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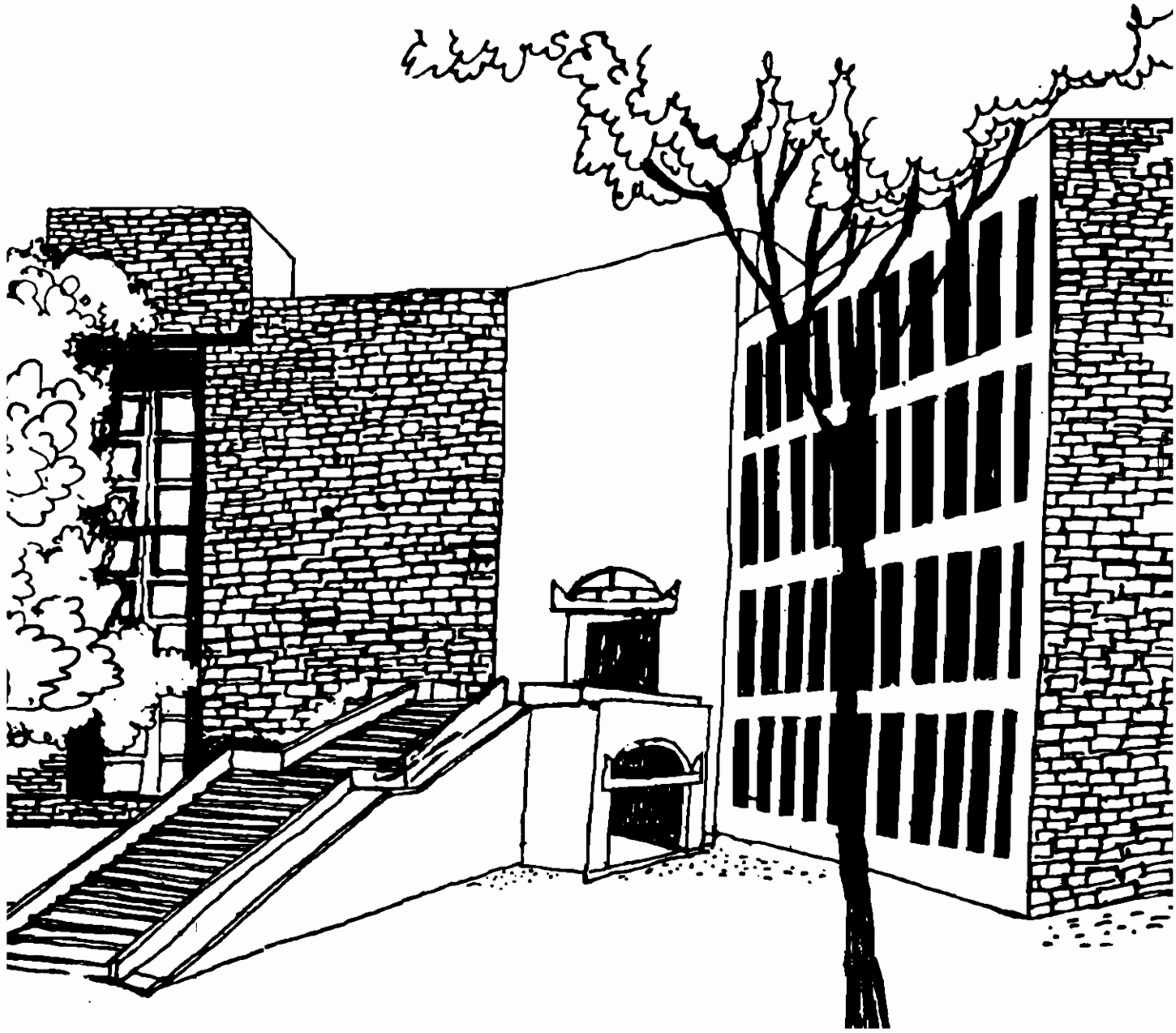

STRUCTURE, FIRM SIZE AND TECHNICAL EFFICIENCY: SOME OBSERVATIONS ON INDIAN INDUSTRY

By

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Structure, Firm Size and Technical Efficiency : Some Observations on Indian Industry.

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Abstract:

The empirical results of this paper, for a sample of firms belonging to a light Indian engineering industry, show that very small and large firms are relatively technically inefficient in production. The larger size group of small firms appear to realize the highest level of technical efficiency. This is explained on the basis of organizational behaviour of large and small firms as a response mechanism to the product and factor market structure conditions.

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I. Introduction.

The structure, conduct and performance (SCP) approach in industrial organization generally takes the structure of an industry in terms of firm size asymmetry as exogenously given and observes the conduct and performance in terms of organizational and technological behaviour and consequent relative profitability and efficiency of large and small firms. [Caves (1980) Porter (1979)] But, on the other hand, Demsetz (1973) and others have argued that the structure of an industry is an endogenous outcome i.e., certain firms in an industry grow into a larger size because they are more efficient than the others. The differences in efficiency across firms could be attributed to organizational, technological, marketing and also random factors. The structure of an industry might be a continuously evolving process with a two way interaction between structure and conduct. A small firm may adopt conduct strategies aimed at achieving higher relative efficiency in order to grow into larger size. Similarly, a large firm could continue to remain large by maintaining it's relative efficiency.

The structure of an industry in terms of skewed size distribution could remain stagnant over a sustained period due to capital market imperfections. Capital market imperfections could help firms that could grow into larger size initially to impose mobility and entry barriers effectively and remain large without having to be more efficient than the smaller rivals. Such an outcome might be a dominant feature of industrial structure in

India wherein factor markets are highly distorted and segmented.

In many Indian industries a few large and a large number of small firms coexist [Desai (1982)]. Most of the industries continued to be dominated by a few dominant well known firms for long periods with very rare cases of small firms growing into larger size. In Indian industry, not only because of macro policy distortions but also the factor market segmentation, large firms have access to capital at far below it's shadow price in the labour abundant and capital scarce Indian economy [see Meade (1991), Sen (1991) Patibandla (1994)]. On the other hand small firms, operating in the unorganized factor markets, pay factors of production according to their shadow prices. This paper adopts the approach that the structural conditions like the presence of long run domestic market power and factor market segmentation determine the organizational and technological behaviour of large and small firms which, in turn, determine their relative technical efficiency (or total factor productivity) in production and examines the association between firm size and technical efficiency for an Indian industry.

Page (1984), Little et al (1987) examined the association between technical efficiency and firm size for four Indian industries on the basis of an extensive survey data. They found no significant association between firm size and technical efficiency for three out of the four industries. This paper explores the possibility of a non-linear association between technical efficiency and firm size and

shows that very large and very small firms are relatively inefficient and technical efficiency is maximum in the middle size group. This association is explained on the basis of technological and organizational behaviour of size groups as a response mechanism to the product and factor market structure conditions they face in the domestic market.

The paper is organized as follows. In Section II, technical efficiency is defined. Section III presents a simple theoretical model to put forward the crucial argument of this paper. In Section IV, the relevant issues for Indian industry are discussed. A major part of the issues are derived from the qualitative information collected from a field survey conducted for a sample of firms belonging to a light engineering industry, i.e., Hand, small and cutting tools industry, at a (SITC) disaggregate classification. The data pertains to the year 1983/84. The survey covered 84 firms, of which 9 were large firms and the rest were small and medium sized firms. In Section V, the statistical association between firm level technical efficiency and firm_ size is examined on the basis of a sample of 76 firms. The concluding remarks are given in Section VI.

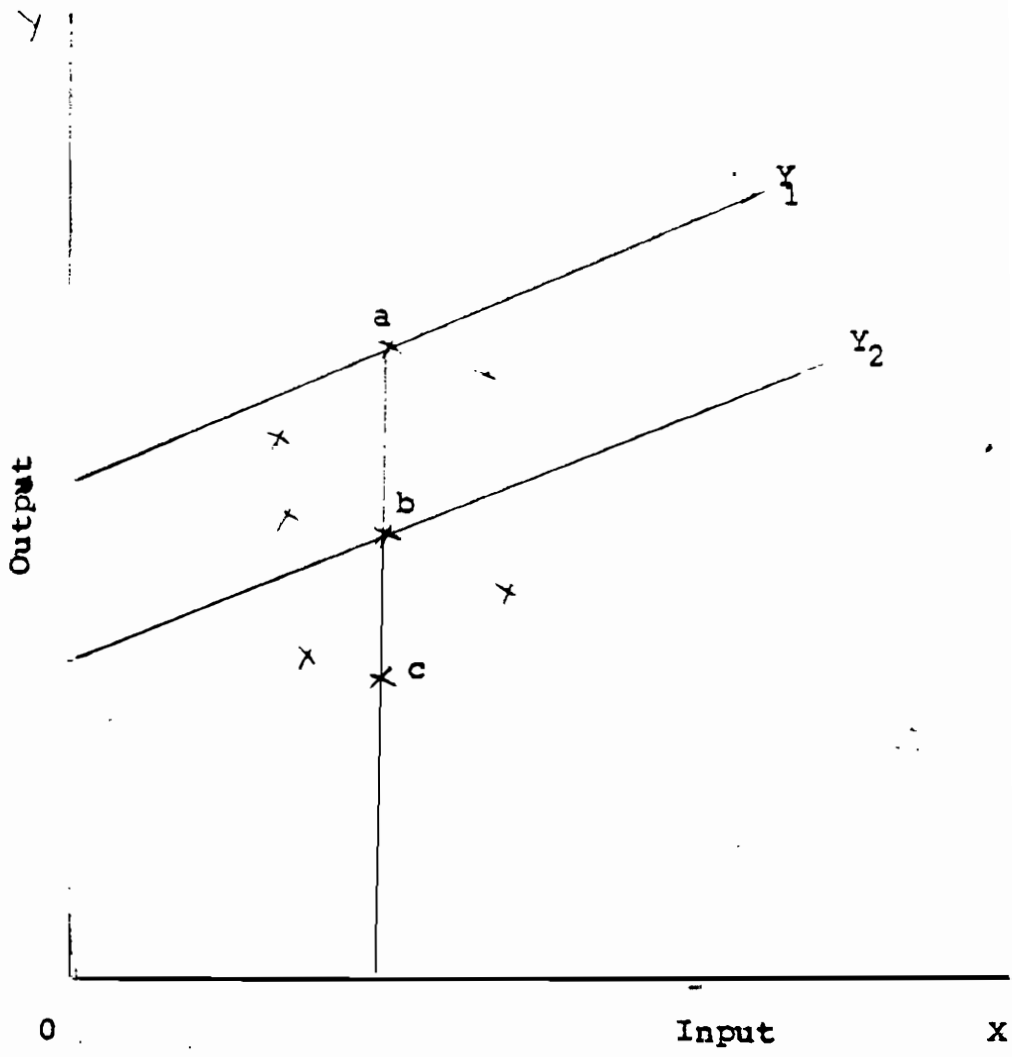
II. Technical Efficiency (TE).

We follow Farrel's (1957) approach in defining firm level technical efficiency in production. TE refers to realization of maximum level of output for a given level of inputs employed. The most efficient production (or technology) frontier of an industry is determined by the most efficient firms, and the extent of deviation of output realized by other

firms from the frontier is taken to be the level of relative technical inefficiency. In other words, the extent by which the actual output is less than the potential output is equivalent to the difference between technical efficiency (or total factor productivity) that is based on the best practice and that of the actual practice of a firm. [Nishimuzu and Page (1982)]. As shown in Fig 1, observations above the efficient frontier 'Y1' are not technologically feasible. The firms (or the observations) below the frontier are technically inefficient as they realize lower output for a given level of inputs employed than the maximum represented by 'Y1'. The points 'a', 'b' and 'c' are three levels of outputs realized for a given level of inputs employed - with 'a' being the potential or the maximum output that could be realized. 'Y1' and 'Y2' can also be taken to be as two different levels (or vintage) of technology. In such a case, if 'Y' is taken to be the technology adopted by firm 'A' and 'Y ' refers to the technology adopted by firm 'B', the TE difference from 'a' and 'b' is purely due to the technology gap between firms.

Under perfectly competitive product and factor markets and a homogenous technology across firms in an industry, the TE differences across firms (at a given time) would be purely due to organizational factors. If the markets are imperfect, the (estimated) TE differences (the methodology is explained in Section V) could be due to not only organizational factors but also - 1) the technology gap across firms, 2) the product and factor prices realized by firms if the output is taken in value terms and also 3) the presence of scale economies.

Fig. 1



III. The Model.

We present a simple textbook theoretical model to put forward the crucial argument of the paper. We take firms to have strategic interdependence - given the market size (or demand curve of an industry), any firm (large or small) can grow into larger size through higher relative production efficiency by taking larger market share. There are two representative firms competing in Cournot quantity space. The technology is non-increasing returns to scale. This assumption is consistent with the stylized facts that increasing returns to scale are insignificant in most Indian industries [Page (1984), Patibandla (1992b)]. The respective profit functions of firms 'i' and 'j' are;

$$\Pi i = P(Q)qi - (1/2)aiq_i^2 \qquad (1)$$

$$\Pi j = P(Q)qj - (1/2)ajq_j^2 \qquad (2)$$

$$Q = qi + qj$$

'P' is the market price, 'qi' and 'qj' represent the outputs of firm 'i' and 'j' and 'ai ' and 'aj' represent the parameters of the corresponding cost curves. The first order conditions of profit maximization are as follows;

$$P(\cdot) + P'(\cdot)qi = aiqi \qquad (3)$$

$$P(\cdot) + P'(\cdot)qj = ajqj \qquad (4)$$

From (3) and (4) it can be observed that whenever 'ai = aj ' then 'qi = qj '. Comparative static calculations on the basis of equations (4) and (5) provide the following results.

$$\begin{bmatrix} 2P'()+P''()qi- ai & P'()+P''()qj \\ P'()+P''()qi & 2P'() +P''()qj - aj \end{bmatrix} \begin{bmatrix} dqi \\ dqj \end{bmatrix} = \begin{bmatrix} qidai \\ qjdaj \end{bmatrix}$$

by applying the Cramers' rule, it can be shown that;

$(dqi/dai) < 0$; $(dqj/dai) > 0$;

which implies that as a consequence of it's cost reduction, firm 'i's sales increases while sales of firm '2' decline.[1] The lower cost firm is the larger firm. If firm 'i', due to any exogenous factor, can raise capital at a lower price than the other firm, it can not only lead to a direct reduction in costs but also facilitate the adoption of capital intensive and possibly, superior technology. But this possibility can be taken as an endogenous outcome because it is larger firms that get access to capital at a lower price. In other words, once a firm gains initial relative advantage in higher production efficiency leading to it's growth in size, the higher firm size helps it to break into organized capital markets and raise capital at a lower price than it's smaller rivals. This, in turn, provides the firm a cumulative advantage to grow into a dominant large size. Furthermore, lower capital price should help the firm 'i' to adopt advanced capital intensive technology. This technology could be the one that determines the most efficient technology frontier in an industry. This, in turn, should make the larger firm 'i' the most efficient, if we take organizational efficiency to be similar for all firms.

Capital market imperfections enable the large firm to block entry and impose mobility barriers on smaller firms effectively, and consequently, it derives long run market

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1 See Shapiro (1989) for an explanation of the intuition for this result.

power. To recapitulate, structural conditions like the presence of long run market power and factor market segmentation determine the organizational behaviour of large and small firms which could be an important determinant of their relative TE. In the following section, the issues for Indian industry are discussed along this perspective.

IV. The Issues

As shown in Fig. 2, most Indian industries in the light engineering and low technology sectors like shoe making etc., are characterized by a structure in which a few large firms take major share of the domestic market and a large number of small firms share the residual.2 As mentioned in the previous section, this type of structural outcome could be attributed to factor market segmentation and also to the industrial policies towards the large and small scale sectors [Desai (1982), Patibandla (1994)]. Large firms operate in the organized capital and labour markets. They have greater access to banking and share capital markets, skilled labour and better information. Consequently, these firms generally operate with relatively more modern capital intensive technologies, largely imported from developed countries. Small firms, on the other hand, operate mostly in the unorganized capital and labour markets and tend to pay higher price to capital and a lower price to semi-skilled and unskilled labour. As a result, small firms operate with (older vintage)

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2. World Banks' (1989) study of Indian industry shows that 55 per cent of industrial segments in India had four firm concentration ratios in 80 to 100 per cent range, while in Japan only 9 per cent of segments had reached this degree of concentration.

FIG.2. Long—tailed Market Structure.

Hand, small & cutting tools industry.

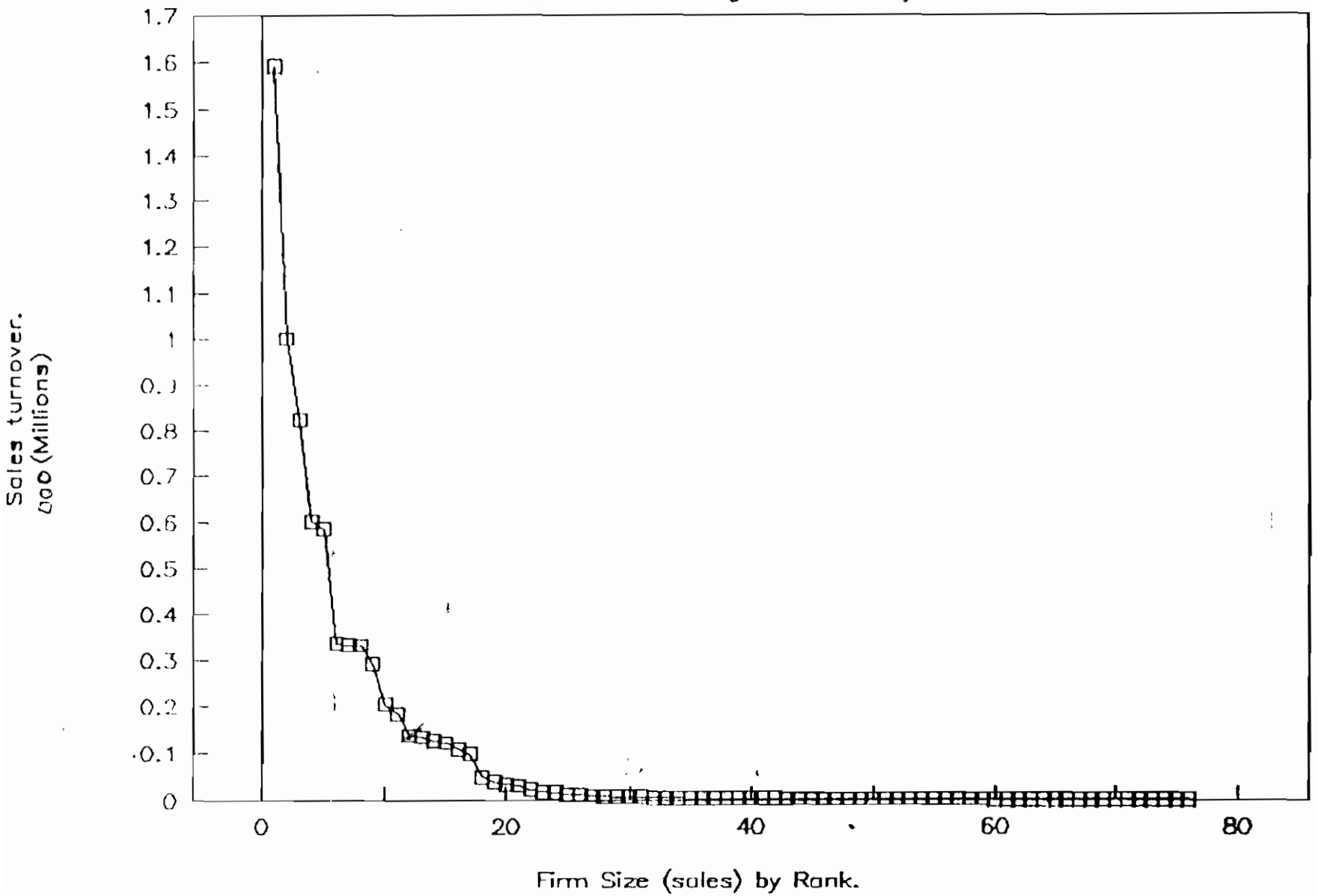

Table. 1

Import Intensity by Firm Size (Sales Turnover) Groups. For the sample of firms of Hand, small and cutting tools industry. 1983-84. Rs.Million.

	Imports	Imports and sales ratio.
Top 20 firms	435	6.1
Bottom 20 firms	0.06	0
All 76 firms	440	5.9

labour intensive indigenous technology [Patibandla (1994)]. As shown in Table 2, the import intensity of large firms is a lot higher than that of small firms. As mentioned earlier, this technological gap should enable large firms to determine the most efficient technology frontier in an industry. Therefore, they should be technically more efficient in production than small firms. But, to recapitulate, the other dominant factor that determines the relative TE of large and small firms could be their organizational behaviour as a response mechanism to the prevailing structural conditions.

It is generally argued that under India's import substitution policy regime, X-inefficiency in industrial performance had been high due to lack of sufficient competitive conditions [Bruton (1989)]. As the central argument of this paper suggests, there had been a structural duality in most Indian industries. In other words, while large firms were able to derive long run domestic market power, small scale firms might had been subject to higher competitive pressures.3 Although small scale firms face strong mobility barriers (barriers to growth in size), entry into the small scale sector had been relatively easy due to certain micro

3. Bruch et al (1983) observed that in many newly industrializing countries large firms concentrated in those areas where Effective rates of protection (ERPs) were very high whereas small firms concentrated in those areas where ERPs were very low. For example, in the case of India's automobile industry, large firms concentrate in the production of final good which is subject to high rates of protection and small firms concentrate in the production of automobile components subject to very low rates of protection. In other words, small firms compete with imports also.

level policy incentives 4 and also due to factor market segmentation which facilitates access to unorganized labour at low wage rates. Consequently, small firms face large group competition within this size group and also compete with large firms.

In the case of large firms, apart from X-inefficiency in production organization caused by long run domestic market power, access to capital far below its' shadow price would not impose adequate pressure on them to take advantage of the domestic factor endowment conditions in their technological behaviour. Realization of optimum TE levels would be not only in terms of realizing maximum output for given level of inputs employed but also in terms of taking advantage of domestic supply side factors like relative factor endowment conditions, especially when one observes the output realization in value terms.5 In this respect, the technological behaviour of the large scale organized sector has been well examined by Lall (1987), Desai (1988), Siddtharthan (1988), Cooper (1988), Goldar (1992) and several others. Large firms which adopted imported capital intensive technologies were observed to make minimal efforts at taking full advantage of these technologies by adapting them to local conditions. When a technology that was developed in (the capital rich) developed countries was

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4. In Indian industry, while the macro policies had heavily discriminated against the small scale sector, a battery of direct micro level assistance programs had sought to overcome the negative effects of the macro policies. See Meade (1991).

5. If inputs in production are taken in value terms, then the input values are simply the price of the input multiplied by the quantity of the input-employed.

adopted locally, it might result in higher costs not only in terms of the costs of transfer but also in terms of the costs of maintenance, especially if it was not adapted to local conditions. 6

From the organizational aspect, Indian large scale firms were observed to under utilize the capital-employed, and also weak in labour management [Lall (1987)]. A significant part of organizational X-inefficiency of large firms could stem from co-ordination failure between different departments within a firm, which might get magnified in a non-competitive environment. As derived from the qualitative information of the field survey, on the production floor technicians or production managers might be able to realize certain technical snags and possible solutions and improvements in the operation of machinery. But, generally, in large firms these findings have to be referred to R&D and other departments for their approval. If these departments are poorly co-ordinated, it would cause not only substantial time and resource wastage but also dissipation of possible learning economies (internal to a firm) in production.

One of the determinants of relative TE of large firms could be the maintenance of excess capacity by these firms as a means of entry deterrence [Leiberman (1987)]. In such a case, the excess capacity of large firms would result in lower relative TE.

In contrast to large firms, to state explicitly, small

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6. A recent paper by Ferrantino (1992) observes that the purchasers of imported technology in most Indian industries are less cost-efficient in production than the non-purchasers.

firms face two major external (to a firm) constraints - (1) strong mobility barriers and higher competitive pressures and (1) limited access to capital. A small firm that perceives the constraints correctly and adopts conduct strategies in terms of minimizing costs at all levels could be the one that survives and grows into minimum efficient scales.

The above observation is illustrated in the following on the basis of the qualitative information of the field study of the technological and organizational behaviour of two small firms, located in Bangalore and Madras. Both the firms were managed by technocrat-owner managers. In the case of the latter firm, three additional professional managers were employed. In both the cases, the organizational efforts were made towards minimizing costs in the instalment of plant and machinery and in labour management through high degree of specialization and involvement of the managers. This behaviour (or conduct) of small firms is characterized as follows;

(1). Small firms' relative advantage lies in specialization within a broadly defined industry (or a product, hand tools or cutting tools, for example).7 The first stage involves the choice of the product to be manufactured. The appropriate choice of the product in relation to the intended scale of operation and available technological skills determines the subsequent production efficiency of a small firm. Once the choice is made, the product is developed by bringing in the designs from overseas

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7. On the other hand, large firms tend to diversify into producing a wide range of products.

and other domestic firms.

(2). The second stage is minimization of costs in buying and installing the machinery. In case of the first firm, mentioned above, the cost of machinery was reduced substantially by buying second hand machinery at a very low price and renovating it with new components and parts secured from the domestic and overseas markets. This process not only reduces the overall cost of machinery by 70 to 80 per cent of the cost of new machinery but provides scope for improvements in the operation.

(3). The third stage is the minimization of variable costs along with the maximum utilization of fixed capital with a high degree of involvement on the part of the owner-managers at every stage of operation. The costs were minimized by - (a) locating the sources of good quality raw materials and (b) effective utilization and maintenance of machinery and management of labour. Because of the small scale of output produced, quality control by the managers tends to be effective. This process, in turn, helps in upgrading the product quality and also in changing product characteristics over time.8

Since small firms operate mostly with unorganized labour, it provides them with relatively higher degree of flexibility in production organization. They could minimize the variable cost of labour by employing a few permanent

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8. But one has to keep in mind that this characterization refers to model efficient small firms. There is high incidence of sickness in the Indian small scale sector due to working capital constraints, poor financial management and the government policies to the small scale sector. See Sen (1991).

skilled labour and temporary semi-skilled and unskilled labour. These firms would tend to utilize the permanent and temporary labour employed to the maximum extent. The labour intensity of production of small firms should be observed not in terms of number of labourers employed but in terms of the intensity at which the employed labour is utilized. Most small firms, as observed in the field study, tended to make labourers work long hours by paying very low wage rates.

Following from the above observation, labour market imperfections could be one of the important factors in determining the relative TE of large and small firms. While capital market imperfections, as discussed earlier, work in favour of large firms, labour market imperfections in the form of exit policies and labour unions, might be a source of relative disadvantage to large firms in realizing optimum TE.9

The mobility of labour across firm size groups, caused by the labour market imperfections, might have had significant implications on the relative TE realized by the different size groups. Sen (1991) observes that there is generally

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9. The degree of unionization in the sample of the field study is as follows. The small firms with sales turnover, approximately, below Rs. 20 million tended to operate mostly with unorganized labour with wage rates ranging from Rs. 550 to Rs.1200 per month (in 1983/84). These firms could pursue hire and fire policy towards labour. There was incidence of semi-organized labour for medium scale firms with sales turnover in the range of Rs. 25 to Rs.200 million, especially if a firm was located in the metropolitan cities. These firms had to provide certain benefits to workers in terms of regular holidays and medical benefits, etc. But, still, most firms in this size group had the flexibility in replacing workers. The very large firms were fully subject to the labour laws and unions with little flexibility in labour replacement.

considerable pressure on small firms to keep their wage bill down. As a result, there is a tendency for larger firms, which can financially afford to pay higher wages, to attract away the best labour from the financially weaker smaller firms. As mentioned earlier, in the case of the very large organized sector firms, labour unions can effectively prevent the replacement of inefficient workers with more efficient new recruits. This, in turn, may result in a situation in which the larger of the small scale firms may be able to draw some of the best workers at the cost of smaller firms which have to do with relatively inexperienced workers. Thus the smaller firms may end up essentially as training grounds for the larger or medium scale firms.

V. The Empirical Analysis.

The following empirical exercise observes the association between firm size and estimated firm level technical efficiency indices on the basis of firm level cross section data. We take these exercises to provide certain empirical regularities and useful stylized facts.10

V.i. Measurement of Technical Efficiency.

Following Aigner and Chu (1968), TE is measured through a parametric approach. [Forsund et al (1980)]. The production relation in simple terms can be expressed as;

$$Y = (X : B) + u;$$

where 'Y' is a vector of output observations, 'X' is a matrix of input observations. 'B' represents the parameters

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10. See Schmalensee (1981) for a detailed exposition of some of the problems involved in the empirical studies on the basis of cross section data in industrial organization.

and 'u' represents one sided error. The one sided error forces 'Y $\leq$ f(X).

In the general estimation of production functions, 'u' is specified to be normally and identically distributed with zero mean and finite variance. From the above specification, frontier estimations take 'u' to have a negative expectation indicating the presence of technical inefficiency in production. The crucial aspect of the estimation of TE is the specification of the distribution of 'u' which, in turn, determines the possible econometric estimators.

In the present case, the frontier is taken to be deterministic. One can argue that the frontier function for Indian industries is stochastic because of supply side, power and transport bottlenecks. But over the years Indian industrial units might have learned to predict these bottlenecks, and consequently the uncertainty element in these bottlenecks gets reduced. Secondly, as our objective is to observe the association between firm size and firm level TE indices rather than the extent of technical efficiency at the industry level, we can harmlessly assume the stochastic elements to be similar to all firms in the sample.

If we take the Cobb-Douglas production functional form, the production frontier can be expressed as;

$$Y = f(X)\, e^{-u}$$

$$\log Y = \log [f(X)] - u;$$

where 'u $\geq$ Ø' and thus 'Ø $\leq$ e^{-u} $\leq$ 1 ' where log [f(X)] is linear in the Cobb-Douglas case. It is assumed 'X' is exogenous, independent of 'u'. As suggested by Richmond

(1974), the above specification can be estimated by ordinary least squares (OLS) by a simple modification. If we let 'w' be the mean of 'u' we can write;

$$\log Y = (\alpha_0 - w) + \sum_{i=1}^{n} \alpha_i \log X - (u-w),$$

where the new error term has zero mean. The error term satisfies all the usual properties except normality. The above equation can be estimated by OLS to obtain the best linear unbiased estimates of $(\alpha_0 - w)$ and α_i. The estimated residuals can be used to correct the OLS constant term. One of the drawbacks of the above method in measuring TE for individual observations is that some of the residuals may still end up above the estimated frontier. One way this problem can be resolved, as shown by Greene (1980), is by correcting the constant term by shifting it up until no residual positive and one is zero. This correction provides consistent estimates of α_0. The extent of deviations of rest of the observations can be used to measure firm level TE indices [Forsund et al (1980) p.12].

The production function is taken to be a two input case. Value-added is taken for output, salaries and wages for labour input and capital input is taken in historical costs. As the sample consists of both large and small firms, the translog production function is used in estimating TE (see the appendix).

V.ii. Data and Measurement Problems.

The firm level data refers to the period 1983/84 and was drawn from Hand, Small and Cutting tools industry. The data, to recapitulate, was collected on the basis of an

extensive field survey. The firms were located in Bombay, Bangalore, Delhi, Madras, Julunder and Ludhiana. In the case of large public limited companies, the company balance sheets were also used. The sample that was used in the following econometric exercise consisted of 76 firms. The firm size distribution of the sample, in terms of sales turnover, ranged from a maximum value of Rs.1592 million to a minimum value of Rs.Ø.7 million (see Fig.2 for the distribution).

One of the major problems of firm level data, for any broadly defined (disaggregate level) industry, is the heterogeneity in the products produced by firms within an industry. As mentioned earlier, in this industry large firms tend to diversify into producing a wide range of hand and cutting tools and small firms tend to concentrate in one or a few specialized product lines. Most firms did not have or were not willing to provide data separated into different product categories. Because of the heterogeneity in the products, there would be a certain degree of technological diversity across firms.11 Consequently, it could result in a certain extent of statistical noise in the estimation of firm level technical efficiency indices.

Secondly, as mentioned earlier, the output and input variables in the production function were taken in value terms. As argued in Section IV, large and small firms face different factor price regimes in Indian industry. Furthermore, large firms, due to their market power and brand

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11. This is issue is different from the argument of technological gap across firms.

names, might be able to realize higher product prices for a given quality of output. Differences in these prices could be reflected in the estimated TE indices. For example, if large firms were able to realize higher product prices, the estimated TE indices would be biased in favour of large firms.12

Despite some of these intrinsic problems, the empirical exercises should provide useful insights into the issue.

V.iii. The Notations of the Variables.

TE = firm level relative technical efficiency.

= $(Y/Y^*) \leq 1$,

'Y' is actual output and 'Y*' is the optimum output.

ZS = firm level sales turnover (normalized by the lowest value in the sample) as firm size variable.

Intercept and slope dummy variables are used to differentiate firms by size groups.

D1 = '1' for firms with sales turnover above Rs.4.5 million.

'Ø' for firms with sales turnover below Rs.4.5 million.

D2 = '1' for firms with sales turnover above Rs.1Ø million

'Ø' for firms with sales turnover below Rs.1Ø million.

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12. The higher product prices would cause the effect that as if a firm is realizing higher output for a given level of inputs employed.

If prices realized by firms differ due to differences in the quality of the output, one can harmlessly assume that higher quality of output corresponds to higher value of inputs. In other words, higher quality can be realized by higher level of inputs (in value terms)- for example skilled labour at higher wage rates, better quality raw materials with higher prices, etc.

V.iv. **The Results.**

Table. 2 shows the average values of the estimated TE indices for the total sample and also for the different size groups within the sample. It can be observed from the Table and also Fig.3, in which the estimated firm level TE indices are plotted against the firm size variable (each dot represents a firm), that very small and very large firms in the sample are relatively very inefficient. TE appears to be maximum in the middle size group of sales turnover ranging from Rs.100 million to Rs.290 million. It can be observed from Fig.3 that the association between TE and firm size appears to be non-linear. If we ignore the few outlier observations in the middle, TE appears to be increasing with firm size until a critical firm size level and there after it appears to decline at a low rate. This possible non-linear association between firm size and firm level TE is tested in the following regression equation by using the intercept and slope dummy variables that differentiate between large and small firms in the sample.

1). $TE = 0.118 + 0.0738(ZS) + 0.289(D1) - 0.0738\ (ZS * D1).$

$\qquad\qquad (1.87)\quad (3.3)^{*}\qquad\quad (4.0)^{*}\qquad\quad (3.3)^{*}$

$\bar{R}^{2} = 0.19 \quad F = 5.7 \quad N = 76$

2). $TE = 0.23 + 0.0289(ZS) + 0.1307(D2) - 0.029(ZS * D1)$

$\qquad\qquad (5.6)^{*}\quad (3.34)^{*}\qquad (2.2)^{*}\qquad (3.5)^{*}$

$\bar{R}^{2} = 0.14 \quad F = 4 \quad N = 76$

Figures in the brackets are 't' values.

* Significant at 0.01 level.

The estimated equation 2, which takes the critical

Table 2.

Technical Efficiency (TE) by Firm Size Groups.

Firm size groups by Sales Rs.in million	Average Value	Minimum Value	Maximum Value	Number of firms in the group.
Rs.1592 to Rs.330	Ø.288 (Ø.1Ø8)	Ø.144	Ø.463	8
Rs.29Ø to Rs.1Ø8	Ø.423 (Ø.139)	Ø.312	Ø.767	8
Rs.97 to Rs4	Ø.4Ø (Ø.245)	Ø.1Ø1	1	18
Rs.4.13 to Rs 2	Ø.379 (Ø.192)	Ø.192	Ø.92	11
Rs.1.85 to Rs.1	Ø.3Ø7 (Ø.148)	Ø.ØØ89	Ø.59	22
Rs.1 to Rs Ø.7	Ø.2Ø8 (Ø.115)	Ø.Ø9	Ø.5	9
Total Sample	Ø.338 (2.2)	Ø.ØØ89	1	76

Figures in the brackets are standard deviations.

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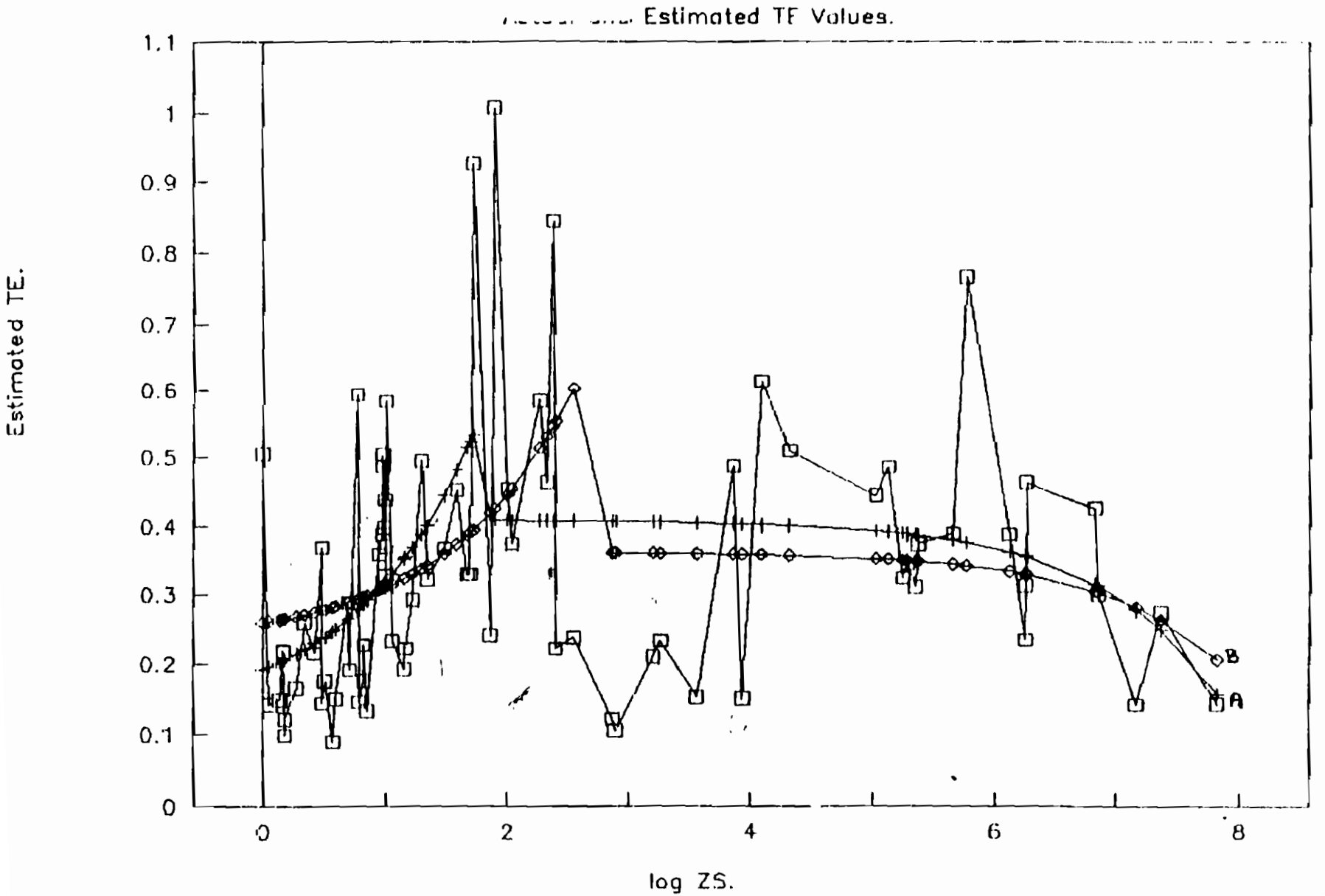
FIG. 3


Estimated TF Values.
Estimated TE.
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
log ZS.
B
A

segregation level between large and small firms at a higher level of Rs.1Ø million sales turnover is statistically more significant than equation 1. If we observe the first order derivatives of the above equations with respect to firm size (ZS), it is noticeable that for the size group of small firms the estimated association between firm size and TE is positive. The plotted curves, 'A' and 'B' in Fig.3, which represent the estimated equations of 1 and 2 respectively, show that TE increases with firm size until a critical firm size and there after it dips and remains, more or less, constant for a range and then it starts declining for the very large size firms. The larger firms show a higher intercept.

The results show that average TE at the industry is quite low (at Ø.338) which is consistent with the results of other empirical studies on this issue by Page (1984) and Little et al (1987). The low level TE at industry level was generally attributed to the import substitution and other interventionist policies pursued by the Indian government [Bruton (1989)]. The central issue of this paper is the relative TE differences across large and small firms that faced different product and factor market structural conditions in the Indian industry. Despite their relative advantages arising out of capital market imperfections and technological gap, large firms were not the ones that could determine the most efficient technology frontier in the Industry. The organizational inefficiency of large firms, caused by the structural conditions, might had been a more dominant factor than their relative advantages through the

technology gap. But the very low level of TE at the very small firms could be attributed to outdated and screwdriver technology and low labour skills of very small firms. The explanation for the maximum level of TE realized by the middle size groups can be derived from the structural conditions discussed in Section IV. The small firms that could attain a certain threshold level of technological sophistication and adapt themselves into efficient producers as a response mechanism to the structural conditions, could be the ones that reach the minimum efficient scales.

VI. The Conclusion.

The structure of an industry in terms of skewed firm size distribution and the domination of the market by a few large firms could remain stagnant for sustained periods due to capital market imperfections. If capital market imperfections are very dominant, which is the general feature of Indian industry, a few large firms could remain to take over the major share of the market even though they are less efficient in production than medium and small scale firms. In other words, capital market imperfections could be an effective source of mobility and entry barriers. In the presence of long run domestic market power, large firms could be prone to high levels of X-inefficiency.

Although the macro policy induced distortions favoured the large scale organized sector firms and they had better access to modern technologies and information, the large firms in the Indian industry appeared to be less efficient in production than the relatively larger size group of small firms. This

paper has attempted to explain this phenomena on the basis of the organizational behaviour of large and small firms as a response mechanism to the prevailing structural conditions.

Although capital market imperfections function in favour of large firms, labour market imperfections caused by the labour policies and unionization could prove to be a major source of disadvantage to large firms in realizing optimum TE. The labour market imperfections could restrict these firms from replacing inefficient labour by the efficient and also from reducing excess labour input. On the other hand, the labour market conditions work in favour of small and in particular the medium scale firms as these firms function largely in the unorganized labour markets.13 The larger size group of small firms might be able to derive an additional advantage of attracting well trained labour away from small firms.

Some of the underlying reasons for TE to be maximum in medium scale firms, as shown by the empirical results of this paper, could be that - (1) these firms were able to reach certain threshold level of technological sophistication unlike the very small firms, (2) they could realize high levels of organizational X-efficiency due to the flexibility and high levels of involvement of owner-managers in production organization, and (3) these firms might had been able to draw on some of the best trained labour due to the labour market

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13. The increasing sub-contracting activity between large and small firms in many Indian industries is attributed to higher organizational efficiency in production and relative in labour markets of small and medium scale firms. See Patibandla (1994).

imperfections.

They are generally certain intrinsic drawbacks in the econometric analysis of firm level production efficiency on the basis of cross section data due to measurement problems and also due to shortcomings in the available firm level data. Although this paper has undertaken a reliable level of disaggregated classification of an industry, in any broadly defined industry there always will remain a certain level of heterogeneity in the products produced by firms. The firm level data, available, generally does not account for this heterogeneity. Because of this reason, there would be a certain degree of statistical noise in the econometric estimation of firm level TE. Nevertheless, the stylized facts provided by the econometric results combined with the qualitative information of the field study should provide useful insights into the issue.

This paper has argued that large firms could derive long run market power because of capital market imperfections and it has implications on the organizational efficiency of firms. In the recent years, certain industrial policy reforms in terms of industrial de-licensing and relaxation of restrictions on foreign direct investment, etc., have been undertaken in India. But the factor markets remain to be highly imperfect. If one intends to attribute larger size of a firm to higher efficiency, it is essential to reduce the factor market imperfections and make the markets highly contestable.

Appendix.

The estimated translog production function.

$$\log Y = 5.4 + 1.12 \log L - 1.02 \log K$$
$$(2.1)^* \quad (2.68)^* \quad (2.22)^*$$
$$+ 0.33\ (1/2)(\log L)^2 + 0.42\ (1/2)(\log K)^2$$
$$(2.68)^* \quad (2.22)^*$$
$$- 0.30 \log L * \log K$$
$$(2.12)^*$$

$R^2 = 0.94 \quad F = 220 \quad N = 76$

Figures in the brackets are 't' values.

* Significant at 0.01 level.

The estimated function is checked at all data points for monotonocity and the function is observed to be well behaved.

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