Chapter 7
INTERREGIONAL VARIATIONS IN INDIA: SOME EXPLANATIONS

The discussions in the earlier chapters brought out two interesting findings: (i) inter-regional inequalities in the level of industrial development reveal a tendency to decline over time in India, and (ii) the analysis of the sectoral composition of the regions leaves a substantial portion of the variations in the industrial growth performance unexplained.

Given the findings, especially the second, one has to seek an explanation of this varied industrial growth in factors other than region-specific industrial structures. A look at the various location theories might provide some valuable insight into the location dynamics. If the factors which make a region more attractive for industries are identified with the help of these theories, one might make an attempt to explain the regional variations existing in the country's industrial economy.

2.1 Conceptual Framework

In early theoretical expositions, raw-material availability and transport-cost were assumed to be the most important factors for attracting industries. But with successive technological innovations, these factors were relegated into the background. Researchers laid more
emphasis on the historical process of regional industrial development, linking it with the level of economic development. This in turn focused on some other factors like export-base, interregional trade, inter-industry linkages, urbanisation, agglomeration economies, human capital and psychic cost of the entrepreneurs, market-size and the government policies.  

We start with three widely respected theoretical propositions: (i) as per capita income increases, there is a distinct shift in the sectoral allocation towards industries (Kuznets, 1957; Clark, 1957), and towards capital goods sector within industries (Hoffman, 1958); (ii) regional inequalities increase in the initial phases, but decline subsequently as the economic/industrial development proceeds (Williamson, 1965); and (iii) whatever be the reason, natural, historical, economic or political, once an economic/industrial activity starts in a particular region, it gets accentuated due to the 'snow-ballling effect' via migration, inter-regional trade, transfer of capital (including human) etc. Left to the free play of market forces, these 'backwash effects' operate more strongly than the equilibrating forces leading to the desirability of government intervention (Myrdal, 1953; Hirschman, 1958).

1/ For a detailed discussion see Chapter 2. Another school of researchers looks at these regional variations in historical or Marxist framework, stressing the historical forces of colonialism. They view development or underdevelopment as a process of global economic exploitation, better known as 'dependency theory'. See Harold (1975); and Polansky (1992).
On the basis of these propositions, we can regard regional industrialisation as a sequential process. It can be postulated that with increase in per capita income in a region, industrialisation will also be set in motion. The increase in per capita income may be (if industries were not significant) derived from agriculture, commerce (trade or services). Once income increases, there will be (1) higher demand for manufactured goods (initially consumer goods) owing to its higher income elasticity, and (2) increase in investible surplus owing to increasing rate of savings which will facilitate industrial development in the region.

However, existing regional demand and investible capital may not be sufficient to foster industrialisation if a critical minimum level of infrastructure is not available. For, raw material can be imported even from distant places if infrastructure (transport, power, banking, etc.) is sufficiently developed. 1/

Another crucial factor is human capital particularly entrepreneurship along with labour supply. 2/ The traditional location theory postulates economic rationality of the entrepreneurs in terms of cost minimisation or profit maximisation. Of late, it has been realised that the "profit maximisation is an unsatisfactory goal for location decision makers", and

1/ Economic history of countries like Japan or South Korea will substantiate the point.

2/ For example Korea is endowed with factors like per capita income, saving, infrastructure and large market. But for entrepreneurship and docile labour, it would have made strides in industrial development.
"location decision, more than most management decisions, has
to take into account psychic income's influence and other
personal factors, which are not easily compatible with narrow
definition of economic rationality" (Richardson, 1977: 103-
109).

The difference in the entrepreneur's psychic costs and
income between regions, apart from some very personal consi-
deration, plausibly depends on his perception of a region's
secure and steady environment for business, manifested in the
quality (submissive) and cost (cheap) of the labour force,
and the response and attitude of the government. Thus,
propensity of the labour force to accept some minimum degree
of discipline becomes an important factor along with the help-
ing and welcoming government attitude toward entrepreneur's in
making a region more attractive for industries.

Government also can play the role of entrepreneur in
giving a initial break to the prolonged stagnant region, by
locating industries. Public sector investment may also help
in creating industrial clusters in a region.1/ Government is
also likely to play an important role in providing infra-
structure, which is another crucial factor in accelerating
the pace of industrialization.

1/ Government can further facilitate industrialisation through
providing easy access to the capital at a cheaper rate.
Governement's role is also crucial as an intervening agency
for correcting imbalances as envisaged by Gunnar Myrdal.
These and many more likewise factors will attract industries. But their level and scale of operation will further be limited by the size of the market, which again will be determined by the size of the population being served by the industries and the purchasing power of the buyers. It will be reflected in the per capita income, income distribution, and the type of demand, plausibly varying according to the degree of urbanization which also, in part, reflects agglomeration and external economies.

One can therefore, postulate that regional variations in industrial development exist to the extent of regional variations observed in the behaviour of factors like per capita income, infrastructure, size of the market, urbanisation, agglomeration economies, entrepreneurship, decile labour force, government policies and so on. However, it may be mentioned that the factors operate in a mutually interdependent fashion. It is difficult to postulate a unidirectional causal relationship among them. The sources of regional industrial variations are seemingly complex and we are on such less a sure ground in isolating the impact of each of them. Difficulties in quantification of some of the variables like entrepreneurship, government attitude etc. and lack of suitable and adequate data base for some other variables like inter-regional trade or agglomeration economies etc. further limit the analysis. An ideal way to examine interdependencies is to adopt a systems approach wherein the cause and effect relationships could be quantified for policy analysis. In
view of the data constraint, computer software resources, etc., the adoption of the systems approach in the present context is not feasible.

2.2 Existing Empirical Evidence

In a pioneering study Chenery (1960) tried to understand the varied industrial growth performances of various countries in a deterministic framework using international cross section data for the 1950s. Using regression techniques, he tried to find an answer to the sources of regional variations by considering some factors like regional market size in terms of population, factor proportions, income distribution and government policies, apart from per capita income. Two of his findings are of special interest: (i) the greatest variation in output levels was found to be in the capital and intermediate good sectors, where economies of scale are most important; and (ii) size of the country (in terms of population) is of crucial consequence.

Chenery's study was followed by others using a similar methodology. However most of the studies are by and large cross country comparisons. Very few attempts have been made in the direction of understanding inter-regional industrial growth differentials in regions within a country.

1/ For example see Chenery, Shishido and Potenabe (1962); Chenery and Taylor (1966); and Taylor (1969).
In the inter-regional context of the Indian industrial economy, Sastry's study (1989) deserves special mention. Using a somewhat similar methodology, he tried to offer some explanation for interregional industrial variation in India for the period 1951-61. The study based on a cross-section of the states, using step-wise regression method, observed that change in per capita income and urban population explained nearly 80 per cent of the total variations in 1961. Another interesting finding was that variations in the cost of electricity across states is of no major consequence.

However, taking total net output, as Sastry did, across states to reflect the level of industrial development is somewhat misleading. It does not take care of the size of the regional economy. For example, bigger states like Uttar Pradesh are likely to have more total output than states like Punjab and Haryana. Thus size bias creeps into the analysis. Moreover, use of current price net output data cast doubts on the results.

Another study by Gupta (1971) using the Chenery-Taylor framework tried to offer some explanations for the better performance by large states in India. He argued that large size states perform better because economies of scale, urbanisation and market size. Government participation was found to be of no consequence. The study further observed that better performance of the large states is owing to the unbalanced growth strategies adopted by them.
The conclusions regarding the unbalanced strategy are not only weak on technical grounds (Denery and Denery, 1972); even the data do not support it. The observation about the role of the government also can be taken at best as conjectural.

Other studies have tried to explain the inter-regional industrial variations in India in terms of historical factors, infrastructure, urbanisation, agglomeration economies, entrepreneurship, docile and cheap labour, availability of industrial finance, public sector investment and government attitudes, etc. However, most of the studies are partial in coverage, as they try to explain inter-regional industrial variations in terms of one or two or a small set of variables.

Here we wish to emphasize that any attempt in the direction of understanding regional variations is most likely to remain incomplete or partial at best: until and unless all or most of the variables (depending upon the availability of information and suitable indicators) are taken into consideration. Thus, an attempt to incorporate more and more variables appears imperative.

3. The Choice of Variables

3.1 Dependent Variables

We have defined the level of industrialisation in two ways.

1/ See Chapter 6

2/ See Chapter 2 for some of the studies.
(i) Per capita net value added (in real terms) generated in
the registered (organised) factory sector. This not only
reveals the level of industrialisation across regions but also
takes care of the size of the regional economies.

(ii) The proportion of net output generated in the factory
(organised manufacturing) sector to the state domestic product
(SDP) of the respective states. But it suffers from a limita-
tion that its behaviour (share) depends not only on the perfor-
mance of this sector but also of other sectors like agriculture,
services, etc. However it does reveal the weight of manufactur-
ing in the economy of the state. Therefore, it may be termed
as a structural variable.

3.2 Independent or Explanatory Variables

For the sake of brevity we initially divide all the
independent variables into two groups viz. demand side factors
and supply side factors. This classification however is
arbitrary because variable like per capita income, may be
treated as demand as well as supply side factor depending upon
the interpretation. Thus such a classification involves value
judgment; and some assumptions inevitably have to be made.
Following is the schema of the variables and their postulated
behaviour with respect to the level of industrialisation.

3.2.1 Demand side Variables

This group includes those factors which exercise a pull
effect on the industries via increasing demand for manufactured
goods. It is postulated that bigger the size of the market,
higher will be the demand for the products of all the three major industrial sectors, viz. consumer, capital and intermediate goods.\footnote{The demand side variables need some clarification. The assumption is that the regional economies are closed economies; and the demand originating in a region is being met (\ldots) within the region. It may look a bit too heroic assumption. The unrestricted inter-regional trade may limit the effectiveness of the size of the regional markets in determining the regional industrial development, and the demand emanating in a region can be met by imports through inter-regional trade. But the fact that market in India is highly segmented and regional in character due to relative immobility of factors (Ganguly, 1962; Scethanam and Chakraborty, 1979), and small magnitude of inter-regional trade (Hashim, 1970; Hashim, 1971; Thaker, 1971) rules out the above apprehension to some extent. One can thus, quite reasonably argue that given the rigid character of the inter-regional trade; the size of the market and its purchasing power are likely to play an important role in the regional industrial development, at least in the Indian context (Mehta, 1953; Memes, 1967; Sastry, 1970; Gupta, 1971).} These components of the demand are reflected in:

(i) Population of the state, reflecting size of the market;

(ii) Per capita income, reflecting the purchasing power of buyers; and

(iii) Proportion of the population residing in towns with 20,000 or more population, reflecting urban demand for modern consumer goods.

(iv) Inter-industry demand is reflected by the inverse of the coefficient of specialisation. The assumption here is that more diversified is the industrial structure of the state, higher will be the inter-industry
demand for the capital and intermediate goods, leading to a higher level of industrialisation by its pull effect.

(v) **Level of agricultural mechanisation** is measured by a composite index of (i) number of tractors per 1000 hectares; (ii) number of oil engines and pumping sets used for the purpose of irrigation per 1000 hectares; and (iii) use of NPK (fertilizer) kg/per hectare. It is postulated that higher the level of agricultural mechanisation, higher will be the demand for industrial products, which also will act as a pull factor for boosting industrialisation in the region.

3.2.2.B. **Supply side Factors**

This group consists of factors which make a region more attractive for locating industries. The major factors considered and their postulated relationship with the level of industrialisation are as follows:

(i) **Availability of raw material**. The finding that the industrial structure of most of the states is still dominated by the raw material oriented industries (Chapter 5) suggests that the spatial variability in the availability of raw material will reflect the existing inter-regional industrial variations. This is reflected by the per capita output in forestry, mining and agriculture (commercial crops).

1/ It may be mentioned here that inter-industry demand, as specified here, only indicates the extent of the region specific industrial diversification, and is not comparable with the inter-industry linkages in an Input-Output sense.
(ii) Agglomeration Economies: The analysis assumes that agglomeration economies are found in urban areas, and that regional agglomeration economies to a great extent depend on the size and spatial distribution of its urban centres (above a threshold size) (Richardson, 1973). We define agglomeration economies as a composite index of (i) the number of urban centres (above one lakh population) per 1000 km² of area; (ii) relative size of urban settlements, with more weight given to the large centres, and (iii) the average inter-city distance between them. Thus "the larger the number of cities, the larger the relative size of the leading cities and the smaller is average inter-urban distance, the greater are regional agglomeration economies" (Richardson, 1973: 179). We assume that higher the level of agglomeration index, higher will be the level of industrial development of a region.

(iii) Infrastructure Index: It is a composite index of (i) transport network, i.e. the length of roads and railways per 1000 km² of area and per lakh people; (ii) power availability per capita and rates per lakh; and (iii) number of bank offices per 1000 km² and per lakh population, across states. It is envisaged that higher the level of infrastructural development, higher will be the level of industrialisation.
(iv) **Government Participation**: It is argued that the favourable attitude of the government makes some regions more attractive for investment than others. We divide government participation into two groups viz. direct government participation and indirect participation. The former participation indicates the entrepreneurial role of government, while latter reflects role of government as promoter agency. Though there is no direct necessity to quantify the attitude, a composite index of the following indicators is likely to reflect the phenomenon, at least in a conjectural manner:

1. The direct participation is measured in terms of per capita gross block investment in public sector undertakings and (2) indirect government participation is reflected by a composite index of (i) per capita loan sanctioned by the non-banking financial institutions like state financial corporations, Industrial Development Bank of India, Industrial Finance Corporation of India, etc; and (ii) industrial licenses issued to the various states. We postulate a positive relationship between the level of industrial development and the government participations - direct and indirect.

(v) **Entrepreneurship**: Entrepreneurship has widely been recognized as a crucial determinant of the industrial
development. Therefore, we postulate that higher the availability of entrepreneurs in a region, higher will be its level of development. Here we make a distinction between two segments of entrepreneurs: (i) local or regional entrepreneurs, who, by and large, are small scale entrepreneurs, are not very mobile and tend to set up their small scale units within or in the vicinity of their place of origin, because of capital constraints, and (ii) large-scale entrepreneurs, who operate at the national level and are not tied to any specific region per se because of dearth of capital. They tend to move wherever they perceive an opportunity and conducive environment for their unit. Therefore, the first category reflects the availability of entrepreneurship at the local/region level, whereas, the later reflects the preference of the entrepreneur for a region.

The local availability of entrepreneurs is being measured by a composite index consisting of region, specific composite index of (i) number of small scale industrial units per lakh of population; (ii) credit-deposit ratio in the commercial banks; and (iii) per capita financial assistance disbursed by state financial corporations. While first indicator crudely reflects the entrepreneurship of the population, the other two variables reflect its entrepreneurial ability.

The preference of large-scale entrepreneurs is measured in terms of a composite index (i) letter of intent
for industries issued to a region; (ii) per capita assistance disbursed by all India financial institutions; and (iii) registrations with the Directorate General of Technical Development (DGET). In the case of the first indicator, it is assumed that an industrialist will actually apply for a licence only if he finds a location profitable enough for his investment. Similarly, the other two indicators will also reflect his actual choice of a particular region.

(vi) Availability of Skilled Labour: Availability of skilled labour at a cheaper rate is seen conducive to the industrial development. We measured it by a composite index of the number of persons undergoing technical training per lakh population which reflects the quantum; and (ii) average wages of workers across space in India which reflects the price.

(vii) Efficiency Wage: An entrepreneur is likely to be willing to pay even higher wages if he is able to get better returns, than otherwise. Therefore, what matter is efficiency wages than nominal wages. It is argued that the 'efficiency wages' are likely to lower in those regions which have above average productivity and output growth (Holden, 1970). Therefore, we postulate a negative relationship between 'efficiency wages' and the level of industrialisation. Efficiency wages is defined as the increase change in money wages relative...
to the change in productivity, i.e., \( \frac{w'}{w} \) where \( w \) is an index of money wages (in constant terms) and \( w' \) is an index of total factor productivity (Richardson, 1973).

(viii) Labour Indiscipline: It is argued that submissive and docile labour is more conducive to a healthy industrial climate. But it is difficult to evolve a direct measure of discipline in the labour force. However, there are some measures which, to some extent, reflect the magnitude of indiscipline. So we use these as a proxy for the nature of labour force. It is measured through a composite index of (1) number of mandays lost per 1000 workers due to industrial dispute; and (2) number of trade unions per 1000 workers.

Here we postulate a negative relationship between the magnitude of these factors and industrial development at the regional level.

1/ Our intention is not to pass a value judgement on the behaviour of labour. It may equally be a consequence of the mismanagement. Exploitative attitude of the employer’s is a widely recognized phenomenon and quite a few times workers are forced to go on strike justifiably. Thus workers alone can hardly be held responsible for this mischief. Nevertheless, it does reflect the environment in which industries are operating. Secondly it is also argued that higher the level of organized trade union movement, more conducive will be the industrial climate, whereas a fragmented movement is likely to affect it adversely. For inter-trade union rivalries will make it more difficult to negotiate the issues with the management (sometimes with the connivance of the management also), leading to loss of production.

2/ We could have added absenteeism and turnover rates also, but they have very insignificant variation across space or over time, unlike the above two measures.
All the above stated factors are expected to behave in the postulated fashion and affect the levels of industrial development across regions in India, as reflected by the per capita value added generated in the registered factory (organised) sector and the share of net output generated in the organised sector in respective states' SIP.

4. Data Base and Methodology

The data base for the aforesaid variables and the methods adopted for constructing respective indices, wherever necessary have been described in the Annexure to the chapter.

Now we are interested in finding some clues to answer the following questions: (i) What factors explain inter-regional variations in the level of industrial development in India between 1961 and 1973?; and (ii) Which of the factors contribute to the decline in the inter-regional inequalities (Chapter 4) in the level of industrial development.

Therefore, first we focus our attention on the empirical verification of the extent to which inter-state variations in the level of industrial development arise due to the variations in the level of various demand and supply side variables.

The analysis is based on a cross-section of the states at three different points of time, i.e. 1961, 1969, 1973, we have estimated single equation linear models using the method of ordinary least square, and have followed step-wise
regression procedure, wherein usual assumptions of classical general linear regression model about the disturbance term apply. Though we recognize the interdependent nature of relationship in such models and consequent simultaneity bias in using unidirectional causal framework, it is assumed that the latter captures the essential elements determining the interregional variations.

In the first stage, we have separately estimated the regressions for the demand and supply side variables for each point of time (1961, 1969, 1973) and then for a pool of these cross-sections of states over time. In the second stage we have combined the demand and supply side variables and estimated the relationships to understand the overall behaviour of these variables.\(^1\)

In our next endeavour we made an attempt to isolate some of the major factors which contribute towards decline in

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\(^1\) Initially all the supply side variables were considered, but later we dropped the variables representing entrepreneurship. For, it was observed that the proxy index for entrepreneurship had high correlation not only with the dependent variables, but also with most of the important variables, may be because the way it was defined. Consequently some of the intuitively important variables did not appear in the results, due to the use of the step-regression procedure; which emerged as quite significant once entrepreneurship index was dropped. Moreover, we feel that it is difficult to ascertain whether entrepreneurship is a cause or the effect of the level of industrialization, as well as of the other supply side variables. Entrepreneurship, by and large, follows only when other variables reach up to a certain critical minimum level of development. Thus, it reflects/level of industrial development does. This reason also prompted us to exclude this variable from the analysis.

\(^2\) the impact of other variables the way the
the regional industrial inequalities. Here also we adopted
the same procedure, i.e., stepwise regression method. In the
first instance we worked out the inequality indices for both
the dependent variables, i.e., per capita value added generated
in registered factory sector across states; and proportion of
the SDP generated in the organised manufacturing sector of the
respective states. Independent variables considered are:
population, per capita income, availability of raw material,
infrastructure, financial availability, government participa-
tion, availability of technical workforce and labour indisci-
pline.1/ The inequality indices for dependent variables were
regressed on the inequality indices of the independent variables.
All the inequality indices, measured in terms of the coeffi-
cient of variation were worked out for each of the individual
years between 1961 and 1973, across states.

The postulated behaviour of the variables and the equa-
tions used for various groups, using stepwise regression
procedure, are specified below.

Specification of the variables: All the variables considered
to explain the inter-regional variations and reduction in the
inter-regional inequalities are specified as:

1/ But for lack of information for all the years between 1961
and 1973, we could have liked to add some more variables
like urbanisation, agglomeration economics, level of agri-
culture mechanisation, etc.
Name of the variables                                      Compressions
1. Dependent variables, i.e. per capita value added generated in the registered factory sector; and proportion of GDP generated in the organised manufacturing sector across the states, as the case may be

2. Size of the market as reflected by the population of the states

3. Purchasing power of the buyers as reflected by per capita income of the region

4. Urban demand for modern industrial products as reflected by the proportion of urban population in the state, residing in 30000+ population town

5. Inter-industry demand as reflected by inverse of the coefficient of specialisation

6. Demand for industrial goods emanating from agriculture sector represented by index of the level of agriculture mechanization

7. Region specific availability of raw materials, represented by per capita output in forestry, mining and cash crops in agriculture

8. Agglomeration economies as represented by region specific agglomeration index

9. Level of infrastructure development (infrastructure), represented by an index of transport, power and banking facilities

10. Direct government participation as reflected by per capita gross block investment made into public sector undertakings

11. Indirect government participation measured in terms of index of financial sanction by the various non-banking financial institutions and industrial licenses granted by the government.
<table>
<thead>
<tr>
<th>Name of the variables</th>
<th>Commutations</th>
</tr>
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<tbody>
<tr>
<td>12 Availability of skills as represented by a index of the number of person</td>
<td>X_{11}</td>
</tr>
<tr>
<td>undergoing technical training per 10th population and wage rate per worker</td>
<td></td>
</tr>
<tr>
<td>13 Efficiency wages, reflecting the wages and productivity in a region</td>
<td>X_{12}</td>
</tr>
<tr>
<td>14 Degree of labour militancy measured in terms of man day lost per 1000 workers</td>
<td>X_{13}</td>
</tr>
<tr>
<td>and number of trade unions per 1000 workers</td>
<td></td>
</tr>
<tr>
<td>15 Relative size of the urban centres with above one 10th population</td>
<td>A_1</td>
</tr>
<tr>
<td>16 Number of urban centres with 10th population</td>
<td>A_2</td>
</tr>
<tr>
<td>17 Average inter-urban distance</td>
<td>A_3</td>
</tr>
<tr>
<td>18 Extent of transport facility</td>
<td>T</td>
</tr>
<tr>
<td>19 Availability of power</td>
<td>p</td>
</tr>
<tr>
<td>20 Existing banking facilities</td>
<td>c</td>
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</tbody>
</table>

**Variable in the Inequality Index Form (I)**

| 21 Size of the market (population)                                                  | I_1          |
| 22 Purchasing power of the buyers (per capita income)                               | I_2          |
| 23 Availability of raw material (region specific)                                   | I_3          |
| 24 Infrastructural development level                                                | I_4          |
| 25 Direct government participation                                                 | I_5          |
| 26 Indirect government participation                                               | I_6          |
| 27 Inequality indices for the dependent variables (Y)                               | I_7          |
| 28 Error terms                                                                      | e, e_1, e_2, u |
| 29 Time variable                                                                    | t            |
| 30 Parameters                                                                       | b_0, b_1, ..., b_13 |
4.2.1 Demand and Supply Side Specifications

Among the variables specified above, variables $X_1$ to $X_5$ are considered to represent the demand side. Accordingly, the following linear equation has been postulated:

\[ Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + c \]

Similarly, the variables $X_6$ to $X_{13}$ are considered to represent supply side variables, and the linear equation postulated is as follows:

\[ Y = b_0 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} + c \]

Where $Y$ is either per capita value added generated in the registered factory sector, or the proportion of GDP generated in the organised manufacturing sector of the states, as the case may be. In the analysis, the estimated equations are presented for each of the three years, i.e., 1961, 1966, and 1973; and also pooling information for all the years.

In another set of equations we have considered all the variables, viz., all the demand side and supply side variables together in the above framework.

4.2.2 Other Specifications

We have also considered some other specifications by placing emphasis on agglomeration economies and infrastructural components separately. The factors such as relative size of the urban centres with lakh * population ($A_1$), number of urban centres with lakh * population ($A_2$) and average inter urban...
distance \((A^2)\) are assumed to constitute the agglomeration economies; while transport \((t)\), power availability \((p)\) and banking facilities \((c)\) are assumed to represent the infrastructural components. The equations are specified as:

\[ Y = b_0 + b_1 A_1 + b_2 A_2 + b_3 A_3 + e_1 \quad \text{and} \]

\[ Y = b_0 + b_1 t + b_2 p + b_3 c + e_2 \]

Following the earlier specifications, the above equations are estimated separately for each year and also for the years pooled together.

4.3 Time Series Variations in Inter-regional Inequalities

We have considered two alternative specifications wherein the variables, both dependent and independent are transformed into the inequality form. For the equation representing per capita income generated in the registered factory sector and the corresponding independent variables, the Theil's index of inequality has been constructed; while in the other case we have resorted to the coefficient of variations. Specifications of the equation are:

\[ I_y = b_0 + b_1 I_1 + b_2 I_2 + b_3 I_3 + b_4 I_4 + b_5 I_5 + b_6 I_6 + t + e \]

It may be mentioned that in this model we have introduced time variable \((t)\) to isolate the time trend effect.

Empirical Results

As elaborated in the methodology, the results have also been discussed in stages. First, the discussion concen-
trates on the behaviour of demand side variables, followed by supply side variables. The behaviour of overall variables is discussed subsequently. As a digression, a disaggregated analysis is carried out for sub-variables constituting agglomeration economics and infrastructure, separately. The step-wise regression results corresponding to the above specification are displayed in Tables 7.1 to 7.4. In the second part, we have speculated on some factors which contribute to the decline in the inter-regional industrial inequalities over time. Results of this exercise are presented in Table 7.5.

5.1 Behavioural Factors and the Inter-Oriental Variations

5.1.1 Demand side Factors: The regressions it show that the values of $R^2$ ($R^2$ adjusted for degree of freedom) are statistically significant at one per cent level in all the years (see Table 7.4). The results show that in the year 1961, the model explains approximately 60 per cent of the total variation in

1/ Only final results are given in the tables, i.e., the estimates having highest $R^2$ have been selected for the analysis. We have two sets for each of the models. Per capita value-added generated in the registered sector $Y_1$, reflecting the levels of industrial development of respective states, has been taken as dependent variable in the first set. Whereas second set treats the proportion of the state domestic product generated in the organised manufacturing sector in various states $Y_2$, reflecting the importance of manufacturing in the states economic structure as dependent variable. As results will show, there is only marginal difference in the behaviour of independent variables with respect of these indicators of industrialization, therefore focus of the analysis will be on the first set only. However, wherever there is a marked deviation from the pattern in the second set, the later indicator will also be accounted for.
the level of industrial development across states in India.
This explanation is offered by the region specific purchasing
power of consumers and inter-industry demand. Both coefficients
are significant at one per cent level with right signs as postu-
lated. In 1969, the explanatory power of the model increases
to approximately 79 per cent and along with the earlier two,
one more variable, viz. the demand for industrial products from
agricultural sector also emerges important in explaining the
total variation. However, the sign of this variable is found
to be negative (opposite to the postulated one). The impact
of other two variables become more pronounced in this year.

Almost similar trend is observed even in 1979, except
that the explanatory power of the model declines to approxi-
mately 65 per cent. Although similar variables appear to
explain the inter-regional variations in per capita value added
generated in the registered factory sector (PCVARS) the
influence of these variables is seen to increase (almost
doubled) over the period. Given the pattern of change in the

1/ Though a bit difficult to explain, the phenomenon is not
altogether surprising, for this is the time when 'Green
Revolution' was taking place in India. And, as we know,
higher level of mechanisation in agriculture is directly
associated with higher use of power in the sector; leading
to a situation where power resources have to be diverted to
agriculture (sometimes even at the cost of industry). If
we accept this as logical, it is quite plausible to
encounter the negative impact of agricultural mechanisation
on the industrial growth. And possibly this was the period
where the agriculture sector might have started paying for
the scarce power resources; so important for the recent and
rapid growth of industrialisation; and the negative sign is
obvious consequence of this kind of behaviour.

behaviour of the explanatory variables, there is a strong reason to believe that the demand from agriculture sector is contributing adversely to the PCVAP. In view of the fact that data used in these equations are cross-sectional type, the result exhibits long run nature of the relationships. Therefore it can be argued that the transfer of resources from industry to agriculture, without striking a balance in the industrial developmental activities may adversely affect the level of industrialisation.

The picture remains, by and large, similar even when the three cross sections are pooled together. However, the regression coefficient of these variables show a different pattern when compared to the year-wise results. This is expected in view of the fact that the pooled regression equations represent a combined structure rather than short or long term.

5.4.2. Supply Side Factors

We regressed each of the dependent variables on various supply side factors viz., availability of raw material, agglomeration economies, level of infrastructure, direct government participation, indirect government participation, availability of skills, efficiency wages and extent of labour militancy. The values of adjusted multiple correlation coefficient ($R^2$) are significant at one per cent level in all the years; moreover the magnitude of the $R^2$ values for the individual year ranges
between 0.75 and 0.92. However the explanatory power of the models declines over time.1

In 1961, indirect government participation along with infrastructure, agglomeration economies and efficiency wages explains about 92 per cent of the total variations observed in the level of industrialisation across states in India. Out of these, only indirect government participation explains approximately 79 per cent of the total variation followed by efficiency wages, infrastructure and agglomeration economies, in that order (see Table 7.2).

A structural shift is observed in 1969 where indirect government participation, agglomeration economies remain important, while infrastructure and efficiency wages are seen to be not important. Degree of labour militancy emerges as an important factor in explaining these variations in 1969. But like agricultural demand in demand side variables; labour militancy has opposite sign to the postulated (negative) one.2 However, one can expect such behaviour of the variable at least in Indian conditions, where industries are concentrated in a few developed regions of the country. Since these regions have a relatively longer history of industrialisation, it is quite likely

1/ It may be mentioned that year to year regressions are not strictly comparable, because structure of the regressions has changed over time in terms of inclusion and exclusion of the explanatory variables.

2/ For logic says that healthy and peaceful environment on labour front is a pre-requisite of the industrial development, and a lack of this might prove detrimental, because of the losses suffered in output due to labour unrest.
that the labour force may become politically more conscious of its rights in these developed regions. Consequently it tends to fight out its claims, leading to more troubled days in such pockets. And that is why, probably, we encounter a positive association between the levels of industrial development and the labour militancy. This phenomenon, however, appears to be short lived, and in 1973 it has right type of (negative)sign.

In the year 1973, infrastructure emerged again, after a lapsed, as a dominant factor, explaining approximately 62 per cent of the total variations. It was followed sequentially by agglomeration economies, indirect government participation, availability of raw material and labour militancy. All variables taken together explain approximately 73 per cent of the total variation in 1973.

Another interesting feature is that the availability of raw material is significant only in 1973. In the earlier period it is not so (see Table 7.2). The reason can be traced in the development process itself. When the level of industrialisation in a region is very low, probably it will export its raw material to developed regions. But as growth proceeds, the region itself will tend to industrialise, using its own resources to begin with, in the early phases of industrialisation.

The possibilities of some such thing taking place in India can not be denied. Because more serious efforts in the direction of balanced regional development in the country started only in the 1970s. Emphasis, to some extent, was also
given on the use of locally available resources and skills. That is why, plausibly only in 1976, the availability of raw material emerges as one of the more important explanatory variables.

Despite the fact that there is evidence to suggest that structure has been changing over time, we tried to see if some significant deviation from earlier results takes place if the three cross sections are considered together. We found that the pooled regressions results, do not confirm the pattern of any single year; but three most important factors viz., agglomeration economies, infrastructure, and indirect government participation emerge significant. In other years also these factors explained most of the variations along with other factors. Another interesting fact is that initially government's indirect participation was most important explanatory variable. But over time some other factors like infrastructure and agglomeration economies become prominent replacing indirect government participation.

When we compare the results of first set with the second set, the picture, by and large, remains the same except

3/ In this context, in the light of the finding that regional industrial inequalities declined over time thus, one can argue, that availability of raw material also might have played a crucial role in achieving regional balances; in whatsoever humble manner.

2/ In pooled regression an obvious step would be to introduce time shifters as dummy variables to judge the structural change in relationship examined. However, since the regression analysis of individual years has already indicated the evidence in favour of structural change through time; the purpose of present pooled regression analysis was to identify those common influences which have transcended the time dimension.
that infrastructure dominates the scene most of the time. Agglomeration economies and government's indirect participation, though important till 1950, remain no more significant by 1973. It is because of the fact that infrastructure is more strongly correlated with the proportion of GDP generated in the organised manufacturing sector, than agglomeration economies or indirect government participation, at least in 1950 and 1973. The overall picture of the pooled data is somewhat similar to that of the first set; however labour militancy appears in the second set while it is not in the first set.

5.3 Overall Factors

At this stage all the demand side and supply side variables were taken together and the dependent variables were regressed on them. All the regressions were found to be significant at one per cent level, as revealed by respective $R^2$. Here also, the trend in the overall explanatory power of the models was found to be declining over time (see Table 7.3).

The table reveals that both demand and supply side variables explain approximately 95 per cent of the total variation in the level of industrial development and approximately 79 per cent of the total explanation is provided by indirect government participation alone in 1951. Consumer's purchasing power and inter-industry demand from the demand side and infrastructure, agglomeration economies, efficiency wages and indirect government participation among the supply side factors, emerge as
significant factors. All the signs of 6 coefficients are as postulated.

In 1969, consumer's purchasing power loses its place to the demand from the agriculture sector; while inter-industry demand improves its impact by becoming more significant among the demand side variables. Among supply side variables agglomeration economies and indirect government participation retain their significance. In addition labour militancy also emerges as a significant variable. The signs of all the 5 coefficients are as expected except for the demand from the agriculture sector and the labour militancy. All variables taken together explain approximately 94 per cent of the total variation.

By 1973, inter-industry demand, agglomeration economies and infrastructure are the only factors which explain the regional variations. Taken together these three factors explain about 62 per cent of the total variations. The impact of the remaining factors seems to have declined over time. Another interesting feature of the regression results is that about 42 per cent of the variation is explained only by inter-industry demand (a demand side factor), unlike earlier period where supply side factors played a more important role.

The predominance of demand side variables is in fact more pronounced when these cross sections are pooled together. The variables such as consumer's purchasing power, inter-
industry demand and demand for industrial products from agricultural sector, from the demand side factors and agglomeration economies and infrastructure from the supply side variables are observed to be statistically significant in the pooled regression equations. More interestingly the contribution of all the demand side factors in the unadjusted $R^2$ is around 36 per cent while that from the supply side factors is only 14 per cent. Thus, the demand side factors assume an important role in explaining the inter-regional variations. It may be noted that these results are in contrast with the results by years which depict the long run behaviour, unlike the pooled ones which represent conglom structure.

The results are quite interesting in the second set compared to the first one, when demand and supply side variables are considered together. The trends, unlike the first set, emerge quite sharply. For in 1961 it is only the supply side which explains the variations and not a single demand side variable is able to make its presence felt. As we move to 1963, there appears to be a balance between demand side and supply side variables. Consumer's demand, inter-industry demand and agriculture sector's demand from the demand side and agglomeration economies, infrastructure and government participation from the supply side, taken together explain approximately 74 per cent of the total variations. In 1973, the only variable appearing from the supply side is infrastructure with interindustry demand and demand from agriculture sector, over all explaining approximately 53 per cent of the total variations.
Signs of the b coefficients are usual ones as encountered earlier.

Results of pooled data in the second set are almost in unison with the first set, except the fact that labour militancy also explains the variation marginally, and with a wrong sign. In this set also, demand side variables explain the major portion of the variations and have stronger bearing on industrialisation than supply side factors. Though there are differences the logical implications of the results by and large, do not change significantly across the sets.

Overall, the results reveal some interesting features which have some policy implications. For example, supply side variables predominate the scene in the early phase. In the later stages, demand side variables become more important. Similarly in both sub-sets indirect government participation is relevant only in the early phases of industrialisation. Later on industrialisation seems to become a self-propellant process. Another notable feature is the presence of efficiency wages in the year 1961 only. Probably in the latter stages the compatibility between the wages and productivity would have been maintained across states. In consequence this variable seems to be not an important one in explaining the variations.

1/ With more and more access to information, a worker is likely to migrate to a high wage island from the low wage one. If such migration takes place at a slightly higher pace, the increase in the supply of labour in the higher efficiency wage island with decline in supply of the labour force in the latter will be the logical outcome, assuming market mechanism to be operative wages will tend to equalise in both regions.
5.1 Further Evidence on Agglomeration Economics and Infrastructure

From the above discussion we observe that agglomeration economics and infrastructure are the two important factors from the supply side which substantially explain the regional variations; and have a strong bearing on the industrial growth. Since both these variables are a combination of some of the important factors which are likely to affect the pace of industrial growth; it might be rewarding to look at the behaviour of these individual components. We discuss the influence of these two major variables, viz., agglomeration economics and infrastructure, separately.

5.2 Agglomeration Economics

In the foregoing analysis we have defined agglomeration economics as an index of three major components, viz., number of cities above a threshold size per 1000 km², their relative size with more weight given to the large centres, and the distance between them in a region.¹ The first two components are postulated to influence positively while the last one negatively.

The step-wise regression results are given in Table 7.4. All the models for various years are found to have a good fit, significant at 90 per cent level of confidence. The overall

¹ We admit that this is a very crude and imperfect index of regional agglomeration economics. And, "How to develop an index of regional agglomeration economics", as Richardson puts it, "is a thorny problem the solution of which requires much more research" (Richardson, 1973:215).
exploratory power of the models seems to be declining over

time and the relative size of urban centres is the only

variable appearing in the final results. The b coefficient

for all the years is found to be statistically significant at

one per cent level and with right sign.

The table reveals that in 1951, a unitary change in the

relative size of the urban centres led to 0.2679 unit

increase in the level of industrialisation whereas in 1970 it

was affected only by 0.1424 unit. It implies that in the

eyarly phase, the size of the urban centres plays relatively

more important role in the process of industrialisation. Once

industrialisation reaches a certain level of development,

importance of such centres possibly starts declining. This may

be owing to several reasons: (1) some spill-over of industries

starts taking place from big and busy urban centres to smaller

ones because of the prohibitive cost of the land and other

services in the urban agglomeration; (2) diseconomies start

operating after a certain stage; (3) probably restrictions.

1/ In order to get some explanation as to why the other two

variables are ignored, we looked at the correlation coeffi-

cient matrix. The results were revealing. That emerges is

that relative city size was most strongly and positively

associated with the dependent variables, followed by number

of urban centres above threshold size. But these two

variables are also significantly correlated with each other,

whereas average inter-urban distance, though with right type

of sign (negative) was weakly (insignificantly) correlated

with the dependent variables. This shows that though relationships

held good and direction also found as postulated, the two

variables are dropped out on technical grounds.

2/ Here we avoid the controversy whether this variable leads to

industrial development or itself is an outcome of the process

of industrial development. We have discussed this issue in

Chapter 2.
imposed by the government, on any further expansion of industries in certain areas may direct growth in some relatively smaller towns.

Infrastructure

The index of infrastructure comprises availability of transport (roads and railways), power and banking facilities. Step-wise regression results are displayed in Table 7.5. All the regressions are significant at 99 per cent level of confidence except for 1964 where the level of confidence is 95 per cent. In the present case also only one factor, namely power availability, explains regional variation in a significant manner. The explanatory power of the model has gradually increased over the period. Moreover the influence of power availability has also improved over the period. A unit increase in power availability has induced 0.3046 unit increase in the level of industrialisation in the initial period. While it was 1.3032 unit increase in 1973. The power being the major constraint for industrial stagnation in India, (Ahlawale, 1935); and the positive feature of the results obtained would highlight the need for a larger allocation for investment in the power sector.

1/ Though there is no direct evidence to support at least first two propositions; the restriction imposed on the growth of industries in metropolitan cities like Bombay by the government must have been of some consequence in diverting industries towards some lesser congested regions like Vepl in Gujarat.
Declining Regional Inequalities: An Explanation

The above account helps us in understanding the role of various factors in determining inter-regional variation, but it is not adequate in explaining the reduction in regional inequalities. In consequence a separate analysis is carried out, where (as discussed in the methodology) we regressed inequality indices of the dependent variables (IY) on the inequality indices of some of the crucial independent variables (depending on the availability of time series information). It is hoped that the analysis would help in isolating factors responsible for the reduction in the inter-regional inequalities. The period covered is 1961 to 1978. The postulated model is as:

\[ IY = b_0 + b_1 I_1 + b_2 I_2 + b_3 I_3 + b_4 I_4 + b_5 I_5 + b_6 I_6 + \varepsilon \]

The postulated behaviour of the various factors, in terms of inequality indices measured in terms of coefficient of variation, is that if inter-regional inequalities in the variables like the market size \( I_1 \), purchasing power of the buyers \( I_2 \), availability of raw materials \( I_3 \), level of infrastructure \( I_4 \) and indirect government participation \( I_5 \) become more uniform across space and over time, the inter-regional inequalities across states would lead to decline. As a consequence, Thus the postulated effect of these independent factors is positive w.r.t. the dependent variables. 

Since we have a priori information that the inter-regional inequalities in the level of industrial development have declined over time, they are postulated to be consequence of the decline in the inequalities in these independent factors.

1/ Direct
government participation (I₃) need some elaboration before we postulate any behaviour of this factor. As envisaged in various government policy statements and plan documents, public sector investment (here defined as direct government participation was supposed to be tilting in favour of the backward regions of the country, in order to achieve balanced regional development. Given the objective, one would expect that the pattern of public sector investment is discriminated in favour of the backward areas, at least till they are able to stand on their own. Under these circumstances, the inequalities in the quantum of the public sector investment across states will, at least, not decline. Consequently there will be a negative association between such investment (I₃) and the level of regional industrial development (IV). We also introduce time variable (t) in order to isolate the time trend, if any, and U is the error term. The results are presented in Table 7.5.

Analysis of the table reveals that availability of raw material, direct government participation (as reflected by per capita gross block investment in the central/public sector undertakings), and indirect government participation (as reflected by a composite index of per capita availability of the institutional finance and industrial licenses issued to various region) emerge as the major contributory factors that determine the inequalities. The models are significant at 99 per cent level of confidence and are able to explain approximately 67 per cent of the total variations in per capita value added generated in the registered manufacturing sectors across
states; and 62 per cent variations in the proportion of MDs generated in the organised manufacturing sector, across the various states.

Out of these three factors, the most significant contribution is that of direct government participation which explains approximately 49 per cent of the total variation.\footnote{The time trend \(t\) was not found to be significant in any case.} Indirect government participation and availability of raw material follow in that order. The signs in case of both the types of government participation are unexpected. Only raw material availability has the postulated sign. What are the implications of the observed signs, especially the opposite ones?

Let us take the case of direct government participation first. What emerges from the table is that the inequality in public sector investment (per capita) has influenced positively the inequalities in the level of industrial development over time. For regional inequalities, in the level of industrialization and per capita gross block investment, move in the same direction, or in other words have a declining trend. However, it may be mentioned that the decline in these two inequality

\footnote{In order to see the trend in the inequality indices of direct government participation \(I_c\) and indirect government participation \(I_c\), we regressed both variables on time \(t\) and its square \(t^2\). The coefficients for these two indices were found to be \(-0.3121\) and \(+0.4270\), significant at 5 per cent and 1 percent level respectively.}
indices has altogether different implications. Therefore, one has to consider these results with a bit more caution.

What has actually happened is that in the early sixties, public sector investment favoured backward region like Bihar, Orissa and Madhya Pradesh etc. But as the sectoral emphasis changed in favour of petrochemicals and electronics and some other sophisticated industries, especially after sixties, the public sector investment also diverted to some better off regions like Gujarat, Maharashtra and Karnataka etc. (see Alish et al., 1989). This probably resulted into a decline in the overall regional inequalities. Therefore, it appears that instead of helping in reducing the inter-regional inequalities, the public sector investment over time played a neutral or even a negative role. It casts serious doubt on the efficacy of the public policies, geared towards the objective of achieving balanced regional industrial development through public sector investment.

1/ For example, the decline in the inequalities in the level of industrial development is possibly observed on account of some of the forces operating in favour of the backward regions, whereas in the other case, probably better off regions gain in the whole deal. Because, a priori we know that the public sector investment was initially concentrated in some of the backward states, which, over time, became more evenly spread, due to the investment in relatively developed states.

2/ The sectoral shift might also have resulted into a rank reversal within the group of industrially advanced states leading to a decline in the overall regional inequalities. Moreover, decline in the public investment inequalities may be observed even if it is more evenly distributed across more and more backward states over time, than getting concentrated within a few backward states. However, data tends to negate such a possibility as the share of developed states in the gross block investment has increased over time (see Udi Sadash, 1983).
This observation is further strengthened by the negative sign of indirect government participation. It implies that the flow of institutional finances and industrial licenses have kept on favouring the better off region, despite the official intentions. It is also clear that mere distribution of raw materials on equalising basis, unless accompanied by favourable direct and indirect participation of the government, may not bring any impressive change in the behaviour of regional inequalities on its own.

Thus the question as to why these regional inequalities in the level of industrialisation have declined over time still remains. May be the technique used for deciphering the factors is not the most appropriate one; or there may be a time lag involved in the relationships, which we are not able to capture; or the list of explanatory variables is not exhaustive. This apart, possibly the inter-regional industrial inequalities might have declined in the natural course of time, because of negative externalities experienced by some points in space (having concentration of industrial activity), consequently some spill over of industries might have favoured backward regions leading to reduction in the inter-regional industrial inequalities. Another related possibility is that the negative government interventions that imposed restrictions on the growth of big industrial agglomerates like Bombay, Calcutta and Ahmedabad, etc, might have helped in altering the scene. It appears that 'sticks' rather than 'carrots' succeeded in affecting a decline in the regional industrial inequalities.
One can also attempt to explain the phenomenon in terms of the industrial stagnation or decline in the growth rates in some industries since mid/late sixties. It can be argued that the stagnation was also unevenly distributed across states, affecting each of them differently, plausibly in proportion to their level of industrialisation. Consequently the states with a long history of industrialisation might have suffered burn of the stagnation more severely than the late starters; for the industrial structure of the more industrialised states was having a relatively higher weight of traditional industries which were facing problems of obsolescence. Here late starters probably had an edge over their more industrialised counterparts, in terms of a relatively more recent technology and new plant and machinery.

We are not, however, in a position to provide any specific answers in a precise manner at this stage. All the possibilities mentioned above are, at best, conjectures. Perhaps a more in-depth investigation into these propositions might probably help in understanding the complex contours of the problem.

However, the implication of such a hypothesis is that if, as and when, the economy revives and market forces again strike back, the inequalities will tend to increase in all likelihood. We are not able to probe into this aspect in detail, but if the observation for the year 1978-79 is any indication, one finds that inter-regional industrial inequalities have marginally increased compared to the preceding year (see Table 4.6). However, it requires data for more recent years to say anything more precisely.
Table 7.1

Estimated Regression Equations by Considering Second Side Variables

\( Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + e \)

(a) Dependent Variable \( Y \): PCVAMS

<table>
<thead>
<tr>
<th>Equation</th>
<th>( R^2 )</th>
<th>No. of Increase in the ( R^2 ) owing to observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( Y_1 = 0.2953 + 0.0784 X_2 + 0.4167 X_5 )</td>
<td>0.6826</td>
<td>17 ( X_2 = 0.5235; X_4 = 0.1921 )</td>
</tr>
<tr>
<td>2. ( Y_2 = 36.6620 + 0.1314 X_2 + 0.2315 X_5 = 0.7677 X_3 )</td>
<td>0.7910</td>
<td>18 ( X_3 = 0.4574; X_2 = 0.2573 )</td>
</tr>
<tr>
<td>3. ( Y_3 = 13.6250 + 0.2022 X_2 + 0.5752 X_4 - 1.3291 X_5 )</td>
<td>0.6315</td>
<td>18 ( X_5 = 0.4160; X_2 = 0.2122 )</td>
</tr>
<tr>
<td>4. ( Y_4 = 15.7425 + 0.2332 X_2 + 0.1934 X_4 = 0.3754 X_5 )</td>
<td>0.5499</td>
<td>53 ( X_5 = 0.3444; X_2 = 0.2055 )</td>
</tr>
</tbody>
</table>

(b) Dependent Variable \( Y \): BSPOS

<table>
<thead>
<tr>
<th>Equation</th>
<th>( R^2 )</th>
<th>No. of Increase in the ( R^2 ) owing to observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( Y_1 = 5.0175 + 0.0933 X_2 + 0.0222 X_4 )</td>
<td>0.6135</td>
<td>17 ( X_4 = 0.2052; X_2 = 0.1806 )</td>
</tr>
<tr>
<td>2. ( Y_2 = 5.819 + 0.0110 X_2 + 0.0322 X_3 - 0.0679 X_3 )</td>
<td>0.5021</td>
<td>18 ( X_3 = 0.4201; X_2 = 0.0890 )</td>
</tr>
</tbody>
</table>

contd.
Table 7.1 contd.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Regression Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Y_3 = -1.0712 + 0.0182 X_2 + 0.0379 X_4 - 0.0383 X_5 )</td>
<td>( R^2 = 0.5214^* )</td>
</tr>
<tr>
<td>( X_4 )</td>
<td>19</td>
</tr>
<tr>
<td>( Y_4 = -4.3676 + 0.0079 X_2 + 0.0325 X_4 - 0.0740 X_5 )</td>
<td>( R^2 = 0.5786^* )</td>
</tr>
<tr>
<td>( X_4 )</td>
<td>53</td>
</tr>
</tbody>
</table>

Notes: (1) The suffix 1, 2, 3, and 4 of the variable \( Y \) represent the years 1961, 1969, 1970 and pooled data (ph) respectively.
(2) Figures in parentheses are the standard errors of \( b \) coefficients.
(3) Only final results are presented. For notations please see the text.
(4) PCVAT stands for per capita value added generated in the registered factory sector; while PSIVPOS denotes proportion of GDP generated in the organised manufacturing sector.
(5) * Significant at 1 per cent level of significance
** Significant at 5 per cent level of significance
*** Significant at 10 per cent level of significance

Source: As per the text
Table 7.2

**Estimated Regression Equation by Considering Supply Side Variables**

\( Y = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + b_7 x_7 + b_8 x_8 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_{12} x_{12} + b_{13} x_{13} + e \)

(a) Dependent Variable (Y): PCVAFS

<table>
<thead>
<tr>
<th>Regression Equation</th>
<th>( R^2 )</th>
<th>No. of Observations</th>
<th>Increase in ( R^2 ) Owing to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( Y_1 = 8.7395 + 0.7339 x_7 + 0.2711 x_8 )</td>
<td>0.9227</td>
<td>17</td>
<td>( x_{10} = 0.7876; x_{12} = 0.0982; x_8 = 0.0394; x_7 = 0.0165 )</td>
</tr>
<tr>
<td>( y_1 = 0.2735 x_{10} - 0.0571 x_{12} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.3965) (0.0990) (0.0517)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. ( Y_2 = 13.9566 + 2.3979 x_7 + 0.4457 x_{10} + 0.0062 x_{13} )</td>
<td>0.8043</td>
<td>18</td>
<td>( x_{10} = 0.7451; x_7 = 0.0702; x_{13} = 0.0235 )</td>
</tr>
<tr>
<td>( y_2 = 0.6251 x_8 + 0.1087 x_{10} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.0608) (0.1087) (0.0043)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ( Y_3 = -45.5476 + 1.3413 x_6 + 2.1072 x_7 - 0.3314 x_8 )</td>
<td>0.7539</td>
<td>18</td>
<td>( x_8 = 0.6232; x_7 = 0.1362; x_{10} = 0.1165; x_6 = 0.0795; x_{13} = 0.0723 )</td>
</tr>
<tr>
<td>( y_3 = 0.9088 x_{10} - 0.1502 x_{13} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.6001) (0.4960) (0.1510)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. ( Y_4 = -35.66 + 1.1025 x_7 + 0.3621 x_8 + 0.8138 x_{10} )</td>
<td>0.4736</td>
<td>53</td>
<td>( x_7 = 0.2499; x_8 = 0.1692; x_{10} = 0.0965 )</td>
</tr>
<tr>
<td>( y_4 = 0.3036 x_9 + 0.1271 x_{10} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.3036) (0.1271) (0.3241)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7.2 (Contd...)

(b) Dependent Variable (Y) : PSDFOS

<table>
<thead>
<tr>
<th>Equation</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-value</th>
<th>Constant</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( y_1 = 2.5117 + 0.3955 x_7 + 0.0489 x_8 + 0.0698 x_{10} )</td>
<td>0.0287</td>
<td>0.00210</td>
<td>3.605</td>
<td>2.5117</td>
<td>0.4724</td>
<td>0.0542</td>
<td>0.3930</td>
<td>0.0315</td>
<td>0.2185</td>
<td>0.0597</td>
<td>0.0526</td>
<td></td>
</tr>
<tr>
<td>2. ( y_2 = 3.9403 + 0.3227 x_7 + 0.2131 x_8 + 0.0838 x_{10} )</td>
<td>0.5558*</td>
<td>0.0542</td>
<td>10.264</td>
<td>3.9403</td>
<td>0.3091</td>
<td>0.0210</td>
<td>0.2185</td>
<td>0.0315</td>
<td>0.1381</td>
<td>0.0597</td>
<td>0.0526</td>
<td></td>
</tr>
<tr>
<td>3. ( y_3 = 15.1961 + 0.0979 x_6 + 0.3235 x_8 )</td>
<td>0.3783*</td>
<td>0.0953</td>
<td>3.940</td>
<td>15.1961</td>
<td>0.3227</td>
<td>0.0210</td>
<td>0.1381</td>
<td>0.0315</td>
<td>0.1242</td>
<td>0.0597</td>
<td>0.0526</td>
<td></td>
</tr>
<tr>
<td>4. ( y_4 = -12.6289 + 0.1306 x_7 + 0.0525 x_8 )</td>
<td>0.3944*</td>
<td>0.0042</td>
<td>9.374</td>
<td>-12.6289</td>
<td>0.0979</td>
<td>0.0210</td>
<td>0.2185</td>
<td>0.0315</td>
<td>0.1100</td>
<td>0.0597</td>
<td>0.0526</td>
<td></td>
</tr>
</tbody>
</table>

Notes: As mentioned in Table 7.1
Source: As per the text.
Table 7.3
Estimated Regression Equations by Considering both Demand and Supply side Variable Together

\( Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \epsilon \)

(a) Dependent Variable (Y): PCVAPS

<table>
<thead>
<tr>
<th>Equation</th>
<th>( R^2 )</th>
<th>No. of observation</th>
<th>Increase in ( R^2 ) owing to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( Y_1 = -8.2337 + 1.0097 X_2 + 0.0523 X_4 + 0.3101 X_7 )</td>
<td>0.9505*</td>
<td>17</td>
<td>( X_{10} = 0.7573; X_{12} = 0.0982; )</td>
</tr>
<tr>
<td>( (0.3333) ) ( (0.0213) ) ( (0.0314) )</td>
<td></td>
<td></td>
<td>( X_2 = 0.0393; X_4 = 0.0165; )</td>
</tr>
<tr>
<td>( + 0.1253 X_8 + 0.3551 X_{10} - 0.0976 X_{12} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( (0.0520) ) ( (0.0010) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. ( Y_2 = -35.0963 + 0.0594 X_4 = 0.7712 X_5 + 1.5340 X_7 )</td>
<td>0.9379*</td>
<td>18</td>
<td>( X_{10} = 0.7451; X_7 = 0.1912; )</td>
</tr>
<tr>
<td>( (0.0132) ) ( (0.2543) ) ( (0.2034) )</td>
<td></td>
<td></td>
<td>( X_4 = 0.0186; X_5 = 0.0122; )</td>
</tr>
<tr>
<td>( + 0.1462 X_{10} + 0.0633 X_{13} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( (0.0125) ) ( (0.0200) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ( Y_3 = -195.6175 + 0.3111 X_4 + 3.4025 X_7 + 1.4026 X_8 )</td>
<td>0.6195*</td>
<td>13</td>
<td>( X_4 = 0.4160; X_8 = 0.1603; )</td>
</tr>
<tr>
<td>( (0.0905) ) ( (1.4034) ) ( (0.5617) )</td>
<td></td>
<td></td>
<td>( X_7 = 0.1030 )</td>
</tr>
<tr>
<td>4. ( Y_4 = -152 + 0.2349 X_2 + 0.3432 X_4 - 1.0676 X_5 )</td>
<td>0.5236*</td>
<td>53</td>
<td>( X_2 = 0.3441; X_4 = 0.1535; )</td>
</tr>
<tr>
<td>( (0.0485) ) ( (0.0717) ) ( (0.6394) )</td>
<td></td>
<td></td>
<td>( X_7 = 0.0316; X_5 = 0.0594; )</td>
</tr>
<tr>
<td>( + 0.7558 X_7 + 0.4347 X_8 )</td>
<td></td>
<td></td>
<td>( X_8 = 0.0196 )</td>
</tr>
<tr>
<td>( (0.3150) ) ( (0.2313) )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cont'd. 29

33
Table 7.3 contd.

(b) Dependent Variable (Y): BBP
dos

1. \( Y_1 = -2.5117 + 0.2454 X_7 + 0.0699 X_3 + 0.0036 X_4 \)
   \( (0.0725) (0.0210) (0.0191) \)
   \( -0.0181 X_12 + 0.0530 X_{13} \)
   \( (0.0039) (0.0297) \)

2. \( Y_2 = -12.5520 + 0.0078 X_2 + 0.0280 X_4 - 0.0931 X_5 \)
   \( (0.0042) (0.0072) (0.0401) \)
   \( + 0.2553 X_7 + 0.1527 X_3 + 0.0524 X_{10} \)
   \( (0.0933) (0.0373) (0.0231) \)

3. \( Y_3 = -11.6031 + 0.0288 X_4 + 0.0632 X_5 + 0.2003 X_6 \)
   \( (0.0030) (0.0420) (0.0913) \)

4. \( Y_4 = -10.3126 + 0.0141 X_2 + 0.0208 X_4 - 0.0335 X_5 \)
   \( (0.0035) (0.0401) (0.0413) \)
   \( + 0.1355 X_7 + 0.0972 X_3 + 0.0052 X_{13} \)
   \( (0.0046) \)

\[ Y_1 = 0.8235, Y_2 = 0.7337, Y_3 = 0.5793, Y_4 = 0.6548 \]

\( Y_1 = 0.4724; Y_2 = 0.2863; Y_3 = 0.5211; Y_4 = 0.4251 \)

Notes: As mentioned in Table 7.1
Source: As per text.
### Table 7.4

**Estimated Regression Equations — Considering The Components Of The Agglomeration Economics and Infrastructure**

\[(Y = b_0 + b_1 A_1 + b_2 A_2 + b_3 A_3 + c_1)\] and \[(Y = b_0 + b_1 T + b_2 P + b_3 c + c_2)\]

<table>
<thead>
<tr>
<th>Agglomeration Economics</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Dependent variable (Y): PCVAES</td>
<td>(a) Dependent variable (Y): PCVAES</td>
</tr>
<tr>
<td>[Y_1 = 32.4997 + 0.2679 A_1]</td>
<td>[Y_1 = -3.2653 + 0.3946 P]</td>
</tr>
<tr>
<td>[R^2 = 0.8018^*]</td>
<td>[R^2 = 0.4013^*]</td>
</tr>
<tr>
<td>n = 17</td>
<td>n = 17</td>
</tr>
<tr>
<td></td>
<td>[(0.0330)]</td>
</tr>
<tr>
<td>[Y_2 = 50.2702 + 0.1836 A_1]</td>
<td>[Y_2 = -36.1792 + 0.4703 P]</td>
</tr>
<tr>
<td>[R^2 = 0.7072^*]</td>
<td>[R^2 = 0.3374^*]</td>
</tr>
<tr>
<td>n = 18</td>
<td>n = 18</td>
</tr>
<tr>
<td></td>
<td>[(0.0283)]</td>
</tr>
<tr>
<td>[Y_3 = 71.6391 + 0.1124 A_1]</td>
<td>[Y_3 = 76.3484 + 1.3032 P]</td>
</tr>
<tr>
<td>[R^2 = 0.2837^**]</td>
<td>[R^2 = 0.3121^*]</td>
</tr>
<tr>
<td>n = 13</td>
<td>n = 18</td>
</tr>
<tr>
<td></td>
<td>[(0.0404)]</td>
</tr>
<tr>
<td>[Y_4 = 53.3032 + 0.1809 A_1]</td>
<td>[Y_4 = 45.0227 + 0.4435 P]</td>
</tr>
<tr>
<td>[R^2 = 0.5826^*]</td>
<td>[R^2 = 0.2377^*]</td>
</tr>
<tr>
<td>n = 53</td>
<td>n = 53</td>
</tr>
<tr>
<td></td>
<td>[(0.0210)]</td>
</tr>
<tr>
<td>(b) Dependent variable (Y): PSDPOS</td>
<td>(b) Dependent variable (Y): PSDPOS</td>
</tr>
<tr>
<td>[Y_1 = 45.1912 + 0.1389 A_1]</td>
<td>[Y_1 = -4.7434 + 0.4629 P]</td>
</tr>
<tr>
<td>[R^2 = 0.5663^*]</td>
<td>[R^2 = 0.2623^*]</td>
</tr>
<tr>
<td>n = 17</td>
<td>n = 17</td>
</tr>
<tr>
<td></td>
<td>[(0.0293)]</td>
</tr>
<tr>
<td>[Y_2 = 62.0055 + 0.0891 A_1]</td>
<td>[Y_2 = -43.5000 + 0.5829 P]</td>
</tr>
<tr>
<td>[R^2 = 0.3259^**]</td>
<td>[R^2 = 0.3219^*]</td>
</tr>
<tr>
<td>n = 18</td>
<td>n = 18</td>
</tr>
<tr>
<td></td>
<td>[(0.0293)]</td>
</tr>
<tr>
<td>[Y_3 = 71.9979 + 0.0624 A_1]</td>
<td>[Y_3 = 87.0555 + 0.8373 P]</td>
</tr>
<tr>
<td>[R^2 = 0.3102^**]</td>
<td>[R^2 = 0.3546^*]</td>
</tr>
<tr>
<td>n = 18</td>
<td>n = 18</td>
</tr>
<tr>
<td></td>
<td>[(0.0354)]</td>
</tr>
<tr>
<td>[Y_4 = 32.9701 + 0.1029 A_1]</td>
<td>[Y_4 = 27.3507 + 1.0621 P]</td>
</tr>
<tr>
<td>[R^2 = 0.3010^*]</td>
<td>[R^2 = 0.3247^*]</td>
</tr>
<tr>
<td>n = 53</td>
<td>n = 53</td>
</tr>
<tr>
<td></td>
<td>[(0.0197)]</td>
</tr>
</tbody>
</table>

**Note:** As mentioned in Table 7.1

**Source:** As per the text.
Table 7.5

Estimated Regression Equations for International Inequality Trends

(Equation: $Y = b_0 + b_1 I_1 + b_2 I_2 + b_3 I_3 + b_4 I_4 + b_5 I_5 + b_6 I_6 + a$)

<table>
<thead>
<tr>
<th>a. Dependent Variable (Y): PCVAFS</th>
<th>$R^2$</th>
<th>$F$</th>
<th>$D.W.$</th>
<th>Increase in $R^2$ due to</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Y = 30.6942 + 0.1352 I_5 + 0.2567 I_5 - 0.1437 I_6$</td>
<td>0.6385*</td>
<td>11.7577</td>
<td>1.9646</td>
<td>$I_5 = 0.4900$</td>
</tr>
<tr>
<td>(0.0382) (0.0579) (0.2485)</td>
<td></td>
<td></td>
<td></td>
<td>$I_6 = 0.1631$</td>
</tr>
<tr>
<td>(n = 17, d.f. = 3, 13)</td>
<td></td>
<td></td>
<td></td>
<td>$I_3 = 0.0725$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b. Dependent Variable (Y): PSIMOS</th>
<th>$R^2$</th>
<th>$F$</th>
<th>$D.W.$</th>
<th>Increase in $R^2$ due to</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Y = 32.6545 + 0.2084 I_5 + 0.2269 I_5 - 0.149 I_6$</td>
<td>0.6433*</td>
<td>9.6337</td>
<td>2.6238</td>
<td>$I_5 = 0.4026$</td>
</tr>
<tr>
<td>(0.0334) (0.0577) (0.0547)</td>
<td></td>
<td></td>
<td></td>
<td>$I_6 = 0.1435$</td>
</tr>
<tr>
<td>(n = 17, d.f. = 3, 13)</td>
<td></td>
<td></td>
<td></td>
<td>$I_3 = 0.1435$</td>
</tr>
</tbody>
</table>

Notes: 1. Only final results are presented; for notations please see text.
2. Figures in the parentheses are standard errors of the b coefficients.
3. PCVAFS stands for per capita value added generated in the registered factory sector, while PSIMOS connotes proportion of SIF generated in the organised manufacturing sector.
4. *significant at one per cent level of significance.
5. **significant at five per cent level of significance.

Source: As per text.
As discussed earlier, we selected certain indicators to be used as proxies for the various behavioural factors affecting interregional industrial structure. Most of these indicators are a combination of some other characters which have to be combined in order to have a single composite index representing a particular variable. Let us take an example to write the methodology. Suppose there are 4 factors to be merged into one index and each factor is spread over 18 states, i.e., has 18 number of observation. Now, let

\[ CI = \text{Composite Index} \]
\[ x_j = j^{th} \text{ variable, where } j = 1, 4; \]
\[ x_i = i^{th} \text{ observation (State), where } i = 1, 18; \]
\[ x_{ij} = i^{th} \text{ observation for } j^{th} \text{ variable}; \]
\[ x_m = \text{maximum value } x_{ij} \text{ for } j^{th} \text{ sector, } m = 1, 4; \]

1/ The data base has been elaborated in the Appendix 1 to the Thesis. However, as and when necessary, important features will be highlighted.

2/ In order to aggregate these series, which have different units of measurement; for example length of roads and number of bank offices; we first normalise them by dividing each of the series by the difference of its maximum and minimum values and thus arrive at \( x_{ij} \).
\[ x_n = \text{minimum value of } x_{ij}; \text{ for } j^{th} \text{ sector, } n = 1,4; \]

\[ n = \text{total number of state/observations;} \]

\[ C_j = \text{inverse of the coefficient of variation for } j^{th} \text{ variable;} \]

\[ \bar{x}_j = \text{mean of the } j^{th} \text{ series} \]

\[ w_j = \text{weight for the } j^{th} \text{ series} \]

then:

\[ \hat{x}_{ij} = \frac{x_{ij}}{x_m - x_n} \]

\[ C_j = \frac{\bar{x}_j}{\left[ \frac{1}{n-1} \sum (\hat{X}_j - \bar{x}_j)^2 \right]^{\frac{1}{2}}} \]

\[ W_j = \frac{C_j}{\sum_j C_j} \]

\[ CI = \sum_j \hat{x}_{ij} \cdot W_j \]

All the composite indices were arrived at following the above methodology. At this stage some of the indices need some clarification. For example, level of agricultural mechanisation. It is a composite index of (i) number of tractors per 1000 hectares; (ii) number of oil engines and pumps per 1000 hectares used for the purpose of irrigation; and (iii) use of NPK (fertilizer) KG/ha. Data for (i) and (ii) are obtained from the
Livestock Census for the years 1961, 1977-72 and 1977-78. It is assumed that the values obtained for 1971-72 and 1977-78 hold good for the years 1969 and 1978, used for the purpose of our analysis. Moreover, hectares are in terms of the gross cultivated area.

Similarly when we considered urbanisation, defined as proportion of population living in 20000 + towns. We have not adjusted this proportion for boundary changes. Further, the population for 1971 and 1981 is used as proxy for 1969 and 1978 while working out these proportions.

Inter-industry demand is quantified as inverse of the coefficient of specialisation, which is calculated on the basis of information provided in Table 5.2. Another interesting indicator we have tried to develop is the index of agglomeration economies, somewhat as suggested by Richardson (1973).

Agglomeration index (AI) is, thus, defined as

$$ AI = \sum_{i} \frac{N_i}{Z} \frac{1+X}{Z + \bar{Z}} = \sum_{i} \sum_{j} \frac{d_{ij}}{2Z(Z-2)} $$

\((d_{ii}, d_{jj} = 0)\)

\((N_i = \text{population of } i^{th} \text{ threshold urban centre in the region; } Z = \text{number of threshold urban centres, } \bar{Z} \text{ is number of threshold urban centres per } 1000 \text{ km}^2, d = \text{distance})\).
where first term on the rhs, is the relative size of the urban centres (with lakhs + population) with more weight \((1 + \alpha)\) given to the larger centres; second term is the number of these threshold level urban centres per 1000 km² of area and the last term is the average inter-urban distance between these urban centres. Once we arrive at these three values on the basis of the data obtained from the Census of India, we used the earlier methodology to aggregate these values accordingly (last value being deducted). Inter-urban distance is approximated on the basis of the Road Map of India, published by the Geological Survey of India. \(\alpha\) weight \((1 + \alpha)\) is the proportion of the population of the city \(i\) in the total urban population of the country.

For calculating efficiency wages we need wage rate and total factor productivity. Wage rate for a particular year is defined as the total emoluments per worker, calculated on the basis of ASI, while for total factor productivity (TFP), we have used Hendrick's measure defined as:

\[
\text{TFP} = \frac{V}{a_V + b_k}
\]

1/ It is assumed that higher the inter urban distances, higher will be the cost of transportation, communication and information flow etc. leading to the diseconomies. That is why it is treated as having negative bearing.

2/ The weights incorporate the element of urban hierarchy in the national mapping.
where $V$ is index of value added, $k$ and $l$ are the indices for capital and labour respectively, and $a$ and $b$ are the base year weights of the two factor inputs in terms of their proportionate share in value added in the base year.  

Quantification of the degree of labour militancy is attempted in terms of a composite index of two factors viz., number of man-days lost per 1000 workers owing to industrial disputes; and number of trade unions per thousand workers (here members). It may be mentioned that the information on man-days lost is available only for those disputes which involve more than 10 workers; and reporting of the membership of trade unions is not very regular. However, we have taken average of three three years for trade union activities, with assumption that higher number of trade union reflects splited trade union movement.

Data base for other variables is discussed in the Appendix 1.

1/ For details, see Kendrick (1961)