et al. 1992; Grabowski et al., 1995; Switzer, 1996; Waldfogel and Smart, 1994; Vander, 1996) empirically support the proposition that M&A lead to better financial performance. However, there are also studies (e.g., Dickerson et al., 1997; Ravenscraft and Scherer, 1987; Mueller, 1985; Ghosh, 2001) that report results at odds with the view that M&A improve financial performance. Further, Ikeda and Doi (1983), Cosh et al. (1984), Kumar (1984), Geroski (1988), Odagiri (1992) also find either such negative impact or little changes in firms' operating performance following M&A.

Thus, the nature of impact of M&A on firms' financial performance is not conclusive as the existing studies report mixed results with the findings ranging from slightly positive improvement to significantly negative or no improvement. The issue is more pertinent in Indian context given that there is little evidence of improvement in firms' financial performance (Basant and Mishra, 2016), whereas a large number industries have recorded either decline or no change in market concentration during the post-reform period (Mishra and Rao, 2014). Further, wherever market concentration has increased, it might not have necessarily influenced firms' financial performance as concentration-markup relationship is not significant in dynamic context (Mishra, 2008). On the other hand, the wave of M&A during the post-reform period has enhanced firms' export competitiveness in Indian manufacturing sector (Mishra and Jaiswal, 2012). Besides, in recent years, India has transformed its image from being a FDI destination to an emerging foreign direct investor with many of the Indian companies venturing abroad, especially in the areas software, biotechnology, automotive and oil and becoming globally competitive (Pradhan, 2008). Thus, one may argue that M&A in Indian manufacturing sector during the post-reform period have enhanced firms' competitiveness making the markets more competitive or leaving them largely unchanged[5].

The above developments in Indian manufacturing sector during the post-reform period raise an important question, how has the wave of M&A affected firms' financial performance given the ongoing process of policy and regulatory changes and subsequent fine tuning of business strategies? Addressing this question in the context of competition law and policy is necessary for three reasons. First, while cost-efficiencies of firms in Indian manufacturing sector do not show any evidence of improvement during the post-reform period, export orientation has increased significantly across major industries and import penetration has recorded a decline, though marginally (Basant and Mishra, 2016). The increase in firms' export competitiveness in Indian manufacturing sector can largely be contributed to M&A (Mishra and Jaiswal, 2012). On the other hand, financial performance, particularly profitability shows sign of improvement only at a very slow rate possibly

power effect (Stigler, 1950) and the pro-competitive efficiency effect (Williamson, 1968).

[5] In a recent study, Mishra and Jaiswal (2017) found that the wave of M&A has caused significant positive influence on both incidence and extent of firms' export competitiveness in Indian drugs and pharmaceutical industry.

due to increasing competition in different markets and failure of firms in choosing appropriate strategies and/or enhancing cost efficiency.

Second, there are evidences of failure of M&A in enhancing business performance in Indian context as well. For example, using panel data of 52 drugs and pharmaceutical companies for the period 2000-2008, Mishra and Chandra (2010) found that M&A have failed to cause any significant impact on firms' profitability. Instead, their financial performance has varied directly with asset base, selling efforts and export and import intensities, but inversely with market share and demand for the products (Mishra and Chandra, 2010). Similarly, according to Saple (2000), mergers could not generate high monopoly rents or impede the competitive process. On the other hand, Das (2000) found rise in post-merger average sales and net worth with very less proportion of the firms experiencing a decline in post-merger profitability. This is contradictory to many of the existing studies in Indian context.

Third, M&A may not necessarily cause any significant impact on financial performance when it is assessed in combination with other business strategies of firms as well as various market structure and policy related aspects. This issue is very important given that economic reforms have deepened over the years in areas like FDI, competition policy, privatization and intellectual property regulation. Such policy and regulatory changes are likely to cause differences in nature and intensity of firms' strategic responses and changes in structure of the markets. When it is so, performance enhancing effects of M&A may not be significant.

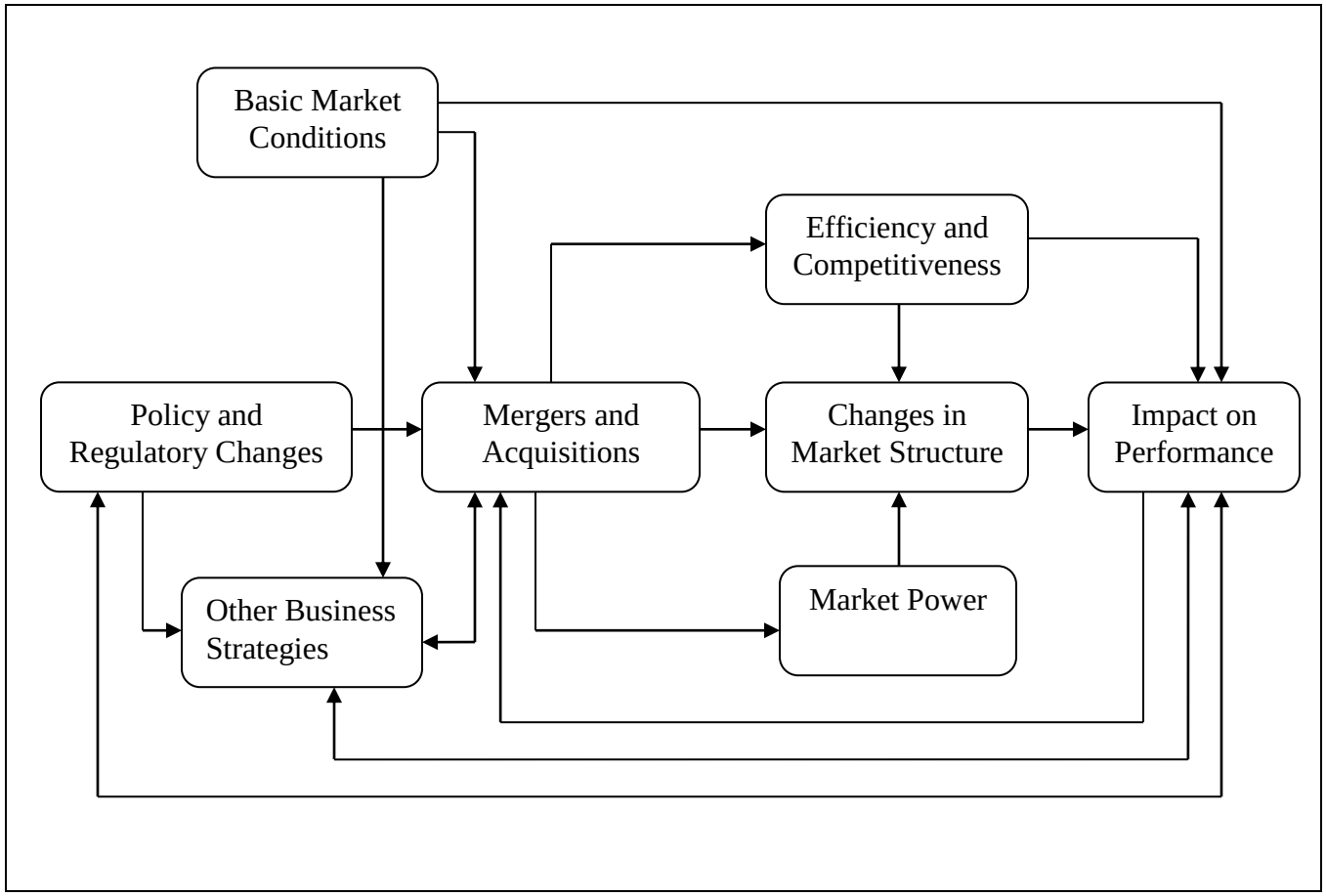
Given this backdrop, it is, therefore, necessary to revisit the impact of M&A on firms' financial performance in Indian manufacturing sector controlling influence of their other business strategies (other than M&A), various structural aspects of the markets and policies and regulations of the government. The present paper is an attempt in this direction. Since M&A are industry specific activities (Mitchell & Mulherin, 1996), and distribution of number of M&A as well as financial performance vary across different industries (Basant and Mishra, 2016), the present paper attempts to examine the impact of such combinations on financial performance at industry level. More specifically, the objective of the paper is to examine how financial performance has varied across major industries of Indian manufacturing sector following M&A during the post-reform period.

The paper is organized in five sections. While the second section specifies the econometric model and hypothesizes possible impact of the independent variables, the third section discusses the estimation techniques applied and sources of data used in the paper. Measurements of the variables are also given in this section. The fourth section presents the regression results and discusses their implications. The findings are summarized and their policy and regulatory implications are highlighted in the fifth and the final section of the paper.

2. Model Specification

In order to examine the impact of M&A on firms' financial performance, the present paper uses the structure-conduct-performance (SCP) framework of Bain (1956). Although the traditional SCP paradigm postulates unidirectional relationships between market structure, firms' conduct and their performance, successive developments in the industrial organization literature suggest for a multidirectional structure-conduct-performance framework (Scherer and Ross, 1990). This new framework recognises both way causalities between market structure and firms' conducts, between conducts and financial performance and between market structure and financial performance (Tirole, 1988). The other important development in the SCP paradigm is inclusion of public policies relating to taxes, subsidies, international trade, investment, etc. (Scherer and Ross, 1990).

Given these developments in the literature, the present paper considers M&A as a conduct variable and explores the impact on financial performance controlling for influences of various structural aspects of the market, other business strategies (other than M&A) of firms and changes in policies and regulations by the government. Further, the present paper also recognizes various feedback effects. Accordingly, the following analytical framework is envisaged:



On the basis of this framework, it is assumed that current financial performance of firms in an industry (PER_t) depends on current market concentration (CON_t), current capital intensity (KIR_t), ratio of current imports to current exports ($IMEX_t$), lagged mergers and acquisitions ($M\&A_{t-1}$), current advertising intensity ($ADVT_t$), current marketing and distribution intensity (MAD_t), lagged R&D intensity ($R\&D_{t-1}$), current foreign technology purchase intensity (FTP_t), and lagged financial performance (PER_{t-1}), i.e.,

$$PER_{it} = f(PER_{i,t-1}, KIR_{it}, CON_{it}, M\ \&\ A_{i,t-1}, ADVT_{it}, MAD_{it}, R\ \&\ D_{i,t-1}, FTP_{it}, IMEX_{it})$$

The present paper uses CON_t, KIR_t and $IMEX_t$ to capture structural aspects of the market, $M\&A_{t-1}$, $ADVT_t$, MAD_t, $R\&D_{t-1}$ and FTP_t for firms' business strategies and PER_{t-1} for past performance. In addition, while the variable M&A captures changes in investment policies in general and competition policy in particular, IMEX controls for the impact of trade related policy changes. On the other hand, R&D and FTP act as proxies for changes in technology related policies of the government including regulation of intellectual properties. Since the relationships amongst many of these variables are not instantaneous, following Kambhampati (1996), suitable lags have been introduced. For example, it is assumed that M&A can influence financial performance only after an interval. Similarly, in-house R&D efforts require gestation lags to influence financial performance.

The present paper examines firms' financial performance in terms of their profitability (PROF) and the rate of returns on capital employed (ROCE). While the profitability shows the relationship between profit and output or sales, the rate of returns ratio reflects the association between profit and investment. The present paper uses these two alternative measures of financial performance to substantiate the findings. Further, the Herfindahl-Hirschman index is used as a measure of the degree of sellers' concentration in a market.

Possible Impact of the Independent Variables

Current Market Concentration (CON_t): It is postulated that industries with concentrated markets facilitate collusion leading to supernormal profit (Bain, 1951; Chamberlin, 1933; Stigler, 1964). While the positive relationship between market concentration and price-cost margin or profitability is well documented in the literature (e.g. Weiss, 1974; Ravenscraft, 1983, Kambhampati, 1996; Goldar and Aggarwal, 2004), the strength of the relationship differs depending on firms' conducts (Mishra, 2008). Further, greater market concentration may not be necessary for better financial performance when the firms' have superior efficiency (McGee, 1971; Demsetz, 1973). On the other hand, greater market concentration may not be sufficient for

better financial performance if there are limited or no barriers to entry (Hay and Morris, 1991)[6]. In the long-run, impact of market concentration on financial performance depends on how these diverse forces empirically dominate each other. For example, using dynamic framework, Mishra (2008) found that the traditional positive relationship between market concentration and mark-up does not hold when other structural aspects of the market, firms' business strategies and policies of the government are controlled.

Current Capital Intensity Ratio (KIR_t): High capital intensity indicates large sunk costs that create entry barriers and thereby give rise to monopoly profit (McDonald, 1999). High capital intensity can also make the domestic firms globally more competitive, particularly when capital goods embody better technology. On the other hand, high capital intensity may result in lesser flexibility in respect of adjustments to various market shocks causing adverse impact on financial performance. Besides, higher capital intensity of larger firms can make the smaller entities less competitive due to capital market imperfections (Basant and Saha, 2005).Thus, the nature of the relationship between capital intensity and financial performance is ambiguous.

Lagged Mergers and Acquisitions (MA_{t-1}): While the efficiency theory suggests that M&A are planned and executed to reduce costs production through scale economies (Porter, 1985; Shelton, 1988), the monopoly theory considers such combinations as the routes to raise market power (Steiner, 1975, Chatterjee, 1986). Hence, M&A are expected to result in better financial performance of the firms through greater market power and/or efficiency gains. However, given the multidirectional structure-conduct-performance framework of Scherer and Ross (1990), financial performance is also likely to be affected by a set of other factors relating to structural aspects of the market, firms' business strategies (other than M&A), their business performance in the past and policies and regulations of the government. Thus, when impact of other factors are controlled, M&A may not necessarily cause any significant influence on financial performance.

Current Advertising Intensity ($ADVT_t$): On the one hand, advertising creates image advantage over the rivals. Besides, advertising can also lead to product differentiation and entry barriers (Comanor and Wilson, 1967)[7]. Thus, industries with higher advertising intensity are expected to experience better financial performance of firms. There are evidences (e.g., Scherer and Ross, 1990) of positive relationship between profitability and advertising intensity. However, informative advertising may not necessarily help in enhancing financial performance. There are evidences (e.g., Delorme et al., 2002) of no significant impact of advertising on profitability. Some other studies finding no systematic relationship between advertising and profitability include Imel and Heimberger (1971), Grabowski and Mueller (1978) and Nagle (1981).

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[6]As mentioned earlier, Mishra (2008) found no significant relationship between market concentration and price-cost margin in Indian manufacturing sector in the 1990s.

[7] High advertising intensity may require the potential entrants to incur disproportionately high advertising expenses to win over the incumbents and this may discourage entry.

Current Marketing and Distribution Intensity (MAD_t): Expenditures on promoting the products or developing distribution networks result in related complementary assets. While marketing related expenditures help in promoting the products by reaching the consumers, wider distribution networks provide easy and timely access to the same. Thus, industries with greater marketing or distribution related efforts by firms are expected to record better financial performance. There are evidences of better financial performance following increase in expenditure on distribution and marketing related activities (Majumdar, 1997).

Lagged R&D Intensity (RD_{t-1}): While product development strengthens/extends market orientation, process innovation reduces the costs of production. Sustained in-house R&D efforts can also act as an important instrument of maintaining entry barriers (Mueller, 1990), resulting in higher profitability in the long run. According to Cefis (1998), persistent innovators earn above the average profit. However, in the absence of effective regulation, competitors may imitate the outcomes and the firms engaged in innovation may lose the edge. Further, the existing accounting practices that allow firms to express R&D expenses entirely in the year incurred instead of amortizing it to recognize its future benefits create the possibility of negative impact of in-house R&D on profitability (Mishra and Chandra, 2010). There are evidences (e.g., Mishra and Chandra, 2010; Mishra and Vikas, 2010) of no significant impact of in-house R&D on firms' profitability in Indian pharmaceutical industry.

Current Foreign Technology Purchase Intensity (FTP_t): Acquisition of foreign technologies helps in lowering operating costs and prices (Hinomoto, 1965; Balcer and Lippman, 1984). Use of such technologies can also enhance product quality and hence demand in domestic markets. Thus, foreign technology purchase is likely to improve firms' financial performance. In addition, foreign technology purchase also helps in creating strategic entry barriers. This means that industries with greater foreign technology purchase intensity are likely to record better financial performance. However, reaping the benefits of these technologies in the long run requires their proper application and development of complementary indigenous technologies. Further, when the technologies purchased from abroad are obsolete, the domestic firms may not have any distinct edge, vis-à-vis the MNCs.

Lagged Financial Performance (PER_{t-1}): Better financial performance is expected to strengthen firms' market position and enable them to develop complementary assets relating to manufacturing, selling and technology. As a result, the incumbents are expected to record better financial performance in future. However, better financial performance of the incumbents is also likely to attract new firms into the industry making the market more competitive and causing downward pressures on financial performance of the incumbents', especially in the absence of effective entry barriers. Better financial performance in the past can also cause adverse impact on

its current level through X-inefficiency. Impact of past financial performance on its current level, therefore, depends on the relative strength of these diverse forces.

Ratio of Current Imports to Current Exports ($IMEX_t$): Greater penetration of imported goods increases competitive pressures in the domestic market. When such competitive pressures enhance efficiency, financial performance may improve (Majumdar, 1997). On the other hand, one may expect positive impact of exports on financial performance (Majumdar, 1997), particularly when the extent of competition differs between the domestic and the international market. When such penetration into the international market is backed by greater efficiency and competitiveness, financial performance may improve. For example, Saluja (1968), Panchamukhi (1974) and Katrak (1980) found that price-cost margin is higher in Indian manufacturing industries with relatively less import competition and high export orientation. Impact of imports vis-à-vis exports on financial performance is, therefore, largely an empirical issue.

From the above discussion it is evident that, in addition to M&A, firms' financial performance depends on a variety of other factors and the nature and extent of impact depends on balancing of the diverse forces. Hence, understanding the impact of M&A on firms' financial performance requires systematic investigation through econometric modelling controlling effects of other forces. What follows next is an attempt in this direction.

3. Estimation Techniques and Data Sources

The functional relationship envisaged in the previous section is estimated with a panel dataset of 84 industries over the period from 2001-2002 to 2010-11. Selection of the study period is based on three specific reasons. First, since M&A during 1995-2000 had significant involvement of the MNCs, financial performance is likely to be affected considerably as these firms have distinct edge in respect of financial resources, technologies, human resources and markets. Second, the amendments to the Indian Patent Act (1970) since the late 1990s, viz., *Patent First Amendment Act* (1999), *Patent (Second Amendment) Bill* (2002) and *Patent (Amendment) Bill* (2005) were expected to incentivize firms towards in-house R&D. Such incentives are likely to influence financial performance through in-house R&D. Third, stable economic conditions and changes in macroeconomic policies since the early 2000s are also likely to have considerable implications for firms' financial performance during this period. However, the present paper does not consider data period beyond 2010-11 as the pace of M&A slackened during 2008-2014 (Basant and Mishra, 2016). Further, due to economic slowdown since 2009-10, consideration of this phase may cause unusual truncation in the envisaged relationships.

It is expected that carrying out panel data analysis in the present paper would help in capturing variations in the variables both across the industries and over time. This relaxes the assumption made in cross-section analyses that the same structure-conduct-performance relationships prevail

across all industries at a particular point of time. Necessary data are sourced from the Prowess IQ database of the Centre for Monitoring Indian Economy (CMIE). The details on measurement of the variables are given in Table – 1.

Table 1: Measurement of the Variables	
Variable	Measurement
Dependent Variables	
Profitability ($PROF_{t)}$	Ratio of profit before tax to industry sales
Returns on Capital Employed ($ROCE_t$)	Ratio of profit before tax to capital employed
Independent Variables	
Current Capital Intensity (KIR_t)	Ratio of capital employed to industry sales in the current year
Current Market Concentration (CON_t)	Herfindahl-Hirschman Index of market concentration
Current Import-Export Ratio ($IMEX_t$)	Ratio of current imports to current exports
Lagged Mergers and Acquisitions (MA_{t-1})	Natural logarithm of total number of mergers and acquisitions during the last three years excluding the year under reference
Current Advertising Intensity ($ADVT_t$)	Ratio of advertising expenditure to industry sales in the current year
Current Marketing and Distribution Intensity (MAD_t)	Ratio of marketing and distribution related expenditure to industry sales in the current year
Lagged In-house R&D Intensity ($R\&D_{t-1}$)	Ratio of in-house R&D expenditure to industry sales in the previous year
Current Foreign Technology Purchase Intensity (FTP_t)	Ratio of expenditure on foreign technology purchase to industry sales in the current year
Lagged Profitability ($PROF_{t-1}$)	One year lagged value of profitability
Lagged Returns on Capital Employed ($ROCE_{t-1}$)	One year lagged value of the returns on capital employed

In the present paper, Arellano-Bond (1991) dynamic panel data model of the following form is estimated to examine the impact of M&A on firms' financial performance:

$$y_{it} = \alpha + \beta y_{i,t-1} + \sum_{j=1}^{m} \gamma_j x_{j,it} + u_{it}$$

The estimation techniques for the above model are based on the generalized method of moments (GMM). As compared to the method of instrumental variables (e.g., Balestra and Nerlove, 1966; Anderson and Hsiao, 1981; Bhargava and Sargan, 1983), the GMM estimators can bring in more information on data (Ahn and Schmidt, 1995). The Arellano-Bond (1991) estimators are also consistent and more efficient than the Anderson-Hsiao (1981) estimators. In addition, the Arellano-Bond (1991) estimators have generalizations that can address the problem of autocorrelation, heteroscedasticity, specification errors, etc.

The Arellano-Bond dynamic panel data estimation techniques uncover the joint effects of the explanatory variables on the dependent variable while controlling potential bias due to endogeneity of the explanatory variables including the lagged dependent variable[8]. The paper also uses one-year lagged values of the predetermined variables as the instruments to control the endogeneity bias further. In the present model, inclusion of the lagged dependent variable as one of the explanatory variables accounts for the dynamic effects[9].

In addition, presence of autocorrelation problem and validity of instruments are tested by applying the Arellano-Bond (1991) test for autocovariance and the Sargan test (1958) of over-identifying restrictions respectively. The present paper uses both the one-step and two-step estimators. The two-step estimators are used for testing specification and overall significance of the estimated model as they yield standard errors that are asymptotically robust to both heteroscedasticity and autocorrelation. On the other hand, inferences on individual coefficients are based on one-step estimators due to their unbiased and reliable asymptotic robust standard errors. It may be noted that, in case of one-step estimators, the Sargan test over-rejects the null hypothesis of over-identifying restrictions, whereas the asymptotic standard errors of the two-step estimators can be severely downward biased in small samples. Hence, the present paper uses both the one-step and two-step estimators to test significance of the overall model and the individual coefficients respectively.

Further, the variance inflation factors (VIF) for each of the independent variables are computed to examine if the estimated models suffer from severe multicollinearity problem. Since the present study uses an unbalanced panel dataset of 84 industries over a period of 10 years, Fisher-type panel data unit root test is carried out to examine if the variables used in regression analysis are non-stationary. The test is based on the null hypothesis that that all panels contain a unit root again the alternative hypothesis is that at least one of the panels is stationary. Both the Augmented Dickey-Fuller (ADF) and the Phillips–Perron (PP) unit-root tests are carried out to ensure consistency in the results of the tests.

Following Choi (2001), two methods have been applied to carry out the tests, viz., Inverse χ^2, and Modified Inverse χ^2. Since the mean of financial performance of an industry may be zero, the drift option is not included. However, for both the methods, the trend components are added and the cross sectional means are removed through demeaning. A lag length of 2 years is selected by using the Newey and West's (1994) plug-in procedure (i.e., the nearest integer of $4*(T/100)^{2/9}$ with T being the time length of the panels).

[8] Since industry is the unit of observation in the present context, endogeneity problem is unlikely to be acute as it normally is when firm or the line of business is the unit of observation (Salinger, 1990).

[9] The use of such dynamic models is favoured, especially, for panels that have a large number of cross-sectional units with a small number of time periods, as we have in the present case. This is so because the estimation methods in such cases do not require larger time periods to obtain consistent estimators.

4. Regression Results and Discussions

Table 2 presents the summary statistics of the variables used in regression analysis. The partial correlation coefficients between the dependent and the independent variables are given in Table 3. It is found that, except the ratio of imports to exports, rests of the independent variables have statistically significant partial association with either of the two alternative measures of financial performance, though statistical significance and the nature of correlation differ across the indicators. Notably, mergers and acquisitions are found to have statistically significant (partial) positive correlation with returns on capital employed, whereas the correlation coefficient is not statistically significant when profitability is considered as a measure of financial performance. Further, low values of variance inflation factors (VIFs) suggest that there is no severe multicollinearity problem in the envisaged relationships (Table 3).

Table 2: Summary Statistics of Variables Used in Regression Models

Variable	Number of Observation	Mean	Standard Deviation	Minimum Value	Maximum Value
$PROF_t$	840	840	0.051	0.085	-0.520
$ROCE_t$	840	840	0.070	0.096	-0.433
HHI_t	840	840	0.189	0.161	0.013
KIR_t	840	840	0.917	0.483	0.232
MA_{t-1}	840	815	1.959	1.001	0.000
$ADVT_t$	827	827	0.013	0.020	0.000
MAD_t	840	840	0.054	0.035	0.005
RDt-1	812	809	0.006	0.031	0.000
FTPt	700	698	0.031	0.073	0.000
$IMEX_t$	698	700	0.890	3.085	0.000

The results of panel unit root tests are reported in Table 4. In case of the ratio of imports to exports (IMEX), the test statistics of the Augmented Dickey-Fuller test are based on one-year lags, whereas those for in-house R&D in Phillips-Perron test are estimated without demeaning. It is found that none of the variables used in the regressions analysis suffers from the problem of unit root. In other words, all the variables included in regression analysis are stationary in nature.

Table 3: Partial Correlation Coefficient between the Dependent and the Independent Variables

Independent Variable	Partial Correlation Coefficient		VIF
	PROF	ROCE	
HHI_t	0.2313^{**}	0.1905^{**}	1.58
KIR_t	0.0573	-0.2690^{**}	1.28
MA_{t-1}	0.0471	0.2086^{**}	1.61
$ADVT_t$	0.0897^{**}	-0.1332^{**}	1.40
MAD_t	-0.0851^{**}	0.0573	1.26

RD_{t-1}	0.1249**	0.0690*	1.15
FTP_t	0.1786**	0.0382	1.33
$IMEX_t$	0.0162	0.0066	1.02

Note: **Statistically Significant at 5 percent; *Statistically Significant at 10 percent

Table 5 and 6 report the Arellano-Bond dynamic panel data regression results of the envisaged model with profitability and the returns on capital employed being the alternative measures of financial performance. It is found that, in both the cases, the Wald-χ^2 statistics are significant. This means that both the estimated models are statistically significant. Further, since the Sargan test statistics are not statistically significant, the estimated models do not suffer from the problem of over identification of restrictions. In addition, the Arellano-Bond test for autocorrelation suggests for no autocorrelation problem of second order, as the respective test statistics are not statistically significant.

Table 4: Results of Fisher-Type Panel Unit Root Tests

	Based on Augmented Dickey-Fuller Tests		Based on Phillips-Perron Tests	
Variable	Inverse χ^2	Modified Inverse χ^2	Inverse χ^2	Modified Inverse χ^2
$PROF_t$	394.13	12.34	621.48	24.74
$ROCE_t$	419.69	13.73	296.08	6.99
HHI_t	283.73	6.31	249.73	4.46
KIR_t	436.62	14.65	279.64	6.09
MA_{t-1}	430.57	14.32	409.38	13.17
$ADVT_t$	647.79	26.44	378.91	11.69
MAD_t	563.65	21.58	404.49	12.90
RD_{t-1}	292.30	7.08	330.93	9.22
FTP_t	160.70	1.37	383.45	13.90
$IMEX_t$	203.89	3.39	1183.66	59.17

Note: (1) In case of FTP, the Dickey-Fuller test statistics are significant at 10 percent level of significance, whereas the rests are statistically significant at 5 percent level of significance.
(2) In case of IMEX, 1 year lag is used for the Augmented Dickey-Fuller test.
(3) The Philips-Perron test for R&D is not mean corrected.

As mentioned earlier, the present paper uses the one-step estimates for examining statistical significance of the individual coefficients. It is found that, for both the models, the coefficients of past financial performance, capital intensity, marketing and distribution related efforts, and foreign technology purchase intensity are statistically significant. This means that variations in financial performance across different industries of Indian manufacturing sector have been caused by these factors. However, while the coefficients of past performance and foreign technology purchase are positive, that of capital intensity ratio and marketing and distribution related efforts are negative. This means that financial performance have been better or have improved in industries that had better financial performance in the past or have spent relatively

more for purchasing foreign technologies. On the other hand, the industries with higher capital intensity or greater marketing and distribution related efforts have recorded poor financial performance or deterioration in the same.

Table 5: Regression Results with Profitability as the Dependent Variable				
Variable	Two-Step Estimates		One-Step Estimates	
	Coefficient	z-Statistic	Coefficient	z-Statistic
Intercept	0.0748	8.57**	0.0908	3.80**
$PROF_{t-1}$	0.1258	4.53**	0.1698	1.36
HHI_t	0.1536	5.39**	0.1099	1.54
KIR_t	-0.0339	-9.24**	-0.0365	-3.05**
MA_{t-1}	0.0010	0.42	-0.0029	-0.59
$ADVT_t$	0.4374	2.90**	0.6535	1.26
MAD_t	-0.6336	-8.44**	-0.6395	-3.33**
RD_{t-1}	-0.3586	-1.27	-0.1391	-0.22
FTP_t	0.1141	17.55**	0.1099	4.24**
$IMEX_t$	0.0005	1.46	0.0009	1.93*
Wald–Chi^2	3240.67**		86.18**	
Sargan Test for Over-Identification of Restrictions	43.59 (0.15)			
Arellano Bond Test for AR (1)	-1.98 (0.05)		-2.41 (0.02)	
Arellano Bond Test for AR (2)	1.43 (0.15)		1.57 (0.12)	
Number of Observations	458		458	

Note: (1) **statistically significant at 5 percent; *statistically significant at 10 percent
(2) Figures in parentheses indicate the level of significance of the corresponding test statistic
(3) For one-step estimates, the z-statistics are computed using heteroscedasticity corrected robust standard errors

Notably, in either case, the coefficient of market concentration or M&A is not statistically significant implying that market concentration or mergers and acquisitions have failed to cause any significant influence on inter-industry variations in financial performance. In respect of financial performance, the findings are consistent with that of Mishra and Chandra (2010) and Mantravadi and Reddy (2008) in Indian context[10]. A large number of existing studies in the context of other economies (e.g., Ikeda and Doi, 1983; Cosh et al, 1984; Kumar, 1984; Geroski, 1988; Odagiri, 1992) also found either negative impact or very little changes in operating performance following M&A. However, the findings of the present paper are contradictory to that of Healy et al. (1992), Grabowski et al. (1995), Switzer (1996), Smart and Waldfogel (1994) and Vander (1996). These studies in general found that M&A improve corporate performance. Such contradictions may

[10] Mantravadi and Reddy (2008) found only minor variations in operating performance following M&As.

largely be due to the multidirectional structure-conduct-performance relationships as propounded by Scherer and Ross (1990) and the analytical framework depicted above. On the other hand, the findings in respect of market concentration are consistent with Mishra (2008).

It is also found that the coefficient of efforts towards developing marketing and distribution related complementary asset is negative. Alternatively, both profitability and returns on capital employed have varied inversely with development of marketing and distribution related complementary assets. This is not only surprising, but also contradictory to Majumdar (1997). Hence, detailed scrutiny is necessary to understand why firms' efforts towards developing marketing and distribution related complementary assets failed in improving their financial performance.

Table 6: Regression Results with Returns on Capital Employed as the Dependent Variable

Variable	Two-Step Estimates		One-Step Estimates	
	Coefficient	z-Statistic	Coefficient	z-Statistic
Intercept	0.1786	15.44**	0.2011	5.82**
$ROCE_{t-1}$	0.1332	12.47**	0.1352	1.49
HHI_t	0.1098	4.02**	0.0722	0.71
KIRt	-0.0842	-9.55**	-0.0940	-2.83**
MA_{t-1}	-0.0051	-1.57	-0.0086	-1.36
$ADVT_t$	0.1528	0.53	0.6391	0.87
MAD_t	-0.8438	-8.63**	-0.9230	-2.59**
RD_{t-1}	-1.2895	-7.10**	-1.1472	-1.17
FTP_t	0.0689	7.93**	0.0692	2.31**
$IMEX_t$	0.0003	0.78	0.0007	1.20
Wald–Chi^2	709.97**		37.21**	
Sargan Test for Over-Identification of Restrictions	45.03 (0.12)			
Arellano Bond Test for AR (1)	-1.49 (0.13)		-1.78 (0.08)	
Arellano Bond Test for AR (2)	1.03 (0.30)		1.22 (0.22)	
Number of Observations	458		458	

Note: (1) **statistically significant at 5 percent; *statistically significant at 1 percent
(2) Figures in parentheses indicate the level of significance of the corresponding test statistic
(3) For one-step estimates, the z-statistics are computed using heteroscedasticity corrected robust standard errors

However, in either case, the coefficient of advertising is not statistically significant indicating that product differentiation or creating entry barriers through advertising does not have any significant influence on firms' financial influence. This is very important given that impact of advertising on performance is not consistent in the literature. For example, Greuner et al (2000)

found that advertising fails to increase profitability, whereas Delorme et al (2002) did not find any significant impact of advertising on profitability in the US manufacturing sector. On the other hand, a number of studies (e.g., Robinson, 1933; Kaldor, 1950; Bain, 1956; Comanor and Wilson, 1974) show that profitability is influenced directly by firms' selling efforts. In Indian context also advertisement intensity is expected to be an important determinant of profit (Siddharthan and Dasgupta 1983). It is, therefore, necessary to understand why impact of non-price competition through advertising is not significant and this can be an interesting area for further research.

The paper also finds that in-house R&D efforts do not affect firms' financial performance and this is contradictory to the findings of Delorme et al. (2002) that show inverse impact of innovative efforts on financial performance. While this may largely be due to the required gestation lags and the problem of amortization in recognizing future benefits, it is also possible that in-house R&D efforts have failed in delivering the desired outcomes. On the other hand, as it is expected, the present paper finds that foreign technology purchase has enhanced firms' financial performance. This is so because acquisition of new technology helps in lowering operating costs and hence the prices (Hinomoto, 1965; Balcer and Lippman, 1984). In addition to enhancing competitive edge, it also benefits the firms by creating entry barriers. However, the negative coefficient of capital intensity, though consistent with Bhandari (2010), is contradictory to the findings of Ornstein (1975), Liebowitz (1982), Domowitz et al (1986) and Martin (1988) that found its positive impact on price-cost margin.

Importantly, the paper finds that the coefficient of imports to exports in respect of profitability is statistically significant and positive. However, the coefficient is not statistically significant in case of returns on capital employed. Alternatively, while profitability has varied directly with larger import competition vis-à-vis exports, it failed to cause any significant impact on returns on capital employed. Such differences in impact across alternative measures of performance are surprising as well as very important given that both competition from imports and export competitiveness have important implications for competition law and policy.

5. Summary and Conclusions

In the context of significant increase in number of M&A during the last two and half decades of economic reforms in India, the present paper attempts to examine how such combinations have affected firms' financial performance in Indian manufacturing sector. Using secondary data collected from the Prowess IQ database of the CMIE and applying the Arellano-Bond dynamic panel data estimation techniques, the paper finds that M&A do not have any significant influence on inter-industry variations in financial performance possibly due to multidirectional structure-conduct-performance relationships as suggested by Scheerer and Ross (1990). Further, wherever

M&A have enhanced operational efficiency or market power of a firm, strategic reactions of other firms or policy and regulatory interventions by the government seem to have limited the benefits of M&A in respect of achieving better financial performance. The paper also finds that other business strategies like foreign technology purchase and development of marketing and distribution related as well as structural aspects like capital intensity influence firms' financial performance. While foreign technology purchase enhances financial performance, marketing and distribution related efforts and capital intensity impact the same inversely.

Findings of the present paper, therefore, suggest for rethinking on policies and regulations relating to M&A, international trade (especially in respect of technology imports) and intellectual property as they can play significant role in determining firms' business strategies as well as enhancing their operational efficiency, competitiveness and financial performance. In specific, the present paper suggests for a relook at the understanding of and approach to regulation of sellers' concentration in different markets as it does not have significant impact on financial performance. Further, the policies for and regulation of M&A also require further scrutiny, particularly as they do not cause any significant impact on financial performance. This is very important considering that integration of (weaker) firms or access to better technology or enhancing scale of production through M&A can enhance efficiency and competitiveness and restrict emergence of monopoly power. The findings of the present paper also create doubts on the rationale for application of uniform thresholds on assets and turnovers in regulating M&A across different industries given that the nature and extent of impact on market concentration and financial performance may differ depending on various industry-specific factors.

Further, the finding that in-house R&D efforts do not cause any significant impact on financial performance also requires serious scrutiny, particularly in respect of identifying the underlying reasons and examining the efficacy of the existing policies and the patent laws. This is so because in-house R&D intensity in Indian manufacturing sector is still very low, though it has recorded significant growth in recent year and M&A and inward FDI are considered as alternative routes of sourcing technology (Basant and Mishra, 2016). On the other hand, there is little empirical evidence that stronger intellectual property rights stimulate local innovation (Branstetter, 2004). In Indian context also the new patent regime seems to have failed so far to make the increasing R&D efforts widespread across the firms or industries (Mishra, 2010). These aspects should be addressed while designing policies for technology development and it has important implications for market competition. Probably, integration of different policies and regulations with greater industry-specific flexibilities is required for reaping better outcomes. This is particularly so as the process of economic reforms has deepened in the areas like FDI, privatization and disinvestment, intellectual property regulation, etc. and a considerable portion of FDI inflows in recent years have taken the route of M&A.

However, the findings of this paper may be tentative and robust conclusions in this regard require further exploration. While a better understanding of the impact of M&A on financial performance should also emphasise on size (i.e., value) of the deals along with their numbers, the present paper fails to capture this aspect due to lack of systematic data. This is very important as different deals may be of different size and simply by considering the number of M&A and thus assigning equal weights may lead to underestimation/overestimation of the impact. In addition, efforts should be made towards understanding the impact on performance according to type M&A, i.e., whether the deals horizontal, vertical and conglomeration in nature. The existing literature suggest that the objectives and hence impact of M&A are likely to differ depending on the type of the deals. More importantly, drawing implications for competition law and policy requires detailed scrutiny of the relationships at firm level. This is so because industry level analysis, as it is done in the present paper, can capture only impact for the average firm in an industry. On the other hand, the issue of market power or efficiency is more relevant at the firm level. Furthermore, a firm level analysis can also help in controlling strategic conjectures following M&A along with examining impact on performance in a broader perspective of changes in product quality and prices, consumers' position in the market (in terms of access to information, choice, etc.), firms' efforts towards innovation, etc. and role of regulatory agencies in this regard.

(The views expressed in this paper are strictly the author's personal and do not have any association with Institute where he works. Usual disclaimers apply.)

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Presence of Profit and Competition in Indian Industry

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ABSTRACT

Competition increases efficiency in resource allocation and utilization in manufacturing industry. Through entry and exit of firms, competition ensures neutralization of economic profit. Abnormal profit arises and persists for temporary period but because of competition, it erodes over time. Firms need to be efficient and innovative (R&D, access to critical raw material etc.) to enjoy short term profit. This paper explores the dynamic nature of competition and measures it for selected manufacturing industries in India for the period 2002-15. Based on the methodology developed by Mueller, persistence of profits is analyzed in select Indian manufacturing industries. It is found that there has not been much change in terms of long term competitive profit. But as compared to earlier studies, persistence of profits might have increased and also varies across and within sectors.

Key words: Industry studies: Manufacturing, Firm behaviour: Empirical analysis, Competition

JEL Classification: L6; D22; D41

I. INTRODUCTION

With the emergence of World Trade Organization (WTO), countries have been under pressure to become economically competitive. There is a widely held perception that there is a need to become domestically competitive first, to become globally competitive. These factors contributed to shift in policy thrust of various economies to create competitive environment in domestic economy. Thus, it becomes crucial to understand the nature and degree of competition prevailing in an economy.

Competition evolves due to the presence of abnormal profit in an industry. According to theory of perfect competition, abnormal profits cannot persist in an industry for long time. Such abnormal profit arises and persists for temporary period due to presence of barriers to entry and exit in the short run. The above normal profit, even in a competitive environment, can also be justified by variation in innovation efforts. Using R&D, business agents develop new product or efficient production process which attracts profit. Presence of profit in excess of the normal rate of return (enjoyed by any business agent such as firm etc.) will attract other business agent to enter the industry. But in the long run, if there is no entry or exit barrier, development of competitive product or process also takes place. This results in more and more number of business agents competing for customers and thus, such process of competition results in erosion of abnormal profits over time.

There are broadly two views (static and dynamic) regarding persistence of profit in a competitive environment. Cournot and Bain (1956) are the proponents of static view which tries to explain persistence of above normal profit through industry characteristics like industry concentration and industry elasticity of demand. On the other hand, Joseph Schumpeter (1934, 1950) is the proponent of dynamic view which tries to explain the persistence of abnormal profit by characteristics of business agents (firms) like size/growth/share of a firm, effectiveness of R&D of a firm. In a competitive environment, firms compete with each other by new innovation and/or copying innovation of its competitor. New innovation provides 'first mover advantage' to firm and provides them opportunity to earn above normal profit in the short run. Over time, when such innovation is adopted by other competitors, the 'monopoly power' of the innovator converges to 'competition' and results in erosion of above normal profit. This is consistent with rise and persistence of above normal profit for some point of time. Thus, it is important to

identify and measure different firm and industry characteristics/behaviour to explain persistence and erosion of abnormal profit.

The paper is divided into five sections. Section two provides review of literature with regard to competition. The third section discusses the objective of the paper and also elaborates on the methodology and data used in the paper. The fourth section provides analyses the empirical findings, while the fifth section concludes the paper.

II. LITERATURE REVIEW

The persistence of profit literature discusses the static and dynamic long-run equilibrium profit. Other than the seminal work by Mueller (1977, 1986, 1990), there are some other important work including Geroski and Jacquemin (1988), Kambhampati (1995), Connolly and Schwartz (1985), Jacobsen (1988), Waring (1996) and Cable and Jackson (2008). These studies have analyzed persistence of abnormal profit for different economies in different time periods. Mueller (1990) found, using a sample of nearly 600 firms for the period 1950 to 1972 (23 years) that firms tend to converge to the industry-average profit rate, but that the convergence process is incomplete. Geroski and Jacquemin (1988) analyzed the data of large German, French and British firms and found that the British firms have less variation in profits and these profits persist over time. In contrast, the German and French firms have larger variation in profits and also tend to converge more quickly to the industry-average profit rate. Similar results are obtained by Schwalbach, Grasshoff and Mahmood (1988) for German firms. In a similar study, using a sample of 241 American firms over a 20 year period, Jacobsen (1988) finds that industry concentration has no significant effect on the level of profitability and abnormal profit rates vanishes over time. Connolly and Schwartz (1985) find an asymmetry in the convergence process between firms, where less successful firms (below an industry-average profitability), did converge to the competitive return, whilst more profitable firms (above industry-average profitability) showed more persistent returns. Waring (1996) examines industry aggregates for American firms over a period of 20 years. They provide evidence that the convergence process is industry specific and that industry specificities, such as R&D, has a significant impact on the speed of convergence. Cable and Jackson (2008) used trend based analysis instead of standard first-order auto-regression model to study the persistence of profits for a sample of UK companies. They found that non-eroding profit persistence to be present in around 60% of the

companies. Gschwandtner (2010) analyzed the data for US firms allowing the assumption that firms can enter or exit the industry. They observed constant increase in competition in the US economy post the opening of the economy to international competition in the 1960–80s. They highlighted that the key determinants of persistence of profit are the firm and industry size, industry growth, and more recently risk, advertising and exports.

However, there are very few studies which have measured the level of competition in Indian context in either the pre –liberalization period or mix of pre and post liberalization period. One important Indian study is by Kambhampati (1995) which focuses on pre-liberalization period. The study considered 16 year data (1970-85) and 42 firms to explain the persistence of profit in Indian industry. It observed that large number of industries experience above average profit that persist over time and such persistence is higher in fast growing industries where price competition is minimized and, in industries with high strategic barriers such as advertising-sales ratio. Another study by Glen et al. (1999) also measured competition in industries of nine developing countries (Argentina, India, Jordan, South Korea, Malaysia, Mexico, Peru, Thailand and Zimbabwe) for the period 1980-92 and tried to separate the results for pre and post liberalization period. In post –liberalization period, they observed improvement in capital efficiency and reduction in profit margin in the emerging markets. They also concluded that intensity of competition in developing countries is no less intense than developed countries. While in another study Glen et. al (2001) found different results when they considered seven emerging markets (including Jordan) and dropped three countries Argentina, Peru and Thailand. They found that persistence of profit rate is lower in emerging economics than advanced economies.

There is a possibility of bias given the choice of period of analysis due to the limited availability of post-liberalization data in Glenn (1999, 2001) study. In India, post-1991 economic liberalization and economic changes (like abolition of license raj, allowance of FDI in different sectors) afterwards has completely changed the Indian industrial structure. Because of domestic protection before 1991, firms might have enjoyed abnormal profit if domestic competition was not high due to prevalence of licensing system. Also, identification of long run profit which is a crucial factor affecting convergence of profit was not addressed in those studies. Thus, it

becomes crucial to analyze the impact and how the firms and overall industry behave(s) when the economy is opened up.

However, very few studies have measured competitive rate of profit in case of Indian manufacturing industry. Study by Pushpangadan and Shanta (2008) studied the dynamic view of competition in Indian manufacturing industries. They estimated that competitive rate of profit is 5% and observed average profit rate is 50%. However, the period analyzed by them is till 2000. Also post-1995, India has adopted TRIPS which had impact on the manufacturing industry especially in drugs and pharmaceuticals post-2005. No other study based on recent data on Indian context is available which can throw light on the issue of competition in Indian industries for recent years. Thus, this paper makes an attempt to fill the gap by analyzing the presence and nature of competition and persistence of profit (for selected manufacturing industries) for the recent years (2002-2015).

III. OBJECTIVE AND METHODOLOGY

The paper explores the presence and nature of competition (industry structure, industry and firm characteristics etc.) in selected manufacturing industries (based on their relevance in Indian economy) and measure the level of competition in those industries. With most recent available data (from 2002 onwards), this paper assesses dynamics of competition through persistence of profit using Mueller's methodology. It also measures competitive rate of profit for the selected manufacturing industries which helps to decompose the profit rate into short term and long term components. Lastly, paper evaluates the strength of competition using Cubbin-Geroski's (1990) half-life measure.

To explore the persistence of profit, decomposition of profit is necessary. Total profit (P_{it}) enjoyed by a firm can be broadly decomposed into normal competitive return (C), firm specific permanent rent (R_i) and a transitory rent (S_{it}) which is also firm specific and tend to erode over time.

$P_{it} = C + R_i + S_{it}$

Under competitive environment, in the long run, above normal profit cannot exist. Thus, equilibrium profit will be equal to the competitive return. In that case, Ri = 0 and E(Sit) = 0 as t

approaches infinity. Another important assumption is that short run rents are inter-temporally related but converge to zero over time.

$S_{it} = \lambda_i S_{it-1} + \varepsilon_i$

where $|\lambda_i| < 1$ for stability and convergence over time and ε_i is error term with zero mean and constant variance.

Arranging the above two equations, we can have

$P_{it} = \alpha_i + \lambda_I P_{it-1} + \varepsilon_i$

Where $\alpha_i = (1- \lambda_i)(C + R_i)$.

The above final equation represents the dynamic process (autoregressive time series of order 1 (AR1)). This equation will provide us the long run estimated profit ($\hat{P}_i$) where

$$\hat{P}_i = \frac{\hat{\alpha}_i}{1-\hat{\lambda}_i}$$

$\hat{P}_i$ represents permanent rents which cannot be eroded by competition. $\hat{\lambda}_i$ is a measure of competition. If it is close to zero, competition is strong and adjustment process is fast. Now, $\hat{\lambda}_i$ and $\hat{\alpha}_i$ represent the firm and industry characteristics. Industry size, industry growth, firm size, firm growth, growth of competitive firms, share of the firm in the industry, R&D in the firm and in its competitor are some of the important characteristics (other than industrial policy) which lead to generation of abnormal profit or convergence to permanent rent.

The paper uses firm level data from Capitaline database. The database is an unbalanced panel. The nature of the data set is such that the sample changes every year as some being dropped and some new being added. The most probable reason for dropping some firms is non-availability of data and therefore we cannot consider the assumption of entry or exit of firms from an industry in our analysis. The paper considers a panel of 154 firms for the period 2002/03-20015/16. Apart from all industry analysis, the paper also evaluates nature and strength of competition in five

major industries Indian manufacturing industries: Cotton Textiles, Electrical Machinery, Electronics, Food products and Drugs and Pharmaceuticals.

IV. EMPIRICAL FINDINGS

Profit of a firm can be measured by different indicators like profit after tax, profit before tax etc. This paper has defined profit rate as the profit after tax plus interest payment as a share of total asset (excluding revaluation and depreciation). This is the most common and widely used definition of profit rate in literature. The paper has checked for the presence of auto-correlation (auto-correlation of order one was present) and data was adjusted accordingly for further analysis.

The paper has considered the most recent data for Indian manufacturing industries (2002-15). Data has been collected from ***Capitaline*** database. Few data points (data for a particular year) are missing for number of firms. It may or may not indicate entry and exit of firms. Thus, this paper has considered the firms for which most continuous data is available within the select time span. Finally, 154 firms qualified for this analysis which is distributed across five manufacturing industries, viz., Cotton textiles (37), Drug and pharmaceuticals (67), Electronics (13), Electric machinery (23) and Food products (14).

The paper first examines the persistence of profit rates and the distribution of short term (λ_i) and long term (π_{ip}) profit rates of Indian manufacturing industries (selected industries) considered together to understand the nature and trend of short term and long term profit rates. Based on Mueller's search method, study has identified and estimated the competitive rate of profit to facilitate decomposition of the observed profit rate into three broad components – the competitive rate, long term and short term rent. Inter-industry variation has been analyzed based on this decomposition. Finally, the paper has evaluated the strength of competition for each industry selected for the study.

The auto-profit equations are estimated for 154 firms to identify and measure the permanent component of profit rate and the short term profit rate which is carried over from one year to next year. **Table 1** shows the average value of λ_i (short term profit rate) and π_{ip} (long run profit rate). **Table 1** reveals that while on an average short term profit rate is about 38%, long term profit rate

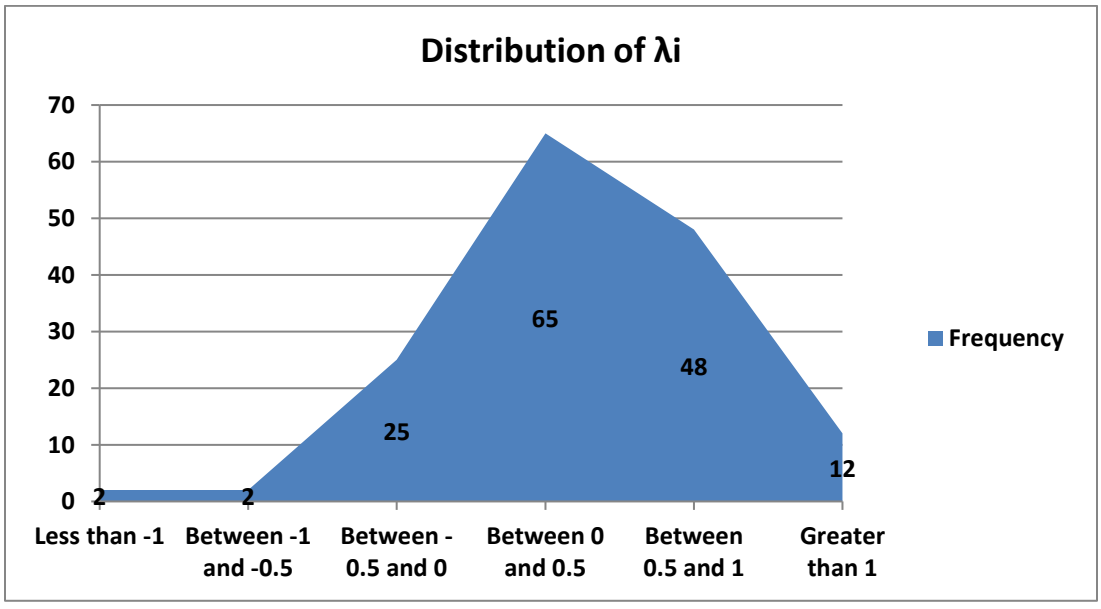
is only 5%, for the selected industries taken together. One previous study (Glenn et al, 2001) has found that short term profit was 22% in 1982-92. Another study by Pushpangadan and Shanta (2008) using Indian Industry data till 2000 found that short term profit rate was 47%. Thus over time, short term profit rate and hence competition changed in Indian industry. But, in the recent years (post-2000), short term profit has declined.

Table 1: Summary of λ_i (short run profit rate) and π_{ip} (long run profit rate)

Variable	Obs	Mean	Min	Max	Standard Error
π_{ip}	154	.0498773	-2.53094	.4712557	0.020781586
λ_i	154	.3896603	-3.059321	7.295678	0.063002084

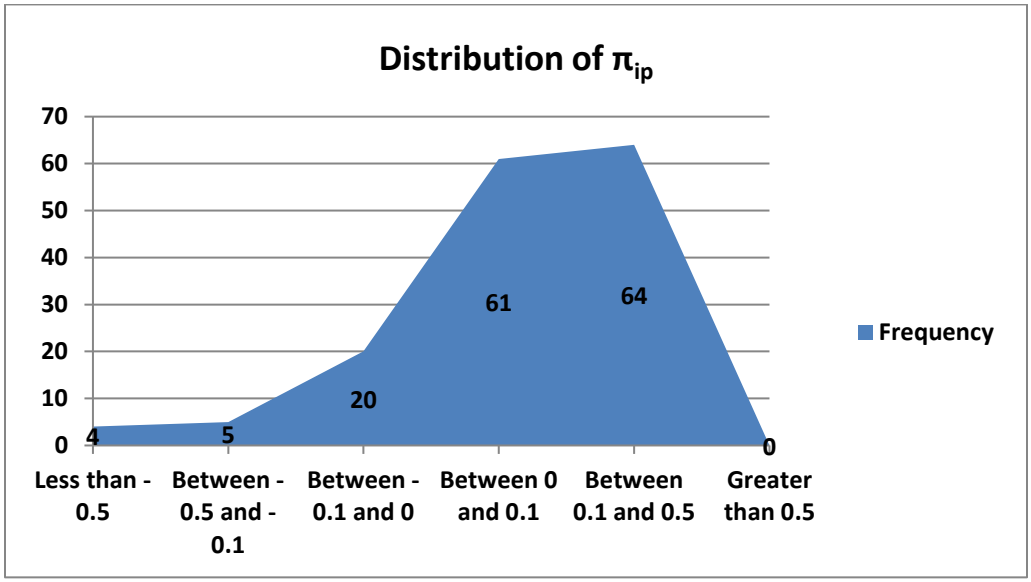
To explore the nature and trend of short term and long term profit rate, evaluation of frequency distribution of λ_i and π_{ip} is important. **Figure 1** and **2** displays the frequency distribution of λ_i and π_{ip} respectively. Out of 154 firms, 41 (2+2+25+12) firms lie beyond the range specified in the profit function i.e., outside (0-1) range (**Figure 1**). Only 73% of the sample firms (113 firms out of 154) are valid, i.e., had λ_i positive and significantly different from zero (at 5% level of confidence).

Figure 1: Distribution of adjustment coefficient of short run profit rate (λ_i) of 154 firms



As per **figure 2**, 29 firms have negative long run profit rate and maximum number of observations (number of firms) lies in the range (0.1-0.5) and (0-0.1). Thus, it indicates that competitive profit rate will belong in the range (0 – 0.5). The exact value of competitive long run profit rate is calculated based on the Mueller's search procedure.

Figure 2: Distribution of long run profit rates (π_{ip})

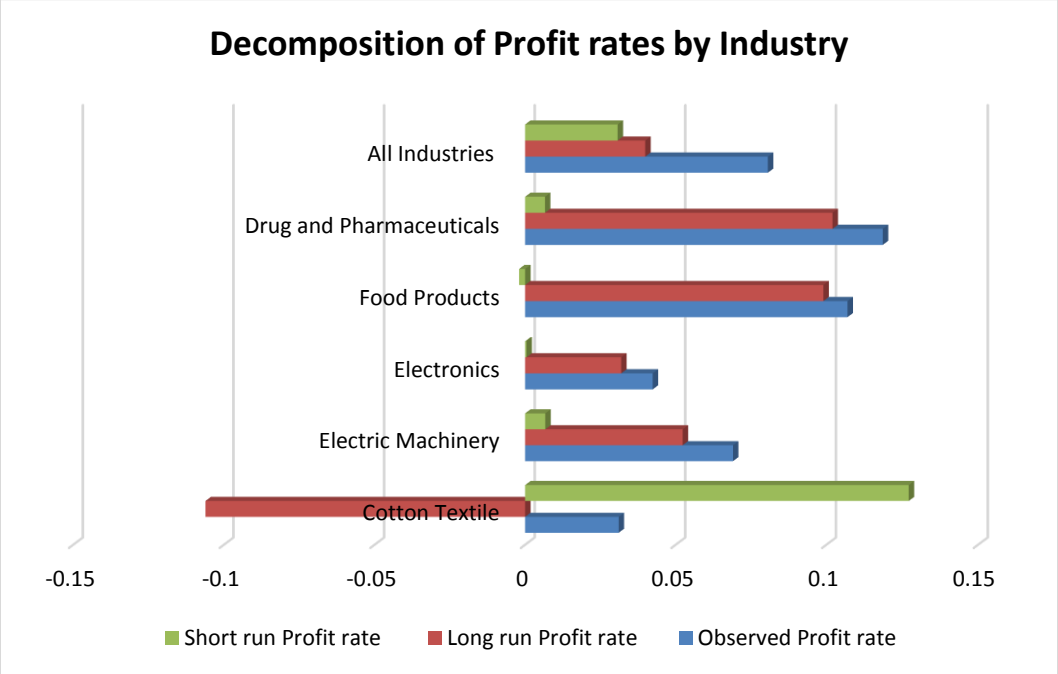


According to Mueller (1990), competitive rent is the level of profit for which number of firms is minimum. If profit increases beyond that level, more firms are attracted towards the industry, and this competition (given there is free entry and exit) will lead to erosion of profit to the permanent rent level. Based on Mueller's search procedure, this study estimates the permanent rent for the Indian manufacturing industry. We checked the distribution of $\boldsymbol{\pi_{ip}}$ and repeating t-test for each profit level, this study finds that 0.01 is the permanent rate of profit for the Indian manufacturing industry. This also helps to estimate the long term firm specific rent which is measured by long term profit rate less the permanent rent. As per the sample, the firm specific long term rent is about 4% (4.987%– 1%) for Indian industry. One previous study by Pushpangadan and Shanta (2008) using Indian Industry data till 2000, found that competitive profit rate was 5% but long run firm specific rent was 4.2%.

The study also estimates the inter-industry variation of observed profit rate and its components. **Figure 3** indicates the average profit rate and its decomposition across various industries. It reveals that all the selected industries enjoy presence of positive level of observed profit. Among

the selected industries, drugs and pharmaceutical industry (11.9%) followed by food products industry (10.7%) enjoys highest level of observed profit. Long term rent (r_i) is also high for these two industries. On the other hand, short term profit (S_{it}) is highest for cotton & textile (12.7%).

Figure 3: Decomposition of profit rates by industry



After industry-wise decomposition of profit, the paper explored the intra-industry or inter-firm (within same industry) variation of long term profit rate. Since, competitive rent is the same across all industries and firms, exploring the intra-industry variation in the long term rent would serve the purpose. To explore the equality of long term profit across firms and number of firms having equal profit, we need to check the equality (of long term rent) between two firms for all possible combination of firms within a particular industry. Following this technique, the result has been shown in **table 2**. For example, in case of electronics industry, there are 13 firms, and hence, there are 78 combinations of firms to check the equality of long term profit rate between two firms. Out of 78 cases, in 38 cases, equality of permanent profit rent was rejected by t-test. As per **table 2**, equality of long term profit is highest for food products sector and lowest in cotton textile. In case of cotton textile, as much as 79% cases, equality of long term profit rate across firms is rejected.

Table 2: Test of equality of permanent profit rates by industry

Industry	No. of Firms	No. of Tests	No. of Tests statistically significant*
Cotton Textile	37	666	525(79%)
Electric Machinery	23	253	142(56%)
Electronics	13	78	38(49%)
Food Products	14	91	21(23%)
Drug and Pharmaceuticals	67	2211	1083(49%)

* 5% level of significance (two –tailed *t*-test)

Finally, the study assesses the strength of competition at firm level. Strength of competition depends on the short term profit or the transitional part (λ_i) of the profit rate which is carried over from one year to next year. Higher is the value of λ_i, higher is the persistence of profit rate and lower is the competition. Strength of competition can be measured in terms of the time required to wipe out the transitional component of profit. However, as suggested by Cubin-Geroski (1990), this study measures the strength of competition as the time required for the transitional profit to be halved (half-life).

As per model specification, λ_i should vary within the range (0-1). This study calculates the strength of competition for the firms which satisfies this criterion. **Table 3** portrays the strength of competition in each of the selected manufacturing industries in terms of average λ_i value (transitional profit carried over from one period to next period) and half-life (time required to wipe out the transitional profit to be halved). As revealed by **table 3**, persistence of profit (transitional) is highest for cotton textile sector while minimum for electronics sector. λ_i itself indicates variation of strength of competition across selected industries. But as a second measure, half-life time is also calculated as per Cubbin-Geroski (1990), where half-life is measured as $T=\log (1/2)/\log \lambda_i$. This also indicates that cotton textile sector has the highest half-life time (1.47 years). Pushpangadan and Shanta (2008) using Indian Industry data till 2000 also found that

cotton textile (1.12 years) had second highest half-life time. A minute comparison indicates that while half-life time increases for cotton textile and pharmaceuticals, for other sectors it has declined over time.

Table 3: Strength of competition in Indian manufacturing industries

• **Industry**	**No. of Firms**	**λ_i Mean**	**Time (in years)**
Cotton Textile	29	0.6248281	1.47
Electric Machinery	17	0.4250699	0.81
Electronics	11	0.3300672	0.63
Food Products	11	0.3329324	0.63
Drug and Pharmaceuticals	47	0.412035	0.78
All Industries	115	0.4464182	0.86

V. CONCLUSION

It appears that not much has changed when it comes to long term profit in Indian industry. While long term permanent profit is about 10%, the long term firm specific rent is about 4% However, immediately after the liberalization exercise, short run profit might have had increased, though in recent years, it might have declined. However, it needs to be noted that short run profit is quite significant in Indian industry.

As with the observed profits, long term rent is also high in pharmaceuticals and food products, while short term profit is relatively high in cotton and textile industry. Persistence of profit is highest in the cotton textile industry and lowest in the electronics industry. Long terms profits of pharmaceuticals are high globally and hence it is quite expected particularly in the post-TRIPS scenario. Pharmaceutical industry is also characterized by a situation where consumers do not make buying decisions and the doctors might not decide the cheapest available alternatives for the patients. This might have led to higher profitability and lower efficiency in the industry.

Equality of profit across firms within an industry is highest for food products industry, while lowest in the cotton textile industry. The study has considered only the large firms in the food products industry who might have equal competitive strength which might be reflected in the equality of profit. However, the lower level of equality of profit in the textile industry, prima

facie, appears to be surprising given that with the dismantling of not only the domestic protection but also the global Multi-Fibre Agreement, this industry should be more competitive. However, it could be due to the fact that a developing country market for textiles and clothing industry has one group of firms that compete on price while there are firms that compete on their brand value.

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Economics of Mergers and Acquisitions in India's Drugs and Pharmaceutical Industry: Implications for Competition Policy

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1. Introduction

Mergers and Acquisitions (M&As) form an important part of the commercial activity of most economies, with 46,000 such transactions being reported in 2015 itself amounting to US$4.7 trillion[1]. This constitutes about 6.3% of the global GDP[2]. In India, transactions totaling about $26 billion were reported in 2015. Though small, this number is likely to increase as the Indian economy continues to grow and more firms seek to use M&As to achieve corporate objectives[3]. Owing to the surge in globalization, incidences of cross-border M&As have grown manifold and as such, the current era is sometimes also known as "New Era of Global Economic Discovery" (Cromwell, 2012). In 2014, Europe witnessed its highest ever activity level of M&As deals since its financial crisis. This substantial increase was about 40% increase over the 2013 levels. It is attributed primarily to the interest shown by the US and Asian acquirers[4]. Similar effect can be seen in other parts of the world as well. The growth in M&As activity is believed to be a result of various factors like improved financing conditions in various parts of the world, stronger cash reserves available with Companies, promising investment returns in private equity/ investment funds and search for talent and new technologies.

A number of factors drive M&As activity including increasing market share / market power, swifter access to markets, industry capacity considerations, securing access to proprietary technology, cheaper skills and distribution channels, managing business operation risks and performance, increasing portfolio of offerings (vertically or horizontally) and tax considerations (Steiner, 1975; Chatterjee, 1986; Porter, 1985; Shelton, 1988)[5]. M&As are the most common way of restructuring. Merger is joining of two or more firms into one, where

[1] https://imaa-institute.org/mergers-and-acquisitions-statistics/ (2016)
[2] http://databank.worldbank.org/data/download/GDP.pdf (2016)
[3] Transactions 2016: PE and outbound to drive M&A – Ernst & Young, India (2016)
[4] https://www.transactionadvisors.com/insights/newfound-attractiveness-european-ma
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assets and liabilities of all firms are vested into one surviving firm. The surviving firm can be one of the existing firm (A+B=A or A+B=B) or it can be a new entity (A+B=C).The former is defined as *merger through absorption* where the surviving entity is called the *merging firm* and the latter is called *merger through amalgamation*, where the newly formed firm is called the *amalgamated entity*. The macroeconomic environment and regulatory framework of any economy are the two major determinants of M&As activity. A number of factors such as, opening of economies on account of liberalization and deregulation, increasing privatization, financial liberalization and global integration of production systems due to advancement of information and communication technologies have led to rising M&As activity globally for past few decades.

A merger may bring changes in the economic efficiency of a firm in any direction. On account of reaping of economies of scale and other synergistic gains, productive efficiency and profitability may enhance post-merger. It may also result in losses in the form of decreasing profit margins, reducing quality and variety of products. However, along with this we also need to consider the possible effects of mergers on the level of industrial concentration and competition and thus, on the price-cost margins of firms. A firm may have greater power to impact or determine prices in the market due to exit of a firm, which is on account of merger. The market power of a firm is defined as the capacity of a firm to influence prices above the level that would prevail in the competitive market. Under the competitive conditions, firms are expected to have no monopoly power to influence prices in any way, and price is equated to marginal cost of the firm. Therefore, the concept used to measure market power is markup over price charged by the firm. It is defined as (P-C)/P, and is called the Lerner index.

Many analytical and empirical studies have been carried out to understand the pertinent post-merger issues of firms' price-cost margins (PCM), profitability and market shares and their impact on the market power of firms, level of industrial concentration and further its consequential impact on the level of competition in the economy. Some of these works are reviewed below.

Culha and Yalcin (2015), using panel data technique, examine the determinants of PCM in Turkish manufacturing firms during 1995-2003[6]. By controlling for size, age, ownership and export orientation of a sample of four thousand manufacturing firms, the study found that there exist striking differences in the pricing behavior of firms depending on their market shares. The price-cost margins of small and large firms behave fairly in opposite direction depending on the control variables. It is observed that interest income has a positive impact on price-cost margins for all groups, though less vigorous for small, exporter and young firms. They found export-intensity of firms had an important role to play to enhance competition while import-intensity was not effective in reducing the price-cost margins of firms.

[6] This period is of special importance as, in the year 1995, Turkey joined the custom union with EU which resulted in liberalization of its foreign trade and thus increasing the competitive pressures faced by the firms. Also, Turkey experienced an economic crisis in 2001.

McClogham, Lyons, and Batt (2007) state that competition policy of a country has an important role to play in determining the market price-cost margins. Therefore, they suggest that governments must facilitate an effective competition policy to curtail exercise of market power of firms. The effectiveness of competition policy has been measured using the ratings of national competition authorities (NCAs) which is published by The Global Competition Review (GCR). The authors find that countries with more effective competition policy have lower price-cost margins than their counterparts in countries with less effective competition policy. Further, they find that market growth plays a significant positive role while excess capacity and import penetration are non-significantly and negatively associated with price-cost margins. In contrast to this, Kee and Hoekman (2007) and Konings *et al*. (2001) suggest that competition policy does not have a prominent role to play in curbing price-cost margins and thus market power.

Aghion et al. (2005) investigate the relationship between market competition and innovation, based on panel data of a sample of 311 UK firms from seventeen industries over the period 1973-1994. They find a strong evidence of an inverted-U shape relationship between innovation and competition, implying that competition may increase incremental profits from innovating for those firms that are in neck-and-neck competition (called "escape-competition effect"), though it may also reduce innovation incentives for laggards (labeled "Schumpeterian effect"). The paper supports the role played by competition in improving economic performance of a country. In trying to examine whether the changed entry conditions impacted the productivity growth of incumbents, Aghion et al. (2004) explored the opening up of the UK economy during the 1980s. Based on a sample of 166 four-digit manufacturing industries during 1980-1993, they find that increased entry (measured by a higher share of industry employment in foreign firms) had led to faster total factor productivity growth of the incumbent firms and in turn faster growth of aggregate productivity. They also demonstrate that this happened because entry of foreign firms significantly improved the innovative activity of incumbent firms.

Nickell (1996) investigates the relationship between competition and corporate performance. The analysis based on a sample of 670 UK firms supports the view that competition improves corporate performance. The two main results of the paper are: market power as captured by market share, generates reduced level of productivity and that competition, measured by increased number of competitors, is associated with both higher level and the growth of total factor productivity of firms.

In addition to the studies reviewed above, a few important works in this area are by Alfaro and Chari (2012), Syverson (2004) and Campbell, (2005).

M&As in the Drugs and Pharmaceuticals Sector[7]: The M&As in the Drugs and Pharmaceuticals sector in India has seen significant activity. In 2015 alone, transactions totaling $4.1 billion in M&As took place. These include outbound (Indian companies engaging foreign firms in transactions), inbound (foreign companies engaging Indian firms in transactions) and domestic (Indian firms engaging each other in transactions). One of the most studied cases pertaining to M&As in the pharmaceutical industry is acquisition of Ranbaxy by Sun Pharmaceuticals, wherein the deal size was to the tune of USD 4billion. The deal entailed 16.4% dilution of equity capital of Sun Pharmaceuticals. This enabled the Company to fill in therapeutic gaps experienced in the United States, expand its market share through deeper market penetration and bolster its presence in the domestic market. It was through this deal that Sun Pharmaceuticals became one of the leading pharmaceutical firms producing generic drugs in the dermatology space[8].

It is nevertheless considered that despite such M&As, these transactions have not had retrograde impacts on the competitive landscape of the industry vis-à-vis the Indian consumer. This can be attributed to the strong price control mechanisms managed by the National Pharmaceutical Pricing Authority, which regulates the ceiling prices for scheduled formulations and monitors unscheduled formulations too. This ensures that key drugs are available to consumers at affordable prices[9]. However, these controls tend to discourage investments in the sector.

According to Mckinsey report (2010), the generics market has seen consolidation and is likely to witness more M&As activity, since the Indian market is largely fragmented[10].

Drugs and Pharmaceuticals Sector in India[11]: The outlook of Indian Drug & Pharmaceutical Industry appears to be very positive and with an overall turnover of around USD 20bn, it ranks third (3rd) in the world in terms of volume and fourteenth (14th) in terms of value. The Drugs and Pharmaceuticals has been one of the fastest growing sectors of the economy, expanding at 12% per annum and it is likely to reach $55 billion by 2020. However, the industry is fragmented and competitive, with the top four companies accounting for 20% market share and the top 10 companies for nearly 39% of the market share in 2015. Further, as many as 160 pharmaceutical firms are listed on the Bombay stock exchange[12] and many more are privately owned. Moreover, the Pharmaceutical business in India is concentrated around Hyderabad, Mumbai, Bangalore, Visakhapatnam and Ahmadabad[13].

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[7] Transactions 2016: PE and outbound to drive M&As – Ernst & Young, India (2016)
[8] http://www.edupristine.com/blog/mergers-acquisitions
[9] Annual Report 2015-16, Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers (2016)
[10] India Pharma 2020: Propelling access and acceptance, realizing true potential, Mckinsey and Company, India (2010)
[11] Pharmaceuticals – Sectoral Report, November 2016, IBEF (2016)
[12] http://www.bseindia.com/markets/Equity/EQReports/IndustryView.aspx?expandable=2&page=60101001+&scripname=Pharmaceuticals
[13] https://en.wikipedia.org/wiki/Pharmaceutical_industry_in_India

Over the last decade, pharmaceutical firms all across the world have been experiencing immense pressure mounting over their core activities like drug manufacturing, Research & Development and various legal/regulatory aspects primarily because of an increasing competition in the pharmaceutical industry. This has resulted in significant dampening of the growth of pharmaceutical industry worldwide. To make things worse, decline in requirement of prescribed branded drugs and emergence of cost-effective generic drug products has further stifled the growth of pharmaceutical industry. As a cascading effect, branded drugs produced by major pharmaceutical firms resort to price increase to cover up for their declining margins, inhibiting presence of a conducive market environment for them to operate and earn sustainable profits.

The post-reform period has been a challenging one for the Indian corporate sector. During this period, the Indian industry not only liberalized, but was also forced to restructure its businesses to survive in the new competitive environment. In its effort to do so, mergers and acquisitions (M&As), as a means to have quick expansion and as a corrective measure to its pre-reform policies, were adopted in large numbers. As expected, the phenomenon of M&As has accelerated in *volume* and *value* in the era of globalization, necessitating merger review on a broad range of issues. M&As activity in the pharmaceutical sector has been analyzed in a number of studies (Mishra, 2005; Beena, 2006; Mishra and Chandra 2010; Kaur 2002)[14]. However, no recent study analyzes the implications of such transactions on the competitive dynamics of the industry. With this background, our paper examines the consequential effects of Indian M&Ason *industrial concentration, firm's price cost margins* and *profitability*. This is undertaken with special reference to the drugs and pharmaceutical (D&P) industry. In light of our results, appropriate policies are proposed.

The paper has 5 sections. Having given a brief introduction in Section 1, Section 2 analyzes the trends in M&As in India's Drugs and Pharma Sector. Thereafter, in Section 3, we analyze variables such as market shares, Hirshman-Herfindahl index (HHI) and Price Cost Margins in the D&P sector. Needless to say, analyzing such variables is expected to provide insight to regulatory authorities while formulating competition policies. Thereafter, in Section 4, we econometrically examine the impact of size (proxied by market share and capital employed) on price cost margins and profitability of firms. This is done separately for Merging firms, Non-merging firms and for the overall sample consisting both Merging and Non-merging firms. In addition to the main variable of interest, viz. market share and M&As (as captured by a dummy variable in the Pooled Econometric specification), some of the firm-specific control variables included in the study are: leverage ratio; age of the firm, labour productivity and firm intensity

[14]Beena ,S (2006), " Mergers and Acquisitions in the Indian Pharmaceutical Industry: Nature, Structure and Performance", available at http://mpra.ub.uni-muenchen.de/8144/; Mishra, P. (2005) Mergers and Acquisitions in the Indian Corporate Sector in the Post- Liberalization Era: An Analysis, Ph.D Dissertation, (West Bengal: Vidyasagar University); Mishra, P. and Chandra, T (2010) Mergers, Acquisitions and Firms' Performance: Experience of Indian Pharmaceutical Industry, Eurasian Journal of Business and Economics 2010, 3 (5), 111-126

measured in terms of R&D intensity, Export intensity and Import intensity. Finally, in Section 5, the paper concludes from a broad policy perspective.

2. Trends in M&As in India's Drugs and Pharmaceutical Sector during 1999-2015

Akin to the global pharmaceutical industry, the Indian D&P industry is also one of the most merger-intensive industries. Soon after the initiation of the economic reform process in 1991-92, the pharma companies started consolidating their capacities through mergers and acquisitions of brands, plants and assets, divisions and units of firms. The driving force behind M&As was to consolidate the highly fragmented pharma sector to achieve faster growth, to avoid delays associated with building a new plant and increasing their shares.

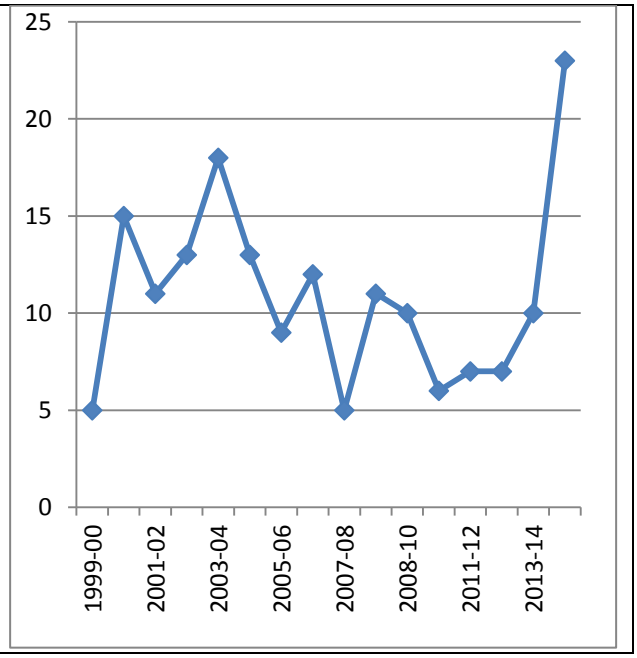
The growth of few companies undertaking mergers, such as *Sun Pharmaceutical* and *Mylan Laboratories Ltd*., is spectacular and worth mentioning. With both organic and external growth through aggressive and strong M&As strategy, *Mylan Laboratories Ltd.* has grown by more than 155 times i.e. from a turnover of Rs 45 crore in 2002, to 7000 crores in 2014, and its profit margin has grown by more than 11 times during the same period. After successfully merging with Medicorp Technologies India Ltd. and Vorin Laboratories Ltd in 2002-03, it continued its appetite for M&As and in 2004-05, it struck a number of deals, such as merger with Strides Arcolab, Fine Drugs & Chemicals Ltd., Medikon Laboratories Ltd. and Vera Laboratories Ltd. During 2001-2005, it entered into mergers with 9 firms. Similarly, Sun Pharmaceutical, with the ability to integrate various entities and successfully consolidate them, is on a high-rise growth path through mergers and acquisitions. It has grown by more than 150 times in its sales and by approximately 900 times in total assets since its inception in 1993. It got 14 firms merged into it, with 11 mergers taking place during 2000-2015.

Concerning trends in mergers in D&P industry, it is observed that close to 170 mergers took place during 2000-01 to 2014-15 (Refer to Table 1). With a few exceptions, most of these mergers were horizontal in nature. In the initial phase of economic liberalization, merger activity was quite slow and acquisition of brands was more common among the firms. In the mid-1990s, the M&As activity picked up moderately and in the early years of this century, the merger activity accelerated rapidly. This has also affected the concentration levels in the industry.

More than 50 percent of the total mergers during 2000-2015 were undertaken in the first seven years and approximately 30 percent took place in the next seven years. An important feature of this activity is that about 20 firms were involved in undertaking more than 100 mergers. Few firms are very aggressive in nature and have undertaken mergers in large numbers. For example, during the period 2000-15, Sun Pharmaceutical Industries Ltd undertook 14 mergers, Piramal Enterprises Ltd. 13, Cadila Healthcare Ltd. 10, Mylan laboratories 9 and Dr. Reddy's Laboratories Ltd. Was involved in 4 mergers.

Table 1: Year-wise Distribution of Mergers in D&P industry during 2000-2015

Year	No. of Mergers
2000-01	15
2001-02	11
2002-03	13
2003-04	18
2004-05	13
2005-06	9
2006-07	12
2007-08	5
2008-09	11
2008-10	10
2010-11	6
2011-12	7
2012-13	7
2013-14	10
2014-15	23
Total	170



Source: Based on Prowess database (CMIE, 2016).

Given the highly fragmented nature of the Drugs and Pharmaceutical industry, market share becomes an important variable in this industry. Out of the total, approximately, ten thousand firms in the industry (including the organised and unorganised sectors) roughly less than 5 percent firms are in the organised sector. The sample of 62 acquiring firm considered for this study accounted for 60 percent of the total sales of the industry in 2004-2005. This indicates a very high concentration of sales among very few firms in the industry. In the last few years, the D&P industry has witnessed intense competition among firms in undertaking M&As. The inter-firm rivalry to increase market share is discernible not only through competitive bids made by different firms, but also through acquisition of brands and plants and other assets of firms. In a situation where a firm's rivals are making acquisitions, it may also be compelled to make acquisitions to prevent rivals from building dominant market positions.

In light of the above discussion and in view of the fact that D&P industry is one of the most merger-intensive industry witnessing competitive bids and high rivalry among firms in the post-liberalised period, this phenomenon requires special attention from the point of view of its effect on the market shares of firms and level of concentration in the industry.

3. HHI, Price Cost Margins and Market Share of Drugs and Pharma Firms

In the empirical literature, several measures of competition are used. Primary among them are concentration measures, such as the Hirshman-Herfindahl index (HHI) and the price cost margins (PCMs). The use of concentration as a measure of competition goes back to the structure-conduct-performance framework. High concentration is seen as a signal of weak competition which leads to high prices and high price cost margins (Scherer and Ross, 1990).

In this Section, a brief is provided on Hirshman-Herfindahl index, Trends in market shares of Merging and Non-Merging firms, and Price Cost Margins of Firms in the D&P sector.

3.1.Concentration Ratio: Hirshman-Herfindahl Index (HHI)

The concentration ratio is a summary statistics used to measure the degree to which an industry is dominated by a *few large firms*. It can be measured by the percentage of total industry sales[15] supplied by the largest 4, 8 and 12 firms in the industry. If the 4-firm concentration ratio is close to 100 or even greater than 60 percent, the concentration is high and it is known as an oligopolistic firm. If it is low or less than 60 percent, then the concentration is low. However, the limitation of this method is that it does not consider the sales of each firm in the industry.

Another method of estimating the degree of concentration in an industry is the *Herfindahl index* (denoted by HHI). The advantage of this method is that it measures the information on all the firms and is not limited to the shares of the few largest firms in the industry.

Assuming there are N firms in an industry, let s_i be the market share of the i^{th} firm (defined as the ratio of sales of i^{th} firm to total sales of the industry), the *Herfindahl index is the sum of the squared values of the market shares* (measured in percentage) of all the firms in the industry. Thus,

$$HHI = s_1^2 + s_2^2 + s_3^2 + s_4^2 + \ldots + s_n^2$$

The index takes a value between 0 and 10,000 ($0 \leq HHI \leq 10{,}000$), where the value 0 indicates no concentration and 10,000 indicates the case of monopoly. If there is only one firm in the industry, then $HHI = (100)^2 = 10{,}000$. If there are two firms in the industry sharing the market equally, then $HHI = (50)^2 + (50)^2 = 5000$. With the 100 equal-sized firms in the industry (perfectly competitive) $HHI = (1)^2 + (1)^2 + (1)^2 + \ldots\ldots + (1)^2 = 100$. The lower the value of HHI, the more competitive is the market, and higher the HHI, the greater is the market concentration. Another advantage of this method is that, by taking the squares of share of each firm, the index gives higher weight to larger firms in the industry (Salvatore, 1996).

From Table 2 and Figure 1, four distinct phases in HHI can be noticed. In the first phase, it is noted that during the time span of 10 years i.e. 1988-89 to 1998-99, the HHI index fell continuously to less than half of its value of 1988-89. In the second phase, HHI rose. There is a perceptible rise in HHI index since 1999-00 until the year 2004, beyond which in the third Phase, it again began to decline. However, in its fourth phase that commenced in 2010, yet again the HHI has risen, indicating a rise in concentration level in the D&P industry.

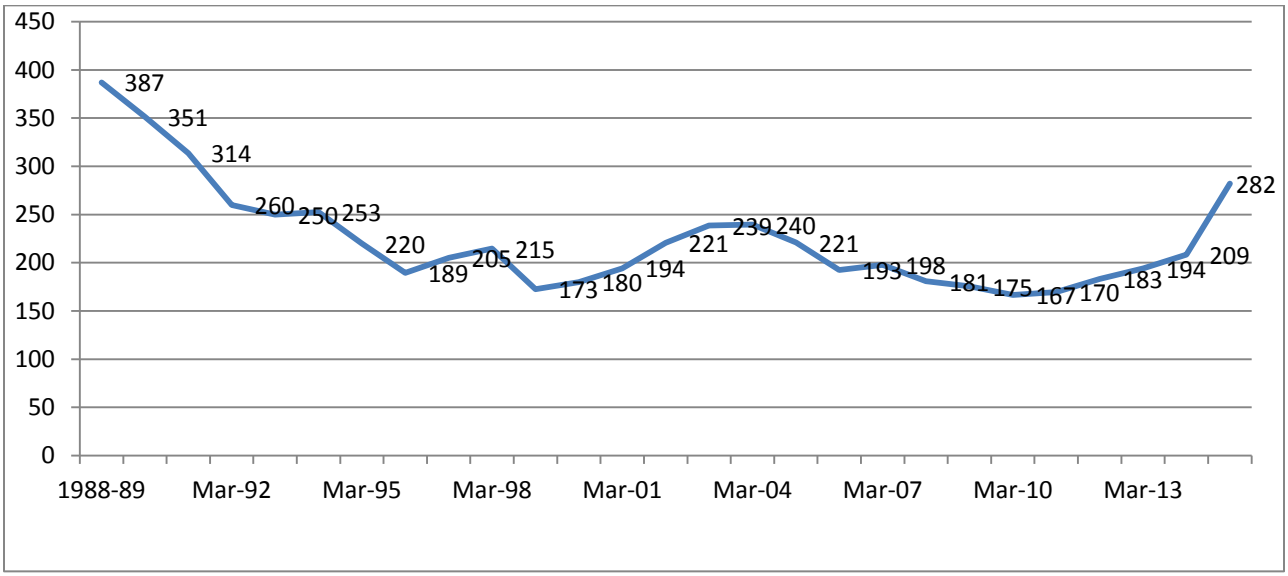
[15]The industry's sales are based on all the firms covered in Prowess database (CMIE, 2005).

Table 2: Concentration Levels in D&P Industry, 1999-2015

Year	HHI	Year	HHI
Mar-90	351	Mar-03	239
Mar-91	314	Mar-04	240
Mar-92	260	Mar-05	221
Mar-93	250	Mar-06	193
Mar-94	253	Mar-07	198
Mar-95	220	Mar-08	181
Mar-96	189	Mar-09	175
Mar-97	205	Mar-10	167
Mar-98	215	Mar-11	170
Mar-99	173	Mar-12	183
Mar-00	180	Mar-13	194
Mar-01	194	Mar-14	209
Mar-02	221	Mar-15	282

Source: Calculations based on Prowess database (CMIE, 2016)

Figure 1:Hirshman-Herfindahl Index (HHI) for the Period 1999 to 2015



Source: Calculations based on Prowess database (CMIE, 2016).

In trying to further explore this issue and provide an explanation for the change in the concentration level, we analyse the entry and exit phenomenon in the sector. This is given in Table 3.

Table 3: Distribution of Firms in the D&P industry according to year of Incorporation

Period	No. of Entrants
before 1950	41
1951-1980	114
1981-1990	261
1991-1995	177
1996-2000	71
2001-2002	18
2003-2004	21
2005-2006	36
2007-2008	17
2009-2010	8
2011-2012	6
2012-2014	7

One of the plausible reasons of continuous reduction in the concentration ratio during the first phase is *entry of new firms outstripping the exit of firms* (during 1990 to2000). From Table 3, we find that approximately 250 firms joined the D&P industry during the first 10 years of liberalization. However, after the year 2000, a continuous fall in the firms joining the industry is a clear indication of the exit of firms dominating the entry (may be due to heightened merger activity in the industry). In a span of five years i.e. 2000-05, close to 70 firms from D&P got merged to other firms within the D&P industry whereas there were only 75 new entrants in the industry during this period. Recently on account of rise in mergers and slowdown in the entry, we find again a rise in the Herfindahl index since the post 2010 period.

3.2: Trends in the market shares of Merging and Non-merging firms:

Based upon the analysis of changes in the market shares of the few prominent merging and non-merging firms during the period under consideration, the following findings are noticeable:

i. The market shares of the merging firms have continuously risen, while those of non-merging firms are showing declining trend (Figure2a and 2b respectively).
ii. The highest rise in the market share was experienced by Dr. Reddy's Laboratories Ltd. Its share rose from 2.05% in 2000 to 5.63% in 2002 and further to 6.5% in 2015. Similarly, market share of Mylan Laboratories Ltd. rose from 0.19% in 2000 to 4.15 % in 2014. Other merging firms, such as, Lupin Ltd., Emami Ltd., and Alkem Laboratories Ltd. too showed a rising trend in their market share over the period 2000 to 2015.
iii. Among the non-merging firms, Alembic Ltd.experienced a fall in market share from 2.19% in 2002 to 0.09% in 2015. Astrazeneca Pharma India Ltd's. share reduced from

0.45% in 2000 to 0.27% in2012. For Biological E. Ltd. as well, its market share declined from 0.54% to 0.16% over the period under consideration.

Figure 2(a): Trends in the Market Shares of Select Merging firms

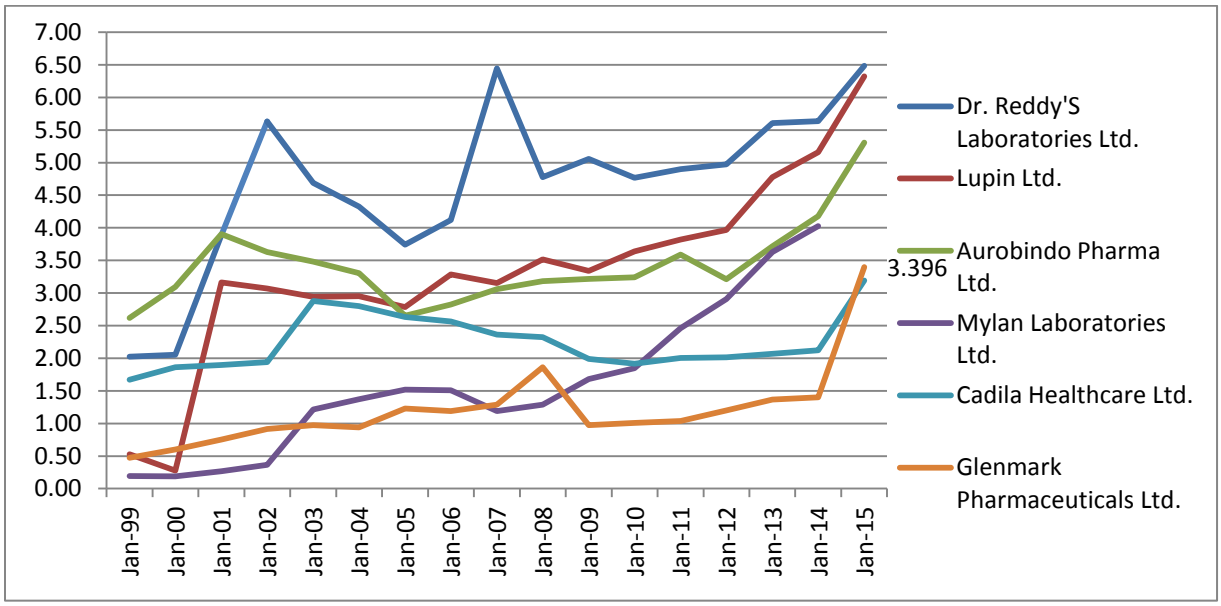
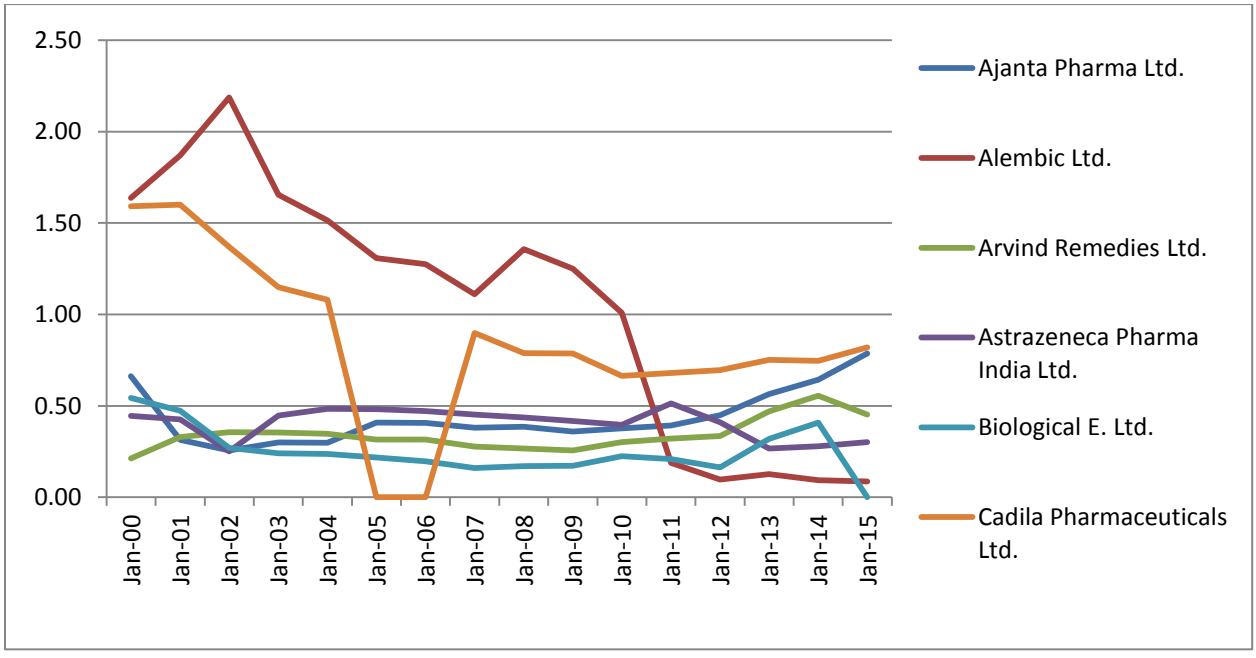


Figure 2(b): Trends in the Market Shares of Select Non-merging firms



3.3.Price Cost Margins, Market Shares and Sales

In Table 4, we provide the descriptive statistics pertaining to merging and non-merging firms and the overall sample for the following three variables:

- Price Cost Margins
- Market Shares, and
- Sales

Pertinent observations based on Table 4 are hereby listed:

i. Price Cost Margins: The average value of PCM for Merging firms is higher than that of Non-merging firms (0.46 and 0.37 respectively). Further, the standard deviation of the same is lower for Merging firms as compared to Non-merging firms (0.19 and 0.50 respectively).

ii. Market Shares: The average market share of Merging firms is higher than for Non-merging firms (1% and 0.2% respectively). Further, the maximum market share ever attained by Merging firms is also higher (Close to 10% for Merging firms as compared with 6.6% for Non-merging firms). The average market share of each firm in the D&P sector is less than half percent.

iii. Sales: Firms that have undertaken M&As as a strategic route, on an average have higher sales viz. a viz. their counterparts that never merged. However, the standard deviation across the mean is also higher for the merged firms.

Table 4: Descriptive Statistics with respect to Price Cost Margins, Market Share and Sales

Merging Firms					
Variable	Obs	Mean	Std. Dev.	Min	Max
Price Cost Margin	1006	0.46223	0.19556	-1.901	0.982456
Market Shares	1054	0.94869	1.24330	0	9.581405
Sales	1006	7849.659	12655.62	0.5	100939
Non Merging Firms					
Variable	Obs	Mean	Std. Dev.	Min	Max
Price Cost Margin	1933	0.37195	0.50877	-16.5	1
Market Shares	2091	0.20879	0.53839	0	6.570986
Sales	1926	1774.868	5680.977	0.1	102277.9
All Firms					
Variable	Obs	Mean	Std. Dev.	Min	Max
Price Cost Margin	2939	0.40285	0.43027	-16.5	1
Market Shares	3145	0.45675	0.91238	0	9.581405
Sales	2932	3859.193	9188.848	0.1	102277.9

In Table 5, we provide the Distribution of Merging and Non- merging firms according to their Average Market Shares (in %) and Average PCM (in ratio), during the period 1999 to 2015. Based on Table 5, select findings are hereby reported:

i. Of the 62 Merging Firms analyzed, over 40 have market share less than 1%. Similarly, for the Non-merging firms as well, 120 out of 123 firms analyzed have less than 1% market share.
ii. Of the Merging Firms, 25 out of 62 have PCMs higher than 0.5. Incidentally, 13 of these have high PCMs despite a market share of less than 1%. For Non-Merging companies, 23 have PCMs in excess of 0.5. Of these, 22 have PCMs in excess of 0.5 despite a market share of less than 1%.
iii. For Merging firms, 43 out of 62 have PCMs in the range of 0.3 to 0.6. This constitutes close to 70% of Merged firms. For Non-merging firms, the corresponding figure is 54%. Further, for Non-merging firms, 92 (74%) have PCMs in the range of 0.2 to 0.6.

Table 5: Cross Tabs for Merging and Non-Merging Firms between Market Share and Price Cost Margins (1999-2015)

Non-Merging Firms										
Avg PCM → / ↓ Avg MS	<0	0-0.1	0.1-0.2	0.2-0.3	0.3-0.4	0.4-0.5	0.5-0.6	0.6-0.7	0.7-0.8	Grand Total
0-0.5	2	3	11	32	19	22	17	3	1	110
0.5-1				3	4	2		1		10
1-1.5					1	1				2
1.5-5										0
5-5.5							1			1
Grand Total	2	3	11	35	24	25	18	4	1	123
Merging Firms										
Avg PCM → / ↓ Avg MS	<0	0-0.1	0.1-0.2	0.2-0.3	0.3-0.4	0.4-0.5	0.5-0.6	0.6-0.7	0.7-0.8	Grand Total
0-0.5		1	3	3	10	5	3	2	1	28
0.5-1			2		1	3	4	1	2	13
1-1.5						2	3		1	6
1.5-2						2	4	1		7
2-2.5					1		1	1		3
2.5-3								1		1
3.5-4					1					1
4-4.5						2				2
5-5.5						1				1
Grand Total		1	5	3	13	15	15	6	4	62

4. Impact of M&As and Market Shares on Price Cost Margins and Profitability of Firms in D&P Sector: Econometric Analysis

Methodology and Variables:

Having estimated and analyzed the concentration ratios through *Hirshman-Herfindahl Index* (HHI) in the Indian D&P Industry, the effect of M&As on the following variables is examined,

- Price Cost Margins, and
- Profitability

A total of 185 firms have been analyzed, of which 62 have adopted Mergers as a strategy, while 123 have not merged. The time period of study is 1999 to 2015. The sample consists of 62 merging and 123 non-merging firms. The study focuses on only those merging firm that entered into mergers during 1999-2015. It is observed that approximately all the mergers are horizontal in nature i.e. both the firms entering into merger engaged in the same lines of business. The sample of 62 merging firms included for our study, on average contributed between 55% and 65% of the industry sales during 2000-2015. During 2003 to 2008, the weight of these firms in the industry's sales was above 60%, with maximum of 65% in the year 2004-05. As far as the sample of non-merging firms is concerned, their contribution varied between 25%and 29% for the period under consideration.

The following panel regression is estimated:

$$Y_{jit} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \ldots + \beta_n X_{nit}$$

Where,

- Y_{jit} represents either the Price Cost Margins (PCM) or Profitability of the firm.

  PCM has been measured as: (Total income – Total cost)/ total income

  Where total cost is sum of following four components, viz,

  - Cost of raw materials, stores and spares
  - Cost of power, fuel and water charges
  - Compensation to employees, and
  - Selling and distribution expenses

  Profitability has been measured as Profit Before Tax (PBT) as % of total income.

- X_{kit} represents firm specific variables such as:

  1. **Size of the firm:** In the present paper, size is analyzed primarily in terms of market shares (defined as the ratio of the amount of a specific firm's sales to the sales of the industry) and by capital employed. It is hypothesized that size, as proxied by market share and capital employed impacts PCM and profitability positively.
  2. **Leverage ratio:** It is a measure of indebtedness and is defined as the ratio of Total term liabilities / tangible net worth. It is hypothesized that greater the firm's indebtedness, lower will be the PCM and profitability.

3. **Import Penetration:** It gives a measure of firm's import intensity. It is estimated as: Raw material imports / Raw material purchases (%)
   It is expected that greater dependence on imports, is likely to constraint the flexibility to exercise monopoly power. As such one would expect lower PCM and profitability.
4. **Export intensity**: exports of firm/sales of the firm (%). An inverse relationship is expected between export intensity and PCM since greater the ratio of exports, greater is the expected competition the firm faces in the international market, thereby forcing it to not have high PCM and profitability.
5. **Age of a firm**: The reason to consider this variable as one of the determinants of PCM/Profitability is to understand whether mature firms (being more experienced) have higher PCM/profitability or do relatively younger firms (being more aggressive and vibrant) are likely to have higher PCM/profitability. Empirically, this variable has been considered as a proxy for the firm's maturity.
6. **Labour productivity:** It is measured as total sales/compensation to employees. Economic literature states that higher labour productivity lowers the cost of production. This is expected to increase PCM and/or profitability. While prices may also fall on account of improved productivity, in general, one would exopect the price fall to be less than the fall in labour costs.
7. **R&D intensity**: expenditure on R&D as a ratio of sales.
8. **Dummy variable:** It takes a value of 1 for post merger years, and 0 otherwise. Firms that never entered into a merger also have a value of 0.

Analysis of Results:
The regression results are reported in Tables 6 and 7. In general the following findings emerge:

Impact on Price Cost Margins:

i. Market Share: In general market shares have a non-significant impact on PCMs. However, for the Pooled data, market shares have been estimated to have a positive and significant impact on PCMs for all D&P firms over the period of study. Further, for the Merging firms, the post merger market share (captured by the interaction between market share and post merger years), continues to remain non-significant.
ii. Capital employed: High capital costs are often associated with high fixed costs that act as a deterrent to entry. With difficult entry, markets are expected to be concentrated thereby increasing PCMs. Our empirical estimates indicate that capital employed has a non-significant impact on PCMs across Firm Groupings and Model Specifications. Thus one may conclude that capital costs do not act as a deterrent for entry of new firms into the market.

iii. Labour Productivity: Labour productivity has been estimated to impact PCMs adversely. This is true across Firm Groupings and Model Specifications. Moreover, the coefficients are highly significant (often at the 1% level). This implies that as the labour productivity improves, the PCM reduces. An important implication of the same is that more than proportionate fall in labour costs are passed on to the consumer. This result has important implications for policy. For instance, while the trend analysis of market shares for select companies shows that market shares went up post merger, the same did not lead to increase in concentration as captured by PCM. This result is reinforced by the negative coefficient of labour productivity. Had competition not been intense in India's D&P sector, improved efficiency on account of enhanced labour productivity would not have led to lowering of PCMs. Thus, it can be stated that negative coefficient of labour productivity with respect to PCM is indicative of intense competition.

iv. R&D intensity: For the Merging Firms, the coefficient of R&D remains negative and significant. For other two Firm Groupings (Non-Merged and Pooled), the impact of R&D on PCM remains non-significant.

v. Leverage Ratio: The impact of leverage ratio remains negative across Model Specifications, though the same is significant for Merging Firms only.

vi. Import Intensity: It has been estimated to have a positive and significant impact on PCMs. However, the impact is often low/negligible.

vii. Other variables, such as, age and export intensity have been estimated to have a non-significant impact on PCM.

Our econometric analysis of correlates of PCM indicates that neither market shares, nor merger activity impacts PCM. While PCM remains an important measure to understand intensity of market competition, nevertheless, from a theoretical point of view recent literature discusses the inappropriateness of PCM and HHI as measures of concentration. Recent literature states that sometimes their interpretation is not straight forward, especially if intensity of competition is high (Tirole, 1988). This is elaborated further.

It is often believed that market competition can be intensified in the following two ways:

(i) When more firms enter a market due to a fall in entry barriers: When more firms enter a market, it tends to lower concentration, thereby lowering HHI.

(ii) When there is more aggressive conduct by incumbent firms: In this case, there could be a problem in interpreting the typical value of concentration ratios. The problem with concentration measures as indicators of competition is that a switch to more aggressive behavior by firms forces inefficient firms out of the market and/ or get merged (selection effect of competition). This raises concentration, though it should (clearly) not be interpreted as a fall in competition.

Table 6: Impact on PCM for Merging, Non-Merging and All Firms (Robust Standard Errors)

	Merging Firms[#]			Non-Merging Firms[#]	All Firms[^]	
	(1)	(2)	(3)	(4)	(5)	(6)
Market Share	0.006	-0.042		0.054	0.105***	
	(0.028)	(0.064)		(0.066)	(0.033)	
Dummy $_{Merge}$		-0.106	-0.095		0.183***	-0.112
		(0.099)	(0.245)		(0.064)	(0.238)
Market Share*Dummy for Merger		0.059			-0.040	
		(0.057)			(0.037)	
Capital Employed (Log)			-0.030			-0.044
			(0.071)			(0.039)
Capital Employed*Dummy for Merger			0.006			0.051
			(0.030)			(0.037)
Labour Productivity	-0.003***	-0.003***	-0.003***	-0.002	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
R & D Intensity	-0.025**	-0.025**	-0.024**	-0.010	-0.014	-0.011
	(0.010)	(0.010)	(0.010)	(0.013)	(0.011)	(0.013)
Leverage Ratio	-0.012*	-0.010*	-0.010*	-0.000	-0.001	-0.001
	(0.006)	(0.006)	(0.005)	(0.002)	(0.002)	(0.002)
Export Intensity	0.003	0.003	0.003	-0.001	-0.001	-0.000
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Import Intensity	0.003*	0.004*	0.003*	0.000***	0.000***	0.000***
	(0.002)	(0.002)	(0.002)	(0.000)	(0.000)	(0.000)
Age	-0.006	-0.002	0.002	-0.003	0.002	0.004*
	(0.006)	(0.005)	(0.012)	(0.007)	(0.002)	(0.002)
Constant	-0.738***	-0.799***	-0.719**	-0.914***	-1.044***	-0.828***
	(0.194)	(0.163)	(0.290)	(0.208)	(0.082)	(0.149)
N	922.000	922.000	922.000	1916.000	2841.000	2775.000
Groups	62.000	62.000	62.000	123.000	185.000	185.000
R^2 *Within*	0.108	0.114	0.112	0.002	0.003	0.008
R^2 *Overall*	0.000	0.023	0.036	0.001	0.047	0.037
R^2 *Between*	0.015	0.002	0.018	0.002	0.195	0.125
Rho	0.627	0.584	0.566	0.206	0.155	0.147
Sigma_u	0.419	0.382	0.368	0.461	0.328	0.317
Sigma_e	0.323	0.322	0.323	0.905	0.767	0.764

[#]Fixed Effects Results (with Robust Standard Errors) as supported by Hausman Test. ^Random Effects Specification with Robust Standard Errors.

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The Dummy variable used in case of Merging Firms takes the value 1 post merger of the firm. The Dummy variable used in case of All Firms takes the value 1 for all Merging Firms.

Incorrect implication with respect to HHI: When there is more aggressive conduct by incumbent firms, it tends to raise the market shares of efficient firms at the expense of inefficient firms. Such a reallocation (of market share) effect raises HHI as well. The reason why HHI incorrectly suggests a fall in competition when the interaction between firms becomes more aggressive is the reallocation effect. As competition becomes more intense, market share is reallocated from inefficient firms (with low initial market shares) to efficient firms (with relatively high initial market shares). Some inefficient firms may even go bankrupt or get merged due to the intensified competition. This raises concentration in the market, incorrectly suggesting a fall in competition. This has been particularly witnessed in the Indian D&P industry. The firms that were small, unprofitable, and highly leveraged were attractive targets for merger by efficient firms. On account of pressure due to lack of funds, these firms preferred getting merged with efficient firms, instead of going bankrupt and exiting the industry. The merging firm is doubly advantageous; it is cheaper to buy such firms; and there is a possibility of getting tax advantage on the enhanced amount of debt post-merger. This raises market share of merging firm and concentration, incorrectly suggesting a fall in competition.

Incorrect implication with respect to PCM: Since in highly concentrated markets, an increase in PCM can be caused by more intense competition, PCM is often not considered a good measure of monopoly power (Fisher, 1987). Sometimes, another problem may also arise with respect to PCM as a measure of competition. Specifically, if a firm's costs fall over time, its PCM tends to go up. Such an increase in PCM should not be interpreted as a fall in competition. Indeed, conditional on a firm's costs, a high PCM indicates market power. But, conditional on price, high PCM reflects efficiency.

Using simulations Boone et al (2007) illustrate that the competition measures, as captured by PCM and HHI work well in the former case, but not in the latter. This particularly involves HHI. They therefore argue for an alternate measure of competition that picks up both forms of changes in competition correctly. The alternate measure of competition proposed is of "profit elasticity" (Boone et al., 2007; Boone, 2008). It is considered to be more robust both from theoretical and empirical perspective. Profit elasticity (PE), is measured for a market and is defined as the percentage fall in profits due to a percentage increase in (marginal) costs. While an increase in marginal costs reduces a firm's profits, regardless of the market structure; however, in a more competitive market, the same percentage increase in costs is expected to lead to a bigger fall in profits. This is because in more competitive markets, firms are punished more harshly (in terms of profits) for being inefficient.

For the present paper, as a proxy for profit elasticity, we estimate how profitability is impacted by labour productivity. Labour productivity and marginal costs are expected to be inversely related, since rise in labour productivity by improving firm's efficiency, is expected to lower costs.

Impact on Profitability:

i. Market Share: Where significant, market shares have been estimated to have a positive and significant impact on Profitability of Firms. As an additional exercise, we interact the dummy of merging firms with market shares (Model specification 2 and 5). Our estimates indicate a non-significant impact of the same on profitability of firms. In Model Specification 6, the estimates indicate that, in general, Merging Firms have higher profitability vis. a vis. Non-merging firms.

ii. Capital Employed: In our econometric analysis, the coefficient of capital employed remains positive and significant. High capital employed is indicative of Firm's size. It is also reflective of high costs that may act as a deterrent to entry. Difficult entry is expected to enhance firm's profitability. Our estimates do indicate the same since increase in capital employed has been estimated to increase profitability.

iii. Labour Productivity: For all the Firm Groupings (Merging, Non-Merging and Pooled), labour productivity has been estimated to have a favourable impact on profitability. In other words, as the labour productivity improves, so does the profitability of the firm. It is important to note that while increase in labour productivity has been estimated to decrease PCMs, the same increases firm's profitability. This result has important implications for policy for D&P sector..

iv. R&D intensity: This has been estimated to impact profitability adversely across firms. The coefficient of the same remains negative and significant across firm groupings (Merging, Non-merging and Pooled). Since high R&D intensity impacts both profitability and PCMs adversely, policy makers need to address such issues by adopting appropriate tax-cum-subsidy policies that promote innovation activities in the D&P sector.

v. Other variables, such as, age, leverage ratio, export and import intensity have been estimated to have a non-significant impact on profitability.

Correct Table 7: Impact on Profitability for Merging, Non-Merging and All Firms (Robust Standard Errors)

	Merging Firms[#]			Non-Merging Firms[#]	All Firms[^]	
	(1)	(2)	(3)	(4)	(5)	(6)
Market Share	4.699*	-0.012		12.666*	12.467	
	(2.393)	(6.852)		(6.900)	(7.756)	
Dummy $_{Merge}$		-2.833	-18.783		16.751**	79.134
		(6.767)	(56.948)		(8.352)	(62.664)
Market Share*Dummy for Merger		5.265			-3.862	
		(6.809)			(8.272)	
Capital Employed (Log)			7.326**			21.261**
			(3.435)			(9.927)
Capital Employed*Dummy for Merger			2.322			-11.722
			(7.321)			(9.420)
Labour Productivity	0.232*	0.231	0.222*	2.115*	0.611*	0.534*
	(0.135)	(0.139)	(0.120)	(1.219)	(0.315)	(0.282)
R & D Intensity	-2.176***	-2.180***	-2.381***	-5.342***	-5.786***	-6.079***
	(0.588)	(0.566)	(0.596)	(0.122)	(0.815)	(0.697)
Leverage Ratio	0.891	0.953	0.738	1.013**	0.359	0.009
	(0.727)	(0.713)	(0.638)	(0.492)	(0.346)	(0.505)
Export Intensity	0.121	0.109	0.106	0.242	0.486**	0.099
	(0.599)	(0.581)	(0.549)	(0.208)	(0.219)	(0.141)
Import Intensity	0.234	0.241	0.229	-0.002	0.012	0.015***
	(0.167)	(0.157)	(0.138)	(0.004)	(0.011)	(0.005)
Age	-0.330	-0.351	-1.776	2.269*	0.584*	0.268
	(1.459)	(1.333)	(2.167)	(1.266)	(0.303)	(0.220)
Constant	1.254	4.424	-6.490	-112.266**	-48.028**	-153.282**
	(32.037)	(32.413)	(46.276)	(46.435)	(24.259)	(70.561)
N	930.000	930.000	930.000	1967.000	2900.000	2829.000
Groups	62.000	62.000	62.000	123.000	185.000	185.000
R^2 *Within*	0.044	0.045	0.050	0.022	0.017	0.022
R^2 *Overall*	0.090	0.083	0.020	0.019	0.028	0.037
R^2 *Between*	0.182	0.154	0.019	0.037	0.140	0.206
Rho	0.217	0.223	0.408	0.079	0.000	0.000
Sigma_u	26.773	27.271	42.103	93.986	0.000	0.000
Sigma_e	50.828	50.855	50.715	321.094	266.424	268.492

[#]Fixed Effects Results (with Robust Standard Errors) as supported by Hausman Test. ^Random Effects Specification with Robust Standard Errors.

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The Dummy variable used in case of Merging Firms takes the value 1 post merger of the firm. The Dummy variable used in case of All Firms takes the value 1 for all Merging Firms.

5. Summary, Conclusion and Policy Implication

Several studies on M&As have been undertaken, covering issues, such as trends, industrial clustering, reverse mergers, mergers by sick companies, and pre and post-merger performance. However, most of the studies lack in application of econometric tools as also its implications for regulatory and competition authorities. Further, since M&As could have differential economic impact, depending on the sector and county's level of development, it remains important to have not just country-specific studies, but also studies that are sector-specific. In this context, in order to deepen our understanding of the subject and assess its impact on issues such as competitive environment, and concentration in the industrial structure, the present study analyzes market shares and M&As in the Indian Drugs and Pharmaceutical sector.

Often, high market shares and rise in industrial concentration are looked upon with skepticism by competition authorities. This is because they are reflective of firm's and industry's monopoly power, with its associated potential of being abused. In this context, an important implication of our paper is that competition authorities and regulators need to be careful while interpreting an observed increase in concentration measures such as HHI and PCMs as evidence of collusion or abuse of a dominant position. This is because if the industry is already quite concentrated, such trends may actually be caused by rising intensity of competition, rather than a reduction in the same. Since some inefficient firms may exit the market and/or get merged due to the intensified competition, the act would raise concentration in the market incorrectly, suggesting a fall in competition. Under such circumstances, estimating profit elasticity may be a better way to determine whether competition has actually intensified or not. An increase of this elasticity indicates an increase in competition because firms are punished more harshly for losing efficiency.

The findings of our study are also reflective of the same. Our results indicate that while the market share of merging firms increased over time, it did not significantly impact the firm's price cost margins. The lack of such a relationship could be on account of few entry barriers in the industry. As such, the threat of potential competition may have deterred merging firms, as well as, firms with high market share to increase their respective price cost margins. Our findings also substantiate that while market shares of select firms did go up, the overall HHI for the industry did not necessarily move in the same direction. In view of our results, we conclude that for the Indian D&P sector, rise in market shares in general and M&As in particular, need not necessarily be looked upon with suspicion by the competition authorities.

Further, an important implication arises when PCMs and Profitability are analyzed with respect to labour productivity. Concerning the contention that M&As increase concentration, it must be noted that in the Indian drugs and pharmaceutical sector, the industrial concentration fell till 2000. Evidence of mergers increasing concentration exists only for short spans of time. Further, so long as increasing concentration is not associated with any entry deterring effects, it is not necessarily considered to have adverse effects on the economy. Additionally, even if a

rise in concentration leads to emergence of a few dominant firms, this is not a sufficient ground for a case against the development of market for mergers, acquisitions and takeovers if the synergies associated with M&As lead to welfare gains. In this context, what remains important is effective regulation of the Competition Law. The Law clearly states that it is not dominance *per se* but the abuse of dominance that is to be challenged. If Competition Commission of India (CCI) is effective enough to prevent misuse of dominance, there is a case for market for corporate control (MCC) to evolve.

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Maximum Retail Price Policy of India: A Comparative Law and Economic Inquiry

Shivans Rajput[1], Akash Krishnan[2]

Introduction

In India, as a consumer protection mechanism, it is obligatory for the manufacturers of pre-packed goods in India to print a Maximum Retail Price (MRP) on the products meant for sale and consumption in India.[3]It is obligatory for the retailers irrespective of any circumstances to sell such products not above MRP.[4]The government reasons that such rule will prohibit retailers from indulging in price gouging which of course does not find full support in economic theory as we will see later. On the other hand, the government has failed completely to appreciate the economic incentives it creates for or problems faced by manufacturers when they are mandated to decide uniform MRP for their products which are sold across country as varied and as big as India. The MRP policy stands on a very unsound economic premise that it helps consumers to avail lower prices as retailers cannot charge above MRP. MRP policy will be a good consumer protection policy if with certainty it can be established that manufacturers are able to take into consideration all variables that effect retail prices all across India and that their self-interest is perfectly aligned with consumers' interest which is a far cry from reality. Not only that MRP policy is based on an unsound economic premise but it is in direct conflict with the modern competition policy and law as will be shown later.

MRP policy creates a ubiquitous network of arrangements in the Indian pre-packed consumer goods market which would have been rarely seen had there been no such mandatory rules because such arrangements are not warranted in competitive markets as shown below. In other words, given the organization of retail market of pre-packed consumer goods in India characterized by millions of small shops and miniscule share of big retail chains there is no need

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[3]For details see Standard of Weights and Measure Act 1976 and Legal Metrology Act 2009. India is the only country in the world to have such a price regulation law.
[4]For details see India's Consumer Protection Act 1986.

for imposing MRP. India's MRP rule acquires features of maximum Resale Price Maintenance (RPM) which are seldom used by manufacturers to address any inefficiency that is present in the downstream retail market[5] and such arrangements are not always legal under competition laws as such arrangements though sometimes may be privately beneficial to a manufacturer and a retailer they are not invariably beneficial to society at large.

The Ministry of Consumer Affairs has commissioned two Expert Committees in the year 1994[6] and 2007[7] respectively with the mandate to review and suggest best method of declaration of retail sale price on pre-packed products. Both expert committees recommended continuation of MRP because in their opinion it protects consumers' interest besides providing a fixed benchmark for collecting excise duty on finished consumer products despite the fact that several representatives of the manufacturing sector hinted towards flaws of the MRP rule and the problems that they face while deciding the MRP. The representatives from manufacturing companies lamented that it is problematic for manufacturers to print the MRP which is applicable for a country as big as India as they face different costs and overheads in different locations but it is not feasible for them to print different MRP for different regions of India. Besides that different rates of excise, different distribution channels, different transportation costs, different rates of octroi and taxes across states adds to the complexity which make it even more difficult to calculate the optimal MRP. Representatives of FICCI, ASSOCHAM, and CII mentioned that one of the reasons why the MRP of packaged products is on the higher side because very often than not manufacturers consider highest tax rate prevailing in a particular region while arriving at a MRP.

[5]Manufacturers seldom use maximum RPM to address inefficiencies in supply chain as there are other effective ways of doing that like having two-part tariff(as in franchisee system) or acquiring a firm downstream or upstream as the case may be. In jurisdictions that permit maximum RPM we do not necessarily witness that manufacturers invariably indulge in imposing maximum RPM because besides being attracting anti-trust scrutiny it is difficult to set a maximum RPM that results in profit maximization because manufacturers can never have perfect information about local market conditions that retailers can boast of.

[6]Ministry of Civil Supplies, Consumer Affairs and Public Distribution, (n.d.): Report of the Expert Committee on Best Method of Determining the Declaration of Retail Sale Price on Pre-Packed Commodities. The report is not available in public domain. It is on record with the Authors.

[7]Department of Consumer Affairs, (n.d.): Report of the Expert Committee on Review and Suggest Best Method of Declaration of Retail Sale Price on Pre-Packed Commodities.
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Incompatibility of MRP Rule with Competition Act 2002

Section 3 and Section 4 of the Competition Act 2002 prohibit anti-competitive agreement and abuse of dominance respectively. MRP rule d*e facto* acquires the features of maximum RPM agreement which is per se legal under the Competition Act 2002. But *de jure* it can be seen as a unilateral conduct by a manufacturing enterprise towards a retailing enterprise as there is absence of any bilateral agreement among the two as against a commonly observed maximum RPM arrangement. Therefore, MRP is closer to unilateral conduct than agreement though the unilateral conduct is a result of state policy rather than a voluntary business decision. It can be surmised that the MRP policy is in conflict with the provisions that prohibit abuse of dominant position as per section 4 of the Competition Act 2002.

Hypothetically speaking, if it were not a mandate of State policy to impose MRP and in such a scenario a dominant manufacturer voluntarily decided to impose a MRP on its retailers (without an express agreement), then it would have been caught by Section 4 (2) (a) of Competition Act 2002. In fact, for instance in some product markets like tobacco products, chocolates, and soft drinks single company holds more than 50% of market share in India.[8] If there was no MRP rule prevailing in India and if these dominant companies unilaterally imposed maximum RPM they would have been caught by Section 4 of Competition Act 2002. Further, the economic literature also shows that requiring companies to publish their prices openly runs the risk of facilitating coordination among companies which is otherwise difficult in the absence of such requirement. In other words such government policies render cartel provisions of competition laws ineffective. In a nutshell, MRP policy is undoubtedly at odds with the cartel and abuse of dominance provisions of the Competition Act 2002 and there is a need to resolve this antinomy between the two laws. In the section on "Legality/Illegality of State Authorized Anti-Competitive Conduct' it will be explored how such antinomies can be resolved. For now it is to be explored how other jurisdictions deal with maximum RPM conduct.

[8] India Tobacco Company (ITC) has 81% market share in cigarettes; Cadbury has 72% market share in chocolates; Coca Cola has 60% share in carbonated soft drinks market in India. There are many more consumer goods manufacturers in India which enjoy more than 30% market share. Market share data obtained from http://prowess.cmie.com/ in 2012. Above 30% market share enterprises in the EU do not qualify for block exemption for using maximum RPM.

Inconsistency of MRP Policy with Global Approach

Mandatory printing of MRP by manufacturer is not consistent with the global practice for in the US and the EU, maximum RPM is prohibited prima facie as it has anti-welfare effects[9] such as focal-point effect, but it is not prohibited per se because it has pro-welfare effects primarily under double-marginalization situations characterized by an upstream and downstream monopoly in supply chain.[10] European Commission Guidelines on Vertical Restraints of 2000 states that when the market share of suppliers exceed above 30% then there are various competition risks of maximum RPM. There is a possibility that maximum price will work as the focal point for resellers and might be followed by most or all of them. At the supplier level publishing maximum price may facilitate collusion between suppliers especially in markets characterized by a narrow oligopoly as they can easily exchange information on the preferred price level thereby reducing the likelihood of lower resale prices.[11]In the EU, prior to the year 2000, maximum RPM was considered hard-core restrictions and were illegal per se.[12] Currently, maximum or recommended resale prices are not considered hard-core as they enjoy presumed legality under Block Exemption Regulation (BER) when market share of each of the parties to an agreement is 30% or less of a total relevant market.[13] However, maximum or recommended resale price agreements can be vulnerable to disapplication of BER if parallel networks of similar maximum or recommended resale price agreements cover more than 50 per cent of a relevant market.[14] In India, practically, 100% of the market for majority of pre-packed products is characterised by such networks.

In the US, in Albrecht v. Herald Co[15] the latter a newspaper publisher stopped supplying to Albrecht, a newspaper carrier because it did not adhere to the maximum RPM imposed by the latter. The Court ruled in favour of Albrecht asserting that maximum prices are per se illegal under the Sherman Act on the grounds that maximum prices may be fixed too low, maximum prices may channelize distribution through large or advantaged dealers or maximum prices can

[9]See Guidelines on Vertical Restraints (2000). Official Journal of the European Communities. Page 44.
In the US, post 1997 after *Khan* decision by the US Supreme Court maximum RPM is still a violation of Section 1 of the Sherman Act but it is not prohibited per se.
[10]For details on double marginalization see below the section on Economics of Maximum RPM.
[11]Guidelines on Vertical Restraints (2000). Official Journal of the European Communities. Page 44.
[12]Green Paper on Vertical Restraints in EC Competition Policy, Com (96), 721, para 157 at 46.
[13]Article 3 of the Block Exemption Regulation has this provision. See Guidelines on Vertical Restraints, 2010, para 23.
[14]For the detailed disapplication procedure of BER see Guidelines on Vertical Restraints, 2010, para 79-85.
[15]Albrecht v. Herald Co. 390 U.S. 145 (1968).

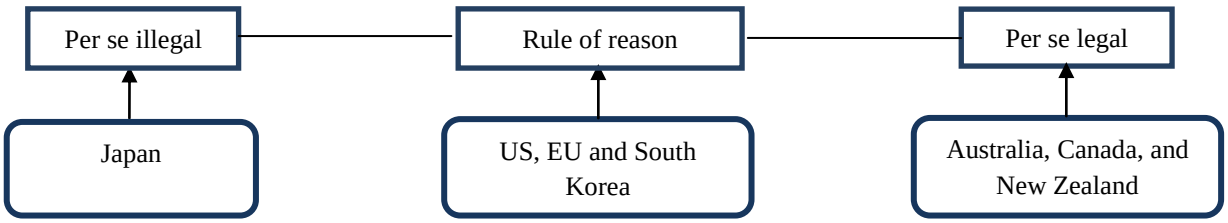
be used to actually fix minimum prices. These arguments were based in economic theory but not sufficient to hold maximum RPM per se illegal for eternity. Hence, in 1997 the US Supreme Court in *Khan* [16] reversed *Albrecht* with reasoning that "there is insufficient economic justification for per se invalidation of vertical maximum price fixing" and set the precedent that maximum RPM will be given a rule of reason treatment.

In Australia,[17] Canada,[18] and New Zealand[19] maximum RPM is per se legal probably with a presumption that whenever manufacturers use maximum RPM it will have pro-welfare effects which is not necessarily always true. Brebner (2001) rightly argues that exemption given to maximum RPM under Australia's Competition and Consumer Act 2010 should be withdrawn because though the anti-competitive effects of maximum RPM will be rare but those rare cases should be subject to scrutiny under the competition law.[20]

On the other hand, in Japan maximum RPM is prohibited per se regardless of market power[21] probably with a presumption that such conduct invariably results in anti-welfare effects which is also not true under the light of economic theory. Whereas, in Korea, maximum RPM though is prohibited prima facie but it is permitted provided the company involved does not have market power and the arrangement does not have the purpose or likely effect of substantially lessening competition.[22] Hence, both per se illegal and per se legal standards are not consistent with the economic literature available on the maximum RPM so far. But, the legality standard followed in the US and the EU and to some extent in South Korea on the issue of maximum RPM though not perfect is consistent with the economic theory. Given this global approach it can be safely surmised that the legality standard on the issue of maximum RPM prevailing in India i.e. obligatory imposition of maximum RPM by manufacturers on retailers is a far cry. To

[16]State Oil Company v. Barkat U. Khan and Khan & Associates, Inc. 522 U.S. 3 (1997).
[17] Section 45(5)(c)(iii) of Competition and Consumer Act 2010 of Australia exempts maximum RPM even in cases where it can substantially lessens competition.
[18] Under Canada's Competition law maximum RPM are deeemed lawful as it raises usually less competition concersn. See Larry Markowitz (n.d.). Price Maintenance: The View from Canada. Distribution Law Commission Newsletter No. 1. Page 1. Accessed on 10.10.2016 athttp://www.mcmillan.ca/Files/ARTICLE_Price_Maintenance_View_from_Canada_0310.pdf.
[19]Commerce Commission, the enforcer of Competition Act in New Zealand in its guidance to suppliers on RPM states that they can set maximum price for the on-sale of goods. See http://www.comcom.govt.nz/business-competition/fact-sheets-3/resale-price-maintenance-2/.
[20] Julie Brbner (2001). Resale Price Maintenance – The Need for Further Reform. 9 Trade Practices Law Journal. Page 14.
[21]Antitrust Asia (n.d.). Where are my arrangements at risk? Page 2. Accessed on 01.10.2016 at http://antitrustasia.com/sites/default/files/banners/G+T_Vertical-Arrangements.pdf.
[22]Antitrust Asia (n.d.). Where are my arrangements at risk? Page 2. Accessed on 01.10.2016 at http://antitrustasia.com/sites/default/files/banners/G+T_Vertical-Arrangements.pdf

summarize, various jurisdictions and the legal standard they apply to the institution of maximum RPM can be plotted on a continuum as follows:



India's legal standard of making it mandatory by way of a statute is grossly inconsistent with any of the legal standard applicable across various jurisdictions globally.

Legality/Illegality of State Authorized Anti-Competitive Conduct

After looking at how the MRP rule is inconsistent with the competition law of India and also its divergence vis-à-vis global practice it warrants an effort to explore ways in which this can be rectified. It is common wisdom that governments do not solely rely on competition compliant regulation for advancing social welfare. Socio-economic welfare can be achieved by other government regulation which at times conflicts with the substantive provisions of competition law. Under competition laws it is possible to challenge government regulation if it leads to anti-competitive effects and this stands true for the competition law of India too. However, in these circumstances the courts have to decide if both competition law and anti-competitive measure instituted by a government can coexist or one prevails over the other. There is no simple answer to this question. However, on the basis of case law developed in the US and the EU it can be safely surmised that furthering social welfare does not necessarily require upholding competition law invariably disregarding other government regulation neither it does require always giving supremacy to a particular government regulation over competition law.They have developed a set of elaborate doctrines though not set in stone but well evolved to give guidance on when competition law prevails over regulation and vice-versa.

State action liability doctrine of the EU

In the EU, when a Member State ***either*** requires or favours the adoption of agreements, decisions or concerted practices contrary to Article 101 *or* to reinforce their effects***(or)*** when the Member State deprives its own legislation of its official character by delegating to private traders the

responsibility for taking decision affecting economic sphere it is held liable under the State action liability doctrine.

In *GB-INNO-BM,*[23] the Belgian legislation required manufacturers or importers of tobacco products to mention the retail price on the product itself on the tax label and prohibited retailers to sell it above or below the price mentioned on the tax label and retail price was independently set by manufacturer or importer without any intervention by any State authorities. The ECJ ruled that the above scheme might encourage abuse of dominant position and hence state legislation encouraging such conduct is prohibited by Article 102 of TFEU and the State delegated to private parties the responsibility for taking decision affecting economic sphere. Hence, it ruled that the above government decree is incompatible with competition law provisions of the TFEU.

In *Cullet,*[24] as per the French State Order of 1945 and Decrees of 1982 the State authorities independently set the maximum and minimum retail price of fuel.[25] Private undertakings had no role in setting either the ceiling price or floor price. The refiners or importers only had the independence to set the wholesale price called ex-refinery price which has to be below the retail price set by State authorities. This Member State was not held liable for this anti-competitive conduct because the economic decision making powers fully rested with the State authorities unlike in *GB-INNO-BM*.

State action immunity doctrine of the US

In the US, an anti-competitive State action will be immune to anti-trust scrutiny if it can be shown that first, 'the challenged conduct must be 'one clearly articulated and affirmatively expressed as state policy'; second, the policy must be 'actively supervised' by the State itself. An anti-competitive State action has to pass both tests to avail immunity from Sherman Act. Clear articulation test is fulfilled when the state requires, compels or authorizes a conduct but not when a conduct is merely prompted or approved by the state.

In *Midcal,*[26] the California statute required all wine producers and wholesalers to file fair trade contracts or price schedules with the State. In *Ticor*[27] and *Town of Hallie,*[28] the challenged

[23]Case 13/77 GB-INNO-BM v. ATAB (1977), ECR 2115
[24]Case 231/83 Cullet v. Leclerc (1985), ECR 305.
[25]This is similar to the State policy India had before 2010 for petrol prices and before 2014 for diesel prices when it independently and directly decided the price of petroleum products in India. Such policy though anti-competitive in nature is unlikely to be held as incompatible with Competition Act 2002.
[26] California Liquor Dealers v. Midcal Aluminum, Inc. 445 U.S. 97 (1980)

conduct was though not required by the State but it was authorized by the State. In all the above three cases the Court ruled that the conduct passed the clear articulation test. However, in *Goldfarb,*[29]Fairfax County Bar Association adhered to the minimum fees (price floor) schedule published by the State Bar and claimed that it was prompted by the action of the State Bar but the Court reasoned that it is not enough that the anticompetitive conduct is 'prompted' by state action to avail anti-trust immunity. In *Cantor,*[30] private electricity Supply Company engaged in light bulb exchange scheme (also called tie-in scheme). The Michigan Public Service Commission which is a State agency merely approved the light bulb exchange scheme. The Court reasoned that approval of challenged conduct by a state authority is not the kind of state action which enjoys immunity from Sherman Act.

Active supervision standard is set very high; first, the state must have the power to review reasonableness of an anti-competitive activity; second, state must not only have the power to review reasonableness but also must have the power to disapprove an anti-competitive activity of private actors; third, not only that the state must have the potential to do the above two but it must exercise that power in reality as regards particular anti-competitive acts and; fourth, the state not only must exercise the power but also that the state must exercise such power sufficiently.

In *Patrick,*[31]the Court concluded that there was no immunity because the State did not have the authority to review the anticompetitive action undertaken by the private parties involved. In *Midcal,*[32]the Court ruled that the California State statute failed active supervision test because the State simply authorized price setting and enforced the prices established by private parties; the State neither established prices nor reviewed the reasonableness of the price schedules. In *Ticor,*[33] the Court found that the State Officials though had the power to review the reasonableness of rates set for title search and title examination fees by insurance companies they did not supervise the private conduct sufficiently. Hence, the conduct does not pass the active supervision test and no immunity was granted. In the US, a State action must pass both the test; failing on either test renders the State action ineligible for anti-trust immunity.

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[27]FTC v. Ticor Title Inc. Co., 504 U.S. 621 (1992)
[28]Town of Hallie v. City of Eau Claire, 471 U.S. (1985)
[29]Goldfarb v. Virginia State Bar 421 U.S. 773 (1975)
[30]Cantor v. Detroit Edison Co. 428 U.S. 579 (1976)
[31]Patrick v. Burget, 486 U.S. 94, 101 (1988)
[32] California Liquor Dealers v. Midcal Aluminum, Inc. 445 U.S. 97 (1980)
[33]FTC v. Ticor Title Inc. Co., 504 U.S. 621, (1992)

In a nutshell, as per the established case law a government regulation which requires, adopts, enforces or facilitates an anti-competitive activity through private economic actors is deemed contrary to competition law.

Learnings for India

India's MRP policy, if looked from US perspective will pass the clear articulation test but will definitely fail the active supervision test. MRP rule is very clearly articulated as State action and is an outcome of the two statues viz. Legal Metrology Act 2009 and Consumer Protection Act 1986. Both the statutes respectively require manufacturer to print MRP and retailer to refrain from breaching the printed MRP similar to *Midcal* case. However, Department of Consumer Affairs, India that enforces the MRP policy does not examine the reasonableness of the MRP of any product and in fact the Supreme Court of India in *ITC*[34] case ruling has categorically remarked that it is not open for the Excise Department of Government of India to question the reasonableness of MRP. The Department of Consumer Affairs has stated in response to a question raised about the issue in the Rajya Sabha[35] that it does not aim at controlling MRP itself and there is no authority that authorizes or approves MRP printed by manufacturers.[36]

Similarly, if the MRP policy is scrutinized on the lines of EU state liability doctrine then it is certainly contrary to the provisions on abuse of dominant position of the Competition Act 2002 and the the State authorities have delegated to private traders the responsibility for taking decision affecting economic sphere as they do not oversee or check reasonableness of the MRP printed by the manufacturers. Further, the MRP policy also facilitates adoption of agreements (cartelization by manufacturers) that are contrary to Section 3 of Competition Act 2002.

In light of the above conclusion can it be surmised that the MRP rule should yield to the Competition Act 2002. It is not so straight forward because both the Competition Act 2002 and MRP rule are Central Acts whereas the antinomy witnessed in the US and EU is between laws at different levels of hierarchy in government i.e. in the US anti-competitive States' laws yielded to the Sherman Act which is a Federal law. On the other hand, in the EU anti-competitive Member States' laws yielded to the TFEU law which is the domain of Supra-National body, the European Union.

[34]2004 Supp(4) SCR 293 ITC v. Commissioner of Central Excise.
[35]Rajya Sabha is Upper House of Indian Parliament.
[36]Rajya Sabha Question and Answer Sessions discussing the issue of MRP is on record with the authors.

Nevertheless, the state action doctrines of US and EU do not necessarily upheld one law over the other on the basis of hierarchy of law but on the principle that whether the government has the ultimate authority to decide the level of anti-competitive harm or does it leave it to the private economic actors to decide the level of harm. In the case of MRP policy, the government authority unarguably does the latter.

Apart from the above challenge there are other challenges that can come in the way of changing/scrapping the law. There will be huge resistance from excise department as it is now well accepted that MRP provides a fixed benchmark to levy excise duty compared to earlier method of levying excise duty on the basis of value of transaction which caused uncertainty among excise department and manufacturers and led to undesirable amount of litigation in the past. Expert committees set up to evaluate MRP rule further reinforced this belief through their recommendation that the MRP rule should continue despite its adverse welfare effects as it provides fixed benchmark for collection of excise duty. Consumer Associations on the other hand not content with the MRP rule are bent upon having more regulations to oblige manufacturers to display even factory price. There will be strong resistance from them as well if government were to decide to change the MRP rule.

In the coming sections, we analyze developments in economic literature on issues of maximum RPM and present a model trying to capture the dynamics of the whole system in the presence of MRP.

The Economics of Maximum Retail Price

Maximum Retail Price (MRP) is commonly referred to as Maximum Resale Price Maintenance (RPM) in Industrial Organization literature. It is a price ceiling imposed by the manufacturer on the retailer. Minimum RPM has received a lot more attention among scholars than Maximum RPM. Studies pertaining to Maximum and Minimum RPM could be broadly classified into three categories (Mathewson & Winter, 1998). We summarize the essential arguments of each school of thought below:

1. *Efficiency of the Distribution System*: The most popular argument in favour of Maximum RPM is the fact that it makes the whole supply chain efficient by avoiding the problem of double marginalization. Double marginalization is the phenomenon wherein each agent in the supply-chain decides the output and price that maximizes his/her own profit to the detriment of the

whole supply chain. The resulting profit that emerges under double marginalization would be lower than if agents' interests could have been aligned under vertical integration.

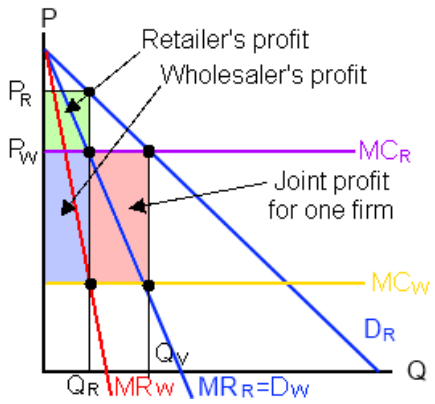

Figure 1: Showing double marginalization problem in the presence of retailer and wholesaler[37]

The diagram above depicts a situation where the wholesaler and retailer independently fix prices, resulting in lower profits for each of them, and also the consumers being worse off. One can clearly comprehend this phenomenon by observing in the diagram above that the area of joint profits is larger than both the retailer's and wholesaler's profits combined. By imposing a Maximum RPM, the manufacturer would ensure that the retailer does not further increase prices beyond an optimum level, thus preventing loss of sales. A two-part tariff is an alternative to imposing a maximum RPM in order to overcome double marginalization. A non-price vertical restraint often used by the manufacturers to overcome the problem of investment externalities is exclusive territories. Non-price vertical restraints have been looked at more favourably by courts in the US than vertical restraints involving price. The GTE Sylvania case[38](Continental T.V., Inc. v. GTE Sylvania, Inc., 1977) is a classic example of this fact wherein the courts repealed the per se illegality of exclusive territories on the grounds that it was efficiency enhancing.

2. *Cartel Among Retailers*: A cartel among the retailers may be benefitted by ensuring that the manufacturers imposeMinimum RPM (a floor price) as a barrier to entry toward firms that would otherwise make an entry into the market with low cost and high volume.

[37] Source: (Senadin, 2016) – URL: http://www.ken-szulczyk.com/economics/production_lecture_11.php
[38]URL - https://supreme.justia.com/cases/federal/us/433/36/case.html

3. *Cartel Among Manufacturers*: A cartel among manufacturers may want to impose Maximum RPM as retail prices can be better monitored than say wholesale prices. A cartel has to constantly ensure that none of its members are defaulting on their commitment provided, as there is always the incentive to default. In order to ensure that all manufacturers sell their prices as committed, it is easy for the cartel to keep a tab of individual manufacturer's retail prices. Nevertheless, there may be certain inefficiencies associated with manufacturers setting a price ceiling, as manufacturers are not familiar with the local demand and supply conditions(Jullien & Rey, 2007). Jullien and Rey argue that since retailers are best aware of local demand and supply conditions, they would be the best persons on the supply-chain to maximise profit by setting prices as per what the circumstance demands. Beck however has an empirical result which shows that focal prices are not an outcome of RPM imposed but are rather efforts of competition coordination (Beck, 2004). The study was based on cross section data obtained from the German book market.

RPM imposition by the manufacturer was illegal per se in most jurisdictions up until 1998 or so. Since 2000s, there has been a drastic reversal of jurisprudence, with courts acknowledging the economic merits of RPM and considering material on a case-to-case basis (Comanor & Rey, 1997). Another twist has nevertheless been witnessed globally with the Chinese courts giving their judgement in favour of the plaintiff regarding a vertical restraint case involving Ruiban (plaintiff) and Johnson and Johnson (defendant) in 2012 (Dodoo, 2013).

In what follows, we present a simple model to depict the fact that a cartel among manufacturers would clearly be benefitted by imposing Maximum RPM. We undertake a simulation exercise to show that retail prices are higher when RPM is imposed than when they are not imposed. This clearly has policy implications for a country like India where the Maximum Retail Price is considered the norm and has been taken for granted.

Maximum Retail Price: A System Dynamics Approach

The advantage of a system dynamic approach is that it gives one a bird's eye view of all factors that tend to undergo a change when there is any policy intervention or shock to a system. In the real world, no sector responds to policy interventions in isolation, and one intervention could have unintended consequences on other sectors or a feedback process that was not anticipated in the intended sector. This is precisely what systems thinking attempts to capture.

System dynamics typically consists of causal loop diagrams that provide information as to the transmission mechanism of a particular policy intervention. Apart from this, there are stock and flow variables. A flow variable captures the rate of change, like for instance, income. Income is a flow variable as it reflects the increase/decrease in a person's wealth during a year. Stock variables on the other hand are an aggregation of a flow variable. Wealth for instance, is an aggregation of an individual's income earned across the years.

The influence diagram and simulations were carried out using Vensim PLE with a time window of 120 years with a time step of 1. We present below a simple model comprising of consumers, retailers and manufacturers interacting in an economy with some level of GDP growth and inflation. We assume perfect competition in both the retail market and the manufacturer markets. A glance at the model below reveals three major blocks, namely the economy comprising of national reserves, growth rate and inflation, secondly the interaction between the consumer and the retailers and thirdly, the manufacturing sector. We discuss below transmission mechanism in the system and important results. Refer appendix for exact equations associated with each variable that was used for simulation.

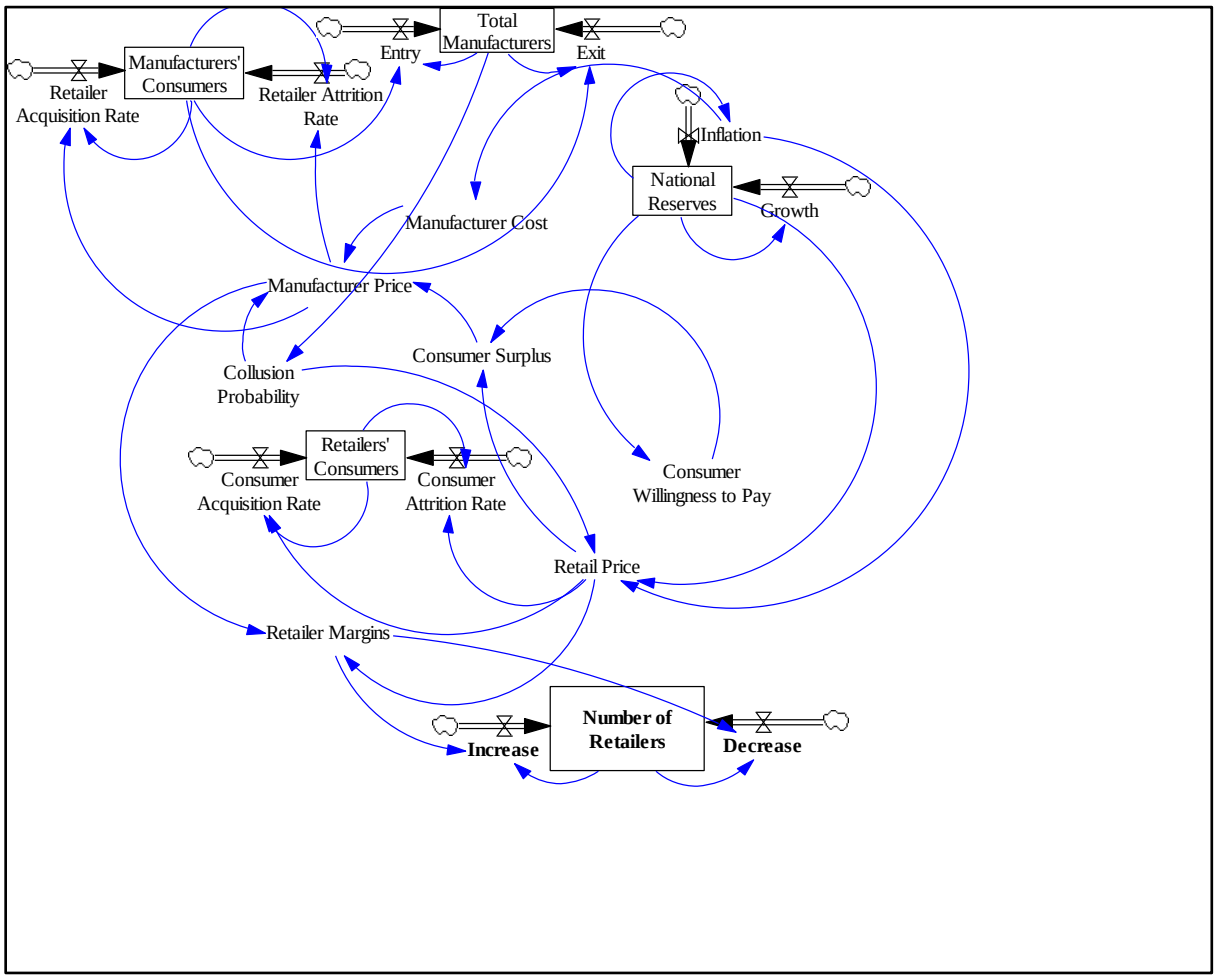

Figure 2: A Simple Model of a market involving Consumers, Retailers and Manufacturers

The variables in boxes are stock variables, namely manufacturers' consumers, total manufacturers, retailers' consumers, retailer density and national reserves that form the cumulative of all the flow variables. There exist ten stock variables namely growth rate, rate of inflation, consumer acquisition rate, consumer attrition rate, increase in retailers, decrease in retailers, entry of new manufacturers, exit of manufacturers, retailer acquisition rate and retailer attrition rate. As mentioned earlier, these measure the rate of change of the stock variables.

Now coming to the economy block of the system, 'National Reserves' refer to the accumulation of income over the period, while inflation is taken to be 4% while the growth rate is taken to be 8%, somewhat reflections of the Indian Economy.

In the Consumer-Retailer interaction block, Consumer Willingness-To-Pay (WTP) is taken as a proxy for the measure of utility obtained through consumption. A Permanent-Income-Hypothesis (Friedman, 1957)approximation to consumption is undertaken, wherein WTP of the consumer depends on the National Reserves. Retail Price is modelled as a function of National Reserves, Inflation and the Collusion Probability. It is important to mention here that we have implicitly assumed the starting margin of a retailer to be 30%, which over time would increase as a function of Inflation and National Reserves. Consumer Acquisition and Attrition Rates are both functions of Retail Price. Number of retailers gives a retailer countin a fixed geographical location, say, a country. It is influenced by more people getting into retail business and some retailers closing shop and seeking an alternative means of livelihood.The most important variable of interest in the consumer-retailer block is the Consumer Surplus which is modelled as the difference between the WTP of the Consumers and the Retail Price.

In the Manufacturers' block, manufacturers' cost is a function of Inflation, and an implicit cost that we have assumed as part of the model, such that the initial manufacturers' margins amount to 40%, and grow thereafter as a function of inflation. Manufacturers' price is a function of inflation, the implicit starting margin of 40% and Consumer Surplus of the retail consumer. Retailer Acquisition and Attrition has been taken as a function of Manufacturers' Prices. Total Manufacturers captures the number of manufacturers in the country at a particular point of time, and is influenced by new manufacturers entering the business and old ones leaving the business. Total manufacturers also affect the Collusion Probability which could take two discrete values, 0 or 1. A collusion probability of 1 can be achieved when the total number of manufacturers is less than or equal to 20, and any number above 20 would mean that this probability is reduced to 0. The rationale behind this is the standard result in oligopoly theory that it is easier to establish a collusive agreement when there are fewer competitors than when there are many competitors (Cabral, 2013).

Now, we proceed to test our hypothesis that consumer surplus would be lower in the presence of MRP, translating into a higher retail price in comparison to a situation without MRP. Our simulation results clearly confirm the fact that Consumer Surplus is higher in the absence of MRP and Retail Prices are clearly higher in the presence of MRP. Consumer Surplus without MRP reaches the $8,000 mark at the end of the 120 year period, while in the presence of MRP it

manages to reach about $5,000. In the case of Retail Prices, a mark of $4,500 is breached in the presence of MRP while in its absence, it reaches a maximum figure of $1,300.

A comparison of the simulated manufacturer price makes for interesting analysis. The Manufacturer Price without MRP hits close to $500 in the 120 year window while in the presence of MRP this figure rises to about $1,500. The lower manufacturer prices in the absence of MRP imposed by the manufacturer means that the manufacturers can't effectively maintain a cartel with efficient monitoring of MRP to ensure that cartel members adhere to the terms discussed. This lack of ability to monitor leads to a reduction in both the retail prices and the manufacturer prices.

The retail prices also vary with and without the manufacturers imposing the MRP on the retailers. In the presence of the imposition of MRP, the retail prices soar above $4,500 while in the absence of this MRP imposition by the manufacturer the corresponding figure stays at around $1,250.

Thus, we have clearly depicted higher retail prices in the presence of MRP which is in favour of our hypothesis. This translates into a larger consumer surplus, and hence there was economic merit in the US and UK deeming Maximum RPM as per se illegal prior to the 2000s. In India, retailers are constrained by the prices imposed on them by the manufacturers. This not only may lead to the reduction in margin of the retailers, but also a reduction in the total consumer welfare, as we have depicted above. Hence, we urge the regulator to debate the issue at hand and initiate a policy discussion which has so far been missing on this issue in the country.

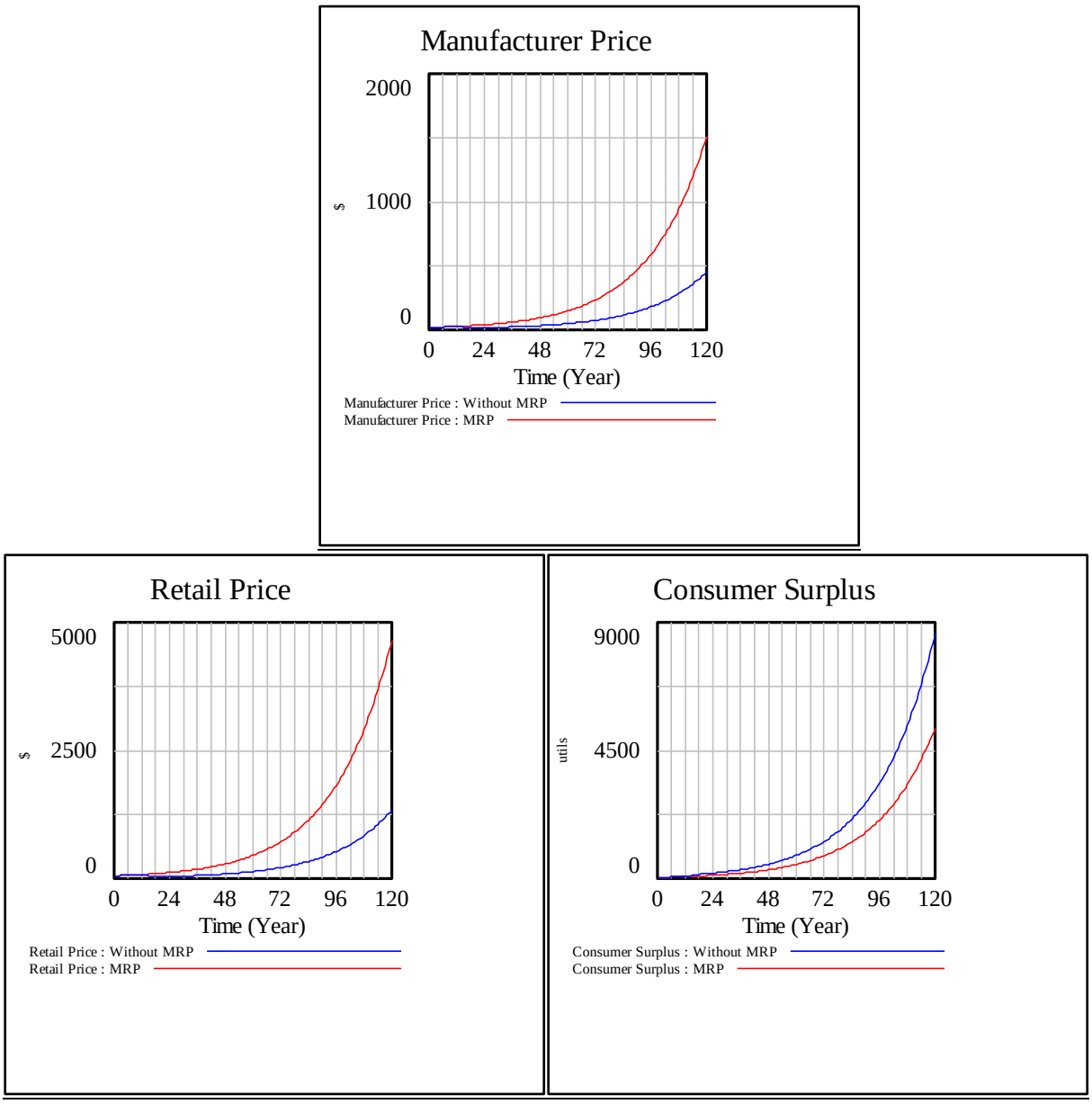

Figure 3: Comparison of Simulation Results for Consumer Surplus, Retail Price and Manufacturer Price with and without MRP

Conclusion and the Way Forward

Absence of a law in India to mandate retailers to display an offer price further adds to the challenge as MRP policy besides being a price controlling measure acts as a price display mechanism for consumers to make an informed choice (though it is not the best policy as the paper argues). A great majority of the countries across the world mandate retailers to display a price prominently in their stores instead of mandating manufacturers to do so. This was also

suggested by the manufacturing fraternity to the Expert Committee when they were asked to give their views on the best method of declaring the price of pre-packed products. It would be appropriate for policy makers in India to get thinking about aligning rules in India with the global practice to reap maximum benefits of the market forces for the benefit of all the stakeholders concerned in the pre-packed consumer goods industry in India.

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APPENDIX

Here's a list of equations for all the variables used in the simulation:

(01) Collusion Probability=

IF THEN ELSE(Total Manufacturers<400000 , 1 , 0)

Units: Discrete Probability [0,1]

(02) Consumer Acquisition Rate=

0.3*Retailers' Consumers-5*Retail Price

Units: Customers/Period

(03) Consumer Attrition Rate=

0.01*Retailers' Consumers+0.001*Retail Price

Units: Customers/Period

(04) Consumer Surplus=

Consumer Willingness to Pay-Retail Price

Units: utils

(05) Consumer Willingness to Pay=

0.09*National Reserves

Units: utils

(06) Decrease=

0.01*Number of Retailers-0.05*(Retailer Margins)^2

Units: Retailers

(07) Entry=

0.05*Total Manufacturers+0.05*Manufacturers' Consumers

Units: Manufacturers

(08) Exit=

0.018*Total Manufacturers-0.002*Manufacturers' Consumers

Units: Manufacturers

(09) FINAL TIME = 120

Units: Year

The final time for the simulation.

(10) Growth=

0.08*National Reserves

Units: {%}

(11) Increase=

0.1*(Number of Retailers)+0.1*(Retailer Margins)^2

Units: Retailers

(12) Inflation=

0.04*National Reserves

Units: **undefined**

(13) INITIAL TIME = 0

Units: Year

The initial time for the simulation.

(14) Manufacturer Cost=

3+0.1*Inflation

Units: **undefined**

(15) Manufacturer Price=

Manufacturer Cost+4+0.2*Consumer Surplus*Collusion Probability

Units: $

(16) Manufacturers' Consumers= INTEG (
Retailer Acquisition Rate-Retailer Attrition Rate,
10)
Units: Retailers/Period

(17) National Reserves= INTEG (
Growth-Inflation,
1000)
Units: $

(18) Number of Retailers= INTEG (
Increase-Decrease,
10)
Units: Retailers in a Country

(19) Retail Price=
10+0.3*Inflation+(Collusion Probability*0.03*National Reserves)
Units: $

(20) Retailer Acquisition Rate=
0.1*Manufacturers' Consumers-0.03*Manufacturer Price
Units: **undefined**

(21) Retailer Attrition Rate=
0.003*Manufacturers' Consumers+0.001*Manufacturer Price
Units: **undefined**

(22) Retailer Margins=
Retail Price-Manufacturer Price

Units: **undefined**

(23) Retailers' Consumers= INTEG (
Consumer Acquisition Rate-Consumer Attrition Rate,
10)
Units: Total Customers

(24) SAVEPER =
TIME STEP
Units: Year [0,?]
The frequency with which output is stored.

(25) TIME STEP = 1
Units: Year [0,?]
The time step for the simulation.

(26) Total Manufacturers= INTEG (
Entry+Exit,
2)
Units: **undefined**

'Structural Change and Competition in the Indian Non-life Insurance Industry: A Study in the Post-reform Period'

Tapas Kumar Parida[1]
Debashis Acharya[2]

ABSTRACT

To promote competition in the Indian insurance industry, Government of India has opened up the sector to private players with 26% foreign equity capital participation of the company in August 2000. This has been raised to 49% in 2015. It has now been more than a decade and half since the sector was liberalized and this is time to review the industry by studying the trends emerging and benchmarking its status with respect to that prior liberalization (2000). So, the paper attempts to assess the state of competition and measure the structural change in the line of business (LOB) in the Indian non-Life Insurance industry.

To assess the level of 'competition' in the non-life insurance industry, a set of concentration indices such as the K-Concentration Ratio (CRk), Herfindahl-Hirschman Index (HHI), The Hall-Tideman Index (HTI), Horvath Index (HOV), Entropy Index (ENT), Ginevicius Index, and GRS Index is estimated for each year separately, starting from 2000-01 to 2014-15. The study has used two important structural change indices (SCI) for the period 2005-06 (data available) to 2014-15 (latest data available) to measure 'structural change' in the non-life insurance industry.

The results indicate that concentration in the non-life business segment is moderate. All the measures quantified indicate healthy competition in Indian non-life insurance business. The average numbers of HHI, GIN and GRS indices yield low market concentration. However, HOV index confirm moderate concentration. The structural change indices indicate that the structure of the non-life insurance has changed but slowly over the years. However, in business segments, there has been significant structural change in health insurance, followed by fire and motor insurance.

Key Words: Concentration, Competition, Structural Change, Insurance and Premium

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1. Introduction

The existence of non-life insurance in India dates back to the pre-nationalisation era, but the sector has not been so developed compared to other global peers. In August 2000, the Government of India has allowed private insurers to enter into the Indian market with foreign equity participation of up to 26%. The new insurers have explored the market, though not fully, by innovation in products, services and distribution channels. Some of these players have established themselves as reputed insurers in the sector. At present, the non-life sector comprises of 29 insurers (including 7 specialised insurers and 1 reinsurer), competing with each other to attract new customers. In the post reform period (after 2000), the non-life insurance premium underwritten has witnessed an average growth of 15.7% compared to India's average GDP growth of 7.4% in the period 2000-01 to 2014-15. Among the different business segments of non-life insurance, the emergence and growth of 'health insurance' business in India is noteworthy. However, the concern is that, the non-life insurance penetration in India is only 0.7% in 2015, compared to advanced countries like US (7.3%), UK (10.6%) and South Africa (14.0%).

To increase the insurance penetration in the country, in the last 2-years Government has taken a number of steps like, FDI limit hike up to 49%, insurance for all at nominal prices (Jan Suraksha), and health insurance for BPL families etc. In addition to that the insurance regulator, Insurance Regulatory and Development Authority of India (IRDAI), has allowed the insurers, who have completed 10-years of operations in India, to raise capital through Initial public offerings (IPOs) from the market. Further, to meet the desired capital and bring efficiency in the 4 public sector non-life insurance companies, in the Budget 2016-17, Government has planned to reduce their stakes by registering in the stock exchanges. In September 2016, ICICI Prudential Life Insurance Company has raised Rs 6000 crore through IPO.

Since it's been more than a decade and half since the sector was liberalized, the industry merits review in terms of emerging trends and structural changes compared to its pre-liberalization period (2000). This paper attempts to assess the *state of competition and measure the structural change* in the line of business (LOB) in the Indian non-life insurance industry.

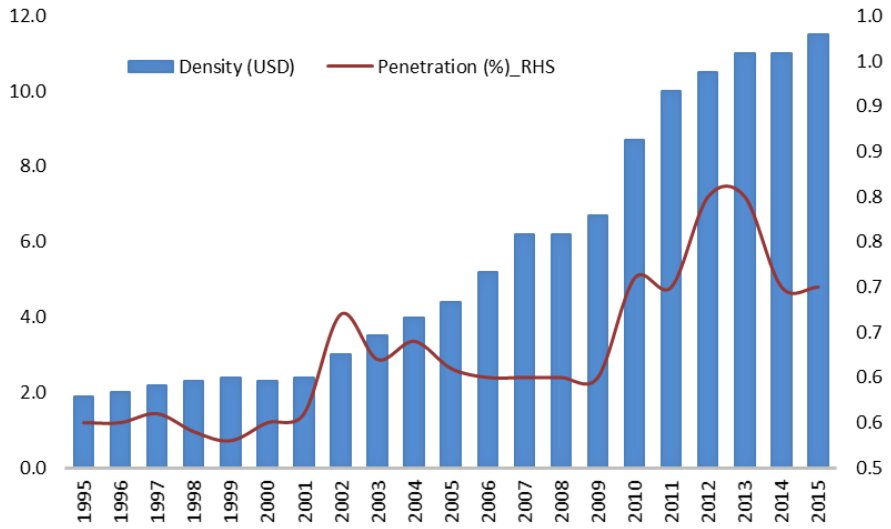
2. A Brief Overview of the Indian Non-Life Insurance Sector

2.1 Performance & Growth of the Industry

Prior to liberalisation of the sector, there were only 5 public non-life insurers in India, namely General Insurance Corporation (GIC) of India and four of its subsidiaries. It was also noticed

that there was less competition between them for acquiring business in the sector. However, after deregulation of the sector in 2000, a number of private players entered into the market with joint ventures (JVs) with foreign insurers. But the penetration of non-life insurance sector in the country remained steady in the range of 0.5%-0.8%. However, its density has gone up from USD 2.4 in 2001 to USD 11.5 in 2015 (refer graph 1).

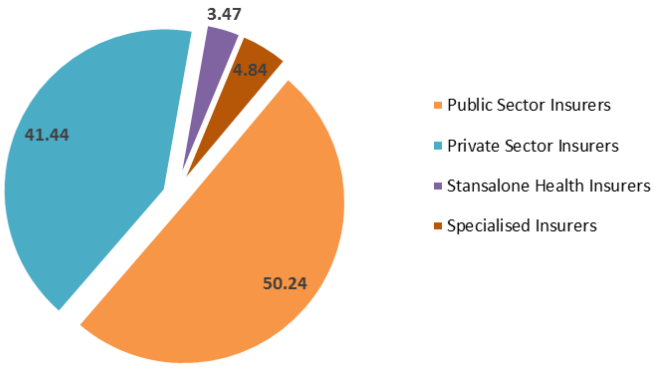
Graph 1: Development of Non-life Insurance in India



Source: IRDAI

As of 31st March 2015, the non-life insurance sector consists of 29 insurers, including national reinsurer *'GIC Re'*, 5- Standalone Health insurer [3]and 2-Specialised Insurer (AIC & ECGC)[4], and 21 general insurers. The structure of the non-life insurance market based on the market share of

Graph 2: Non-life Insurers Group wise Share* (2015)



Source: IRDAI *Gross Direct Premium Income in India

[3] Star Health & Allied Insurance Co., Apollo Munich Health Insurance Co., Max Bupa Health Insurance Co., Religare Health Insurance Co., and Cigna TTK Health Insurance Company.
[4] AIC: Agriculture Insurance Company of India Ltd & ECGC: Export Credit Guarantee Corporation of India Ltd

the insurers in 2015 in Gross Direct Premium in India is given in graph 2. Till now, the public sector insurers hold a major share of 50%.

In the post-reform period (2000-01 to 2014-15), the non-life industry premium underwritten grew at an average growth rate of 15.7%, compared to around 10% growth in the period 1996-97 to 2000-01. However, due to lower economic activity, the industry's growth slowed since 2011-12 from 24.2% to 20.0% in 2014-15. The private insurers has been gaining their market share from 0.1% in 2000-01 to 43.8% in 2014-15. The business performance of the non-life insurance companies are highlighted in the table 1 (Parida, 2015).

Table 1: Non-Life Insurance Sector in Post-reform Period

Particulars	2000-01	2001-02	2005-06	2010-11	2011-12	2012-13	2013-14	2014-15
No. of Insurers (incl reinsurer)	9	13	15	25	25	27	28	29
No. of Offices	-	-	-	6,660	7,050	8,099	9,872	10,407
No of New Policies issued (in lakhs)	-	-	511	793	857	1,070	1,025	1,183
Gross Direct Premium^ (Rs Crore)	-	12,385	21,339	43,842	54,578	62,973	70,610	77,640
% Growth	-	-	15.6	22.4	24.2	19.1	12.1	10.0
Market Share of PSUs*	-	96.2	74.9	60.2	59.1	57.0	56.1	56.0
Incurred Claims Ratio	88	78.3	88.4	93.3	88.9	82.8	81.98	81.70
Profit After Tax (Rs Crore)	-14	-72	1,747	-1,019	25	3,282	4,439	4,738

Source: Parida, 2015 * excluding GIC, AIC & ECGC, ^ Within & outside India, # net incurred claims to net premium, '-'NA

Among the non-life insurance companies, 'New India' insurance company is the biggest insurance company, which holds 19.3% of market share, followed by the other three public insures. While, the private insurer, ICICI Lombard, has placed at the 5th rank with a market share of 8.3%.

Table 2: Market Shares of the Non-Life Insurers*

INSURER/YEAR	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15
Bajaj Allianz	--	1.1	2.0	2.9	4.6	6.0	6.9	8.3	8.3	6.9	6.5	6.0	6.2	6.2	6.5
Cholamandalam	--	--	0.1	0.6	0.9	1.0	1.2	1.8	2.2	2.2	2.2	2.5	2.5	2.5	2.4
HDFC ERGO	--	--	0.1	0.7	1.0	0.9	0.7	0.8	1.1	2.6	2.9	3.4	3.8	4.0	4.0
ICICI Lombard	--	0.2	1.4	2.9	4.7	7.4	11.5	11.5	10.8	9.2	9.7	9.4	9.4	9.4	8.3
IFFCO Tokio	0.1	0.6	1.4	1.9	2.7	4.2	4.4	3.9	4.4	4.1	4.1	3.6	3.9	4.0	4.2
Reliance	0.0	0.6	1.2	1.0	0.9	0.8	3.5	6.8	6.1	5.5	3.8	3.1	3.1	3.3	3.4
Royal Sundaram	0.0	0.6	1.2	1.6	1.8	2.1	2.3	2.4	2.6	2.5	2.6	2.7	2.4	2.0	2.0
TATA AIG	--	0.6	1.6	2.1	2.4	2.7	2.7	2.7	2.6	2.4	2.7	3.0	3.3	3.2	3.4
PRIVATE SECTOR	0.1	3.8	9.1	13.6	19.0	25.1	33.3	38.2	39.2	39.0	39.7	40.9	43.0	43.9	43.8
National	21.2	19.7	19.3	20.6	20.6	16.6	14.8	14.0	13.7	13.0	14.2	14.3	14.1	14.1	14.1
New India	33.3	33.9	32.4	29.8	27.6	26.6	22.9	21.4	20.5	19.8	18.8	18.5	18.3	18.8	19.3
Oriental	21.4	20.2	19.3	17.5	16.7	16.9	15.5	13.5	13.0	13.6	12.7	11.3	10.4	10.0	9.4
United	24.0	22.5	20.0	18.5	16.0	14.8	13.5	13.0	13.6	14.6	14.5	15.0	14.3	13.3	13.3
PUBLIC SECTOR	99.9	96.2	90.9	86.4	81.0	74.9	66.7	61.8	60.8	61.0	60.3	59.1	57.0	56.1	56.2

Source: IRDAI, Parida (2015)' *Gross Direct Premium

2.2 Changing Business Structure

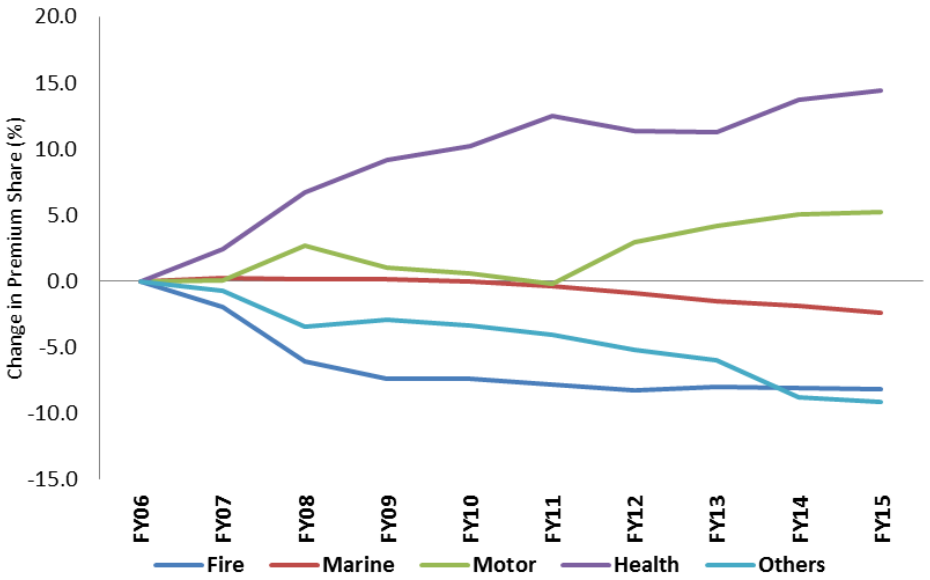
Though, the 'health insurance' products were launched in India in 2005 but the business segment has been growing in a diverse path than the other lines of business (LOB) segments. This has led to changes in the structure of the non-life insurance business in India, which can be noticed from graph 3 and table 3. However, the structure of marine insurance and motor insurance business segments has not changed, which may be due to regulatory decision to buy mandatory insurance for both the business segments. *So, this would be more interesting to evaluate the degree of change in business structure and competition level in the Indian non-life insurance sector.*

Table 3: Business Segment-wise Non-Life Insurance Market Share* (India)

	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	CAGR Growth in FY06 to FY15
Fire	18.54	16.59	12.43	11.15	11.18	10.70	10.27	10.57	10.43	10.38	8.79
Marine	6.31	6.54	6.47	6.44	6.26	5.92	5.44	4.81	4.48	3.89	9.97
Motor	42.90	42.95	45.59	43.94	43.46	42.70	45.84	47.05	47.90	48.14	17.53
Health	10.91	13.33	17.59	20.06	21.12	23.36	22.27	22.19	24.63	25.37	27.44
Others	21.35	20.60	17.92	18.41	17.98	17.33	16.18	15.37	12.57	12.22	9.06
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	

Source: IRDAI, Parida (2015), *calculated based on Gross Direct Premium

Graph 3: Business Segment wise Change in Market Share* of Non-Life Insurance



Source: IRDAI, Parida (2015) *based on Gross Direct Premium

2 Review of Literature

There are few empirical studies available on the Indian insurance sector and most of them aim to investigate performance of the insurance companies by analysing the profitability ratios. However, the issue of 'measuring competition' is dealt with in a number of papers for other sectors like manufacturing, banking etc. The scarcity of empirical studies on assessing competition is mostly due to shortage of historical data relating to insurers. However, in developed insurance markets a number of studies are available, which have examined different aspects of the insurance industry. A brief overview of the past studies on measuring competition in insurance (both life and non-life) industry around the World is presented below:

A study by *Eling & Luhnen (2008)* has described the price competition in German motor insurance market since 1994, (1996-99 & 2005-06 are two price war periods and times of intense competition in this industry) and compare it to that of other property-liability lines of business. The authors concluded the motor insurance market has experienced intense price competition since regulation of the European insurance markets in 1994. An indicator of this development is the steady decline in premiums per vehicle since 1994. The average premiums per vehicle declined by 18% from €484 in 1994 to €393 in 2006, whereas average premium in other lines of property-liability insurance remained stable or increased.

In a paper by *Njegomir, Stojić and Marković (2011),* has examined the market structure, liberalisation and performance relationship for the non-life insurance industry in the Ex-Yugoslavia region. They used country-specific fixed effects models for panel data allowing each cross-sectional unit to have a different intercept term serving as an unobserved random variable that is potentially correlated with the observed regressors. Three models were presented, each placing market structure, liberalisation and profitability in distinct surroundings defined by related control variables. The research results indicate strong influence of market structure and liberalisation on market profitability.

Sastry (2012) has calculated the completion level through a set of concentration indices of the Indian insurance industry (both life and non-life) for the period 2003-04 to 2007-08. The results concludes that the concentration in the industry is slowly declining and competition is emerging. So, the monopolistic nature of the insurance market in India which was observed at the time of opening up of the sector is slowly giving way to competition. However, the study indicate that the results need to be interpreted with carefully as there are a small number of companies operating with differences in their composition and business models.

Parida and Acharya (2016) assessed the state of competition in the Indian life insurance industry for the period 2000-01 to 2014-15 highlighting the nature of competition after the economic reforms in the economy. The study used a set of concentration measures to assess the state of competition. Accuracy of these indices is also tested along with use of concentration curves and indices. The concentration indices value indicate that there exists a uniform trend across various concentration measures, showing a fall in the concentration across all indices of the life insurers for both the samples including and excluding LIC in terms of total premium and first year premium except in the year 2013-14. Secondly, though reform process seems to have reduced concentration in the life insurance sector, the speed of reduction is noticeably slow. By following the *Ginevičiusa and Čirba (2009)* criterion, GRS index is found to be the most accurate index to measure concentration in life insurance in India. The GRS index indicates that though the concentration in the market has declined, still it remains at a relatively higher level. So, there is adequate scope for the regulator to promote competition in the life insurance industry in India.

Rothschild and Stiglitz (1997) raise an important point when they describe the insurance markets from being different from most other markets because in insurance, market competition can destroy the market rather than working better. One dimension along which insurance companies compete is underwriting, i.e. trying to ensure that the risks covered are 'good' risks or that if a high risk is insured; the premium charged is at least commensurate with the potential cost. The resulting partitioning of risk limits the amount of insurance that potential insurance customers can buy. In the extreme case, such competitive behaviour will destroy the insurance market altogether. The paper concludes that an important problem both for theory and policy is to devise ways for providing health insurance that use the power of competition to bring about efficiencies without severely limiting people's ability to insure against misfortune. Envisioning competition and insurance twenty years from then, the author states that as the ability to predict health outcome improves, this issue will become more salient. To date policy makers have not had enough good information about health status to make risk adjustment practical. It may be possible that revolution in genetic science will provide insurers and regulators with enough information to make real risk adjustment possible.

Rao (2000) remarks in his paper that conventional theory of competitive markets does not apply directly in the study of insurance business in less developed economies where credit and insurance markets are either thin or non-existent and in many developing economies the market is regulated. To be specific, in the insurance market, asymmetry of information leads to moral

hazard and adverse selection. Being incapable of incurring high monitoring costs, the insurer/lender fails to gather sufficient information on the economic agent. Moral hazard arises when the insurer or lender is unable to discern the undertaken activities of the insured/borrower and fails to foresee the probability of an adverse event. If the insured/borrower knows his/her own risk but the insurer/lender does not, then it affects the realized ex post profitability which falls below the ex-ant profitability of a contract signalling adverse selection. The insurer may charge premiums based on its calculated average experience, but it may happen that the low risk individual being aware of the riskiness of the enterprise may not opt for insurance. And in this process low risk prone individuals end up with less insurance, but paying a low premium. Thus, the insurer is exposed to high risk leading to market failure. The paper highlights that macroeconomic implications of privatization and foreign participation in the insurance sector are far reaching but the path must be approached cautiously with a 'step-by-step' approach and should be preceded by microeconomic institutional and legal reforms.

Rastogi and Sarkar (2007), identify the causes and the objectives with which the insurance sector was reformed in 2000 to conclude that only in the last decade, the hybrid model of privatization with regulation adopted by the Government has yielded positive results and the sector has started to look up. The sector in its present form looks promising for the consumers, the insurers and the nation as a whole. Thus the firms, the industry and the nation are healthier than ever before having adopted this model.

Acharya (2012) examines the state of competition in life and non-life insurance sectors in India primarily by using a variety of concentration measures. The results indicate that the market concentration of the life insurers is high in presence of LIC than in its absence. There is a fall in the concentration for the 9 years period (2001-02 to 2009-10) of the life insurers in both the samples including and excluding LIC. The study also summarized the discussions and field interviews with middle and senior managers (with an average of 10-12 years of industry experience) on understanding the level of commoditization and the marketing response by the insurance companies. Most of the executives found the product offering by their companies to be homogeneous and easily inter-changeable with the competitor offering. Both private and public sector insurers pointed that the customers gravitate towards lowest price products and covert commission kick-backs are fairly common. Most of the executives saw no risk for the customers if they switched insurance providers. The executives felt that there has been no change in the product mix offered by the insurance companies since the start of the financial

crisis. In fact, the insurance companies had dared for product innovation through ULIPS which did not find favour with the regulators.

Miller (1995) tries to examine the significance of various measures of monopoly power and concentration for both economic analysis and public policy. It is perhaps a sign of the immaturity of the Science of economics that the notion should persist that the competitiveness of the economy or of a sector of the economy can ultimately be characterized by some single number or set of numbers. One might have supposed that theoretical and empirical developments in the last two decades would have brought home the essentially heterogeneous nature of our industrial structure and behaviour. But the illusion still persists in influential quarters that there is some simple key which will enable us to separate the monopolistic from the competitive. This paper was designed not to disparage progress to date but rather by underlining its limitations to suggest the magnitude of the task ahead.

Bikker and Leuvensteijn (2008) investigate competition by analysing several factors which may affect the competitive nature of a market and various indirect measurement approaches. After discussing various supply and demand factors which may constitute a so-called tight oligopoly, we establish the existence of scale economies and the importance of cost X-inefficiency, since severe competition would force firms to exploit available scale economies and to reduce X-inefficiencies. Both scale economies and X-inefficiencies turn out to be substantial, although more or less comparable to those found for insurers in other countries and to other financial institutions. Further, they applied the Boone indicator, a novel approach to measuring the effects of competition. This indicator points to limited competition in comparison to other sectors in the Netherlands. Further investigations of submarkets should reveal where policy measures in order to promote competition might be appropriate.

Ginevicius and Cirba (2009), examine effectiveness of the additive measures to assess market concentration most effectively. The analysis shows that all currently used measures, including the most widely used Herfindahl index, have some limitations and, therefore, cannot adequately describe the market state. This index is still widely used because it is easy to calculate. However, now, when calculation is computer-aided, this argument has hardly any sense. A possibility to assess the state of the market much more accurately, searching for new, more precise measures, is more relevant now. The accuracy of some particular measures may be defined by the total difference between the relative value of market criterion bearers in the market and their value calculated by the formula of a particular concentration measure. The smaller the total difference between the relative value of the criterion bearer in the market and

relative value calculated by the formula of an additive measure, the more accurate is the additive measure. A new formula suggested in the paper, i.e. GRS index, which yields zero deviation, therefore, it may be used both in theoretical research and practical calculations.

Mishra, Divesh and Parimal (2011), attempt to examine the accuracy of the conventional additive measures of market concentration by using the criteria as suggested by *Ginevicius and Cirba (2009)* in relation to Indian Manufacturing Sector. The study found that the GRS Index of Ginevicius and Cirba (2009) is a more accurate measure of market concentration. The Herfindahl- Hirschman Index, the most widely used measure of market concentration, deviates far from accuracy. Hence, examining market concentration on the basis of the conventional indices may result in misleading conclusions and hence guide policy formulations in wrong directions

A theoretical approach of 10 market concentration measures and similarities between them in applications has given by *Bikker and Haaf (2000).* The measures of competition in literature is divided into two approaches, namely structural and non-structural. The structural approaches to measure concentration indices acquired the central position in order to describe the market structure, forging a link between concentration and competition in an industry. The impact of market concentration values on market performance has its roots in both the oligopoly theory and the structure-conduct-performance (SCP) paradigm. While, the non-structural approaches to measure competition in an industry not depends on the concentration level in an industry. In another study by *Ginevičius and Čirba (2009),* has examined effectiveness of the additive measures to assess market concentration most effectively. They suggested a new measure that is the GRS index, which termed as most accuracy measure of concentration in literature.

Literature and the associated empirical evidences, illustrate both advantages and disadvantages of concentration in the service led industry like, banking and insurance (Beck et al; 2006). The advantages are: (a) the impact of systematic crisis is expected to be less in a more concentrated market; (b) it is often argued that it is easier to supervise a few large players than a number of small players in the industry. However, on the flip side, (a) high concentration is often associated with higher price (premium) resulting from a collusion among the insurers; (b) the risks of too-big fail are more acute in the highly concentrated sector; (c) it is observed that more competitive the industry, the country will suffer less from any crisis or market failure.

3 Objective, Data and Methodology

3.1 Objective

Since it's been more than a decade and half since the sector was liberalized, the industry merits review in terms of emerging trends, level of competition for business and structural changes compared to its pre-liberalization phase. This study tries to examine the structural change in line of business, market structure and level of competition in the Indian non-life insurance industry. Further, an attempt is made to suggest the best concentration index to study the state of competition in Indian non-life insurance industry.

3.2 Data

To assess the level of competition in the Indian non-life insurance industry, the study used insurer wise data on 'Gross direct premium' for the period 2000-01 to 2014-15 (latest data available). While to the structural change, we have considered the period 2005-06 to 2014-15, as the health insurance business segment started its operation in 2005. All the data are of annual frequency and are secondary in nature. The data of the insurers are collected from different publications of IRDAI like Quarterly Journal, Annual Reports and Handbook of Indian Insurance. However, some of the financial indicators of the individual life insurers are collected from the balance sheet of the respective insurers. As competition needs to be calculate for the life insurance industry as a whole, so here we include all the companies operated in the study period. To build a level playing market, the study includes 21 non-life insurers in the sample and excludes the 7 specialised insurers and 1 reinsurer.

3.3 Methodology

To measure the competition in the Indian non-life sector and structural change in the line of business, the following methodology has been employed:

3.3.1 Measuring Competition

To measure competition in a market, it is a well-accepted practice to use the concentration ratios mainly due to their ability to capture structural features of the market. In industrial economics, concentration ratio is a measure of the total output produced in an industry by a given number of firms in the industry. This ratio reflects the changes in market concentration as a result of the entry or exit of a company into the market or caused by a merger. In literature, there are mainly two approaches to measure competition in any market economies are: (a)

Structural Approach and (b) Non-Structural Approach. The concentration ratios are often used in structural models to explain the competitive behaviour in the insurance and banking industry.

To assess the level of 'competition' in the non-life insurance industry, a set of concentration indices such as the K-Concentration Ratio (CR_k), Herfindahl-Hirschman Index (HHI), Hall-Tideman Index (HTI), Horvath Index (HOV), Entropy Index (ENT), Ginevicius Index (GIN), and GRS Index is estimated for each year separately.

In general, the concentration indices (CI) exhibiting the following form:

$$CI = \sum_{i=1}^{n} Si\ Wi \qquad \ldots\ldots (1)$$

Here, *Si* is the market share of the firm/company, *wi* is the weight attached to the market share and *n* is the number of firms/companies in the industry.

Before going ahead, a theoretical foundation of the various market concentration indices is needed. So, the mathematical formulae and the basic properties of each of the measures are discussed below (Bikker and Haaf; 2000 & 2002).

a) The K-Concentration Ratio (CR_k)

The ratio is defined as the sum of market shares of n largest insurer in the market and it takes the form:

$$CRk = \sum_{i=1}^{k} Si \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, *Si* is the market share of insurer *i* and *k* is the number of insurance companies in the industry ($i = 1\ 2 \ldots k$). Under this method, the concentration ratio gives equal emphasis to all the 'k' leading insurers and neglects the effect of many small companies in the market. There is no general rule determining the optimal value of *'k'*. However, in the empirical analysis, *'k'* is generally determined to be 3, 4 or 5. The ratio ranges between 0 and 1. It approaches zero, if there is an infinite number of very small insurance companies in the system and it equals 1, if there is a single insurer in the market

The index provides information only about shifts in market shares between the top *n* insurers and the remaining small insurance companies, but does not capture changes in distribution within these two groups. Moreover, it ignores the structural changes in the part of the industry which is not included in concentration ratio and also neglects the competitive influence of small companies on the decisions of the large banks in the market (Bikker and Haaf; 2002).

b) Herfindahl-Hirschman Index (HHI)

HHI is defined as the sum of the squares of the relative sizes (expressed as proportions of the total size of the market) of the firms/companies in the market. The formula takes the form as:

$$HHI = \sum_{i=1}^{n} s_i^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots \ (3)$$

Where, *Si* stands for the market share of the i^{th} company in the industry. HHI stresses the importance of larger firms by assigning them a greater weightage than smaller firms, and it incorporates each firm individually, so that random cut-offs and insensitivity to the share distribution are avoided. This index ranges between 0 to 1 (0 to 10,000, if market shares are expressed in terms of percent rather than in fractions). The values of 0 and 1 represent perfect competition and monopoly respectively. Usually, a value in the range 0 to 0.10 indicates highly competitive market (non-concentration), a value within 0.10 to 0.20 indicates that there is no adverse effect on competition. However, the value above 0.20 is a concern and needs to increase competition further in the industry.

In empirical literature and also in practice, HHI is the most common measure to measure concentration in the industry, largely due to its simplicity. While, the flip side of HHI is that it assigns higher weight to the bigger firms and smaller weights to the smaller firms. This not only raises the importance of the larger firms in the index, it is also reduces the effects of the smaller firms even if they are very large in number, giving a distorted measure of market concentration.

c) The Hall-Tideman Index (HTI)

This is estimated by using the following formula:

$$HTI = 1/(2\sum_{i=1}^{n} iS_i - 1) \quad \ldots\ldots\ldots \ (4)$$

Here, the market share of each insurer is weighted by its ranking in order to ensure that the emphasis is on the absolute number of insurer, and that the largest insurance companies receives weight i = 1. The HTI ranges between 0 and 1, being close to 0 for an infinite number of equal-sized companies, and reaching 1 in the case of monopoly.

d) Horvath Index (HOV)

The index is defined as the sum of the proportional share of the leading company and the summation of the squares of the proportional sizes of each company, weighted by a multiplier

reflecting the proportional size of the rest of the industry. The index owes its intellectual heritage to the HHI and is defined as:

$$HOV = s_1 + \sum_{i=2}^{n} s_i^2(2 - s_i) \quad \ldots\ldots\ldots\ldots(5)$$

Here, s_1 represents market share of the largest firm in the industry. The value of the index ranges between $\frac{3n^2-3n+1}{n^3}$ *(for n ≠ 2)* and 1, i.e., $\frac{3n^2-3n+1}{n^3} \leq HOR \leq 1$ with n being the number of firms in the industry. This index assigns larger weights to all the market players, compared to HHI.

e) Entropy Index (ENT)

The Entropy measure is defined as,

$$ENT = \sum_{i=1}^{n} s_i \, ln \left(\frac{1}{s_i}\right) \quad \ldots\ldots\ldots\ldots(6)$$

This index generally measures the degree of uncertainty faced by a firm in the marketplace. The value of the Entropy varies inversely to the degree of concentration. In case of monopoly there is no uncertainty in the market and the index takes the value zero. On the other hand, when there is *'n'* number of firms and all of them are equal in size, there are uncertainties in the market and the index takes the value *ln (n)*. Hence, the index ranges between *0* and *ln (n)*, and is therefore not restricted to *[0, 1]*, as most of the other measures of concentration presented above.

This index is criticised for using the logarithm of the market share rather than its value as the weight. As a result, the importance of the larger firms decreases, while that of the smaller ones relatively increases.

f) Ginevicius Index

The Ginevicius Index is given by the formula

$$GIN = \sum_{i=1}^{n} \left(\frac{si}{1+n(1-si)}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

This index is intended to assess two basic market indicators, the number of firms in the industry and their market share in a balanced way. It is based on the assumption that larger the number of suppliers, greater is the competition hence higher is the uncertainty in the market. The degree of this uncertainty depends on market shares of the firms when there is monopoly *GIN = 1*. On the other hand, as $n \rightarrow \infty$, $GIN \rightarrow 0$. In other words, as the number of firms in the industry

increases, the degree of seller's concentration in the market declines. Hence, this index takes the; $0 \leq \text{GIN} \leq 1$.On a positive note, that GIN index gives emphasis to both the number of firms in the industry and their market share. However, it fails to represent the true scenario of market concentration, particularly when the distribution of market share is highly skewed towards few firms.

g) GRS Index

The GRS Index suggested by Ginevicius and Cirba (2009) is an attempt to overcome the weighting problem and thereby to provide a more accurate measure of market concentration. In this index, the weights to different firms are assigned in such a way that (i) the value of the index ranges from *0 to 1, i e,* $0 \leq GRS \leq 1$, (ii) if all firms in the industry have equal market share, i e, if $s_i = \frac{1}{n}$, $GRS = \frac{1}{n}$, and (iii) it gives a more accurate measure of market concentration. Accordingly, the index is defined as,

$$GRS = \sum_{i=1}^{n} \left(\frac{n^2 s_1 + 0.3\, s_i^2}{n^2 + 0.3 n s_1 s_i}\, s_i\right) \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where, s_1 stands for market share of the largest firm in the industry.

Table 4: Features of Concentration Measures

Index Type	*Defined as*	*Range*	*Features*
CRk	$CRk = \sum_{i=1}^{k} Si$	0<*CRk=1*	▪ Takes only large companies into account; arbitrary cut off
HHI	HHI = $\sum_{i=1}^{n} s_i^2$	1/n=HHI =1	▪ Considers all insurers; sensitive to entrance of new companies
Horvath	CCI = HOR = $s_1 + \sum_{i=2}^{n} s_i^2(2 - s_i)$	0<*CCI=1*	▪ Address relative dispersion and absolute magnitude; ▪ Suitable for cartel markets
Entropy	ENT = $\sum_{i=1}^{n} s_i \ln(\frac{1}{s_i})$	0=ENT= Ln(n)	▪ Uses the logarithm of the market share rather than its value as the weight value; ▪ Importance of larger firms decreases while smaller ones relatively increases
Ginevicius Index	GIN = $\sum_{i=1}^{n}(\frac{si}{1+n(1-si)})$	0≤GNI≤*1*	▪ It emphasises both the number of firms and their market share; ▪ Fails to represent true scenario of market concentration particularly when the distribution of market share is highly skewed towards few firms
GRS Index	GRS = $\sum_{i=1}^{n} (\frac{n^2 s_1 + 0.3\, s_i^2}{n^2 + 0.3 n s_1 s_i}\, s_i)$	0≤GRS≤*1*	▪ Attempt to overcome the weighting problem to provide a more accurate measure of market concentration
HTI Index	$HTI = 1/(2\sum_{i=1}^{n} iS_i - 1)$	0<HTI=*1*	▪ Market share of each insurer is weighted by its ranking in order to ensure that the emphasis is on the absolute number of companies

Among the above discussed approaches to measure the concentration in an industry, the choice of the concentration index is mainly dependent on the policy makers'/researchers' perception of the relative influence on competition attached to large and small firms or companies. The HHI and the K-concentration ratio appear most frequently, both in theory and practice. The simple structure of these two indices and the limited data requirement of the CR_k contribute to this success.

3.3.2 Measuring Structural Change

To see the structural change, two different indices are calculated, following *Dietrich (2012).* The first is the simplest measure of structural change (SC), the Norm of Absolute Values (NAV) and the second index is the modified Lilien index (MLI). Both the indices are discussed below:

a) Norm of Absolute Values (NAV)

The Norm of Absolute Values (NAV) index is defined as:

$$NAV = 0.5 \sum_{i=1}^{n} I\, Xit - Xis\, I \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

Where, the terms x_{it} and x_{is} are the market share of i^{th} line of business at points of time t and s. The absolute (modulus) values of the difference of the two is taken and summed over all lines of business. It varies from 0 to 100 (if shares are expressed in per cent) or from 0 to 1 (if shares are expressed in proportions). The amount of structural change equals exactly the share of the movements of the sectors as a percentage of the whole economy. If the structure remains unchanged the indicator is equal to zero and if all sectors change at its most, which means the whole industry has a total change then the index is equal to unity. One of the disadvantages of NAV is that there might be similar impact due to huge movements in a few components and due to light movement in many components.

b) Modified Lilien Index (MLI)

The Lilien index is an important measure of structural change in a number of fields of economic research. Here, we used Lilien index as a measure of structural change in the Indian non-life insurance industry. It is derived from an axiomatic analysis of structural change indices. The index is defined as:

$$MLI = SQRT\ [\sum Xit * Xis * (Ln\ \frac{Xit}{Xis})\text{^}2], \quad t > s \quad \ldots\ldots\ldots(10)$$

Where, Xit as the market share of sector *i* at time *t*. The index has to be equal to zero if the sectoral composition is unchanged.

4 Empirical Results & Discussions

This paper attempts to assess the state of competition and measure the structural change in the business segments in the Indian non-life Insurance industry. To access the competition level, a group of concentration measured tested for the period 2000-01 to 2010-15. An attempt also made to suggest the best concentration index to study the state of competition in Indian non-life insurance industry. Further, to measure structural change in the sector after health insurance business started operation in 2005, the study calculated tow SC index for the period 2005-06 to 2014-15.

4. 1 Competition Results

In literature, it is well evident that concentration in a market weakens competition by promoting collusive behaviour between the firms. More specifically, competition in an industry depends on the degree of concentration in the sector. In market economics, read in micro-economics, a market is classified into four categories, viz Monopoly, Oligopoly, Monopolistic Competition and Perfect competition, which is linked with the level of market competition/concentration. In perfect competition, there is no concentration of power and the concentration index would be zero. However, in monopoly, the index would be one. Here, the results are calculated by using 9-concentration indices to measure market concentration in the Indian non-life insurance sector by using the market share of the insurers based on 'Gross Direct premium' for the period 2000-01 to 2014-15. The indices are calculated every year by considering all the insurance companies operating in the sector in that year, which varies from 7 in 2000-01 to 21 in 2014-15.

The results are outlined in the table 5 and the concentration curves presented in graph 4. As CR_n index considers the top *n* companies in market based on share, so, we have calculated CR3, CR5 and CR10 to have a clear representation of the index. The all 3-CR indices indicate the same trend that concentration in the Indian non-life insurance sector declined over the period but not significantly. The indices, HHI (used mostly by the regulators due to the simplicity), HTI and GIN indicates that there was less concentration in 2000-01 but declined further in 2014-15, may be due to the entry of new players in the sector. HOV and GRS indicate the same trend, though the index value differs. Finally, ENT index also shows a rising

concentration curve, which means decline in concentration in the sector. Some indices indicate that concentration in the sector started to increase in 2014-15, which may be temporary.

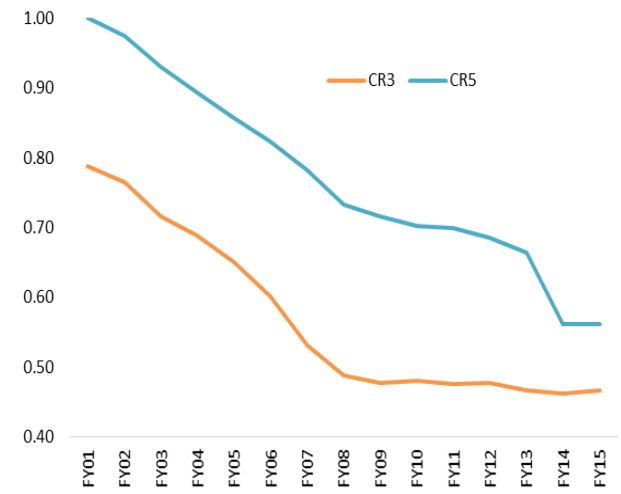
Table 5: Concentration Indices of the Indian Non-Life Insurance Industry

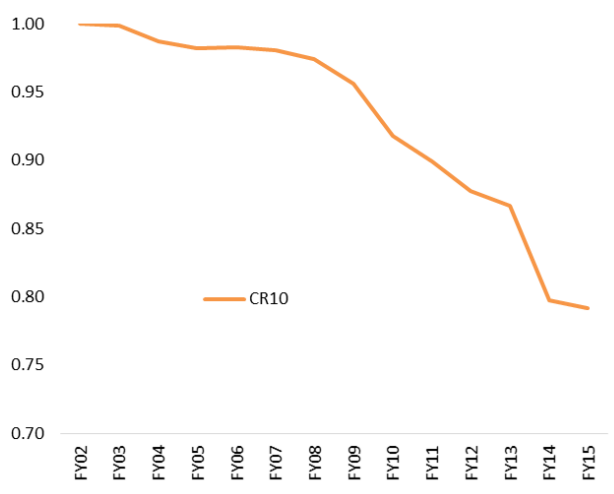
Year	Number of Insurers	CR3	CR5	CR10	HHI	ENT	HOV	HTI	GIN	GRS
2000-01	7	0.787	1.000	-	0.259	1.373	0.597	0.277	0.162	0.332
2001-02	10	0.765	0.974	1.000	0.245	1.533	0.572	0.258	0.118	0.338
2002-03	12	0.716	0.929	0.998	0.220	1.707	0.533	0.224	0.098	0.323
2003-04	12	0.688	0.893	0.987	0.199	1.841	0.497	0.202	0.095	0.297
2004-05	12	0.650	0.857	0.982	0.179	1.948	0.463	0.186	0.093	0.276
2005-06	12	0.601	0.823	0.983	0.161	2.035	0.433	0.171	0.091	0.266
2006-07	12	0.532	0.782	0.980	0.139	2.143	0.391	0.151	0.089	0.229
2007-08	14	0.489	0.733	0.974	0.128	2.205	0.369	0.141	0.076	0.213
2008-09	16	0.478	0.716	0.956	0.123	2.274	0.357	0.134	0.067	0.205
2009-10	17	0.480	0.702	0.918	0.117	2.362	0.344	0.124	0.063	0.198
2010-11	19	0.476	0.700	0.899	0.113	2.403	0.334	0.119	0.056	0.188
2011-12	21	0.478	0.686	0.877	0.109	2.453	0.326	0.113	0.056	0.185
2012-13	21	0.467	0.664	0.867	0.105	2.500	0.317	0.108	0.051	0.183
2013-14	21	0.462	0.561	0.797	0.103	2.528	0.247	0.137	0.051	0.162
2014-15	21	0.468	0.562	0.792	0.103	2.539	0.318	0.104	0.051	0.193
Average	**-**	**0.569**	**0.772**	**0.929**	**0.154**	**2.123**	**0.406**	**0.157**	**0.081**	**0.233**

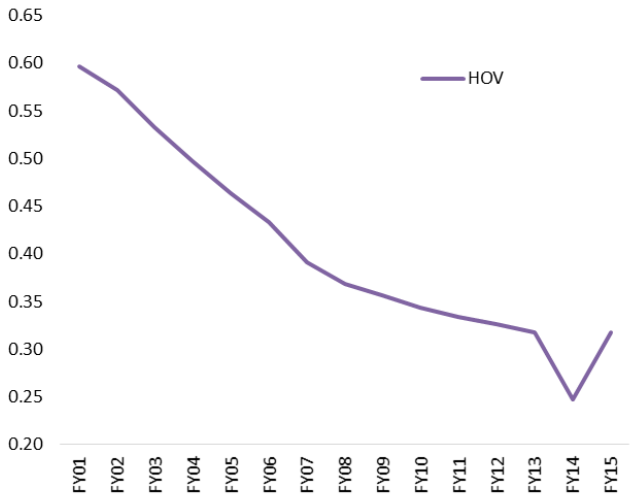
^based on Gross Direct Premium

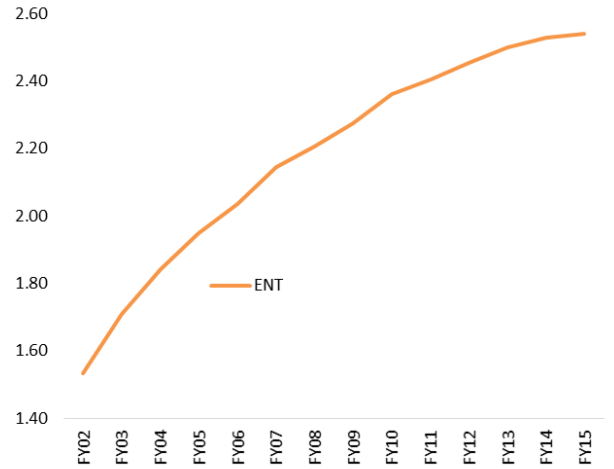
Thus, the results indicate that concentration in the non-life business segment is moderate. All the measures quantified indicate healthy competition in Indian non-life insurance industry. The average indices value of HHI, GIN and GRS indices yield low market concentration. However, HOV index confirm moderate concentration. Additionally, there is a significant improvement between the results of the CR3, CR5 and CR10, which indicate that as the sample size increases the indices approaches to one. In other words, the business in non-life industry is well distributed among the insurers. The ENT index results interpreted in an opposite way to the other indices. If the indices value increases the there is competition in the market is increasing. Another interesting point to note that the global financial crisis of 2008 has not impacted the concentration results in the non-life insurance industry, as all the industry trends are continuously declining. Though, the concentration indices indicate the same trend but which index is more appropriate to study the state of competition in Indian non-life insurance industry, is discussed in the next section.

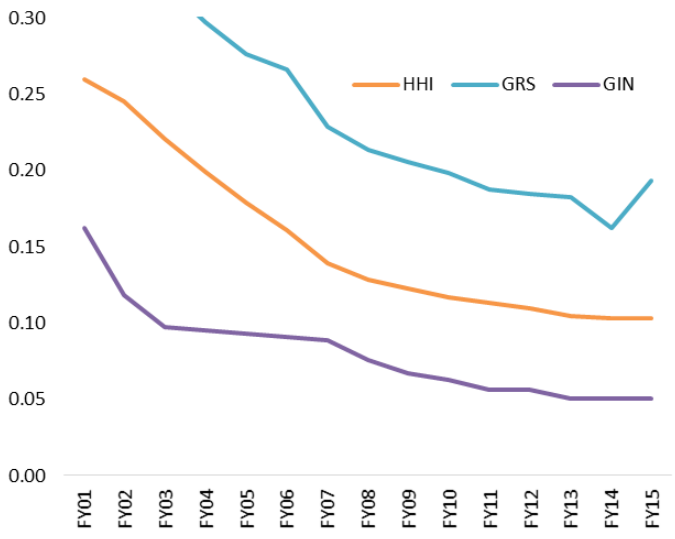
Graph 4: Concentration Curves of Non- Life Insurance Industry (Gross Direct Premium)*











Where,

- CR3: 3-firm Concentration Index
- CR5: 5-firm Concentration Index
- CR10: 10-firm Concentration Index
- HOV: Horvath Index
- HHI: Herfindahl-Hirschman Index
- ENT: Entropy Index
- GIN: Ginevicious Index
- GRS: GRS Index
- HTI: Hall and Tideman Index

Note: ENT index indicate that '0' means higher concentration, i.e. monopoly in the industry

Note: * Gross Direct Premium

4.2 Testing Accuracy of Concentration Indices

In order to investigate the accuracy of the concentration indices used to compute the level of market concentration in the life insurance industry in India, the study followed the criterion suggested by *Ginevicius and Cirba (2009).* The criterion takes the form:

$$R_j = \sum_{i=1}^{n} |Sij - Sij^*| \text{..... } (11)$$

Here, 'R_j' is the criterion of accuracy of j-th concentration measure; S_{ij}* is the relative value of the market share as per the formula of j-th concentration measure and S_{ij} is the actual calculated market share.

According to *Ginevicius and Cirba (2009),* a concentration measure will be most accurate, when $R_j = 0$, it ideally reflects the market situation. The calculated R_j values are presented in table 10, which indicates that none of the concentration measures is ideally accurate, i.e., R = 0. The difference between the actual market share and the relative market share is more than zero in all the cases. So, to find out a more accurate measure of concentration and not the most accurate measure, it is assumed that smaller the 'R', the more accurate is the measure of market concentration. To have a better insight, the values of 'R' in table 6, ranked by assigning 1 to the lowest value and then 2 to the next value in ascending order.

Table 6: Comparison of the Accuracy of Concentration Measures

Year	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15
Index	**Value of 'R' in Non-Life Insurance (Gross Direct Premium) Variable**														
HHI	0.188	0.260	0.303	0.310	0.366	0.374	0.349	0.329	0.355	0.426	0.437	0.463	0.474	0.487	0.518
ENT	0.132	0.211	0.270	0.311	0.313	0.285	0.233	0.206	0.224	0.256	0.267	0.275	0.271	0.274	0.273
HOV	0.450	0.507	0.568	0.601	0.640	0.697	0.713	0.731	0.741	0.757	0.749	0.763	0.786	0.539	0.830
HTI	0.441	0.481	0.518	0.529	0.553	0.558	0.547	0.537	0.553	0.594	0.604	0.627	0.636	0.434	0.660
GIN	0.058	0.077	0.081	0.069	0.071	0.065	0.051	0.044	0.045	0.052	0.051	0.053	0.053	0.054	0.057
GRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Index	**Ranking of 'R' in Non-Life Insurance (Gross Direct Premium) Variable**														
HHI	4	4	4	3	4	4	4	4	4	4	4	4	4	5	4
ENT	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3
HOV	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
HTI	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5
GIN	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
GRS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Source: Calculated

The ranking of indices in table 6 indicate that GRS is more accurate measure of concentration, followed by GIN index and ENT index, in case of Indian non-life insurance industry. HHI ranked at fourth place and HOV ranked at last. Thus, it may conclude that GRS index is the more ideally accurate measures of concentration in case of the Indian non-life insurance industry.

4.3 Structural Change Results

The table 7 provides the NAV for various components of non-life business. The NAV values indicate that the structure of the non-life insurance is changed but slowly over the years. Among the business segments, the NAV value for health insurance indicate a sharp rising, followed by fire and motor insurance. While, the marine insurance business segments structure has not changed significantly.

Table 7: Norm of Absolute Values (NAV) Index for the period 2005-06 to 2014-15

	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15
Fire	0.00	0.97	3.05	3.69	3.68	3.92	4.14	3.98	4.06	4.08
Marine	0.00	0.11	0.08	0.07	0.02	0.20	0.44	0.75	0.91	1.21
Motor	0.00	0.03	1.35	0.52	0.28	0.10	1.47	2.08	2.50	2.62
Health	0.00	1.21	3.34	4.58	5.11	6.22	5.68	5.64	6.86	7.23
Others	0.00	0.38	1.72	1.47	1.68	2.01	2.58	2.99	4.39	4.56
Total	0.00	2.70	9.54	10.33	10.78	12.45	14.31	15.44	18.72	19.71
Source: IRDAI										

As the index values not so much different, we have tested with the next method, i.e., Modified Lilien Index (MLI). The computed values of MLI are provided in the table 4. The MLI values indicate that fire and health insurance business segments have influenced the structure of Indian non-life insurance significantly in the study period.

Table 4: Modified Lilien Index (MLI) for the period 2005-06 to 2014-15

	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15
Fire	0.00	3.79	36.80	53.42	53.07	59.95	66.44	61.80	64.02	64.79
Marine	0.00	0.05	0.02	0.02	0.00	0.15	0.76	2.23	2.07	5.73
Motor	0.00	0.00	7.27	1.09	0.32	0.04	8.67	17.27	17.58	27.52
Health	0.00	5.84	43.83	81.19	100.55	147.68	123.83	122.12	135.52	197.05
Others	0.00	0.57	11.74	8.65	11.33	16.12	26.55	35.43	28.97	81.19
Total	0.00	3.20	9.98	12.02	12.86	14.96	15.04	15.45	15.75	19.40
Source: IRDAI										

Thus, both the indices indicate the same trend that the structure of the Indian non-life insurance industry has changed by health insurance business during the study period (2005-06 to 2014-15), which is mainly due to the high growth of health insurance business in India. As the health insurance in India is largely by demand-driven and the segment may continue to dictate the structure of Indian non-life insurance industry in future also.

5 Concluding Remarks

To sum up, the structural change and concentration indices in the non-life insurance industry in India shows (i) a uniform trend across various measures; (ii) though reform process has reduced concentration in the non-life segment significantly during the period 2000-01 to 2014-15 but noticeably slow. It is also interesting to note that health insurance business segments have influenced the structure of non-life insurance in the period 2005-06 to 2014-15. The GRS is found to most accurate concentration index for the Indian non-life insurance industry to study the competition in the sector.

The GRS index values indicate that the concentration has declined to 0.193 in 2014-15 from 0.332 in 2000-01. In other words, the model of privatization adopted by the Government of India has yielded positive results and the sector has started to be comparable to its global peers. However, there is adequate scope for the regulator to promote further competition in the sector, to increase efficiency in the market as the concentration index is still at above 0.10 or 10% (0.193 in 2014-15). Going forward, the sector in its present form looks promising for the consumers, the insurers and the nation as a whole.

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