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EFFECTS OF STRATEGIC ENTRY DETERRENTS ON SIZE DISTRIBUTION OF FIRMS IN THE INDIAN MANUFACTURING

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The views expressed herein are of the author's and not purported to reflect those of the Competition Commission of India

Scheme of the Paper

- **Objective of the study**
- **Firms size distribution (FSD): Random Vs Systematic forces**
- **Genesis of FSD & LPE**
- **Testing of LPE: Estimation & Results**
- **FSD & Entry deterrent Strategies (EDS)**
- **EDS as systematic forces**
- **Firm size inequality model**
- **Estimation results**
- **Conclusion**

FSD

LPE

- According to simplest version of the 'Law of Proportionate Effect' hypothesis by Gibrat, concentration levels emerge as a result of a random process whereby firms face certain probability distribution of growth rates which is independent of the firm's initial size.
- Due to this stochastic process with proportional growth rates, larger firms notice absolutely more growth compared to smaller ones and the distribution of firm size, over a period of time, becomes positively skewed and will approach lognormal distribution.

EDS

LPE AND FSD

In a stochastic firm growth model for which the Law of Proportionate Effect (LPE) holds:

- Firm growth follows a random process and is independent of initial size.
- The resulting distribution of firms' size is lognormal.
- There will be an increasing industrial concentration since both large and small firms have the same chance of growing by a given proportion during any period.
- The inequality of firm size (proxied to be variance in market shares) is independent of the mean size of firms in an industry.
- The inequality measure used depends on relative firm size rather than absolute firm size and market share is a relative firm size (Also refer Culbertson, 1985).

Limitations of LPE

- Stochastic forces can operate on the size distribution of firms in conjunction with cost and competition conditions*
- If the magnitude of cost differences or the levels of competition affect the probability of survival of high cost firms (small firms or entrants), the Law does not hold.
- In this case, the probability of a given proportionate change in a firm's size is not independent of the initial firm size.

Thus, finding the effects of cost and competition variables on the inequality of firm sizes is evidence that the Law does not hold, regardless of the relationship between average firm size and the inequality of firm size.

CONTD..

- Several theoretical models explain the evolution of how firms update their beliefs about their true efficiency and successful firms adjust their size accordingly and grow (Jovanic; 1982 and Ericson & Pakes; 1995)
- In contrast, firms finding out that they are not efficient enough shrink and eventually exit (Huber et al; 2007)
- These models imply that the firms' growth rates decrease in size at given age of surviving firms



CONTD…

- Even when LPE doesnot hold?
- Economic Theory on Skewness?
- Entry & exit – Reality & Continuous!



FSD

LPE

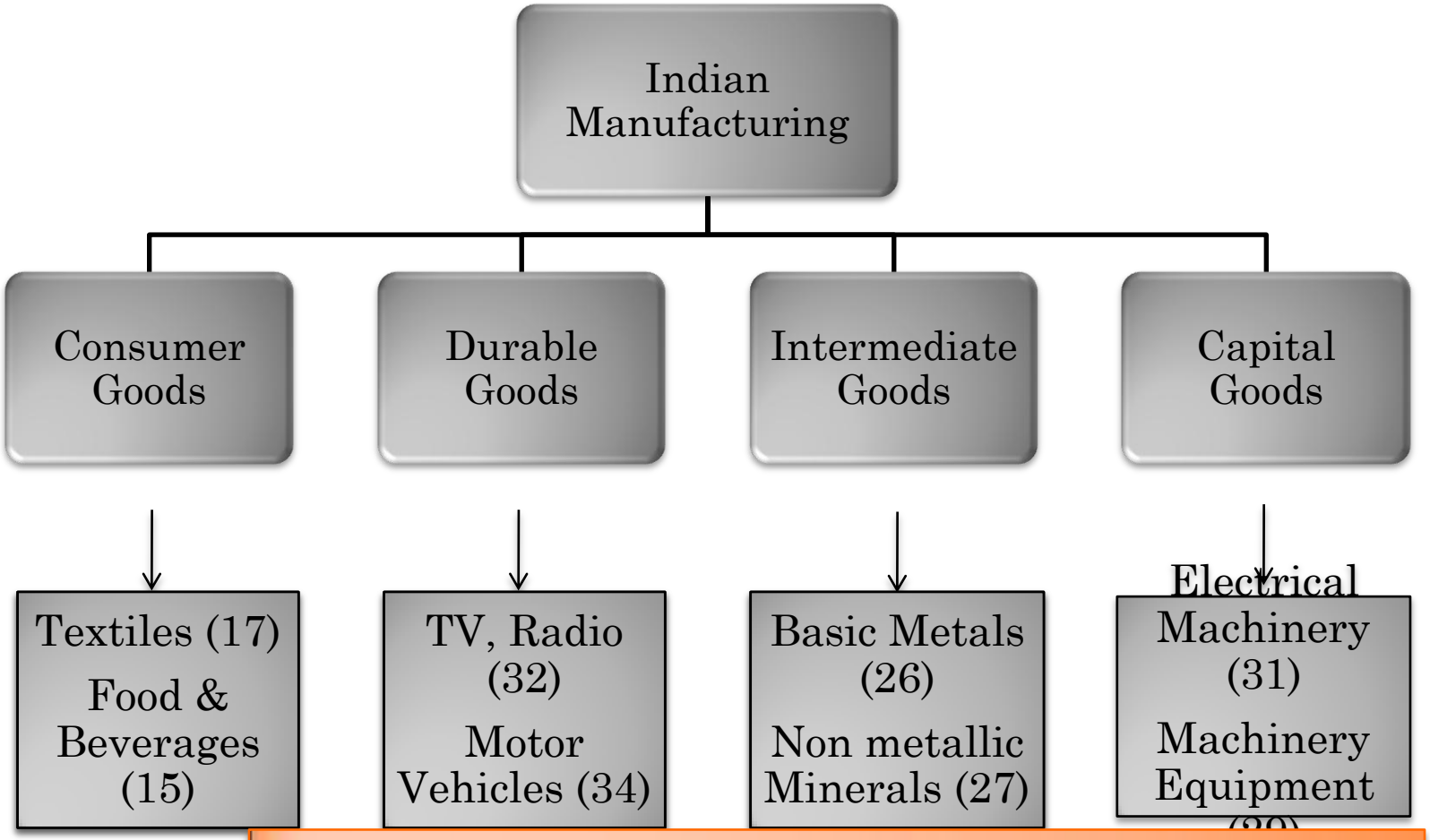
EDS

- Given the initial firm size distribution (FSD), an increased variance in the firms' sizes leads to greater spread of firm sizes over time.
- Spread of firm sizes imply that there is a tendency of an increase in market concentration and hence movement towards anti-competitive markets.
- Hence, defined entry deterrent strategies (EDS) such as advertising expenditure, intangibles, R & D expenditure and excess capacity are being anti-competitive, are expected to have positive impact on variance in the firms' sizes.

RBV - Competitive Heterogeneity [David Hoopes et al., (2003)], Competitive Advantage and Comparative Firm Advantage [Anoop Madhok et al., (2010)]

Industry Sample

We have chosen 8 sectors from Indian manufacturing broadly classifying them into 4 groups and have chosen 2 sectors each for a group as follow:



Note: Within parenthesis are NIC codes of selected sectors.

Data Source

- The empirical analysis of the present study is for the period 1990-2007 using Centre for Monitoring Indian Economy (CMIE) – PROWESS data base.
- Prowess is a database of large and medium Indian firms. It contains detailed information on over 25,000 firms. These comprise all companies traded on India's major stock exchanges and several others including the central public sector enterprises.
- The database covers most of the organized industrial activities, banking, organized financial and other services sectors in India. The companies covered in Prowess account for 75 per cent of all corporate taxes and over 95 per cent of excise duty collected by the Government of India.
- Prowess provides detailed information on each company. This includes a normalized database of the financials covering 1,500 data items and ratios per company.

TESTING LPE

The LPE framework postulates that the growth of firms is a random process; while there may be a large number of systematic factors affecting growth, collectively they exercise only a limited influence on firm's proportionate growth (Hart & Oulton, 1996).

The methodological framework adopted in this study is similar to Dasguta (1985) and Yadav (2007). To test the LPE, the first order autoregressive log liner model AR (1) has been adopted. The formal derivation of this model is given below.

Let $S_{i\,t}$ be the size of i^{th} firm at time't', $S_{i\,t+1}$ be the size of i^{th} firm at time'$t+1$' and let α be the constant growth rate, which is common to all firms, then we have:

$$S_{i\,t+1} / S_{i\,t} = \alpha \qquad (1)$$

CONTD…

The second element in the growth equation is a systematic tendency for the growth of a firm to be related to initial size (i.e.,) $S_{i\,t}^{\beta-1}$ and the third element is a random term e^{Ut} which enter the growth equation multiplicatively. Thus, the growth equation is given by:

$$S_{i\,t+1} / S_{i\,t} = \alpha S_{i\,t}^{\beta-1} e^{Ut} \qquad (2)$$

- The effect of the initial size on growth is determined by the value of β (equation (2)). For β=1, the exponent of $S_{i\,t}$ is zero and so initial size has no effect on future growth (thus, LPE holds). For $\beta > 1$, the initially large firms grow at a faster rate than small ones and for $\beta < 1$, the initially small firms grow at a faster rate than larger ones. Thus, β can be termed as the LPE determining parameter.

Taking natural logarithms on both sides of equation (2), we have,

$$ln\, S_{i\,t+1} = ln\, \alpha + \beta\, ln\, S_{i\,t} + Ut \qquad (3)$$

LPE Test Results

Estimation Results: OLS

Industry	Intercept	Ln S_t	Adjusted R sq	N
Textiles	1.32**	0.87***	0.95	18
	2.78	18.22		
Food & Beverages	2.02**	0.81***	0.87	18
	2.61	11.04		
TV & Radio	2.24**	0.76***	0.72	18
	2.12	6.75		
Motor Vehicles	1.91*	0.82***	0.79	18
	1.85	8.14		
Basic Metals	0.73	0.94***	0.96	18
	1.53	21.38		
Non-Metallic Minerals	0.70*	0.94***	0.97	18
	1.97	26.5		
Electrical Equipment	0.44	0.96***	0.95	18
	0.96	20.18		
Machinery Equipment	1.69*	0.84***	0.85	18
	1.96	10.04		

Note: ***, **, * are significant at 1, 5, and 10 % respectively.

Estimation Results: Panel – Fixed Effects Model

Dep Var	Ln S_{t+1}
Intercept	1.45***
	5.37
S_t	0.86***
	32.24
F	1039.71
	0
F(ui=0)	1.85
	0.08
corr(ui,Xb)	0.56
sigma_u	0.08
sigma_e	0.208
rho	0.131
Hausman	11.94
	0.0005
R Sq	within = 0.88
	between = 0.99
	overall = 0.92
Model	FE
N	144

Note: ***, **, * are significant at 1, 5, and 10 % respectively.

Non-normality: Skewness & Kurtosis

- The Skewness and the Kurtosis indexes are the third and the fourth standardized moments of the distribution. In particular, the literature refers to the Skewness index as:

$$\sqrt{\beta_1} = \frac{E(X-\mu)^3}{\sigma^3} \qquad (4)$$

and to the Kurtosis index as:

$$\beta_2 = \frac{E(X-\mu)^4}{\sigma^4} \qquad (5)$$

where and are the mean and the standard deviation of the distribution under exam. Since for a normal distribution they are equal to 0 and 3 respectively, a natural way to evaluate the non-normality of a distribution is to look at the difference of such empirical moments from those values.

Skewness

Skewness								
Industry	Textiles	Food & Beverages	TV & Radio	Motor Vehicles	Basic Metals	Non-Metallic Min	Electrical Equipment	Machinery Equipment
1990	5.36	4.35	3.45	4.84	9.84	82.90	2.96	9.58
1991	3.89	4.48	3.63	5.97	10.95	80.25	3.26	9.90
1992	4.26	4.10	3.31	6.49	11.78	84.31	3.50	10.44
1993	4.60	4.46	4.58	6.53	12.17	85.52	3.27	11.14
1994	4.76	7.47	4.88	6.89	13.52	84.97	4.04	11.48
1995	5.70	8.41	4.11	7.61	14.21	86.63	4.43	11.14
1996	5.70	8.15	4.61	7.69	13.22	94.16	4.84	11.79
1997	5.03	5.80	4.31	7.90	12.43	99.37	4.68	11.74
1998	5.48	5.29	4.37	7.89	12.60	107.73	5.03	12.21
1999	5.40	6.30	4.43	8.08	13.98	108.07	4.97	13.12
2000	5.31	5.32	4.03	9.02	14.59	126.77	4.45	12.57
2001	5.09	7.53	3.50	8.53	13.20	129.51	3.79	12.40
2002	3.59	5.37	3.89	8.27	12.55	118.65	4.30	13.47
2003	4.67	4.59	5.18	8.48	12.47	124.72	4.88	13.64
2004	4.49	7.36	4.73	8.67	12.19	107.15	4.91	14.03
2005	5.20	7.47	5.02	8.72	11.71	112.38	5.09	13.63
2006	4.78	5.68	4.70	8.24	11.18	105.11	4.90	13.34
2007	4.41	9.96	5.15	7.61	9.78	78.89	4.58	11.78

Note: All the test statistic are statistically significant at 1%.

KURTOSIS

Kurtosis								
Industry	**Textiles**	**Food & Beverages**	**TV & Radio**	**Motor Vehicles**	**Basic Metals**	**Non-Metallic Min**	**Electrical Equipment**	**Machinery Equipment**
1990	35.93	24.24	12.68	25.79	101.40	82.90	11.03	104.30
1991	17.88	26.15	13.45	40.14	125.87	80.25	14.60	113.84
1992	22.40	21.08	10.60	47.04	147.08	84.31	16.92	127.88
1993	26.90	24.23	23.42	46.58	158.65	85.52	13.07	146.58
1994	27.84	79.44	26.97	51.57	196.80	84.97	19.87	156.48
1995	39.61	98.37	16.78	62.76	218.34	86.63	23.42	151.94
1996	40.97	94.55	22.24	63.13	192.66	94.16	29.16	170.21
1997	31.44	42.47	18.92	66.92	169.05	99.37	27.46	167.00
1998	38.19	35.54	19.56	66.39	176.19	107.73	28.77	176.86
1999	40.62	58.46	20.31	70.60	218.22	108.07	30.38	199.63
2000	36.06	35.80	17.25	89.14	237.58	126.77	23.68	188.17
2001	34.89	85.75	12.37	80.65	198.10	129.51	16.11	182.75
2002	15.06	37.25	15.80	74.81	178.44	118.65	22.65	208.29
2003	28.76	26.48	30.25	79.24	177.66	124.72	26.94	215.32
2004	24.41	76.70	24.65	84.39	171.28	107.15	26.57	225.59
2005	33.28	78.87	27.20	86.31	161.13	112.38	28.89	216.20
2006	26.95	43.63	24.18	77.41	146.37	105.11	26.69	203.95
2007	22.72	128.82	31.50	67.20	113.85	78.89	23.21	158.52

Note: All the test statistic are statistically significant at 1%.

EDS as determining factors of Inequality

- From economic point of view, the analysis of the shape of FSD forms the means to describe the evolution of market structure over time.

- Market concentrate under increasing variance or skewness of FSD, then large firms gain dominance

[Harry Bloch; 1981]



EDS AS SYSTEMATIC FORCES AFFECTING FSD

Model: Firm Size Inequality

$$Z = f\,(N, S, X's, G)$$

Where,

Z = Variance in market shares

N = Number of firms

S = Mean firm size

G = Growth rate of sales

X = Strategic entry deterrents

- A multiplicative functional form is used in estimating the relationship, such that

$$Z = \beta_1 N^{\beta 2} S^{\beta 3} e^{(\beta_4 G + \gamma i \Sigma X_i + \varepsilon)}$$

where $i = 1, 2, 3, 4$ and

X_1 = Advertising/Sales

X_2 = Intangibles/Sales

X_3 = R&D expenditure/Sales

X_4 = Inventories/Sales

Estimation Results: Panel Regression

Dep Var	Ln Variance in Market Shares										(144 Observations)
Model	1	2	3	4	5	6	7	8	9	10	11
Constant	-0.34	3.19***	2.65***	2.56***	1.86***	2.79***	2.43***	2.61***	2.05***	1.78***	1.92***
	-0.97	7.37	5.52	6.03	3.82	4.97	5.54	4.42	3.35	3.58	3.03
Advertising	-24.51**	3.27	2.54	4.37	-5.46	3.75	4.6	4.13	-5.87	-5.04	-5.36
	-2.44	0.39	0.31	0.53	-0.62	0.45	0.56	0.5	-0.66	-0.57	-0.6
R & D	9.77	22.74***	18.55**	16.54**	14.33*	16.73**	15.08*	15.34*	14.51*	13.2*	13.41*
	1.00	2.88	2.40	2.17	1.91	2.19	1.95	1.97	1.93	1.74	1.75
Intagibles	0.93	0.45	0.98	4.45*	4.41*	4.69*	4.91*	5.05*	4.60*	4.79*	4.90*
	0.36	0.24	0.51	1.72	1.75	1.79	1.88	1.91	1.80	1.87	1.90
Inventory	1.82***	0.59	1.20***	1.11**	1.16***	1.14**	0.97**	1.01**	1.18***	1.04**	1.07**
	3.85	1.49	2.65	2.50	2.66	2.54	2.09	2.13	2.69	2.29	2.31
No. of Firms		-0.66***	-0.68***	-0.65***	-0.53***	-0.68***	-0.65***	-0.67***	-0.56***	-0.53***	-0.55***
		-9.54	-10.02	-9.75	-6.76	-8.51	-9.7	-8.3	-6.12	-6.75	-6.03
Mean firm size			0.11**	0.08*	0.14***	0.06	0.11**	0.09	0.13**	0.17***	0.15**
			2.45	1.77	2.89	1.17	2.06	1.5	2.25	2.97	2.35
Growth				0.09	0.04	0.12	0.06	0.09	0.07	0.02	0.04
				0.70	0.35	0.86	0.48	0.61	0.5	0.18	0.3
Export Open					-2.01***				-1.99***	-1.96***	-1.95***
					-2.7				-2.67	-2.63	-2.6
Dummy 1						-0.04		-0.02	-0.03		-0.02
						0.53		-0.45	-0.52		-0.37
Dummy 2							-0.05	-0.04		-0.04	-0.04
							-1.06	-0.96		-0.88	-0.8
Wald chi2(7)	32.31	143.99	157.04								
	0	0	0								
F				22.45	21.51	19.6	19.8	17.51	19.04	19.17	17.15
				0	0	0	0	0	0	0	0
F(ui=0)				78.27	78.4	74.04	78.25	73.73	72.64	78.29	72.36
				0	0	0	0	0	0	0	0
corr(ui,Xb)	0 (assumed)	0 (assumed)	0 (assumed)	0.156	0.44	0.118	0.068	0.049	0.403	0.354	0.334
sigma_u	0.863	0.512	0.598	1.013	0.935	1.02	1.041	1.044	0.94	0.958	0.96
sigma_e	0.232	0.178	0.176	0.176	0.172	0.177	0.176	0.177	0.173	0.172	0.173
rho	0.932	0.892	0.919	0.97	0.966	0.97	0.971	0.971	0.967	0.968	0.968
Hausman	0.89	5.78	0.1	1456	1467	863.48	1393.14	869.01	814.66	1411.72	817.45
	0.92	0.32	0.99	0	0	0	0	0	0	0	0
R sq											
within	0.19	0.52	0.53	0.54	0.57	0.55	0.55	0.55	0.57	0.57	0.57
between	0.34	0.68	0.77	0.25	0.51	0.23	0.19	0.18	0.47	0.42	0.4
overall	0.25	0.62	0.7	0.26	0.47	0.24	0.2	0.2	0.45	0.4	0.39
Model Type	RE	RE	RE	FE	FE	FE	FE	FE	FE	FE	FE

Note: ***, **, * are significant at 1, 5, and 10 % respectively.

Estimation Results [Overall]

- We have modeled inequality as a function of EDS and other control and policy variables referring to Bloch (1981).
- Estimated results in various models show strong and statistically significant relationship between inequality of firm size and EDS.
- Intangibles, R & D expenditure, excess capacity and mean firm size are statistically significant and inequality increasing.
- Number of firms operating and export openness are statistically significant and inequality decreasing.
- Growth is statistically insignificant through-out.
- Mean firm size is statistically significant and not independent of Inequality of firm sizes



CONCLUSIONS

- Competition agencies should clearly assess whether the intended EDS has any anti-competitive impact in the market
- Should assess clearly whether EDS are inequality increasing or not
- More sectoral study at disaggregated data are of practical use for clear sector-sensitive assessments of competition concerns and hence enforcements
- Perfect competition is not the right benchmark to see any anti-competitive act to be deviated from



Thank You

