INTER-STATE VARIATIONS IN PRODUCTIVITY TRENDS AND TECHNOLOGICAL CHANGE IN INDIAN INDUSTRY

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CERTIFICATE

Certified that the thesis "**Inter- State Variations in Productivity trends and Technological Change in Indian industry** " is the record of bonafide research carried out by Mr. Muraleedharan, under my guidance. The thesis is worth submitting for the degree of Doctor of Philosophy in the Department of Applied Economics under the faculty of social sciences.

Prof. M K Sukumaran Nair
Supervising Guide

DECLARATION

I declare that the thesis entitled "**INTER-STATE VARIATIONS IN PRODUCTIVITY TRENDS AND TECHNOLOGICAL CHANGE IN INDIAN INDUSTRY** " is the record of bonafide research carried out by me under the guidance and supervision of Dr M K Sukumaran Nair, Professor, Department of Applied Economics, Cochin university of Science and Technology. I further declare that the thesis has not formed the basis of the award of any degree, diploma, associateship, fellowships or other similar titles of recognition.

Kochi

10-6-2002

S Muraleedharan

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CHAPTER 1

INTRODUCTION

Industrialisation is a part as well as process of development, though industrialisation is not a panacea for all economic problems in a developing country like India. One of the disquieting features of a vast economy like India is that the level of industrialization is uneven. This is very true in the case of a federal economy like India (Sastry and Kelkar, 1987, Awasthi,1995). This kind of unevenness in industrial developments results in disastrous consequences both in the international and intra-national contexts. Therefore recent years witnessed an upsurge of interest in understanding the dynamics of the pattern of industrialisation in the context of regional economics.

1.1 Regional industrialisation and theoretical development

One of the strongly contented facts is that resources base can activate industrial process in a particular region where as other regions will be low in the race. As history shows, proper utilization of the regional resources facilitates a transition of economies from subsistence stage to a modern exchange economy. Rich deposits of strategic resources can augment industrilisation and generate surplus output for exports; otherwise a particular region will become industrially "bare – footed"

Resources base approach has recently got a new dimension in the name of politics of place (Higgins, 1988). Therefore the argument is that it is people's livelihood that is fundamentally at stake (Williams, 1983, quoted in Freeman and Forest, 1988). It considers cultural developments and values of regional resources along with the normal system of production. Resources distribution and common property rights are also important in politics of place. It recommends a planning mechanism that aims at endogenous development (Freeman and Forest, 1988).

It seems that Perrox (1950, 1988) put a solid base to the regional dimension of an economy by introducing the concept of 'growth pole' and 'development pole' A growth pole is the conglomeration of economic and other activities functionally related to other similar centres. These centres are expected to diffuse growth impulse to various socio-economic spheres through propulsive industries. 'The growth pole is a set that has the capacity to induce growth of another set; where growth is a lasting increase in the dimensional indicator' (Perrox,1988). Development pole is a set that has the capacity to engender dialectic of economic and social structures (Perrox, 1988). It is argued that they are capable to increase the complexity of the whole and to expand its multi dimensional return.

Another mainstream axiom of regional development theory is the central place theory of spatial organization. This is largely concerned with the spatial and other human activities marked by concentration. Hirschman (1958) and Myrdal (1957) developed these ideas in a comprehensive and broad manner. It is argued that higher levels of growth can be achieved through the development of one or many regional centres of economic growth poles that mark the presence of international or inter-regional inequality or unbalanced growth.

Hirschman (1958) argues that development in one centre induces its impulses back to hinterland. This contains both favourable and unfavourable forces. Favourable forces are those that activate growth symptoms if the two regional economies are complementary. This is known as trickling down effect.

Unfavourable forces may act in different ways. Firstly, backward regions may find it difficult to withstand competition from the growth poles in manufacturing and exports. Secondly, growth may lure away professionals and experts of backward regions instead of stretching a helping hand to the surplus manpower. Thirdly, investment opportunities of the growth centres are such that the available savings of the backward regions may flow to these. These are named as polarisation effects.

Myrdal (1957) also treats trickling down and polarisation effects in a similar fashion. He points out that growth impulses will be extended to the hinterlands and they create certain positive impacts, which are called as spread effects. The associated negative forces are considered as backwash effects (Polarsition). If the spread effects (trickling down) were dominant, the growth process would spread to backward regions.

One of the undercurrents in these deliberations is the prevalence of international or inter-regional inequality. To Perrox (1988,P.52) the economic system consists of economic space and territorial space created by agents based on their degree of efficiency and their powers. In actual practice, unequal agents take decisions regarding unequal structured subsets (industries). They exert symmetric effects from the point of view of development that are named as propulsive effects (Perrox, P.52). There are innumerable propulsion effects in advanced economies. They are mainly between unequal units as a result of flow of commodities, transfers of productivity and investment flow.

Propulsive effects operate through growth inducing units and industries. One dynamic enterprise 'A' will exert induction effects upon 'B' in a given environment. Induction effect has two components viz. (a) dimension effect and (b) innovation effect (productivity). Dimension effect shows an increase in demand on B by A or the possibility provided by A to B through the increase of its supply. Innovation effect (productivity) is the capacity provided by A to B or induced by A to B to introduce an innovation. This trend will spread throughout the economy. Net effect is a shift from growth inducing unit to the growth inducing industry (Perrox, P.67).

If there are sets of firms, which have higher rates of growth of output and productivity than the average and a rapidly increasing share in the industry as a whole, they are called as growth industries. Perrox (1988, P.86) divides industries into three groups such as (a) entirely new industries, (b) modern industries and (c) traditional industries. 'The first two groups exert powerful effect on the traditional group and on the pace of renewal of the entire economy' Innovations have major role in this renewal rate. Industry introduces innovations into agriculture through indirect means in less developed countries. Thus linkages and innovations (productivity) determine the general growth of an economy.

Growth pole theory focuses on three key issues, namely domination, linkages and distribution (Polenske, 1988 P.96). Perrox tried to project the favourable effects of growth pole strategy within a capitalist framework. Though he claimed scientific neutrality in his approach, dependency theorist took parallel views to the three key issues mentioned above. The initial investment, according to Perrox, by dominant nations would generate income, expand effective demand, and create new market for the increased production by the third world producers (Polenske, 1988).

Dependency theory is to (Baran, 1957; Prebisch and Singer, 1955; Amin, 1977; Emmanuel, 1972) maintain the view that the world economy is divided into a core of dominant nations and a periphery of dependent ones (third world). This dichotomy has both international and national dimensions. In other words, core and periphery exist within and between industrialised and third world countries. The periphery consists of subsistence agriculture and small-scale and informal rural industry with low productivity. Cores within industrialised and third world countries drain profits and resources from their own peripheries and also core in the former expropriate from the periphery of the third world (Polenske, 1988,P.100).

Perrox holds the view that dominant firms could reap the benefits of economies of large-scale production and promote innovative activity (more productive). The resultant advantages would disperse throughout the economy. As noted early, Hirschman and Myrdal expressed such views as trickling down effect and spread effects respectively. The spread effects take place via linkages that can guide a policy maker to select the appropriate sector or firm. The argument is that investments in units with high linkages (both backward and forward) can generate greater multiplier impact than units with low linkages.

Dependency theorists discuss linkages in a broader context. They consider the social relations of production in a nation or in the world on one side and the flows of resources and commodities on the other (Polenske, 1988,p.103). They argue that linkages will enhance the drainage of income from the periphery to core. This gives rise to the questions of distribution of the growth effect, which is the third key issue in the growth pole theory.

As per the growth pole strategy, investment in the dominant firm would raise output and employment both in the dominant firm and other firms through linkages and multiplier effect. But views differ in the resultant effect on distribution. Kuznets (1964) and Williamson (1965) pointed out that inequalities reduced while Leontief (1977) and Timbergen (1976) concluded that sufficient progress in reducing income inequalities is not to be seen.

In the present study, it is proposed to consider the nature of regional variations in industry and also the inter-state variations in manufacturing productivity in India within the frame work growth pole strategy. Regional variation in industry will be looked at through innovation (productivity) effect. Hence we shall consider the determinants of regional industrialisation in India in the next section.

1.2 Determinants of regional industrialisation in India.

Generally speaking, the various determinants of regional industrialisation can be grouped into three viz. historical forces, public policy and infrastructure (Awasti, 1995). Early industrialisation took place in port towns like Bombay, Calcutta and Madras, which acted as the captive market for Britain (Awasti, 1995). Resources base, Local skills, agricultural development and political stability acted as other historical factors behind the growth of industrial centres. These centres helped certain states to accelerate the tempo of industrialisation (Maharashtra and Gujarat) and did not augment same process in some other states.

Public policy was instrumental to industrialise certain areas, which otherwise would not have been in the industrial map of India (Ahluwalia, 1985; Tharakan and Issac 1994). The Second Five Year Plan, which emphasized public sector as the commanding heights of the economy, is a clear example. Setting up industrial estates, industrialisation of the backward regions, district industrial centres and formation of tiny sector were a few notable attributes of public policy. Other aspects of public policy, which deserved mention, are licensing system, price policy and forecasting and regulating of foreign collaboration. However, it may be noted that public policy debate is not very strong in the well-established theories in regional economies.

The third major determinant of regional industrialisation was infrastructure facilities. (Ahluwalia, 1985;Kurien, 2000). Along with the usual economic overheads, agglomeration economies, entrepreneurship and skilled manpower, linkages and urbanisation determined the level of industrialisation (MohananPillai, 1994; Sastry, 1993).

The above categorization of the determinants of industrialisation in India makes it clear that the theoretical propositions outlined in section 1.1 are applicable and relevant as well. Historical forces, resources base and public policy were the key factors in fostering industrial development in centres as explained by Hirschman but their growth impulses did not spread to the different parts of the country causing considerable regional variations.

1.3 Regional industrialisation and empirical studies.

Almost all the theories of regional economics admit the fact that regional variation is an ongoing reality. The available literature suggests that the process of industrialisation was not uniform in all Indian States (regions). Sekhar (1982) and Gupta (1985) argued that there had been a decline in inter-state industrial disparities overtime though the process has been slow. Sastry and Kelkar (1987) examined not only regional variation but also inequality within the region. They concluded that there had been a decline in the inequality within the states during 1960-81. However, the imbalance that existed between the regions was declining. Further, decline in inequality within the regions was not found during 1970-81.

The relative position of each state in terms of per capita value added in the factory sector also varied over time. For instance, West Bengal, which stood second in 1960-61, slipped to fifth position in 1980-81. As far as the value added in the factory sector is concerned, the same state dipped to sixth place in 1988 from second in 1969-70. Meanwhile, Gujarat and Tamil Nadu improved their position from four and three to three and two respectively during the same period. In addition, Gujarat became second in the order in terms of per capita value added in the factory sector in 1980-81. Similar changes were discernible in the case of Tamil Nadu as well.

Can these variations be attributed to the three sets of determinants outlined in this section? It seems that the discussion can assume a new dimension as presented in sub-section 1.4

1.4 The research problem

Studies on growth and productivity trends in Indian manufacturing sector at various levels pointed to two important trend changes. They are the 'stagnation' and 'turnaround'theses confining to late 60s and the 80s respectively. There is a general agreement among experts that the country had gone through a stage of stagnation since the mid-sixties (Ahluwalia, 1985 and 1991. Goldar, 1984; Shetty, 1978; Raj, 1984). However, there is no such common acceptability in the case of 'turn around' thesis. Total factor productivity growth (TFPG), which was slightly positive before 1966 marked a moderately higher growth rate. (turnaround) during the 1980s. (Ahluwalia, 1991). L.C.Jain (1992) disputed the 'turn around thesis ' It was Balakrishnan and Pushpangadan (1994; B-P hereafter) who showed that the productivity was less during the 1980s than the 1970s. Having improved the methodology Dolokia and Dolokia (1995, D.D hereafter) and Rao (1996) also came out with a similar conclusion.

One can trace out three major research gaps in the arguments presented above. Time and regional dimensions of manufacturing productivity are the first two gaps. The third issue is the use of deflation methods and their impacts on productivity at the regional level. The time dimension of the productivity analysis can be viewed from two angles: (i) the inclusion and exclusion of certain periods, and (ii) the impact of changes in the base period. The former one is very important in comparing the findings of Ahluwalia on the one side and of B-P and D-D on the other.

The critics of 'Turn around' thesis excluded the late 1960s when 'Structural retrogression' (Shetty 1978) and industrial stagnation, (Ahuluwalia 1985) took place. Once the stagnation period was excluded there were all possibilities of a conclusion that productivity growth was better during the 1970s than the 1980s. Such a possibility was already pointed out by Raj (1984 Goldar (1985), Brahmananda (1983) and Ahluwalia (1991). This necessitates a fresh analysis incorporating the four decades from 1960.

As regards the second aspect of time dimension in productivity, there are different lines of argument regarding productivity during the pre-stagnation period. One argument was that TFPG marginally increased during 1950-65 (Sastry, 1981, Goldar, 1985; Ahluwalia, 1985 and 1992). Another line of argument, however, was that TFP declined during same period (Krishna and Metha, 1968, Banerjee, 1971, Mehta, 1980).

Some studies even considered the pre-planning period and concluded that the rate of increase in industrial productivity was much higher during 1946-56 than in 1960-65. Chaudhary (1966) argued that real absorption of technology took place only in the manufacturing only during the 1950s, while Banerjie (1971) found that the TFP declined during 1946-59.

It is interesting to note that TFPG and capital productivity were higher during 1970-79 than during 1965-70 (Goldar; Raj). In the studies of Ahluwalia (1985 and 1992) too, it was found that TFPG was high during the early eighties compared to the whole decade of the 1980s. Brahmanada (1983) concluded that TFP of registered manufacturing was better during 1971-81 than during 1961-71; while all other sub sectors of the industry had been displaying decelerated growth in terms of TFP during 1951-81.The above arguments show that productivity comparisons shall be done from a common base year. It also requires short term and long term comparisons so as to incorporate the stages of stagnation, recovery and turn around' As the time element would distort many of the conclusions, it is proposed to focus the analysis on a five years or appropriate short period along with the popular decade wise break up. The short period is justified as that Indian economy is largely shaped by programmes under five year plans. This can be also supported by the argument that effective demand derived from agriculture is an important influence on industrial productivity (Goldar, 1992). It is also argued that more detailed research addressed to the determinants of sectoral and temporal variations in industrial productivity is required (Rao, 1996).

The second important aspect to be noted here is the regional dimension in productivity variation. This was not sufficiently cornered in the works of B-P, D-D and others. It implies that variation in productivity need not be uniformly spread across the country and industries. For instance, there was a significant decline in TFP of Bihar during 1950s, while no such significant decline was registered at the all India level. This trend reversed in the cases of Bihar and all India respectively during the 1960s (Mukherji, 1983). Similarly, industrial productivity in Kerala was on the rise (Subrahmanian and Pillai, 1987) during the same period while the national scenario was one of industrial stagnation and decline in TFPG (Ahluwalia, 1985). Industry in Kerala suffered a set back when Indian Industry began to show symptoms of recovery in 1970s. Kerala recorded a higher growth rate in terms of all indices of productivity compared to South India and all India during 1976-87 (Arun, 1994). He also found that the trend in partial productivity growth remained the same across different states during the same period. As far as the industrial growth is concerned, the relative position of West Bengal declined during the 1980s.

The brief sketch of literature on the regional variations in industrial productivity in India prima-facie enables us to hypothesise that inter-state (region) variations in Industrial productivity had been diverging and not converging since 1960. It is to be noted that available studies on the regional variations in productivity are either short duration or limited spatial or time coverage. Further, they do not seriously corroborate with the major debatable issues like industrial stagnation, industrial recovery and 'turn around' at the all India level. Hence these issues are to be discussed at regional level against the backdrop of the structure and time coverage.

The third and the most important aspect on industrial productivity in India is the methodology issues related to the deflation of values, especially value of output and the material price. Most of the popular works on industrial productivity followed single deflation technique. In this, the value of output and the value of input are deflated by a single price index, i.e. that of output (B-P, 1994). Double deflation method, which was recommended by UN in 1968, consists in deflating the outputs and intermediate inputs of industries in some base year prices, and in computing their real value added by subtracting the deflated inputs from the deflated outputs (Durand, 1994). B-P and D-D questioned its validity and came out with new results be adopting double deflation (results referred to early). But double deflation method requires extremely restrictive assumptions and has major statistical difficulties of application at the disaggregated industry level (Durand, 1994). The difficulties increase with one move away from the base year.

Mohan Rao (1996) recently suggested that measuring TFPG with single or double deflation of value added, in general, would lead to bias. That is, the growth in value added at single deflation will be slower than the growth of the same at double deflation when material-output price relative increases and vice verse. Ahluwalia also questions the results based on double deflation because of the empirical compromises made in the process of attempting to drive the price index for intermediate inputs to perform the double deflation (IMF, 1995). Mohan Rao, on the other hand, argues that a measure of TFPG can be obtained indirectly from the measure of total productivity growth (TPG). It may be noted that manufacturing in India constitutes 80% of the total value added in Indian industry.

1.5 Objectives

In the background of the preceding analysis, the present study has the following main objectives.

1. to understand the periodical variations in the Indian manufacturing productivity growth during 1960-1998-99.

2. to assess the regional variations in the Indian manufacturing productivity growth during 1960-1998-99 within a common framework of time dimension;

3. to investigate whether the convergence's and divergence are at least partially due to variations in manufacturing productivity;

4. to identify the determinants of technological change in regional manufacturing; and

5. the nature of regional structure of manufacturing in the context of variations in productivity.

1.6 Hypotheses

1 Industrial stagnation, recovery and turn around were not uniform among different states (regions) in India.

2 Industrial productivity was not uniform among different states in India.

3 Variations in industrial productivity are determinant of regional industrialization in India.

4 The extent of technological change is determined by the capital intensity, skilled labour to number of employees and fuel intensity

1.7 Source of data

The study is purely based on secondary data. The most reliable data on manufacturing in India is published by Central Statistical Organisation under the title Annual Survey of Industries (ASI). The difference between aggregate data of ASI, and, data on electricity, steam and is gas relating to manufacturing. The data relate to factory sector and the factory sector data for the 1960s are sums of census and sample sectors. The state level data for electricity, steam and gas are taken as an interpolation of the concerned data in late 1960s and mid1970s. The data cover a period from 1960 to 1998-99 at state level. Data on certain variables like depreciation are absent at the regional level for the early 1960s. Such items have been extrapolated based on average value of the concerned variable in the late 1960s. The data correspond to calendar and financial years respectively before and after 1966. The variables used in the study are defined in the appropriate context.

1.8 Limitation of the Study

Regional price indices are not used due to their non-availability. Variations in productivity are not analysed in the cases of input-based and use-based industries.

1.9 Scheme of the study

Apart from this introductory chapter, there are six chapters in this work. Concepts and methodology are discussed in the ensuing chapter. The regional industrial scenario is sketched in the third chapter. The fourth chapter deals with the productivity measurement and the convergence-divergence issues at the state level. An attempt is made to find out the explanatory variables for regional trends in TFPG in the fifth chapter. The sixth chapter is devoted to analyse the regional industrial structure in the background of TFPG. The emerging conclusions are presented in the final chapter.

CHAPTER - 2

CONCEPTUAL AND METHODOLOGICAL ISSUES

2.1 INTRODUCTION:

The most important conceptual issue in any regional study pertains to the definition of a region. Boudeville (1966 quoted in Krishnamurthy, 1990) makes a three-fold classification of regions. One is the most homogeneous region, which is close to natural regions of geographers. The second is the polarised regions, which represent polarisation in terms of population density. The third category is planning regions, which represent administrative areas. Higgins (1988) argues that a region can be identified with three features, viz., homogeneity of economic features, administrative unit and historical aspects. It seems that region is more akin to an administrative unit or planning region in a country like India. In other words regions closely correspond to states or provinces in a democratic federal set up (Higgins, 1982, P.2). Hence a state is taken as a region in the present study. As the concept of the region is defined, the step is to discuss various tools and models of regional development. This is the subject matter in the following section.

2.2 TOOLS, MODELS AND REGIONAL DEVELOPMENT

There are many tools to study regional economic development. Richardson (1988, P.142) makes an excellent survey of different tools on the basis of policy relevance along with forecasting, and impact analysis as well as policy choice and evaluation. Initially he refers to two demand oriented models. They are economic base and input-output models. Though there are many versions of the former, the popular variants of the same are location quotient and minimum requirements methods. Location quotient method has the inability to correct across overhauling, whereas minimum requirements method essentially assumes that export share is an inverse function of population and invariant with structure. The major problem with this method is its failure to accommodate regions with high specialisation.

Richardson concludes that regional input-output models, in spite of search for alternatives for several years, remain to be superior to other techniques for measurement of economic impacts and many dimensions of region policy. It is, in addition, the best method of measuring both forward and backward linkages.

A third tool is shift-share analysis, which is used as a diagnostic and descriptive device for explaining changes in regional industrial structure. This is also used as a forecasting method and sometimes as a guide to policy analysis. A relative shift in each industry is expressed as a function of relative profits and it contains certain principles of comparative advantage and location theory. The basic hypothesis is that increasing diversification leads to a common industrial structure across regions.

Another tool available in the Economists' Kit is the gravity model (Alonso, 1978). To Richardson, it is a shorthand way of summarising the forces of agglomeration and dispersion that determine the distribution of population and economic activities over space. Any forecast based on this model requires the forecast of the future spatial structure of the economic system as a whole. A natural doubt that arises is about the applicability of this model in the context of macro regions like states or provinces.

Now we can consider two special models, viz., demo economic model and cost-benefit analysis. Demo economic model deals with the role of population especially migration, in regional growth (Alonso, 1988). The argument is that migration is sensitive to changes in the economic performance of a region. Unlike the first two demand oriented models, the demo economic model has a relatively balanced emphasis on supply and demand factors. But its application is yet at a premature stage.

Cost- benefit analysis deals with the benefits accrued and the costs involved behind each programme and policy. But the efficacy of cost-benefit (CB) analysis in the context of regional development is questionable mainly on two grounds. Firstly, C-B analysis is not efficient to measure non-economic goals. Secondly, it is essentially useful for evaluating single projects.

As a forecasting tool and an aid to national and regional economic policy evaluation, structural econometric models (SEM) are treated as a better tool of analysis. Regional econometric models normally assume that changes in national demand drive the regional economy (top-down approach). Richardson (1988) considers SEM as superior technique since it can be used for direct policy evaluation. It is also helpful to assess the effect of national policies in accelerating economic growth, especially its regional impacts. Its role is, further, countable in understanding the regional impact of changes in the location of federal government's investment.

Apart from the superior qualities of SEM, there are strong objections to its use in the regional context. One such serious objection is the incomplete nature of the model if any key variable like regional capital stock is absent. In addition, SEM is built on the macro economic theoretical framework, which need not be most appropriate for regional economic analysis. This type of models usually analyse short run impacts of a policy while long-term structural change may be the pertinent concern at the regional level. Another unattractive side of a SEM is its inability to examine the effects of regional or local policies. Moreover, the standard econometric problems are generally more serious in regional applications.

There are alternatives to SEM, time-series forecasting models. They are very much economical in data requirements. The most popular versions of these models are Box Jenkins, auto regressive moving averages and vector auto regression. Richardson points out that these models are helpless in shedding light on potential policy impacts. They also lack solid theoretical backing and their spatial versions have not been really tested in a regional economic context. In this respect, it is argued that SEM is superior to time series models.

Most of the models outlined above are specialised models. It emphasises the need for comprehensive models that can accommodate alternative policy mixes, linkages among particular sub models and non-economic impacts. Here one may prescribe integrated multi-regional models. Richardson presents mainly six elements in an integrated multi-regional model. They are namely (a) national econometric module (b) input-output and programming module (c) demographic module (d) multi-region econometric module (e) Investment supply econometric module (f) and multipolicy formation module. The last element can catch non-economic factors also.

One of the main difficulties of the models discussed so far is their orientation towards quantification. Quality of entrepreneurship, administrative efficiency of regional development agencies, changes in environmental quality and other social political factors have qualitative dimensions. Only qualitative models can consider such factors. Scaling methods are useful to make quantitative conclusions from qualitative data.

Richardson counts 'growth pole' as a tool of analysis though it is a concept and a policy instrument. There are two reasons why 'growth pole' is considered as a 'tool of analysis' Firstly, it facilitates agglomeration benefits from investment concentration and secondly, the economic history of regional policy reminds us the emphasis given to growth centres.

The most important aspect of a region in a federal set up is the question of aggregate growth versus inter-regional equity. Richardson argues that it is the question of efficiency and equity. Setting apart the question of efficiency aspects for the time being, we can consider the inter-regional equity here. One way of measuring inter-regional equity is to express it in terms of spatial equity. It refers to measures of dispersion among regions in average regional per capita incomes. But this approach cannot explain what is happening to interpersonal equity. It is pointed out that the average per capita incomes within a geographical area are very sensitive to the size of the spatial unit and its degree of urbanisation (Richardson). Williamson (1965) who took much pain regarding the regional industrial disparities introduced a measure that is sensitive to regional moulding. He provides us with un-weighted and weighted coefficients of variation to examine the disparities among regions. The weighted co-efficient of variation takes care of the population factor both at the regional and national levels. Hirschman and Herfindahl provide a simple index (H.H index) to measure regional concentration. It considers the percentage share of each state with respect to each variable concerned. The H. H index ranges from one to hundred and any rise in the index value shows increase in the disparity. One of the serious limitations of H.H index is its inability to catch the size, population and income across the regions. Thiel index is suggested as an alternative in this context. This index accounts for the percentage shares of the variable and population of the region. A zero value of the index shows convergence and a rise in the value displays tendencies of divergence. Currently the most popular method of convergence is to plot logarithm of per capita income against time. This is illustrated in chapter V.

2.3 AN EVALUATION OF VARIOUS TOOLS AND MODELS

Of the two demand side models input-output model (I-O) is treated as superior to economic base models. I-O technique has better coverage and is more scientific in measuring linkage effects. But, for regional studies, regional I-O models have to be set up for which regional level data are necessary. Reliable regional I-O data are not available in India. Even if such data are available, their analytical power for long period is dubious (Richardson 1988). Further, integrated multiregional models can accommodate I-O and programming module. As the present study is a specialised rather than a general one, integrated multiregional models have limited applicability here. Similar argument can be put forward in the case of SEM models, which are based on macro economic theoretical framework. It is normally unable to capture the effects of regional policies. Meanwhile, time series forecasting models, which are alternative to SEM, are unable to capture the potential policy impacts.

Cost-benefits analysis is better recommended for specific project evaluations while the implications of qualitative and demo economic models are not much relevant in the present study. As the key objective of this study is to understand industrial growth and its divergent-convergent character at regional levels, the following tools will be more useful for our purpose.

1. Identification of regional growth poles and various indicators of regional industrialisation as described in chapter3.

2. Plotting of the logarithm of labour productivity and capital productivity against time to examine the divergent-convergent phenomena.

So far we have been referring to the various tools and models relating to the regional development and industrial growth. Though the general divergence-convergence in industrial growth is an objective of the present study, the major intention of this work is to capture the diverging-converging nature in productivity. Hence it is necessary to discuss the issues and tools pertaining to productivity.

2.4 PRODUCTIVITY:

As we have already noted one of the lively issues in regional development is the question of efficiency-equity. The efficiency is normally explained in terms of Pareto optimality. "An efficient state exists if it is not possible to make anyone better off within the given constraints by changing to another state of affairs that also satisfies the applicable constraints" (Sharpe, 1995). In other words, efficiency may be located along the production possibility curve (PPC) and more output is possible only with more input. Conversely, any point within the curve will represent inefficient levels which suggests that more output is possible with the existing stock of inputs. Any level related to PPC has a corresponding productivity level.

Productivity can be generally defined as the ratio of output to the volume of one or more inputs, i.e. it is the output per unit of input or inputs. Productivity, as a source or cause of comparatively high levels of output and improvements in productivity as the major contributor to growth, has been an important theme of analytical enquiry in Economics all along (Brahmananda, 1982). Perrox (1988, P.67) explains productivity in terms of innovation, which provides same quantity of product at a lower price and of better quantity for a given quantity of factors of production.

Economists generally refer to three types of productivity (Bruno, 1984) Balakrishnan and Pushpangadan, 1994, Rao 1996). They are productivities of labour, capital and total factor productivity (TFP). The first two are known as partial productivities. As per the definition of productivity, partial productivity is computed by dividing output by the respective input. Productivity can be also expressed, as the derivative of production function and each derivative will be taken with respect to each input. The former one represents average productivity while the latter is known as marginal productivity. TFP is found by dividing output by all the weighted inputs together (Brahmananda, 1982; Sharpe, 1995). Alternatively, TFP is expressed as a measure of ignorance or residue (Branson, 1978). It is expressed as the difference between output and the sum of the productivity of all inputs. (Solow, 1958, Christensen and Jorgenson, 1970, Balakrishnan and Pushpangadan 1994, Rao 1996, Ahluwalia 1991).

The central concern of economist is to sort out the efficiency level of output (Sharpe, 1995). There are two types of efficiency, viz. allocative efficiency and technical efficiency. (It may be noted, as shown earlier, that any point on the PPC has a corresponding productivity level). Allocative efficiency is the conventional approach that is referred as the tangency between the price curve and PPC. This approach advocates attaining the tangency point for greater allocative efficiency. It mainly explains the need for moving along the production frontier to reach the best point of allocative efficiency. Technical inefficiency exists when firms can produce more with given inputs, or need less factor inputs to produce a given output (Sharpe, 1995). Leibenstein (1966) calls this 'X-inefficiency' This approach emphasises the movement of firms to the production frontier as there will be significant gains in output. In this context, Sharpe (1995) argues that the concept of technical efficiency is more sensible. This concept is also useful in the dynamic sense, i.e. it is the rate at which the PPC moves out overtime.

The popularity of the concept of technical efficiency in recent times has been due to two reasons. Firstly, the real market environment consists of many imperfections, whereas the traditional approach is based on the assumption of certainty and profit maximisation. Secondly, many techniques like stochastic frontier production function (SSPF) are in vogue nowadays to measure technical inefficiency (Sharpe, 1995).

While discussing the tools relating to regional development, it is argued that the efficiency-equity question is a vital aspect to be touched upon. Whatever may be the nature of efficiency it is pertinent to know the extent of regional variation and actual efficiency attained. As this research is designed to focus on the regional variations in productivity, it is proposed to study productivity variations in manufacturing of the selected states in India.

Once the concepts and tools for the study are identified, the next step is to discuss the issues related to measurement. This is the burden of the next section.

2.5 EFFICIENCY AND PRODUCTIVITY- MEASUREMENT ISSUES

Caves (1990, as discussed in Sharpe, 1995) points to the fact that efficiency is a relative concept while partial productivity can be expressed in absolute terms. Meanwhile, total factor productivity (TFP) is relative. To Caves, 'Plant labour efficiency is represented by the ratio of output per unit of labour in a given plant to the PPC of the industry, which can be proxied by the plant in the industry with the highest labour productivity level, that is the best-practice plant' (Sharpe, 1995). As the present study concentrates on the inter-state variations in the manufacturing productivity, the logic of comparing plant level productivity with the best practice plant in the industry can be adopted to state level comparisons. In other words, the labour productivity level of one type of industry or manufacturing as a whole in one state can be read corresponding to the best practice situation of a state. If the average productivity level of an industry or manufacturing in a state is close to that of the leading industry or state, the industry or manufacturing of the state may be considered relatively efficient. Here the average productivity levels may be weighed with the technical production possibility frontier of the leading industry or state. If there exists a large gap between average productivity levels and the best practice industry or manufacturing of a state, the industry or state in question is relatively inefficient. The same approach can be adopted in the cases of capital productivity.

If output is homogeneous in physical terms, labour productivity is computed as units of output per unit of labour. The case differs if output is heterogeneous. Different types of output may be aggregated in terms of prices and labour productivity can be expressed in money terms of output per unit of labour input. Total employment in the manufacturing can be used to measure labour (B.P. 1994).

In the case of capital stock also there are several issues in the estimation, which is a controversial subject both in theory and practice (B.P 1994). The debates on capital theory, which is known as the Cambridge controversy, have a very long tradition. Classicists who represented the surplus product approach viewed the determination of profits and prices independent of quantity of capital (Kurz, 1990). That is, the quantity of capital would be determined by accumulation and economic and social development. Picking the thread from Ricardo, Marx tried to measure capital in terms of labour values.

Marginalist or neo-classicists took up the discussion against the background that the forces of supply and demand determined all prices. They tried to view the service of capital and quantity of capital (Kurz, 1990). They attempted to fix the rate of profit as the price of the service of capital, while the quantity of capital was determined independent of the price of its service.

One of the crucial issues in the deliberations of capital theory was the measurement of capital in value terms. Both surplus product and marginalist approach confronted this issue. In order to measure capital in value terms, it was necessary to express it in a standard value (Kurz, 1990). Marginalists expressed capital in two dimensions, viz. one in terms of consumption goods and the other one in time content. The argument in favour of the former one was that capital emerged from the investment of past savings or abstention from consumption. Hence capital was measured in terms of some composite units of consumption goods. As far as the time content is concerned, capital could be increased either by using more of it or by lengthening the period of time for which it was invested. Sraffa (1960) made a consistent formulation of the classical surplus approach to the problem of capital and distribution. Sraffa's explanation starts from a given system of production in use in which commodities are produced by means of production. Assuming wages are paid at the end of production period, in the case of single - product industries and with gross outputs of the different products all measured in physical terms and make equal to unity by choice of inputs, we have the price system (Kurz, 1990)

$P = (1 + r)\,Ap + wL$, where P = column vector of normal prices;

r = the rate of profit;

A = the square matrix of material inputs;

L = the vector of direct labour inputs; and

w = wage rate.

Joan Robinson attacked the concept of aggregate production function on the ground of Wicksel effect. With capital as a value magnitude Wicksell showed that the rate of interest is generally not equal to marginal productivity of capital. This discrepancy is due to the revaluation of the capital stock entailed by a change in distribution. Despite the heterogeneity of capital goods, Samuelson (1962) tried to rationalise neoclassical assumption of single homogenous factor called capital. For this Samuelson constructed 'a surrogate production function' based on equal input proportions where the equality between marginal productivity and the rate of interest can be maintained.

The role of technology in the production system generated new waves of thought in the debates on capital theory. It was around reswitching, which implies selection of the same technique of production both at high and low levels of interest rate and another one at an intermediate level. The reswitching case violates four important properties of the neoclassical parables (Baumol, 1987). Firstly, there is no unique ranking of techniques based on successive reduction in interest rates. Secondly it contradicts to claim that marginal returns to capital must always diminish. Thirdly, the society will opt for the same technique with the present and future output levels at a high and low rate of interest. Lastly, it violates the neoclassical conclusion that a rising interest rate will always decrease the capital -output ratio. Sometimes the same process may yield the same output with the same amount of capital both at high and low interest rates.

Meanwhile attempts were made to accommodate reswitching with the neoclassical theory. Bruno, Burmeister and Sheshinski (1966) drew an analogy between reswitching and the long known probability of the existence of multiple internal rates of return. But reswitching is based on a macro framework and the other has a partial 'fixed price' framework. Hahn (1982) even contented that Sraffa's system could be considered as a special case of general equilibrium theory due to Sraffa's concern with uniform rate of profit. Thus the debates on capital theory continue without settlement.

2.5.1 MEASUREMENT OF CAPITAL IN INDIA

This section gives a brief survey of the issues in connection with the measurement of capital in Indian Industry, especially the manufacturing sector. The main issue relates to the question of gross Vs net capital stock (Hashim and Dadi, 1973, Ahluwalia, 1985). The debate is in favour of net capital stock but there should be a measure of true economic depreciation. It is argued that estimates of depreciation followed in the early studies in India were either tax based accounting concepts or based on certain rules of thumb (Ahluwalia 1985). The book vale of depreciation is in fact, an overestimation of reality. Hence there is a dominant view to consider the gross fixed capital stock instead of net capital stock (Hashim and Dadi, Goldar, 1981; Ahluwalia, 1985, Balakrishanan and Pushpangadan, 1994, Rao, 1996).

Conventionally, there are three methods of measuring capital in India. They are

1. Perpectual Inventory Method (PIM)
2. Census/ Survey of assets and

3. Insurance values (Mall, 1994). The latter two are used for specific purposes and have no popularity as a true measure of capital. But PIM is very popular with many authors in the studies of Indian Industry. PIM is based on three facts; they are (a) capital expenditure (b) whole sale price index for machinery and equipment and (c) service life of the assets.

PIM helps us to obtain gross fixed capital. It contains the following items (B.P., 1994). They are

1. land and improvement of land
2. building and construction
3. Plant and machinery and
4. transport and fixed assets.

B - P assumes that the gross net ratio for the land is unity (Gross net ratio is the ratio of purchase value to book value). In most of the studies, only fixed capital is considered. But Rao (1996) argues that exclusion of working capital is defensible only if its ratio to fixed capital remains unchanged overtime. As the reality is contrary to this, he considers productive capital that includes both fixed and working capital.

Another two important assumptions popularly followed in India deserve mention. The total capital stock for manufacturing is treated as homogeneous aggregates to form capital input (Ahluwalia, 1991; Rao 1996). Further, it is considered that the flow of capital is proportional to the (changing) stock of capital. These two assumptions are very much in the debates on capital theory among economists of various persuasions.

As noted early, estimates of capital stock in India initially followed the rule of thumb i.e., doubling the value of fixed capital stock at book value for the bench mark year to estimate the replacement cost figure (Ahluwalia, 1985).

It was Hashim and Dadi (1973) who carried out a pioneering work in estimating capital stock in Indian Industry. They analysed the balance sheet of 1000 firms covered by ASI and computed GNR for fixed capital. Hashim and Dadi did not provide GNR for certain industries. In such cases, B.P took GNR as twice the book value of fixed capital in the line discussed by Goldar (1986).

Ahluwalia (1985) referred to an important aspect in ASI data on fixed capital stock. The so-called fixed capital stock was virtually the net fixed capital stock on book value basis. She obtained the gross investment in the following form:

a) changes in net fixed capital stock between consecutive years- this was treated as the time series of net investment at current book value;
b) depreciation at book value was added with (a); then a time series of gross investment was derived. One of the problems of data on depreciation is that it is the historical book value and not the value at replacement cost.

Leading studies in Indian industry took 1960 as the benchmark year because Hashim - Dadi provided GNR ratio for most of the industries for that year. After computing the gross value of the fixed capital at purchase price, B- P also tried to assess the age structure of the assets. Hashim - Dadi further supplied the information on gross value of capital purchased during the period 1901 -1960. In this, the purchase value for each year was given for 1946 - 1960. B - P applied this proportion to the gross value of fixed capital in 1960 in order to obtain the year wise value of fixed capital bought in the past. The estimate for each year was then inflated using the current to -purchase price ratios given in Hashim - Dadi to obtain the gross value of fixed capital at replacement cost in 1960 prices. The investment figures were computed using the following formula.

$$I_t = (B_t - B_{t-1} + D_{ot}) / R_t$$

Where B = book value of the fixed capital

D = depreciation, and

R = whole sale price index of machines and machine tools

t=time period

B-P used the following formula to estimate capital stock at any year:

$$K_t = Ko + \sum_{t=1}^{T} I_t$$

Where I_t = investment in year 't' in 1960 price

Ko = Capital stock in the benchmark year in 1960 prices.

A word about depreciation may not be out of place at this juncture. It was already pointed out that the book value of depreciation represents only historical cost and not replacement cost. In addition the present system of depreciation rate lacks any economic reasoning. For instance, depreciation may be adjusted to get certain tax benefits or so. Hence it is essential to think of a meaningful economic depreciation rate, which is not an easy task.

There are three methods of fixing depreciation rates. One is to opt for certain rates, which have standard acceptance in other cases. Then one may make it sure that it is appropriate to the context. This is known as exogenously determined depreciation rates. The second option is to generate suitable rates from the data itself. It requires the following assumptions (a) all the firm's capital stock has useful life L_t; (b) firms use straight line depreciation rate dt = $2/L_t$. Then

$$L_t = GFA_t \ / \ DEP_t$$

Where GFA = gross fixed assets, and

DEP = the depreciation provision in year 't'

This method is known as endogenously determined rates. The third one is named as a horse- shoe model. As per this, economic depreciation is zero during the life of machine and 100% at the end of the life of the machine. It is assumed that the initial condition is restored through repairs and maintenance. Even then, this method cannot capture quality difference in both capital and output. In addition, how is it possible to assume that a capital good is in tact until a particular period and collapses at a point of time?

Though PIM is generally accepted as the measure of capital stock in India alternative lines of thinking have development recently. It is known as fixed asset accounting simulation model (FAASM). It was developed by a Canadian expert, Jaffey in 1990 (Mall, 1994). FAASM makes it possible to infer service life of assets statistically using the data on their fixed asset account, the account balances and capital expenditure.

The simulation model has the following components viz.

accounting values,

equations representing the fixed accounting procedures that yield those values and service lives. FAASM bears the following advantage over PIM (Mall):

a) It accounts for changing vintage lives,
b) It uses a series of survival curves as against the conventional fixed life assumption,
c) It systematically and fully exploits the fixed assets accounts of the companies,
d) In simulation exercises, it adjusts for overcharging or undercharging of depreciation and also provides estimates of true capital consumption and
e) True profit estimates can also be derived residually.

FAASM is yet to get popularity in India. One question that remains is whether this can be extended to time series studies for longer period. Further, a meaningful estimation of capital needs to be started from the possible disaggregated level. It necessitates a large volume of data and time for processing the data. Therefore PIM is used in the present study. The concern of sub-section 2.4.2 is discussion of TFP

2.5.2 TOTAL FACTOR PRODUCTIVITY (TFP)

Partial productivity can only express the efficiency in the use of a single factor input. The over all improvements in efficiency are determined by the contribution of the all inputs. Apart from other factors, technical progress is the most important agent for the general improvement in efficiency. This is normally measured in terms of the average product of all inputs or the so-called total factor productivity (Sharpe, 1995; B-P, 1994). If partial productivity is the ratio between output and the relevant input, TFP is the ratio of output to a weighted combination of inputs. Kendrick method (1961) of TFP index was widely used in the initial days. Kendrick method is the ratio of output and the sum of combined inputs of labour and capital. The inputs are weighted by their base year remuneration and variable are expressed in real terms symbolically.

$$K_T = \frac{V_t}{W_O L_t + r_o K_t}$$

Where K_T - Kendrick index

V - Value added in year

W - Wage rate

r - return on capital

L and K - labour and capital respectively and subscripts 'o' and 't' for base period and particular year respectively. Kendrick method assumes a linear production function and hence, fails to accommodate the concept of diminishing marginal productivity of factors.

Solow index is another popularly used method to compute TFP This is based on the Cobb- Douglas production function. The function takes the following form.

$$q_t = A_t f\ (L_t, K_t)$$

Where A_t represents the multi-factor productivity or TFP

This is represented by shifts over time without the influence of the quantitative changes in inputs L and K. As per the Solow Index, TPFG is computed from the following identity.

$$At + 1 = At\ (1 + \frac{A'}{A})$$

Here the dot indicates the time derivative. This function involves a rigid assumption of unitary elasticity of substitution. To Solow (1964), elasticity of substitution is an important parameter in determining resource allocation, economic growth, and trade and income distribution. In order to overcome the difficulty of assuming unitary elasticity, Solow and others (1961) developed the constant elasticity of substitution (CES) production function. It implies that elasticity will be constant along an isoquant but can vary from industry to industry. Assuming this, TFP in CES production function can be computed as in Cobb - Douglas production function (Heath field and Wibe, 1987). Both these functions assume Hicks' neutral technical progress, which implies that L/K is constant when PK/ PL is constant (P stands for the price of the corresponding variable).

Further theoretical and empirical refinement took place in the study of production function. Thus Christenson and Jorgenson (1970) developed the translog production function. This one does not insist on any particular numerical value in the case of elasticity of substitution. The value can vary at any level and time.

Assuming L and K as constants the translog production function reduces to log qt = m.t - log q_o where q is output and subscripts 't' and ' o' are time. By taking the time derivative, we get dqt/dt. 1/q = m which represents the technological progress or

TFPG. It may be noted that 'm' in Cobb - Douglas and CES production functions are dq/q (Heath field and wibe, 1987).

The precision in the computation of productivity relies on different variables involved in real terms. Hence it is necessary to look into the methodological issues related to deflation. The unsettled issues of current versus constant values are briefly presented in the section that follows.

2.6 TFP AND METHODS OF DEFLATION

As sketched in the first chapter, there is a great deal of literature regarding the estimation of TFP in Indian industry. It was also seen that the methodology of computing TFP was questioned by many writers. The normal procedure of computing productivity growth was based on the value added at constant prices as the measure of output (B.P 1994). The value added is deflated by index of manufacturing prices (Ahluwalia, 1985; Goldar, 1986). Based on the lines of argument put forward by Bruno (1984) and, Stoneman and Francis (1992), B-P argues that there will be a bias in the measure of values added if the price of materials relative to the price of output is not more or less constant over time. This bias will eventually reflect in the computation of productivity growth. This fact was admitted by Ahluwalia (1991) and Goldar (1992). But no attempt was made to adjust this bias by them mainly on the ground that sufficient data was not available in Indian context. Initially B-P and later Dolokia and Dolokia made serious attempts to adjust for changes in price of materials relative to the price of output.

The content of dispute revolves round the obtaining of real value added. It can be made available in two ways. One is the single -deflation method and the other is the double deflation method. In the former method, the value of output and the value of the input are deflated by the price index of output (B-P, 1994). This index is known as 'wholesale manufacturing price index' in India. The argument is that the single deflation method is sensitive to the changes in the relative price of material inputs. If the relative price increases over time value added as per single deflation method will have a sluggish growth compared to the double deflation method and vice versa. It implies that value added will be an underestimate, proportional to the rate of change of the relative price of raw materials. Eventually this will manifest as a slow down in productivity without affecting efficiency in production (B-P, 1994). In the opposite case, there will be an over estimation of value added and productivity growth without a change in the efficiency of production.

B-P in their pioneer work examined the above theoretical argument. They worked out the relative price of raw materials, which is the ratio of price index of raw materials to that of manufacturers for four decades since 1950-51. It is found that the relative price remained constant during the 1950s and had no change in the trend in the next decade. But there was clear direction and fluctuation during the seventies and eighties. The fluctuation was on the upswing in the 1970s and on the downswing in the last decade. As the theoretical proposition shows, B-P argued that TFP estimates in Indian industry were either an underestimate or overestimate during the last two decades. On this premise, B-P computed the correlation co-efficient between relative price of raw material and the TFP indices worked out by Goldar (1986) and Ahluwalia (1991). The result was significant which ratified the proposition that there exists an inverse relationship between relative price of raw materials and TFP index.

In this background, B.P estimated TFPG based on double deflation method and concluded that TFPG was more in the 1970s than in the 1980s. This virtually put an axe on the finding of Ahluwalia (1991) that there was a 'turnaround' in industrial growth in India. The 'turnaround' thesis was even projected as a positive outcome of transgressed liberalisation in the eighties. The work by Dolokia and Dolokia also supported the arguments of B.P Nevertheless, Ahluwalia (1994 and 1996) rebutted the finding on the basis of her earlier contention that sufficient and reliable data are not available in Indian context to apply double deflation method.

But the deliberations on this issue are not still exhaustive. Though UNO insisted member countries to switch over to double deflation method in the early seventies, it is objected by many on the ground that this method is also biased (Durand, 1994, Rao, 1996). As pointed out in the first chapter, double deflation method provides a meaningful measure of net output only under rigid and less realistic assumptions (Durand). There is no definite basis for choosing between single and double deflation and both are unattractive (Rao, 1996).

Meanwhile, Rao makes an impressive attempt to develop an alternative method to overcome the biased nature of deflation methods on TFP index.

Rao starts his analysis by questioning the very measurement of TFPG, which is conceptually ill -founded. He argues that a direct measurement of TFPG is not warranted if the production function is not separable. In other words, TFP measure is possible only on the assumption that production function is not separable in material and factor inputs. TFP, in this context, is related to value added and a natural question arises whether TFP can be computed without a direct reference to value added and separability assumption. Rao argues for specifying output as gross production instead of value added to find a solution to this puzzle. If output is treated as gross production, the TFP can give way to total productivity (TP). Assuming the production function as

$$Q_t = F\,(L_t, Kt, Mt, t) \qquad \ldots.(1)$$

Where L = labour, K = Capital, M = inputs and Q = gross output. From the growth form of (1) after differentiating w.r.t. time, we can obtain the 'Total Productivity Growth' (TPG) as

$$TPG = gQ - XgL - (1 - \alpha\text{-}\beta)\, gK - Bgm \qquad (2)$$

Where gi is the Rate of growth of the ith element in the production function, α the competitive (imputed) share of labour in gross output and β, the competitive share (imputed) of input. Rao also provides us an expression for TFPG in terms of TPG. It is given as follows:

$$TFPG = \frac{TPG}{1 - \beta} \qquad \ldots\ldots(3)$$

Originally he derives TFPG expression on value added method and later equation (3) is derived. His contention is that material inputs can be measured in real terms using an appropriate input price index and this calculation does not necessitate any measurement of value added. Even if the separability assumption is incorporated, TFPG can be very well computed from equation (3) without double or single deflation of current value. It may be remembered that measuring TFPG based on value added can generally have downward bias in the case of double deflation and an inverse bias to the change in the material- output price relative in the case of single deflation (Rao, 1996)

In the new approach also Rao questions the turnaround thesis of Ahluwalia. He points out that 1980s do mark a turning point but from positive to negative productivity. Thus Rao also reached the same conclusion as that of B-P whose estimates were a little higher Hence it is argued that the double deflation Indices has significantly smaller bias than the single deflation index, which may be considered a special case in Indian manufacturing.

Before concluding this part, one more point needs to be emphasized. It is the cyclical fluctuations in Indian manufacturing (Anandraj, 1992). This is often forgotten, but needs to be considered while computing trends. While B - P and Rao concluded that turnaround was negative during the 1980s compared to the 1970s; it is possible to observe varying levels of TFP index within the decade of 1970s. That is TFP index was higher during the later 1970s relative to the early part of the same decade. Further, industrial stagnation persisted in the late 1960s. This necessitates studying mid-term changes in the productivity growth of Indian manufacturing.

CHAPTER - 3

THE REGIONAL INDUSTRIAL SCENARIO IN INDIA

After having discussed the problem, hypothesis and methodology in the first two chapters we may now focus our attention on the general industrial scenario at the regional level. It is analysed with respect to the following indicators: intra-regional difference in industrialisation, ranking of different states in terms of various variables, relation among different variables, cost ratios and productivity. Let us start our analysis with a discussion of the intra-regional disparities in regional industrialisation.

3.1 Characteristics of intra-regional industrialisation

One of the striking features of the intra-regional industrialisation in India is the emergence of a few focal points and leading industrial regions. Calcutta became the first industrial focal point in India mainly on account of imperial patronage (Nag, 1993; Awasti, 1995). Later Bombay occupied the nodal place in the industrial map of India due to the presence of financial institutions, governmental support systems and proximity to the Western world (Pawar and Shinde, 1993; Awasti, 1995). Bangalore transformed itself into an industrial centre recently (Barai, 1993) while Ludhiana and Amristhar became the centres of industrial complexes in Punjab (Kishan, 1993). Ahmedabad and Vadodara are earmarked as the industrial constellations in Gujarat, which is one of the fastest growing industrial regions in India (De, 1993). Similar focal points can be found in other states also. All the major focal industrial points are schematically presented in table 3.1.

TABLE 3.1

FOCAL INDUSTRIAL POINTS AND MAJOR INDUSTRIAL REGIONS IN INDIA

(STATE-WISE)

STATE	FOCAL POINT (S)	MAJOR REGION (S)	REFERENCE PERIOD	REMARKS
Maharashtra	Greater Bombay	Greater Bombay Pune Thane	1986	55 percent of industries and 66 percent of employment in the three regions
Gujarat	Ahmedabad City Vadodara	Ahmedabad Saurashtra Valsad	1968 1965	50 per cent of factories and employment. 75 percent of the textile employment in Ahmedabad City
West Bengal	Calcutta Metropolitan area (Calcutta & Howrah)	Districts of Calcutta. 24 Parganas and Howrah Asansol, Durgapur	1986-87	More than 50 percent of factories in Calcutta metro region.
Karnataka	Bangalore	Bangalore, Mysore, Chitradurga, Belgaum, Dharwar	1981-82	50 per cent of large and medium units and 35 percent of small units in Bangalore 60 percent Of employment in large and medium units and 40 percent employment in small units in Bangalore.

Punjab	Ludhiana, Amristar	Districts of Ludhiana, Amristar and Jalandhar	1973 1983	59 percent of registered working factories in the regions
Uttar Pradesh	Kanpur Ghaziabad Agra	Western, Central and Eastern Uttar Pradesh	1982	64 percent of factories and 53 per cent of employment in western Uttar Pradesh. 75 percent of industrial units and 68 percent of industrial employment are urban biased.
Bihar	Singhbum Dhanbad	Chotanagpur South Bihar plain	1968	75 percent of industrial units and 80 percent of employment in the region.
Andhra Pradesh	Hyderabad	Coastal Andhra Telengana	1987	55 percent of medium and large-scale units and workers respectively in the Telengana region. It is 85 percent each if the two regions taken together.
Orissa	Rourekela, Talcher Rayadurga, Cuttack-Tajpur Industrial complex	Rourkela Hirakud and Coastal Regions	1980	70 percent of industrial workers in the two regions
Kerala	Cochin	Districts of Ernakulam, Trissur and Palakkad	2000	More than 50 % of employees, and, medium and large scale industries in these three districts

Table 3.1 reveals a subtle feature that industrial activities are converging to one or two focal points and industrial regions emerge out of the focal points in almost all the states. One general characteristic of these industrial complexes and regions is that they approximately accommodate 50 to 75 percent of industrial units and workers. Regions other than industrial complexes and regions mainly house agro-based, labour intensive and household industrial units and workers (Sinha and Singh, 1993; Awasti, 1995; Singh, 1994). Convergence has an urban orientation, which emanates from focal points. This reminds us of the theoretical argument made in Section 2 that regional growth depends on center-periphery relationship. But we do not prolong the discussion in this line, as it is not the main theme of the present study.

One question that arises here is whether intra-regional concentration of industrialisation continues unabated overtime. There is evidence against this viewpoint. There had been some improvements in the share of factories and employment in the industrially backward districts of Uttar Pradesh (Singh and Pandey, 1993). For instance, the percentage share of factories and employment in the backward districts increased from 17.77 and 15.34 in 1960 to 21.42 and 25.92 in 1982 respectively. The general trend in Punjab during 1973-1985 was an increase in industrial dispersal, but concentration continued for those industries which required bulky raw material or specially skilled manpower (Kishan, 1985). Backward regions registered higher growth in terms of employment and number of factories in Gujarat between 1968 and 1985 (Singh, 1994; De, 1993). Industrially backward districts in Maharashtra (except Greater Bombay, Pune and Thane) also marked improvement in these two magnitudes during 1961-1986 (Pawar and Shinde, 1993). There is a notable argument that higher growth rate in terms of employment and number of factories in the backward regions of Gujarat was only an arithmetic Phenomenon (because of initial low absolute value) (De 1993). Still, Gujarat has a better record of intra-regional diversification and industrialisation than in Punjab (Singh, 1994). Meanwhile, backward districts in Maharashtra acquired enhanced share in terms of number of factories and employment between 1961 and 1987 That is to say, the share in the number of factories and factory employment of the districts other than Greater Bombay, Pune and Thane went up to 45 and 34 percent from 29 and 20 percent during the period.

There are also situations where industrial growth did not make any visible impact on the intra-regional dispersal. Reddy and Rao (1993) point out that industrial backwardness of Rayalseema in Andhra Pradesh continues without change. The story of Santal Parganas in Bihar is also somewhat similar to that of Rayalseema. (Krishnamurthi; Mukherjee,).

Intra-regional difference can be viewed from the angle of geographical location of the specified major industries. It is worth to consider the view of Martin (1991) that those regions or locations must be conceptualized as real places rather than treating regions as 'controlled units' or part of linear economy. The real place is defined as real communities in real historical, social and cultural settings with real people in 'ordinary business life' It is considered here that the geographical location of the most of the industries in India occurred in the context of real places. Hence it is very important to consider the spatial concentration of industries in different states. The spatial pattern of industries is broadly formed around metal based and non-metal based industries. These two categories are further sub-divided into

12 groups and they are presented in table 3.2.The sub-divisions are made on the basis of the actual geographical concentration of industries. The locations are shown in charts 3.1 and 3.2.

Table3.2

SPATIAL CLASSIFICATION OF MAJOR INDUSTRIES

Metal Based Industries (MBI)	**Non-Metal Based Industries (NMBI)**
Electrical Machinery (EM)	Beverage and Tobacco Products (B and T)
Metal Product (MP)	ChemicalProducts and Pharmaceuticals(CPP)
Non-Electrical Machinery (NEM)	Food Products (FP)
Transport Equipment (TE)	Leather, Rubber and Plastic Products (LRP)
	Textile Industries (TI)
	Non-metallic Products (NMP)
	Paper Products (PP)
	Wood Products (WP)

The geographical distribution of major industries in major states is shown in Chart 3.1. The distribution provides us with the following conclusions. The Chart signifies the case of intra-regional concentration of industries. In nine states the mostly located metal-based industry is the Metal Products Industry. They consist of both industrialised and less industrailised states. Electrical Machinery Industry is mainly found in Tamil Nadu and Uttar Pradesh. West Bengal has more locations of Transport Equipment Industry. One expected result is the presence of more industrialised centres in the industrialised states (Maharashtra, Gujarat, Tamil Nadu and Uttar Pradesh). Andhra Pradesh is also included in this club. Uttar Pradesh has a better regional representation of all forms of metal-based industries.

In the case of non-metal based industries, the mostly located industry is CPP in nine states (Andhra Pradesh, Gujarat, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Uttar Pradesh and West Bengal). NMP is found prominent in Bihar, Karnataka, Uttar Pradesh and Orissa. Karnataka and Tamil Nadu have good locations of FP while Punjab and Uttar Pradesh have more representation of TI. Compared to metal-based industries, six states have more intra-regional representation of NMBIs (Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh). Like MBIs, more industrial centres are found in industrialised states (except in West Bengal) and in Andhra Pradesh and Rajasthan. It implies that NMBIs have more intra-regional dispersal than MBIs.

CHART 3.1
METAL BASED INDUSTRIES

STATE	EM	MP	NEM	TE	MIC*
Andhra Pradesh		Adilabad Kottagudem Ramachandr-apuram Machilipatnam Cuddapah	Tirupati Anantpur	Anantpur	Medak Hyderabad Visakhapatnam
Bihar		Patna Ghatsila			Bokaro Ranchi Jamshedpur
Gujarat		Bhavanagar Bharoch	Udhana		Ahmedabad Rajkot Vadodara Ankleshwar
Haryana	Sonipat	Yamunanagar Bhivani		Sonipat Gurgaon	Hisari Rewari
Karnataka	Gulbarga	Gulbarga Belgaum Hospet Shimoga Bhadravati Mangalore	Shahabad Harihar		Bangalore Mysore
Kerala	Ernakulam	Trissur Ernakulam		Palakkad Kottayam	Thiruvananth-apuram
Madhya Pradesh	Satna	Gwalior Retlam Indore			Bhopal Bhilai
Maharash-tra		Aurangabad Chandrapur Naneed Kolhapur	Aurangabad		Jaigon Nagpur Nasik Bombay Thane Ahamadnagar Pune Satara

Orissa	Hirakud Bhuvanesh- war	Rourkela Hirakud Talcher Cuttak Bhuvaneshw- ar			
Punjab	Raipur	Amritsar		Ludhiana	Hoshiarpur Chandigarh
Rajasthan	Jaipur Ajmer	Khetri Jaipur Ajmer			Alwer Kota
Tamilnadu	Mettur Neyveli Madurai Tuticorin Tirunelveli	Salem	Padi Mettur Salem	Padi	Madras Hosur Coimbatore Tiruchirappalli
Uttar Pradesh	Agra Shikohabad Rai Bereli Allahabad Naini Haridwar	Dehradun Aligarh Allahabad Naini Renukut Haridwar	Mathura Haridwar	Meerut Varanasi	Ghaziabad Faridabad Lucknow Kanpur
West Bengal	Haldia	Durgapur		Chittranjan Assansol Burnpur Durgapur	Haora Calcutta

Source: ttk Atlas MIC: Major Industrial Complex

CHART 3.2
NON - METAL BASED INDUSTRIES

STATE	B & T	CPP	FP	L	TI	NMP	PP	WP	IC*	OIC*
Andhra Pradesh		Mancheral Karim Nagar Srikakulam Vijayawada Machilipatnam	Nizamabad Rajmundry Vuyyuru		Vijayawada Anantpur	Anantpur	Sirpur Kamalpur Rajmundry		Medak Visakhapatnam Hyderabad	Secunderabad(LFP,NMP,TI) Kakinada(CP,TP,MP) Guntur(TI,FP,B and T)
Bihar		Sindri	Bhagalpur		Gaya	Katihar Dalmianagar Dhanbad Jharia Chaibara Mur Sindri	Dalmianagar		Bokharo Ranchi Jharia	
Gujarat		Kalol Sikka Kodinar Udhna	Junagadh Surat		Surat Udhna	Dwaraka Junagadh			Ahmedabad Rajkot Vadodara	Kandla(NMP,TI,CPP,CP) Porbandar(CPP,FP,TI,NMP) Bharuch(CPP,TI,L) Jamnagar(TI,FP,CPP,NMP) Bhavanagar(CPP,FP,TI) Bilimora(CPP,L,TI,PP)
Haryana		Panipat	Panipat							Yamunanagar(PP,FP,CPP) Fatehabad(NMP,TI,FP)
Karnataka	Hassan	Gulbarga Harihar Mandya	Belgaum Hospet Davanagere Hassan		Gulbarga Harihar Davanagre	Shahabad Wadi Hospet Shivnagar Bhadravati	Dandeli Bhadravati Mandya		Bangalore Mysore	Mangalore(NMP,CPP,FP)
Kerala		Kozhikode Palakkad Aluva Kollam		Kottayam	Trissur	Kozhikode Ernakulam	Kottayam Punalur	Aluva	Kochi Thiruvantha- puram	
Madhya Pradesh		Ratlam Satna Kaimori Neepanagar Raipur Durg	Gwalior Jabalpur Hoshangabad		Gwalior Nagda Ratlam	Kaimori Jabalpur Raipur	Neepanagar		Bhopal	Indore(CPP,FP,TI)
Maharashtra		Aurangabad	Sanghi	Chandrapur	Kalyan				Nagpur	Kolhapur(FP,L,TI)

		Chandrapur Kalyan		Aurangabad	Ratnagiri				Bombay Thane Ahemadnagar Pune	Solapur(NMP,CPP,TI) Nandeed(CPP,TI,PP) Adilabad(PP,TI,CPP)
Orissa		Rourkela Taicher Paradip Bhuvaneshwar Ganjam	Brajaraj	Bhuvaneshwar		Rourkela Hirakud Baragarh Taicher		Phulabam		Cuttak(NMP,TI,CPP)
Punjab	Jalandhar Nangal	Jalandhar	Rajpura	Ludhiyana	Dhariwal Amritsar Ludhiyana				Chandigarh	
Rajasthan		Khetri Sawai Madhapur Lakheri	Bharatpur		Jaipur Ajmer				Kota Udaipur	Bhilwara(NMP,CCP,FP,TI) Ganganagar(TI,B&T,FP) Jodhpur(CCP,TI,NMP)
Tamil Nadu			Mettur Mettupalayam Thanjavur Tuticorin Karaikudi		Padi		Mettur	Madras	Madras Coimbatore Tiruchirapilly	Madurai(FP,TI,WP)
Uttar Pradesh		Deharadun Rishikesh Mathura Bara Banki Gorakhpur Phulpur Naini Renukut	Meerut Aligarh Varanasi		Moradabad Hathras Bara Banki Rae Bareli Varanasi	Dehradun Rikesh Mathura Churk			Ghaziabad Faridabad Lucknow Kanpur	Bareilly(CPP,L,NMP,WP) Saharanpur(B&T,TI,PP)
West Bengal	Darjiling	Asansol Raniganj Durgapur					Shilaguri Raniganj		Haora Calcutta	Haldia(CCP,L,TI)

* MIC - Major Industrialised Centres
IC - Industrialised Centres
OIC - Other Industrialised Centres

The geographical location of metal based and non-metal based industries show that most of the locations are found in the leading industrial states like Maharashtra, Gujarat, Karnataka, Andhra Pradhesh, Tamil Nadu and Uttar Pradesh. It is revealed from the number of industrial centres as shown in the last columns of charts 3.1 and 3.2. It also gives the idea that industrial centres within the region (intra regional convergence) are mainly responsible for the high level of industrialization (table 3.1 and section 3.3).

The comparative picture that emerges from charts 3.1 and 3.2 is akin to the main theme of the present study. That is, inter-regional growth of industries was not uniform in India (section 3.1). Intra-regional growth also sounded the same style of performance. In short, there exists, both converging and diverging forces in the intra-regional industrial growth in India.

Inter-regional growth of industries can be viewed from a different perspective also. Relative state level shares of value added and technical collaboration in the industries can give a quick view of regional industrialisation. The value added figures are presented in table 3.3.

Table 3.3 Relative industrial share of 14 major states in value added in selected years

States	1962 S	1970-71 S	1975-76 S	1980-81 S	1985-86 S	1988-89 S	1993-94 S	1998-99 S
AP	2.94 (9)	3.96 (8)	4.99 (8)	4.89 (8)	5.42 (7)	5.26 (7)	5.55 (8)	5.50 (7)
Bihar	7.14 (5)	5.53 (7)	7.78 (5)	4.20 (9)	5.38 (8)	7.44 (5)	7.61 (4)	5.97 (6)
Gujarat	8.79 (4)	9.13 (4)	8.94 (3)	9.55 (4)	9.25 (3)	9.79 (3)	10.65 (3)	13 (2)
Haryana	-	3.16 (10)	2.3 (11)	3.75 (10)	2.93 (12)	2.91 (11)	2.39 (12)	3.76 (9)
Karnata	3.74 (7)	5.74 (6)	5.07 (7)	5.06 (6)	5.03 (9)	4.69 (9)	4.68 (9)	6.40 (5)
Kerala	2.66 (10)	2.87 (11)	2.5 (12)	3.27 (11)	2.91 (13)	2.74 (12)	2.05 (13)	2.83 (12)
MP	1.91 (11)	3.55 (9)	4.34 (9)	5.05 (7)	5.86 (6)	4.95 (8)	6.07 (6)	3.05 (11)
MH	27.1 (1)	26.78 (1)	24.6 (1)	22.65 (1)	25.88 (1)	23.72 (1)	24.43 (1)	21.52 (1)

Orissa	1.55 (12)	1.76 (14)	1.6 (140	1.66 (14)	1.45 (14)	2.55 (14)	1.90 (14)	1.43 (14)
Punjab	3.13 (8)	2.25 (12)	2.65 (10)	2.98 (12)	3.22 (10)	3.09 (10)	3.37 (10)	3.43 (10)
Rajasthan	1.10 (13)	2.10 (13)	2.44 (13)	2.8 (13)	2.73 (11)	2.55 (13)	2.69 (11)	2.46 (13)
TN	8.82 (3)	9.82 (3)	8.52 (4)	10.31 (3)	10.32 (2)	10.86 (2)	11.18 (2)	9.38 (3)
UP	5.68 (6)	6.86 (5)	6.50 (6)	6.28 (5)	5.96 (5)	8.59 (4)	6.53 (5)	7.55 (4)
WB	21.0 (2)	13.63 (2)	13.33 (2)	11.52 (2)	8.37 (4)	6.34 (6)	6.06 (7)	4.66 (8)

S-Share *Figures in brackets show ranks*

Table 3.3 shows that the relative share of major states broadly remained more or less same overtime with marginal changes. Maharashtra (MH) and Orissa are positioned almost at the top and bottom respectively. Other states changed their positions by one or two rank except West Bengal (WB), which had two features. Firstly, the relative industrial share of WB in value added substantially reduced to 4.66 percent in 1998-99 from 21.01 in 1962. Secondly, the rank of WB slipped to 8 from 2 during the same period. Meanwhile, Gujarat, Tamilnadu (TN) and Uttar Pradesh (UP) improved their positions to 2, 3 and 4 respectively by 1998-99.

Regional divergence persists in the case of approved foreign collaboration proposals also. This is shown in Table 3.4.

Table 3.4 State-wise Breakup of Foreign Collaboration Proposals Approved during the August 1991 to January 1997

States	No. of proposals	Ranks	% of the total
AP	439	5	4.23
Bihar	69	13	0.67
Gujarat	548	4	5.27
Haryana	414	6	3.99
Karnataka	689	3	6.65
Kerala	104	12	1
MP	192	10	1.85
MH	1355	1	13.08
Orissa	77	14	0.74
Punjab	105	11	1.01
Rajastan	193	9	1.86
TN	812	2	7.84
UP	395	7	3.81
WB	271	8	2.61
Total	10359		

Source: Report of ministry of Industry, Govt of India, 1998

Maharashtra acquired maximum share (13.08) of foreign collaboration proposals between 1991 and 1997.Around a quarter of such proposals flowed to the three top rank states (Maharashtra, Tamil Nadu and Gujarat) during the same period. Meanwhile, the three bottom rank states (Orissa, Rajastan and Kerala) could attract only less than four percent such proposals during the reference period. Thus foreign capital indirectly fostered the regional divergence in the level of investment in manufacturing during the post-liberalised period.

3.2 Level of Industrialisation

There are several indicators of industrialisation (Kuznets; Hirschman; Rostow; Williamson; Gupta; Sekhar; Awsati). Considering the various aspects in literature, we may take into account the following variables as indicators of industrialisation:

1. Gross value of output (VO)
2. Value added (VA)
3. Number of factories (NOF)
4. Level of employment (NE)
5. Levels of fixed capital (FC), working capital WC) and productive capital (PC)

Major states in India will be ranked in terms of different variables to gauge the extent of regional differences in industrialisation. The data relating to the ranking of these states are presented in Table 3.5.1 to 3.5.17 The comparative features are discussed in the following passages for selected years from 1960 to 1998-99.

The absolute figures of different variables are ranked from one to 14 for major states. This enables us to categorize these states into three groups: top, middle and bottom. The positions are more explicit at the top and bottom groups. Hence they are taken for detailed discussion.

MH , WB , Gujarat, TN and UP are the top rank industrial states. Their rankings with respect to different variables are given below.

Table 3.2.1 Ranking of Top Industrilised States

1962

States	VO	VA	NOF	NE	PC
MH	1	1	1	1	2
WB	2	2	2	2	1
Gujarat	3	3	3	3	5
TN	4	4	4	5	6

Table 3.2.2

1970-71

States	VO	VA	NOF	NE	FC	WC
MH	1	1	1	1	1	1
WB	2	2	4	2	2	2
Gujarat	4	4	2	4	6	6
TN	3	3	3	3	4	3
UP	5	5	6	5	3	5

Table 3.2.3**(1975-76)**

States	VO	VA	NOF	NE	FC	WC
MH	1	1	1	1	1	1
WB	2	2	5	2	5	2
GUJ	3	3	2	4	4	7
TN	4	4	3	3	6	5
UP	5	6	6	5	3	6

Table 3.2.4**(1980-81)**

States	VO	VA	NOF	NE	FC	WC
MH	1	1	1	1	1	1
WB	4	2	5	2	5	5
GUJ	2	4	2	5	4	4
TN	3	3	3	3	4	3
UP	5	5	6	4	3	3

Table 3.2.5**(1980-81)**

States	VO	VA	NOF	NE	FC	WC
MH	1	1	1	1	1	1
WB	4	2	5	2	5	5
GUJ	2	4	2	5	4	4
TN	3	3	3	3	6	2
UP	5	5	6	4	3	3

Table 3. 2.6(**1985-86**)

States	VO	VA	NOF	NE	FC	WC
MH	1	1	1	1	1	1
WB	4	4	7	3	5	6
GUJ	2	3	4	2	6	2
TN	3	2	4	2	6	2
UP	5	5	5	5	2	3

Table 3. 2.7(**1988-89**)

States	VO	VA	NOF	NE	FC	WC
MH	1	1	1	1	1	1
WB	5	6	3	8	5	7
GUJ	2	3	6	4	4	4
TN	3	2	2	3	3	2
UP	4	4	4	5	2	3

Table 3.2.8(**1993-94**)

States	VO	VA	NOF	NE	FC	WC
MH	1	1	1	1	1	1
WB	7	7	8	5	6	9
GUJ	2	3	4	6	2	3
TN	3	2	2	2	5	4
UP	4	5	5	4	3	5

Table 3.2.9 (1998-99)

States	VO	VA	NOF	NE	FC	WC
MH	1	1	2	1	2	1
WB	8	8	8	5	12	12
GUJ	2	2	3	4	1	2
TN	3	3	1	2	5	3
UP	4	4	5	6	3	4

Maharastra tops the list throughout the period except in one or two points of time. WB Stands next to MH in 1962 and 1970-71.Since 1970-71, the position of WB started changing .The position of WB in terms of number of factories (NOF) stepped from two to eight. This trend later embraced fixed capital (FC) in 1975-76 and output variables in the 1980s and the 1990s. Gujarat and TN tried to catch up with MH and WB with interchanging positions (2nd, 3rd and 4th) in many cases. UP also follows the same path of Gujarat and TN, and the former occupies a better position in capital than the latter. TN improves its rating in terms of NOF and employment in the 1980s and the 1990s. Gujarat captured top position in FC by 1998-99. On the whole, Gujarat, TN and UP stepped into the shoes of the WB in the 80s and 90s.

Ranking of Bottom Ranked States

Table 3.2.10 (**1962**)

States	VO	VA	NOF	NE	PC
KERALA	11	10	6	8	11
ORISSA	12	12	13	12	12
RAJSTAN	13	13	12	13	13

Table 3.2.11 (**1970-71**)

States	VO	VA	NOF	NE	FC	WC
KERALA	11	10	11	10	14	10
HARYA NA	12	12	12	13	13	13
RAJSTA N	13	13	13	12	11	14
ORISSA	14	14	14	14	10	11

Table 3.2.12(**1975-76**)

States	VO	VA	NOF	NE	FC	WC
KERALA	8	9	10	9	7	4
HARYA NA	9	7	8	8	11	9
RAJSTA N	13	12	12	12	10	11
ORISSA	14	14	14	14	14	8

Table 3.2.13(**1980-81**)

States	VO	VA	NOF	NE	FC	PC
KERALA	11	10	11	10	13	11
HARYA NA	12	12	13	13	12	13
RAJSTA N	13	13	12	12	10	14
ORISSA	14	14	14	14	14	12

Table 3.2.14(**1985-86**)

States	VO	VA	NOF	NE	FC	WC
KERALA	13	12	11	12	14	11
HARYA NA	11	11	12	11	12	13
RAJSTA N	12	13	13	13	10	14
ORISSA	14	14	14	14	13	12

Table 3.2.15 (**1988-89**)

States	VO	VA	NOF	NE	FC	WC
Kerala	13	12	12	11	13	13
Haryana	11	11	13	13	14	10
Rajastan	12	13	11	12	11	14
Orissa	14	14	14	14	8	11

Table 3.2.16 (**1993-94**)

States	VO	VA	NOF	NE	FC	WC
Kerala	13	13	10	10	14	14
Haryana	11	11	13	12	13	12
Rajastan	12	12	9	14	12	11
Orissa	14	14	14	13	10	13

Table 3.2.17 (1998-99)

States	VO	VA	NOF	NE	FC	WC
Kerala	13	12	10	11	14	13
Haryana	9	9	12	9	10	7
Rajastan	12	13	12	13	9	10
Orissa	14	14	14	14	11	13

Kerala, Haryana, Rajastan and Orissa are identified as the low ranking states. Most of the variables relating to these states ranked between 11 and 14(Tables 3.5.9 –17). Like Maharastra at the top, Orissa remained at the extreme bottom except in capital. A notable feature is the better ranking of Kerala and Haryana in 1975-76.Both the states ranked below ten in almost all variables in that year. Unfortunately, it did not become a trend later.

Moreover, any of the bottom rank states did not register a continuous fall as WB at the top did. Kerala has a comparable performance with WB in the 90s. Kerala ranked at the extreme bottom in terms of capital and 13 or 12 in VA during this period. A common feature noted in both the groups is that the higher ranking in terms of capital per se did not elevate the states' rank in output. Haryana registered improvement in terms of VA and FC in industrialization in 1998-99.It can be noted from table 3.4 that Haryana was able to attract foreign capital in the 1990s, which was comparable with better ranking states like UP and Karnataka.

The level of industrialisation based on the ranks shows that the top and bottom rank of the states remain broadly the same. WB is the only odd case. This shows that inter-state disparity got reduced only within the similarly situated states and not across the states. This seems to be a major flaw in the regional industrialistion of India. This point is further elaborated in chapter 4 relating to the convergence-divergence issues. Middle ranking states did not show any difference from the general pattern of the extremely rank states.

3.3 LEVEL OF INDUSTRIALISATION AND SYNCHRONISATION

An attempt is made here to understand whether there exists any similarity in ranking of states in terms of various variables referred to in the preceding section. Two variables are taken for one time comparison and they are plotted on graphs for visual comparison (see figures 3.1 to 3.7). If a particular state has the same ranking for two variables, the plotted points are located on the 45° line. This may be conveniently called synchronisation rule. Firstly, the case of GVO and VA can be considered. It is found that only eight states have same ranking in 1970-71, which was reduced to six in 1975-76 and five in the 1980s. One interesting feature of the synchronisation in the ranking of the states in terms of GVO and VA is that they are either ranked at the top or bottom. The degree of synchronization increased in 1993-94, especially among the low ranking states. It improved among the top rank states in 1998-99. Middle ranking states do not show any synchronisation except in 1988-89. It may be due to the difference in the input intensity of the industries in the middle ranked states. The deviating states are almost equally spread on the two sides of the 45° line. It implies that high and low input intensity nature of middle ranking states is somewhat equally distributed.

Next, the similarity in ranking between VA and NE is examined. Compared to GVO and VA, VA and NE show better coincidence at the state level ranking in 1970-71. There are only four states, which violate the rule of synchronisation. The trend changed in 1975-76 with seven states showing synchronisation. Out of these, three states rank at the extreme top and another three positions at the bottom like GVO and VA. Eight middle ranking states are equally distributed on the two sides of the 45° line. This trend almost continued in 1980-81 and 1985-86. More states were ranked below 45° line in 1988-89. It implies that employment in states are more than the value added in terms of ranking. The scenario changed in 1998-99. The synchronization phenomenon increased among low ranking states. That is, more states showed simultaneous improvement in the ranking of both employment and value added.

Value added is also compared with a constituent of NE, i.e., number of other employees (NOE). Two top ranking states and the bottom ranking state fulfill the criterion of synchronisation in the ranking of VA and NOE throughout the period of analysis. The rule is found in the case of five top ranking states in 1970-71 and six bottom ranking states in 1975-76. Generally middle ranking states do not satisfy the criterion of synchronisation between VA and NOE. Thus the relationship between VA and NOE is almost in tune with the first two cases described above.

As the number of factories is treated as one of the criteria for the level of industrialisation and production, the nature of relationship between VA and NOF is also looked at in terms of ranking. Only top and bottom ranking ones have the same ranking during the 1970s and 1980s. More states satisfy the synchronization rule during the 1970s than the 1980s. Synchronisation between VA and NOF occurred in the cases of two top and three low ranking states in 1993-94 and 1998-99 respectively. The ranking of states in terms of value added is marginally higher than the ranking in terms of number of factories. It implies that value addition relatively increases irrespective of the number of factories.

VA is also compared with productive capital that is an important factor of productivity. Only Maharashtra (top ranking) satisfies the synchronisation rule throughout except in 1998-99, while bottom ranking states display a more volatile nature (deviation distance from 45line) in 1970-71 and 1988-89. Certain top ranking states also exhibited volatile nature. Hence we cannot arrive at a definite pattern whether productive capital can elevate the ranking of a state in value added terms at this point of analysis. The is applicable in the case of fixed capital also.

Not only NE and PC are compared with VA but also the components of NE and PC are taken for comparison. Generally the synchronisation phenomenon is seen in the case of NE and NW except in 1985-86. All the middle ranking states, which are equally distributed on either side of the 45°line, deviated except the seventh one in 1985-86 and 1993-94. The consistency coincidence between NE and NW may be owing to the high weightage of NW in NE. Meanwhile synchronisation of ranking of states between NE and NOE is not so strong as in the case of NE and NW Three each of top and bottom ranking states show the coincidence in ranking 1970-71 and 1975-76. Later, only the first two and the last one maintained this rule. Others simply shifted in between. The inconsistency between NE and NOE is reflected in the case of NW and NOE. Only the top and bottom ranking states have consistency in ranking. Other states are changing their respective positions from synchronisation rule, period after period. But most of the states satisfy the rule at a point of time.

Let us now consider the relationship between FC and WC in terms of ranking. Only the top ranking (Maharashtra) state has consistency in the coincidence of ranking. In this context, the bottom rank states do not satisfy the rule of synchornisation except in

1998-99. This is an exception while considering the ranking between other variables in general. The bottom ranking states ~~show~~ deviate greatly from the 45° line. In short, there is no proper synchronization between FC and WC. Perhaps capital at constant prices may show a different picture, which will be discussed, in the next chapter.

3.4 Trends in Cost and Productivity

Cost and productivity may be considered as two sides of the same coin. There are two ways of achieving the optimal path of a firm (Kautsoyannis, 1978). One is the maximisation of output for a given cost and the other is the minimisation of cost for a given output. One way of looking at this phenomenon is understanding the trends in the two alternatives. This is very much evident in the conventional production theory. This can be illustrated graphically.

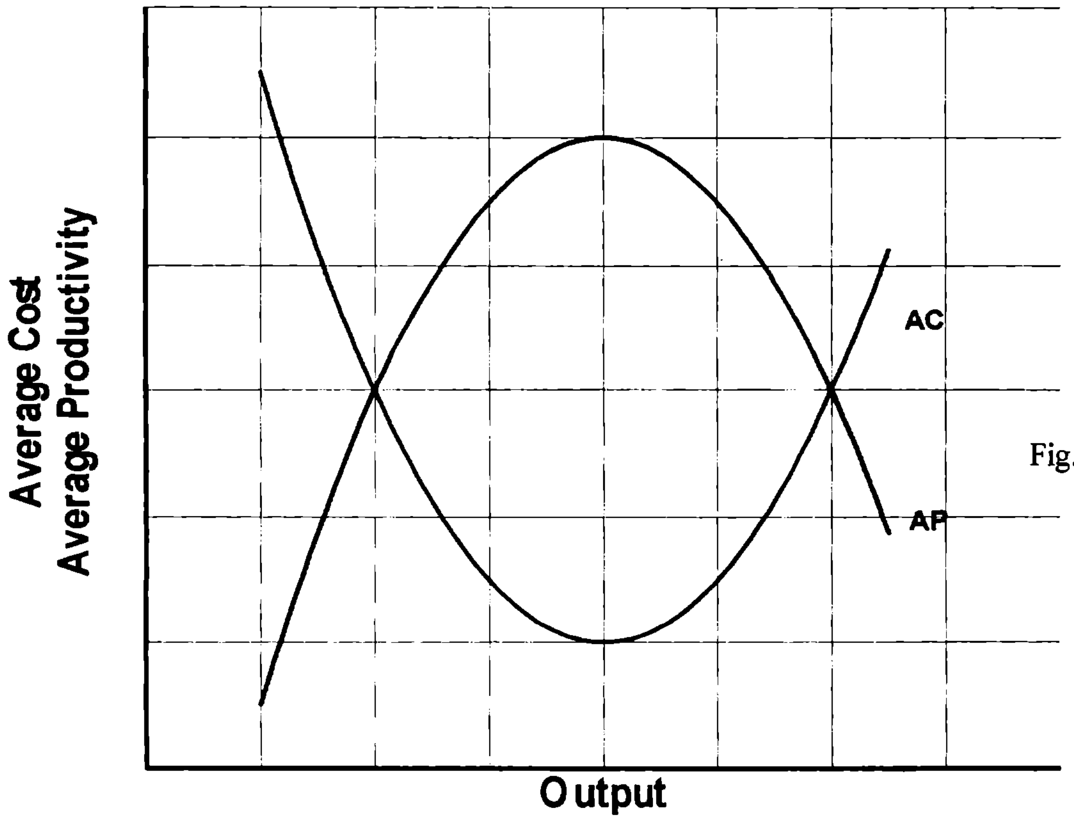


Fig. No: 3·8

In the above figure, average productivity (AP) has an inverted U shape and average cost (AC) has a U shape. The two curves in the figure represent the opposite trends in productivity and cost. Though the modern approach to cost theory does not fully approve of the U shape, the first two stages, falling and constancy in AC, is often articulated.

The algebraic explanation of the AP and AC concepts also points to these opposing trends. Symbolically

$$AP_L = TP/L = P.X/L$$

where,

AP_L stands for average productivity of labour. TP, L, P and X for total product, labour, price and physical output respectively.

Average cost (AC) may be expressed as

$$AC = TC/X = A/X + B/X = TFC/X + TVC/X$$

As the quantum of TFC is normally overwhelmingly higher than variable cost, any increase in output can push down the average cost initially. More over, TFC is constant during the initial phase of production. Any increase in output will push up average productivity upward as X is in the numerator The opposing trends can be represented in terms of marginal concepts also.

Let us examine the Cobb-Douglas production function. It has the following form

$$X = AK^{a1}L^{a2}$$

It ca be easily derived that marginal productivity of Labour,

$$MP_L = d\,X/dL = A\,X/L,$$

where X/L is the average productivity of labour. Following Reynolds (1988) we can write the marginal cost MC as

$$MC = P_L / MP_L \text{ ---------------------(2)}$$

Where P_L is the price of labour services.

Equation (2) shows that MC and MP have a reciprocal relationship. Further equation (1) explains the fact that MP and AP have normally positive relationship. In short, trends in both productivity and cost are treated in the following passages considering the two sides of the same issue.

Though ranking of states in terms of different variables enables us to gauge the variations of the level of industrialisation, it does not provide us with any inference on regional differences in productivity. We can also explore whether productivity variations have any impact on the divergence of the level of industrialisation, especially in terms of value added.

Simple measurement is used to compare cost and productivity in this chapter. Eight ratios are calculated to assess the variations in productivity and one ratio each is used to work out average number of factories per employee (NF/NE) and average fixed cost per employee (FC/NE). Six ratios are related to fixed cost (FC), working capital (WC) and productive capital (PC), total gross value (TG) and value added (VA) respectively. Two ratios stand for material productivity in terms of total gross value (TI/TG) and value added (TI/VA).

As the year-to-year variations are marginal in most of the cases, it is felt that a visual presentation will be more suitable to judge annual as well state-wise variations. The resultant graphs are given in figures 3.1a to 3.13a and 3.1b to 3.13b.

We may initially take up the average fixed cost per total gross value added. (FC/TG). The curves of FC/TG for various states display eight important characteristics. They are presented in the following chart 3.4.1.

Chart 3.4.1 **FC/TG**

NO	CHARACTERISTIC	STATES
1	General falling trend with moderate short term fluctuation	Karnataka Rajasthan Haryana
2	U shape	Orissa (falling upto 1983 and rising later)
3	Stability features	Tamil Nadu (1976-84) Andhra Pradesh (stability upto 1974 and the late 80s) Maharashtra (1976-84 and since 1989) Uttar Pradesh (upto 1975 and after 1985)
4	Short term fluctuations in general	Gujarat (randomness during 76-78) Punjab
5	Falling in the 70s and rising in the 80s	Kerala (upto 1983 and rose later) Tamil Nadu (falling first six years) Maharashtra (falling upto 1976, rising 84-87) Madhya Pradesh
6	Falling in the early 70s and rising in the late 70s	Bihar Madhya Pradesh
7	Rising in the 80s	Kerala Tamil Nadu Bihar Madhya Pradesh
8	Rise and fall between the mid-seventies and mid-eighties	Andhra Pradesh Bihar Madhya Pradesh

The relation between working capital (WC) and TG was also examined. Like FC/TG , WC/TG also has eight important features which are summarised in chart 3.4.2

Chart 3.4.2

WC/TG

No.	Characteristics	States
1	Continuous decline up to the 80s	Bihar, Gujarat, Karnataka and Haryana
2	Continuous rise up to the 80s	A P ,M H and Orissa
3	Straight line long term trend with mild oscillations	Rajastan,Punjab and Orissa
4	Stability features	M P, U P (Early 70s and late 80s),Gujarat except 76-78,T N up to 78
5	Regular oscillation	Kerala, Rajastan and Bihar
6	Volatile from the mid 70s to the mid 80s	U P and M P
7	Decline in the 80s	A P , Kerala (since 85),M H (up to 84)
8	Increase in the 80s	Haryana

The two previous charts show that there is no uniformity in the movement of both

FC / TG and WC / TG ratios. There is no specific pattern among top, middle and bottom ranking states. WC / TG was less than FC/TG due to the higher content of FC. U P had stability in both ratios almost in the same period. The stability feature of T N in these ratios was not uniform. In the 80s WC / TG even crossed FC /TG and this seems to be a unique feature of TN. Rajastan also experienced narrowing down of the difference between FC / TG and WC / TG.

The ratio between productive capital and total gross value added (PC / TG) is computed to get a picture of the overall of the position of the movements of the capital with output for different states. PC / TG almost moved with a change in both WC / TG and FC /TG in most of the cases. FC / TG was the main influential factor in states like AP (up to 1980), Bihar, Gujarat and Haryana. The influence of WC / TG on PC / TG was only in limited cases i.e., in U P and A P in the 1980s. PC / TG was more volatile during 1974 –83 in UP due to the relatively greater influence of WC / TG.

As the value added represents a better picture of growth and productivity we also present the nature of cost ratios in terms of value added .Let us start from FC / VA, the characteristics of which are shown in Chart 3.4.3.

Chart 3.4.3

No	Characteristics	States
1	Regular U shape	A P (since 74), Rajastan
2	Straight line trend	Bihar(70s) Karnataka,U P
3	Upward trend	M H and Gujarat(top ranked states)
4	Falling trend	Haryana,Orissa,Rajastan(70s),U P (up to 77, M P (up to 76)

General Characteristics of F C / V A

a) Declining trend was not uniform among the states;

b) Small oscillations were a common a feature;

c) Sharp rise in FC / VA during 84-86 when first dose of liberalisation took place;

d) Upward trend of the ratio is found in the two top ranked states.

In continuation to FC/VA, it is natural to consider WC/VA. It is shown in Chart 3.4.

Chart 3.4.4 WC/VA

No	Characteristics	States
1	Short term and long term U shapes	AP, Bihar, Orissa, Kerala, Rajstan,(76-77),Punjab
2	Short term U shape	Gujarat,Haryana, Karnataka, MP, and UP
3	Decline in the 70s	MH,Karnataka and Orissa
4	Increase in 70s	TN,Gujarat,Rajstan and UP(up to 76)
5	Decline in the 80s	Bihar and Karnataka,
6	Increase in the 80s	Kerala,UP,Orissa and Punjab
7	Both decline and increase in the 80s	Gujarat,Rajstan and Haryana
8	Very short term high degree volatility	AP,Kerala,MP and Punjab

General features:

a) Short- term and long- term U shapes were found among low ranking states.

b) Features were not always uniform with respect to period.

a) It was difficult to identify a specific pattern for top ranking states.

Specific features

a) Rajastan experienced long period of volatility (1976-83).

b) Karnataka had been displaying decline since 1973, while UP had a reverse experience.

The combined effect of FC and WC is examined in the case of productive capital (PC) to value added (PC/VA).

Chart 3.4.5 PC/VA

No	Features	States	Remarks
1	PC/VA moved with FC/VA	AP,Bihar,Rajstan (70s)	
2	PC/VA moved with both FC/VA and WC/VA	Hryana,Punjab, Rajstan (80s),UP	
3	Decline in the ratio	MH and MP(upto the mid-70s),Karnataka and Rajstan(70s)	
4	Rise in the ratio	Punjab(till1975), Kerala(up to 78)	
5	Rise in the 80s	Kerala,TN,Karnataka, MP,MH,Haryana	
6	U shape	Gujarat,MP,Punjab,UP	Short oscillations except Gujarat

General features:

a) The main determinant of PC/VA was FC/VA.

b) The ratio was mainly influenced by WC/VA in TN.

c) The ratio increased in the 80s on average.

As discussed in chapters 1 and 2, the role of inputs in measuring productivity had been a major point of debate in the 90s. Hence we take up the various cost ratios of input, i.e. TI/TG and TI/VA. The chart on TI/TG ratio is shown in three parts. The first, the second and the third parts deal with general features, a comparison of the movement of TI/TG with capital ratios and a comparison of the magnitude (level) between TI/TG and capital ratios respectively.

Chart 3.4.6a

TI/TG

No	Features	States
1	Broad stagnation	10 states
2	Upward trend	Karnataka,Kerala,MH,Orissa(76-86)

No	Features	States
1	No comparison possible possible	AP(except in the early 70s),Kerala,MP
2	Moving with capital ratios	Gujarat,AP(early 70s)
3	Moved with FC/TG	UP,MH(70s)
4	Moved with WC/TG	Orissa,Rajstan,TN
5	Moved with PC/TG	Punjab,UP,MH(70s), Kartaka(80s)

3.4.6b

Level of TI/TG with capital ratios

No	Features	States	Remarks
1	TI/TG> WC/TG and PC/TG	Haryana,Kerala,Kartaka	More than the capital three ratios in the 80s
2	TI/TG> WC/TG	Bihar,MP,Orissa,UP	
3	TI/TG< WC/TG	TN	
4	TI/TG> capital ratios	MH,Gujarat,AP	
5	TI/TG< capital ratios	Rajstan	

General features

a) The general trend was broad stagnation.

b) TI/TG had no general comparison with the movement of capital ratios.

c) This ratio was generally greater than the capital ratios.

d) TI/TG is less than WC/TG in TN.

3.4.7a

TI/VA

No	Features	States
1	Stagnancy in the early 70s	Bihar,Kartaka,TN,UP(UP to 82)
2	Decline in the early 70s	AP,Haryana,MP,Bihar
3	Increase since the mid-70s	Bihar,Haryana,Karnatka,MH,TN
4	Increase in the 70s	Gujarat,Rajstan,Kerala
5	Rise in the 80s	Karnataka,rajstan,Haryana,TN, Orissa(1982),AP(since 86)
6	Decline in the early 80s	AP,Kerala
7	Long-term decline	Bihar,Gujarat(since 84)
8	U shape	Orissa
9	Regular Oscillations	MP,Kreala(80s),Gujarat,Rajstan,TN

Comparison of the movement of TI/VA with capital ratios 3.4.7 b

No.	Features	States
1.	TI/VA had comparable with FC/VA and PC/VA	Bihar, Karnataka (81s), MP, Punjab, Rajastan, TN
2.	Comparable with FC/VA and WC/VA	AP
3.	Comparable with PC	Kerala

3.4.7. c

Comparing the level of TI/VA with capital ratios

No.	Features	States
1.	TI/VA >PC/VA and FC/ VA	AP (except the early 70s), Gujarat, Orissa, MH, TN (since 1975), Kerala (since 1976)
2.	TI/VA< PC/VA and FC/VA	Rajastan, MP (except 1976-80), UP (up to 1983), Haryana (since 1976)
3.	TI/VA<PC/VA in the early 1970s	Haryana, Kerala, TN
4.	TI/VA <PC/VA in the long run	UP, Bihar (up to 1978)
5.	Regular ups and downs of TI/VA with PC/VA in the 1980s.	Punjab, Karnataka
6.	Widening gap between TI/VA and PC/ VA around 1980.	AP, Gujarat, Karnataka

General Features.

a) There was a general decline or stagnancy in the TI/ VA ratio during the early 1970s.
b) The ratio increased later, especially in the 1980s.
c) Regular oscillations (five states) were found in both industrialised and less industrialised states.
d) This ratio moved mainly with fixed capital and productive capital ratios.
e) The ratio was greater than the FC/PC ratios in most of the states.

Next two ratios are related to factories per employees (NF/NE) and capital intensity (FC/NE). This ratio remained almost constant over time in most of the states. In short, there was an average uniform performance. Like NF/NE, fixed capital per employees (FC/NE) had also a particular pattern. There were three stages having a general pattern in the first and third stages.

Chart 3.4.8 **WC/VA**

Stage	No	Features	States	Remarks
First	1	Stagnancy in with minute variations in the early 70s	all states	
Second	2	Sluggish and gradual increase in the later70s and the very early 80s	AP,Gujarat,Karnataka, MP,Kerala,MH,TN , UP	Diverging levels
,,	3	Continuous rise in the late 70s and the very early 80s	Haryana,Orissa,Punjab, Rajastan	
,,	4	Sharp rise in the late 70s and the early 80s	Bihar	
,,	5	Sharp rise in the 80s	Most of the states	
Third	6	Very high in the 80s	MP	
,,	7	Stagnancy in the 80s	Bihar,Haryana, Karnataka,Rajstan	
,,	8	Stagnancy up to 78, gradual rise up to 86 and oscillated downward later	TN	

General features:

a) The second stage exhibited more divergence than in the other two stages.

b) Tamil Nadu showed a special pattern as in WC/VA.

3.4.2 Productivity

As is argued in the beginning of this section, the second most important aspect of the present study is an analysis of trends of productivity. It is appropriate to think on the nature of productivity trends for FC, WC, PC and TI with respect to both TG and VA. As the yearly changes are marginal in many cases, graphs are provided. The figures are

presented in F3.1b to 3.13b

Firstly, we can take up TG/FC ratios whose main characteristics are depicted

Chart 3.4.9

Chart 3.4.9a

TG/FC(70s)

No	Features	States	Remarks
1	Stagnancy or near stagnancy in the early 70s	Half of the major states: AP,Bihar,Punjab,Orissa, Rajastan,TN	Not highly industrialised
2	Increasing trend in the late 70s	Haryana,Karnataka,Orissa, Kerala,Rajastan,TN	
3	Declining in the late 70s	AP,Bihar,MH(sluggish),MP	
4	More oscillations in the 70s	Gujarat,UP	
5	Stagnancy in the 70s	Punjab	

General and special features for the 70s

a) Orissa had very low capital productivity in the early 70s.

b) Others (not mentioned in 1) had oscillating upward trend in capital productivity; they were mainly industrialised states.

e) Many low ranking states had a rising trend in capital productivity from the mid-70 to the early 80s.

Chart 3.4.9 b
TG/FC (1980s)

No.	Features	States	Remarks
1.	Oscillations in the early 1980s.	AP, Bihar, Haryana, Kerala, Punjab, Karnataka	
2.	General rising trend in the 1980s.	Bihar, Haryana, MP, Kerala, Punjab, Rajastan	
3.	General declining trend in the 1980s	Gujarat, MH, TN, Orissa	All top ranked except Orissa.

General Features.

a) Karnataka had oscillations both in the 1970s and 1980s.
b) Both industrialised and less industrialised states had rising and falling trends.
c) The fixed capital productivity mainly declined in the top ranking states in the 1980s.
d) Stagnancy in the capital productivity in the 1970s was dominantly among the less industrialised states.

Along with fixed capital productivity, working capital productivity is also considered. The main features are shown in chart 3.6.3

Chart 3.4.9c
TG/ WC

No.	Features	States	Remarks
1.	Rising in the 1970s.	AP, Gujarat, Haryana, MP, Punjab	
2.	Sluggish change in the 1970s.	All states except Punjab	
3.	Falling in the 1970s.	Bihar, Kerala. MH, Orissa, Rajastan, UP, TN	
4.	Rising in the early 1980s	Mainly in the less industrialised states	
5.	Falling in the early 1980s	Gujarat, TN	
6.	Rising in the late1980s	Gujarat	
7.	Falling in the late 1980s	AP, Bihar	
8.	Rising since the mid-1970s	Karnataka, MH, UP, Kerala, Rajastan, Orissa (up to 1986)	Long term Behavior
9.	Falling since 1977	Punjab, Haryana	Long term Behavior

General features:

a) Stagnancy phenomenon is not found as in the case of TG/FC.

b) It is difficult to delineate between industrialized and less industrialised states in the case of various features.

As already argued in the context of cost ratios, it is more realistic to look at ratios related to value added. Let us start with VA/FC. The main features are presented in Chart 3.4.11 The Chart also shows productivity level at the end of the 80s compared to the beginning of the 70s.

Chart 3.4.11

VA/FC

No	Features	States	Remarks
1	Stagnancy in the early 70s	AP,Bihar,TN	Less states compared to TG/VA
2	Rise and fall in the 70s	MP,MH	
3	Regular oscillation without any particular direction	Bihar,Haryana,Kartaka, UP	
4	Inverted U shape	Orissa,Rajastan	Low ranked states; Theoretical shape
5	Oscillating U shape	Punjab	Not a theoretical shape
6	Almost stagnant for two decades	AP	
7	Rising (73-76) and Stagnancy (76-83)	TN	

Level

No	Features	States	Remarks
8	50% of the states had higher Productivity	AP,Bihar,Rajastan,MP TN,Haryana,UP	Only slightly higher except in Bihar and Rajastan
9	NO change	Karnataka,Orissa, Punjab	
10	Lower	All other states	

General features:

a) The over all position was that the fixed capital productivity in terms of value added had not been changing appreciably for two decades since 1970. Further oscillation had no uniform pattern.

Now we may examine the case of working capital productivity (VA/WC). The general features and long term trends are shown in Chart 3.4.12

Chart 3.4.12

VA/WC

No	Features	States
1	Oscillating downward in the 70s	Gujarat,MP(upto 76),Rajastan,TN
2	Rising in the 70s	Karnataka,MH,Punjab(76)
3	Rising in the 80s	Gujarat,Karnataka,MH
4	Sluggish trend in the 80s	Punjab,TN
5	Declining trend in the 80s	Karnataka (79-83),Harayana(83onwards)

Long-term trend

No	Features	States
1	Oscillation without clear direction	Bihar,Haryana,Kerala,Orissa(wider),UP
2	Almost stagnating	AP
3	Rising	MH
4	Falling	TN(till 85)
5	Upward Oscillation	MP(76-86)
6	Decline with wider Oscillations	Orissa

General features:

Comparing the beginning and end points, VA/WC was either slightly lower or more at the end point than the beginning point. Oscillation was the general trend both in industrialised and less industrialised states.

It is useful to evaluate the combined effect of FC and WC. It is represented in Chart 3.4.13

Chart 3.4.13

TG/PC

No	Features	States	Remarks
1	Stagnant or near stagnant in The early like TG/FC	AP,Bihar,Orissa,Rajastan UP	Mainly less industrialised states
2	Sluggish upward trend in The early 70s	Haryana,Karnataka,MP	Mainly middle ranked states
3	Upward trend in the early 70s	MH,TN	Industrialised
4	Oscillation in the early 70s	Gujarat	
5	Upward or oscillating upward trend in the late 70s and the very early 80s	Majority of the states	
6	Sluggish downward in the late 70s and the very early 80s	AP,MP,Bihar	
7	Downward trend in the first half of the 80s	Gujarat,Karnataka,MP, MH,Orissa,UP	Mainly industrialised
8	Oscillating upward trend	AP,Bihar	
9	Upward trend in the late 80s	Majority of the states	
10	Downward trend in the late 80s	AP,Orissa,Gujarat,	

General features:

a) Stagnancy or near stagnancy was the main trend in the early 70s, while TG/PC showed a dominant upward trend in the late 70s.

b) The trend reversed in the 80s.

Like TG/PC, VA/PC also shows the combined effect of both FC and WC. The main trends are summarised in Chart 3.4.14

Chart 3.4.14

VA/PC

No	Features	States	Remarks
1	Rising in the early 70s	Majority of the states	
2	Short term Oscillation	General case	
3	Stagnancy (up to 73) declining later	TN	
4	Oscillating inverted U shape	Orissa	Reverse of cost and Similar to VA/FC
5	Repeated U shape	UP(6 to7 years)	Reverse to theoretical shape
6	Oscillating upward trend oscillating Downward trend since the mid-70s	MP,MH	
7	Oscillating downward trend (upto 78) and rise therafter	Kerala	
8	Sluggish upward	Haryana	
9	Oscillating since the mid-70s	Punjab,Gujarat	
10	Rise upto 1979 and decline in the 80s	Rajastan,Karnataka	

Influence of FC and WC on PC

No	Features	States
11	PC productivity moved with FC	All the states except AP
12	Moving with FC and WC in the early 70s	Punjab,Kerala

Level of the productivity between two time points

No	Features	States	Remarks
13	Slightly higher at the end point	Karnataka,MP,TN, Rajastan,UP	No pattern between industrialised and less industrialised states
14	Slightly lower at the end point	Gujarat,Haryana,Punjab Kerala,MH	,,

General Features:

a) A Majority of the states experienced rising trend in the early 70s.

b) Short term oscillation was a general phenomenon irrespective of the level of industrialisation.

c) PC productivity was mainly influenced by FC in almost all states.

d) The level of pc productivity did not appreciably change during 1970-89.

Finally we may touch upon the much debated ratio,i.e.input ratio(TG/TI). Its characteristics are shown in Chart 3.4.15

Chart 3.4.15

TG/TI

No	Featuers	States
1	Oscillating upward trend in the early 70s	AP,Gujarat,MP,Karnataka
2	Reverse (not much change) trend in the early 70s	Bihar,Kerala,Rajastan
3	Oscillating downward in the late 70s	All states except Karnataka
4	Oscillating upward in the early 80s	AP,Bihar,MP
5	Declining trend in the early 80s	Haryana,Kerala,MH,Orissa
6	Stagnancy in the early 80s	Punjab,TN,UP
7	Falling in the late 80s	AP,MP
8	Rising in the late 80s	Bihar,Gujarat,Karnataka

Long Term Features

No	Features	States	Remarks
9	Stagnancy or near stagnancy	Punjab,TN,UP(upto79)	
10	Sluggish downward	Haryana,Kerala,MP, Orissa,Rajastan	
11	U shape	Bihar	Wider oscillation during 74-81

General Features:

a) The general tendency of the early 70s and 80s reminded us the argument of B-P that input prices did not change much during the early 70s compared to the 80s.

b) Oscillation was general tendency.

c)There was no definite pattern between industrialised and less industrialised states.

d) There was a general decline in the ratio in the late 70s.

Comparison of TG/TI ratio with capital ratios

No	Features	States
12	Not comparable	Majority of the states
13	Comparable	Gujarat,UP,Rajastan and Punjab (80s)
14	Comparable with FC	Orissa,Rajastan
15	TG/TI< TG/FC	AP,Haryana,MH,Karnataka,Kerala, Orissa(80s),Punjab
16	TG/TI> TG/FC	MP,UP

Note: TG/TI was closer to TG/WC.

Level Comparison (beggining and end points)

No	Features	States
17	End points were either less or equal to the benchmark point	All states except Karnataka and MP Punjab and TN(equal)

*Note:*No particular pattern was observed between industrialised and less industrialised states.

3.5 Summary

The comparative picture that emerges is akin to the main theme of the present study. There exists both convergence and divergence forces in intra-regional industrial growth in India.

The level of regional industrialisation shows that Maharashtra and Orissa were consistently ranked at the top and bottom respectively during the reference points. West Bengal, Tamil Nadu and Gujarat registered seconds, third and fourth positions respectively till 1980-81. Rajasthan was ranked last but one position during the 60s and

70s. Tamil Nadu was elevated to the second position, while West Bengal was relegated to the third place. Both states displayed a peculiar behaviour in capital. Tamil Nadu had a higher ranking in WC and West Bengal recorded lower levels of capital. Whether the composition of capital had any influence on the ranking will be considered in the ensuring chapter. The middle ranking states had no stable positions in their ranking. Their positions shifted from time to time.

The synchronisation principle, as discussed in section 3.3, shows that the top and bottom ranking states have the same ranking in both GVA and VA. Others do not satisfy this rule. This may be due to the difference in input intensity. Extremely ranked states (the top and bottom) have coincidence between VA and NE as in the case of GVO and VA The second rank state also has the same behaviour. The general trend in the late 1980s showed that employment in the states were more than the value added in terms of ranking. Middle ranking states do not satisfy the synchronisation principle. The same trend was found in the case of VA and NOE. The relationship between VA and NOF showed that the value addition marginally increases irrespective of the number of factories. The synchronisation principle between VA and PC was not found except in the case of Maharashtra. That is, we cannot arrive at a definite pattern whether PC can elevate the ranking of a state in value added terms at this stage of analysis. The coincidence of NE and NW was found to be very strong but no consistency was seen in the case of FC and WC.

As far as the cost ratios are concerned, FC/TG showed regular fluctuations both in the case of industrialised and less industrailised states. WC/TG is lower than FC/TG as expected. Long term straight-line trend was also noted. Rajasthan and Tamil

Nadu have only a small difference between FC/TG and WC/TG. PC/TG almost moved with the change in both WC/TG and FC/TG in most of the cases. A Majority of the states has either short term (mainly higher ranking states) or long term U shapes (mainly low ranking states) for WC/VA ratio. FC/VA ratio generally had either straight line or declining trend. This Ratio rose sharply during 1984-86 when the first dose of liberalisation was injected into the Indian economy. PC/VA was mainly influenced by FC/VA.

A landmark in the general features of TI/TG ratio was stagnation for most of the states. The input intensity was generally more than the capital ratio, especially in the top two indstrialised states viz., Maharashtra and Gujarat. Meanwhile, TI/VA ratio displayed stagnancy and falling trends in the 70s, which could be attributed to the argument of Balakrishnan-Pushpangadan, that Indian manufacturing sector had a higher productivity in the 1970s than in the 1980s. The trend reversed in many cases in the 80s. The interesting feature in the trend of number of factories per employee (NF/NE) was its near stagnancy over time for all states except occasional variations. Capital intensity i.e., FC/NE was stagnating in the early 70s but generally rose in the late 70s. But the same ratio rose sharply in the 80s.

The fixed capital productivity had either stagnation or near stagnation mainly in less industrialised states during the first half of the 70s. Other major states experienced an oscillating upward trend in TG/FC during this period. The ratio went up in the low ranking states during the second half of the 70s. Fixed capital productivity mainly fell in the industrialised states in the 80s. Others experienced oscillations. There was no stagnancy in TG/WC ratio. Most of the less industrialised states showed an upward trend in the WC productivity in the first half of the 80s. Oscillation was the major trend in both FC and WC productivity.

Productivity with respect to value added is also considered. As in the case of TG/FC and TG/WC, oscillation was the general feature of VA/FC and VA/WC. Both upward and downward trends were shown by both industrialised and less industrialised states. The fixed and working capital productivities in terms of value added did not change appreciably for two decades since 1970. The top ranking states showed certain direction in working capital productivity and others did not have such a clear trend. PC productivity in terms of value added was influenced by FC productivity. The overall picture in the productivity pattern of capital was that we are not in a position to figure out any particular pattern in industrialised states.

The main feature of output-input ratio, which is a matter of intense current debate, is its oscillation without any definite trend. The trends in TG/TI ratio of the majority of the states were not found to be comparable with that of the productivities of FC, WC and PC. It was closer to the FC productivity than that of WC. The general pattern in the level of gross output-input ratio at the end point was either less than or equal to the benchmark point. We are not able to point out a particular pattern between the industrialised states and less industrialised states.

To sum up, convergence and divergence forces are found both in inter regional and intra regional levels of industrial growth in India. Maharastra, Gujarat, Tamil Nadu, Uttar Pradesh and West Bengal ranked at the top while Haryana

,Rajasthan, Kerala and Orissa Positioned at the bottom. The middle rank states shifted their positions from time to time. The synchronisation principle is seen in the cases of GVA –VA and NE-VA at the top and bottom rank states (Maharastra and Orissa) .Others do not consistently satisfy this principle. Number of factories and size of the investment need not elevate the rank of a state in terms of value added. Cost ratios almost display theoretical shapes, that is, U shape for WC/VA and straight line or declining trend for FC/VA. The latter ratio and capital intensity rose sharply during 1984-86 as a part of first dose of liberalisation. Meanwhile gross output to capital ratio fell in the industrialized states in the 1980s.

Oscillation was the major feature of output –capital ratio (both in terms of FC and WC) in most of the states. The stagnancy or declining trend of input intensity in the 1970s changed to a rising trend, in many cases, in the 1980s, as shown by BP (1994). Factories per employee were almost stagnant over time. The overall picture shows that one finds it difficult to draw a clear pattern of regional indutrialisation based on simple ratios at current values.

Most of the conclusions made in this chapter are provisional in the sense that computation is made on the basis of current prices. The results may vary once we may consider the same variable at constant prices. This is the burden of the next chapter.

Ranking of the states
Table-3.5a

1962 (CENSUS)

	V O	V A	Persons	P C	WOF
AP	9	8	7	9	7
Bihar	5	5	6	4	11
Gujarat	3	3	3	5	3
Haryana					
Karnataka	10	7	10	8	10
Kerala	11	10	8	11	6
MP	7	11	8	3	9
MH	1	1	1	2	1
Orissa	12	12	12	12	13
Punjab	8	9	11	10	8
Rajastan	13	13	13	13	12
TN	4	4	5	6	4
UP	6	6	4	7	5
WB	2	2	2	1	2

Ranking of the States
1970 -- 71

Table-3.5b

	GV	VA	NE	NW	NOE	NOF	FC	WC	PC
AP	7	8	6	6	7	5	8	9	8
Bihar	6	7	7	7	6	10	5	4	5
Gujarat	4	4	4	4	4	2	6	6	6
Haryana	12	12	13	13	13	12	13	13	13
Karnataka	9	6	8	8	8	8	9	7	9
Kerala	11	10	10	9	11	11	14	10	14
M.P.	8	9	9	10	9	9	7	8	7
M.H.	1	1	1	1	1	1	1	1	1
Orissa	14	14	14	14	14	14	10	11	10
Punjab	10	11	11	11	10	7	12	12	12
Rajastan	13	13	12	12	12	13	11	14	11
T Nadu	3	3	3	3	3	3	4	3	4
U.P	5	5	5	5	5	6	3	5	3

W.B.	2	2	2	2	2	4	2	2	2

Ranking of the States
1980 – 81

Table-3.5c

	GV	VA	NE	NW	NOE	NOF	FC	WC	PC
AP	6	8	6	6	6	3	8	9	8
Bihar	7	9	8	8	7	9	2	6	3
Gujarat	2	4	5	5	5	2	4	4	4
Haryana	12	12	13	13	13	13	12	13	13
Karnataka	8	6	7	7	8	8	11	9	10
Kerala	11	10	10	9	11	11	13	11	12
M.P	10	7	9	10	9	10	7	7	7
M.H.	1	1	1	1	1	1	1	1	1
Orissa	14	14	14	14	14	14	14	12	14
Punjab	9	11	11	11	10	7	9	10	9
Rajastan	13	13	12	12	12	12	10	14	11
T Nadu	3	3	3	3	4	3	6	2	6
U.P	5	5	4	4	3	6	3	3	2
W.B.	4	2	2	2	2	5	5	5	5

Ranking of the States
1975 – 76

Table-3.5d

	GV	VA	NE	NW	NOE	NOF	FC	WC	PC
AP	7	8	6	6	6	4	8	10	8
Bihar	6	5	7	7	7	9	2	3	2
Gujarat	3	3	4	4	5	2	4	7	4
Haryana	12	13	13	13	13	13	12	14	14
Karnataka	9	7	8	8	8	8	11	9	9
Kerala	11	11	10	9	11	11	13	12	13
M.P.	8	9	9	10	9	10	7	4	6
M.H.	1	1	1	1	1	1	1	1	1
Orissa	14	14	14	14	14	14	14	8	12
Punjab	10	10	11	11	10	7	9	13	11
Rajastan	13	12	12	12	12	12	10	11	10
T Nadu	4	4	3	3	3	3	6	5	5

U.P	5	6	5	5	4	6	3	6	7
W.B.	2	2	2	2	2	5	5	2	3

Ranking of the States
1985 – 86

Table-3.5e

	GV	VA	NE	NW	NOE	NOF	FC	WC	PC
AP	6	7	6	4	6	3	8	8	8
Bihar	7	8	9	8	9	9	5	6	5
Gujarat	2	3	4	5	4	1	4	4	4
Haryana	11	11	11	13	10	12	12	13	12
Karnataka	10	9	7	7	8	8	9	9	9
Kerala	13	12	12	11	13	11	14	11	13
M.P	8	6	8	10	7	10	3	7	7
M.H.	1	1	1	1	1	2	1	1	1
Orissa	14	14	14	14	14	14	13	12	14
Punjab	9	10	10	9	11	6	11	10	10
Rajastan	12	13	13	12	12	13	10	14	11
T Nadu	3	2	2	2	2	4	6	2	2
U.P	5	5	5	6	5	5	2	3	3
W.B.	4	4	3	3	3	7	7	5	6

Ranking of the States
1988 – 89

Table-3.5f

	GV	VA	NE	NW	NOE	NOF	FC	WC	PC
AP	6	7	5	3	6	2	6	6	6
Bihar	7	5	8	8	8	10	7	5	5
Gujarat	2	3	6	6	5	4	4	4	4
Haryana	11	11	13	13	11	13	14	10	13
Karnataka	10	9	7	7	7	7	12	12	12
Kerala	13	12	11	11	13	12	13	13	14
M.P	8	8	10	10	10	9	9	8	8
M.H.	1	1	1	1	1	1	1	1	1
Orissa	14	14	14	14	14	14	8	11	9
Punjab	9	10	9	9	9	6	10	9	10
Rajastan	12	13	12	12	12	11	11	14	11
T Nadu	3	2	2	2	2	3	3	2	3
U.P	4	4	4	4	4	5	2	3	2
W.B.	5	6	3	5	3	8	5	7	7

Table-3.5g

Ranking of the States 1993-94							
	GV	UA	NE	NW	NOF	FC	WC
AP	5	8	3	3	3	4	10
BIHAR	8	4	11	10	12	8	7
GUJARATH	2	3	6	5	4	2	3
HARYANA	11	11	12	12	13	13	12
KA	9	9	7	8	7	11	8
KERALA	13	13	10	11	10	14	14
MP	6	6	9	7	11	7	6
MH	1	1	1	1	1	1	1
ORISSSA	14	14	13	14	14	10	13
PUNJAB	10	10	8	9	6	9	2
RAJ	12	12	14	13	9	12	11
T.NADU	3	2	2	2	2	5	4
UP	4	5	4	4	5	3	5
WB	7	7	5	6	8	6	9

Table-3.5h

Ranking of States 1998-99							
	GU	VA	NE	NW	NOF	FC	WC
AP	5	7	3	3	4	6	9
BIHAR	11	6	12	12	13	8	8
GUJARATH	2	2	4	4	3	1	2
HARYANA	9	9	9	9	12	10	7
KARNATAKA	6	5	7	7	6	4	6
KERALA	13	12	11	11	10	14	13
MP	7	11	8	8	11	7	5
MH	1	1	1	2	2	2	1
ORISSA	14	14	14	14	14	11	14
PUNJAB	10	10	10	10	7	13	11
RAJ	12	13	13	13	9	9	10
T.NADU	3	3	2	1	1	5	3
UP	4	4	6	6	5	3	4
WB	8	8	5	5	8	12	12

Fig. 3.1

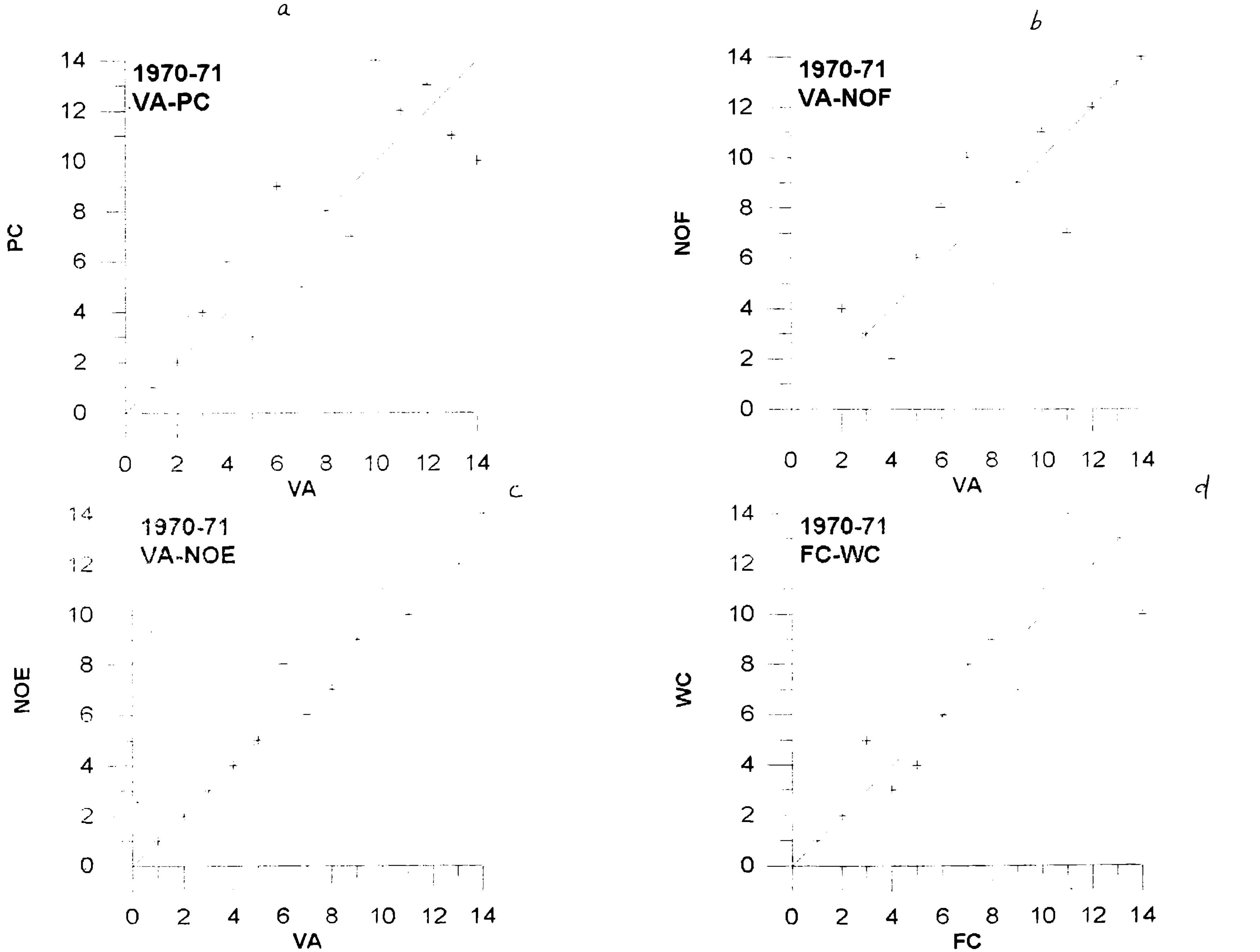
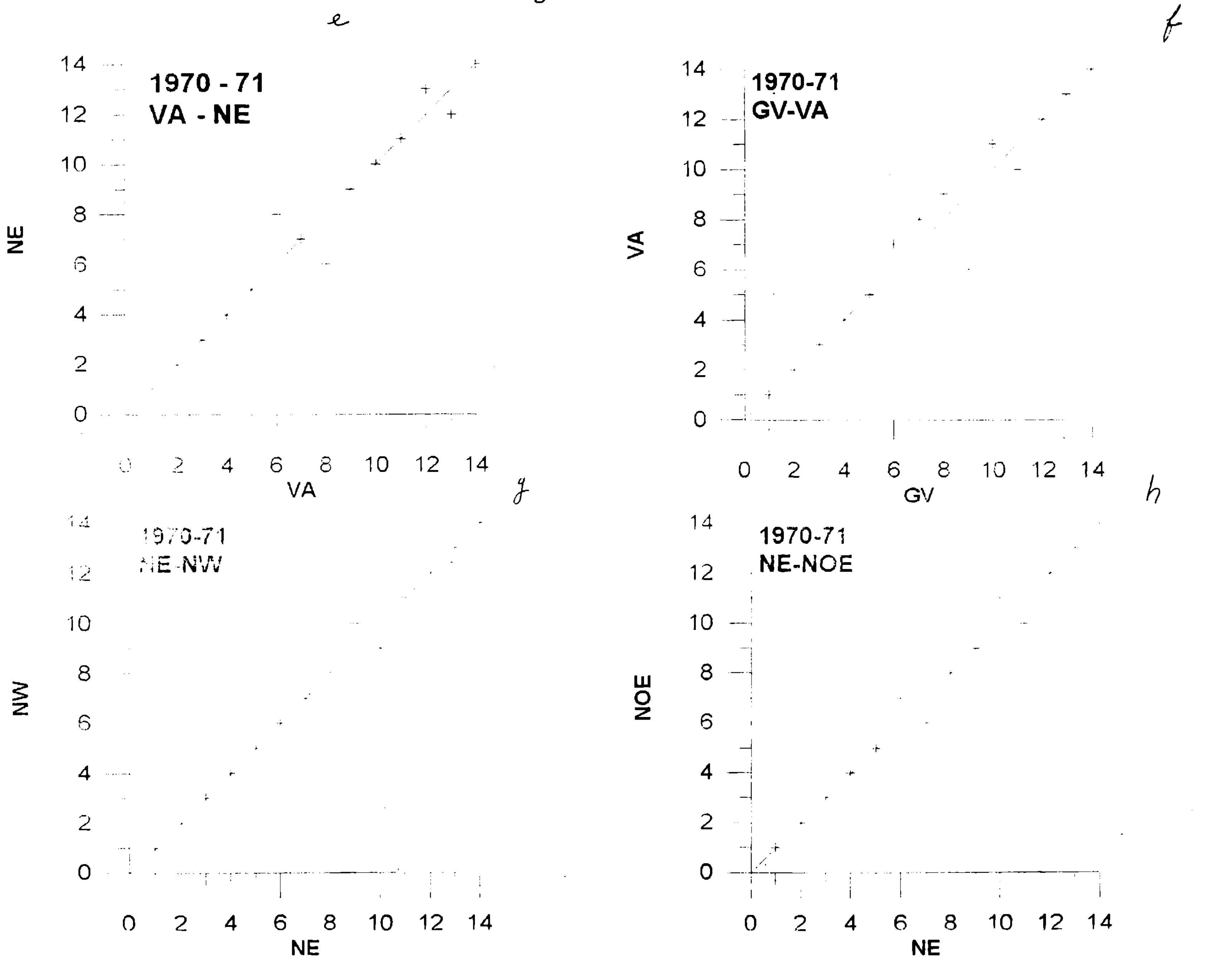

a
1970-71
VA-PC
PC
VA
b
1970-71
VA-NOF
NOF
VA
c
1970-71
VA-NOE
NOE
VA
d
1970-71
FC-WC
WC
FC

Fig. 3.1



e
1970 - 71
VA - NE
NE
VA
f
1970-71
GV-VA
VA
GV
g
1970-71
NE-NW
NW
NE
h
1970-71
NE-NOE
NOE
NE

Fig. 3.2

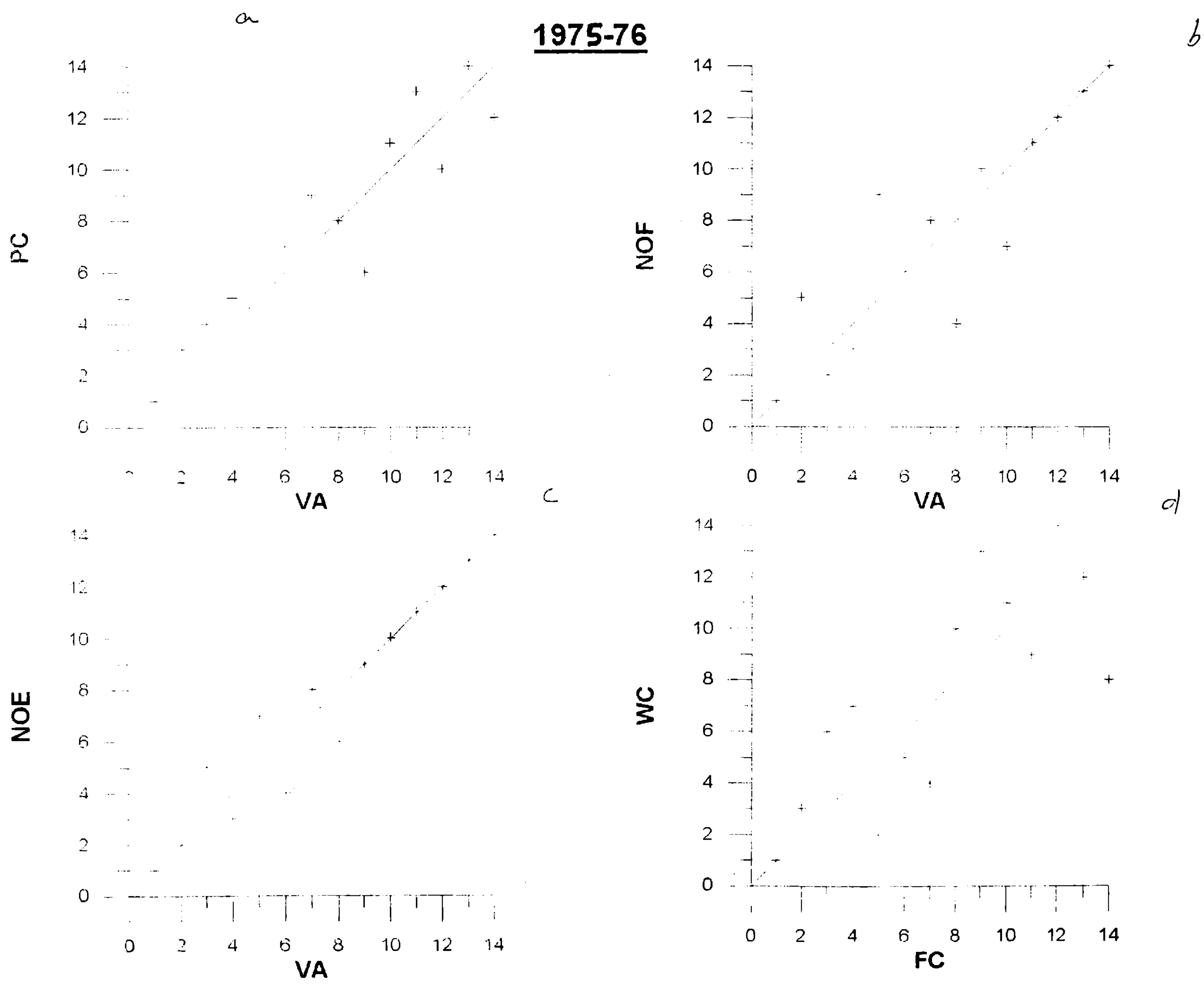


Fig.3.2

1975-76

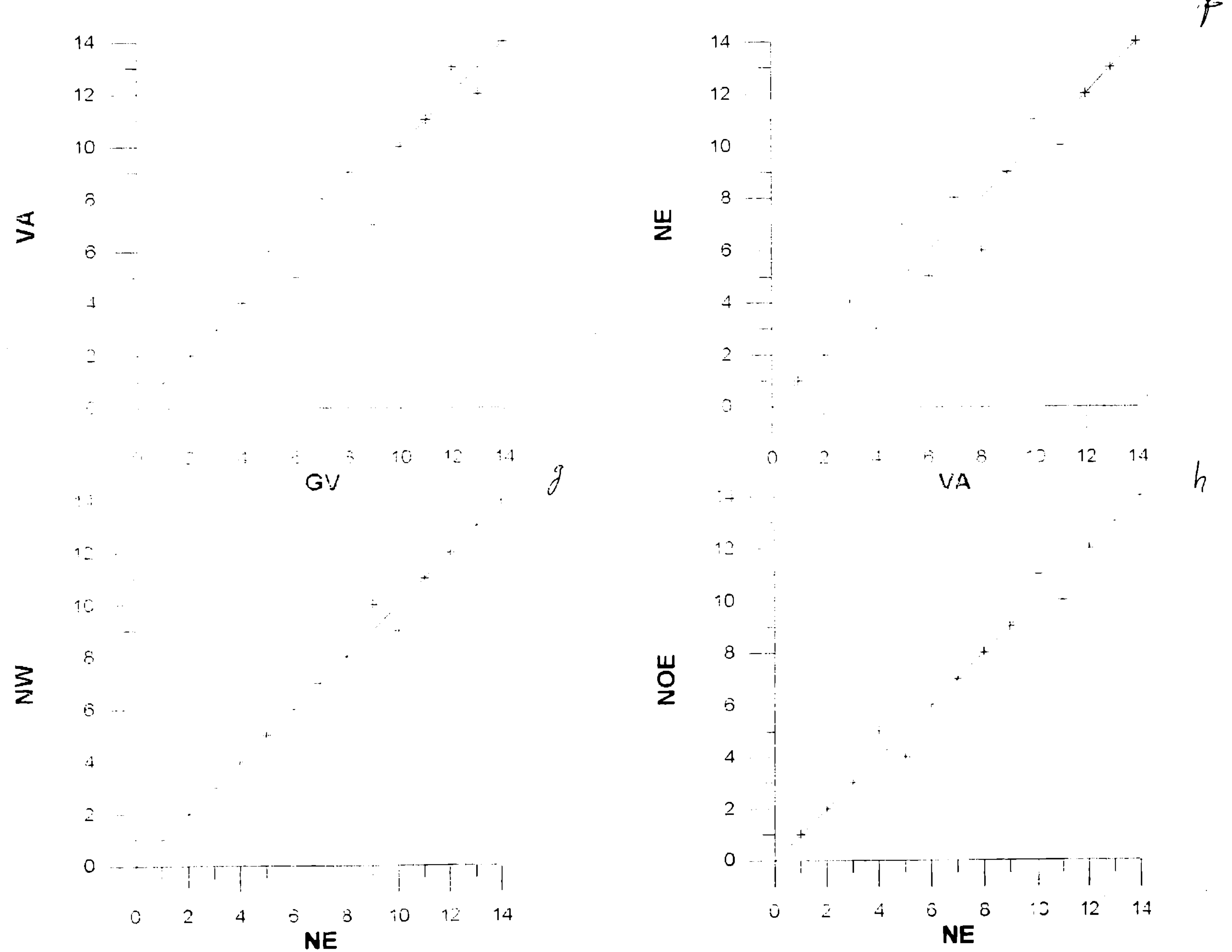


Fig. 3.3

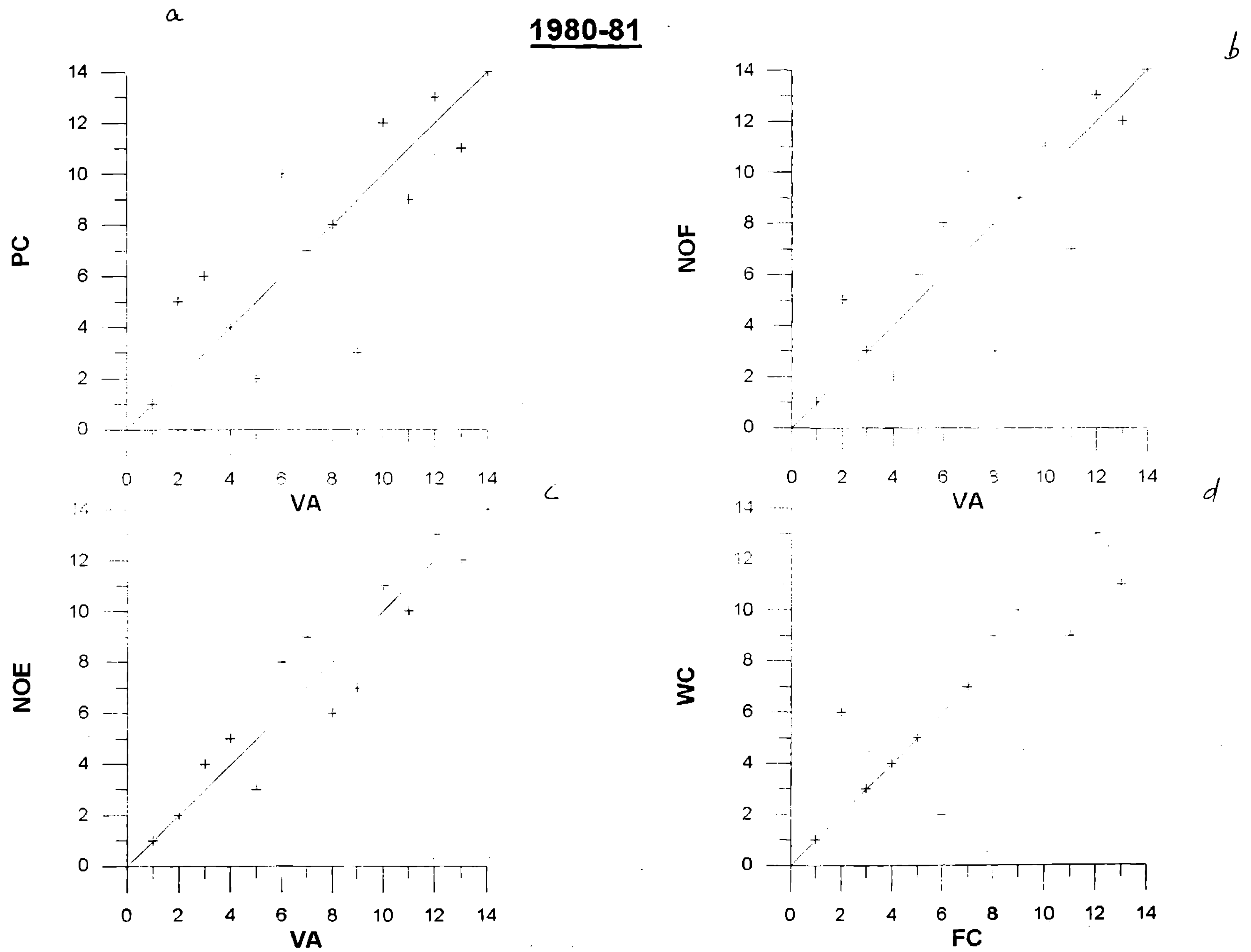


Fig. 3.3

1980-81

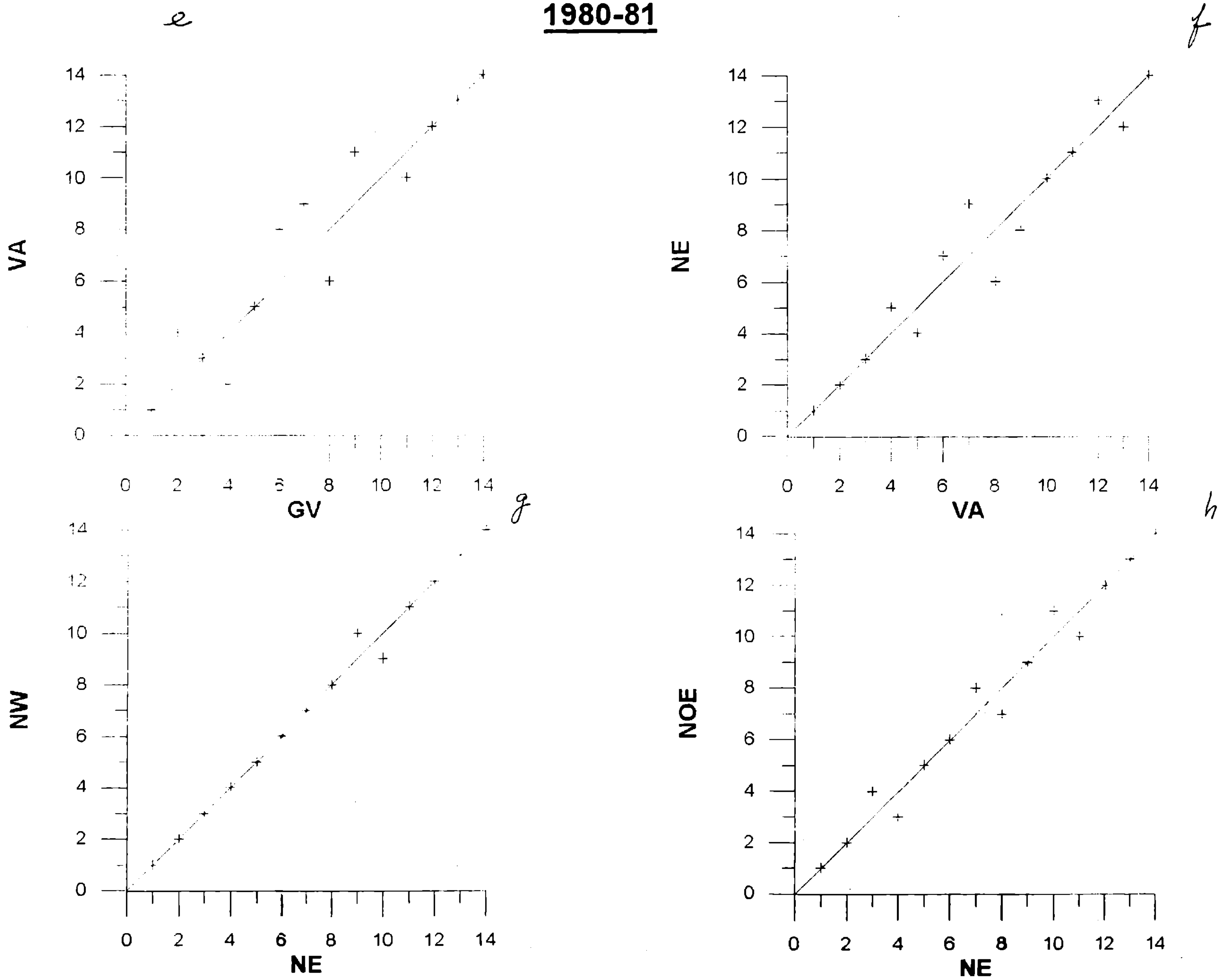


Fig. 3.4

1985-86

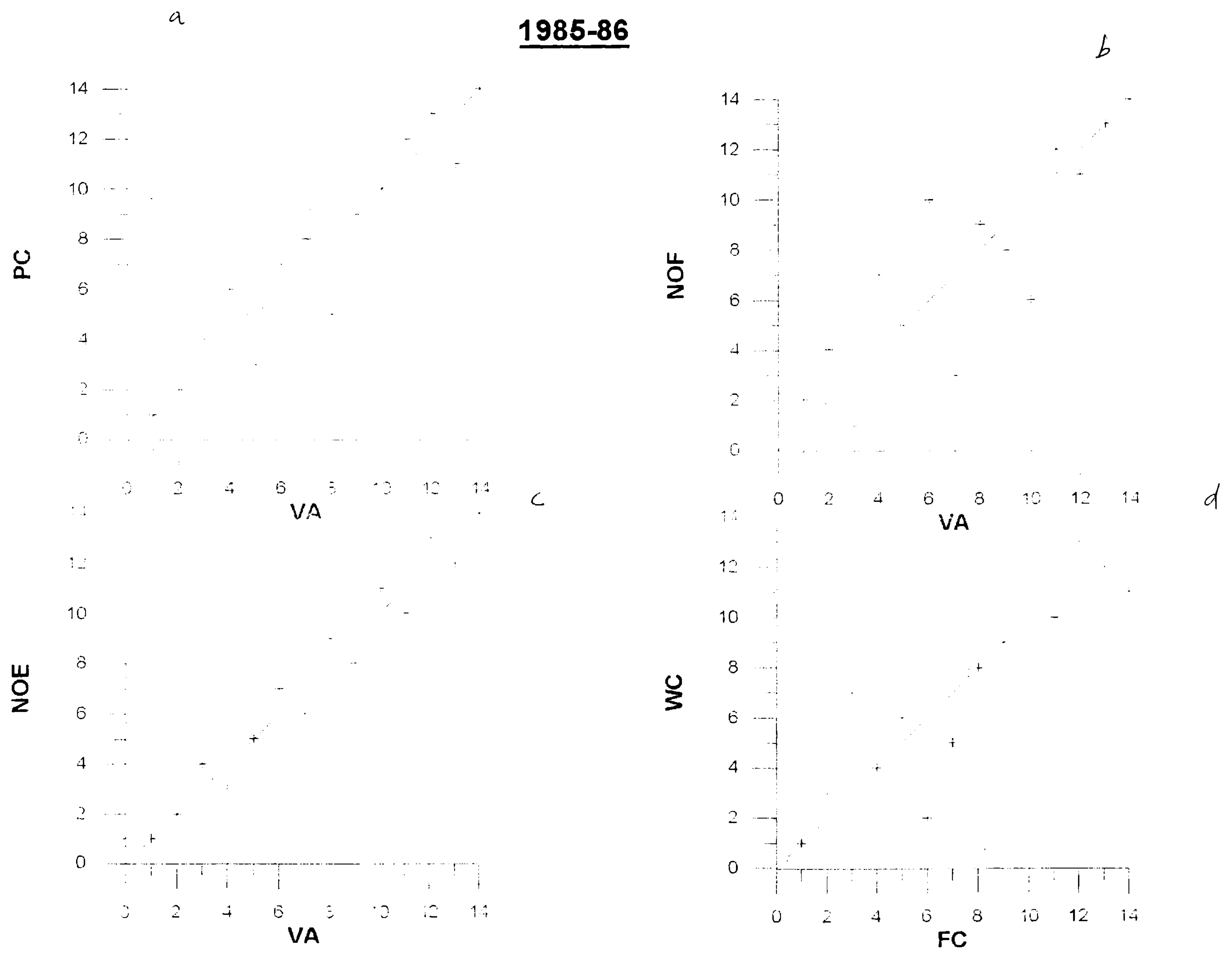


Fig. 3.4

1985-86

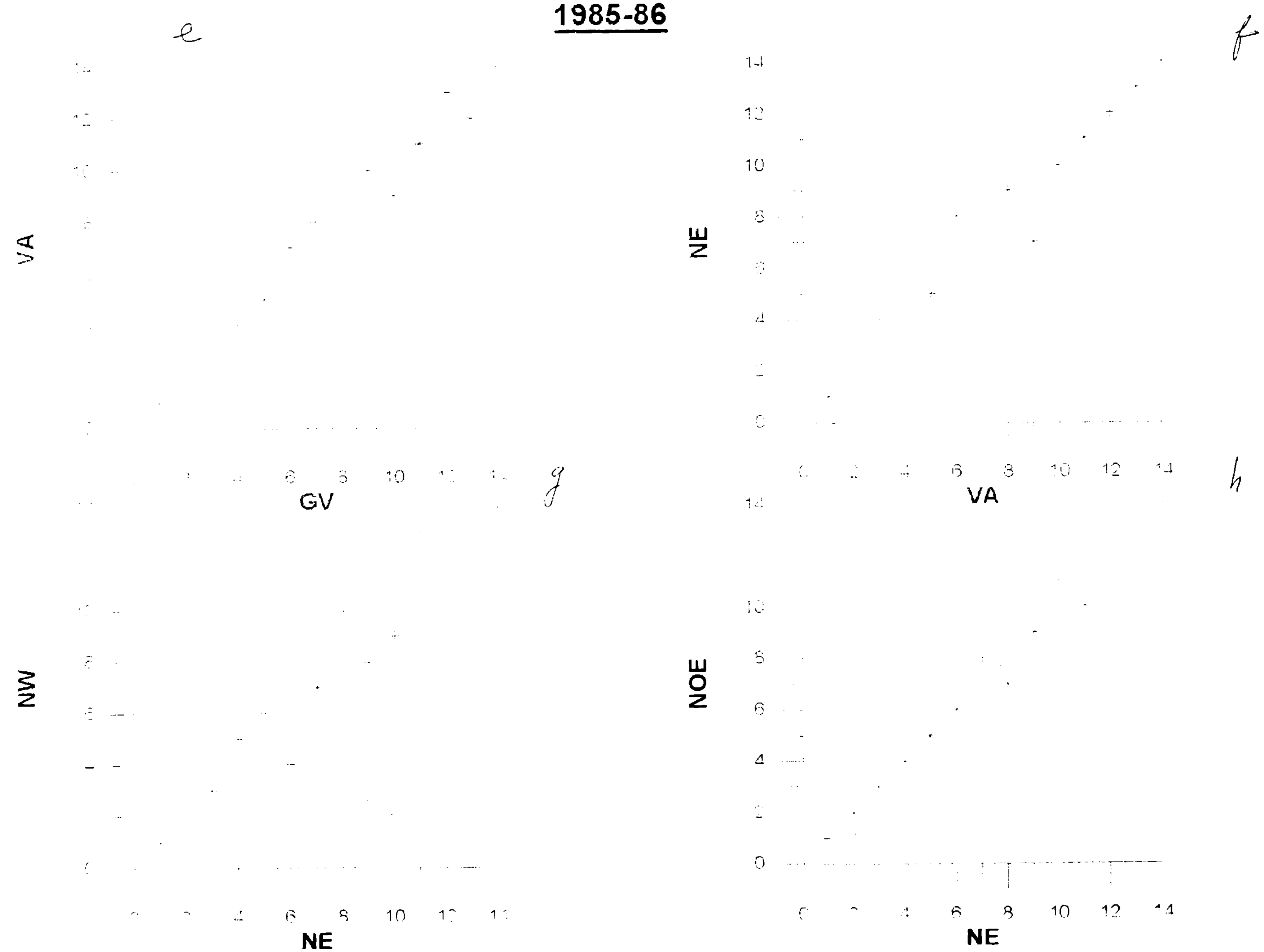


Fig. 3.5

1988-89

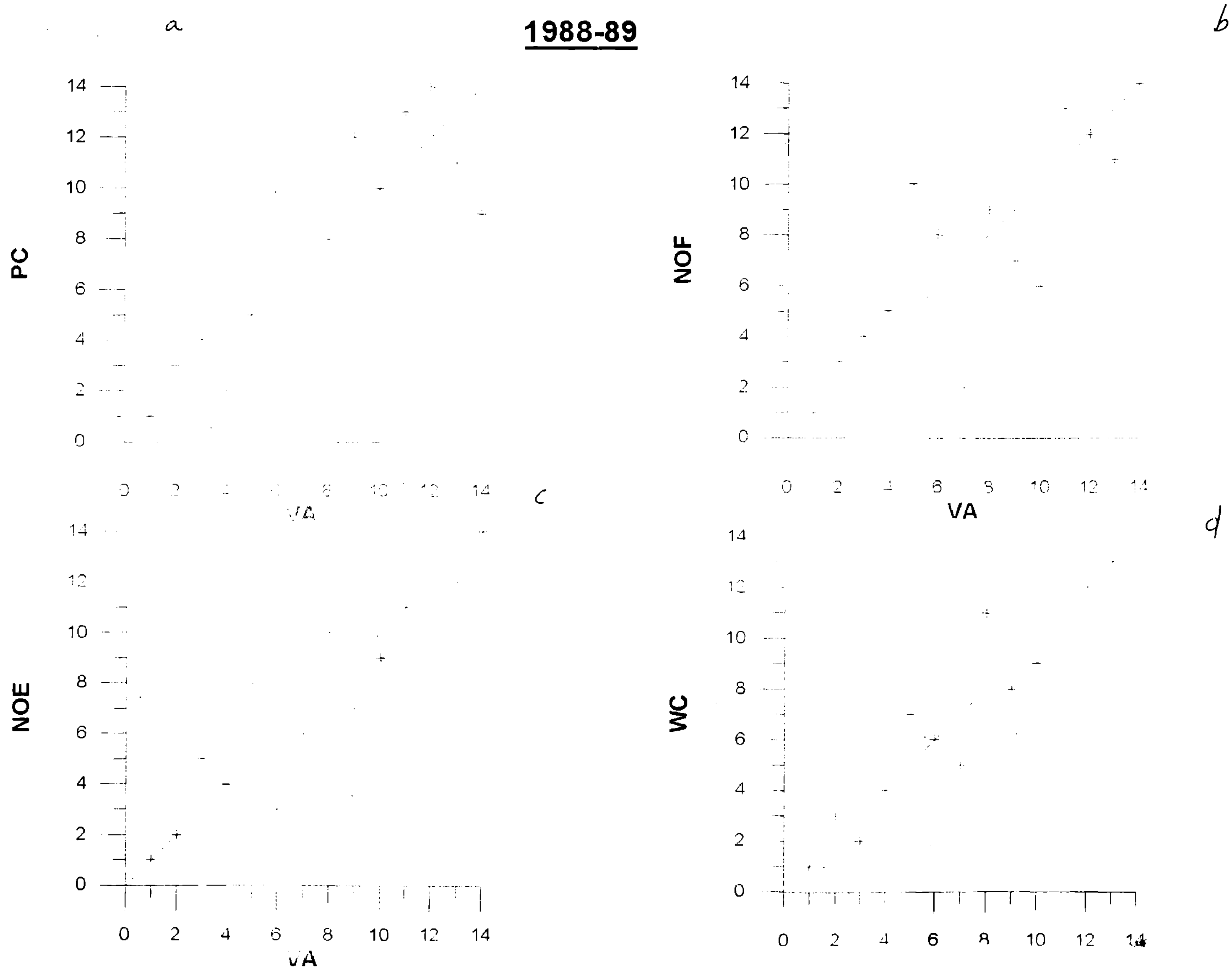
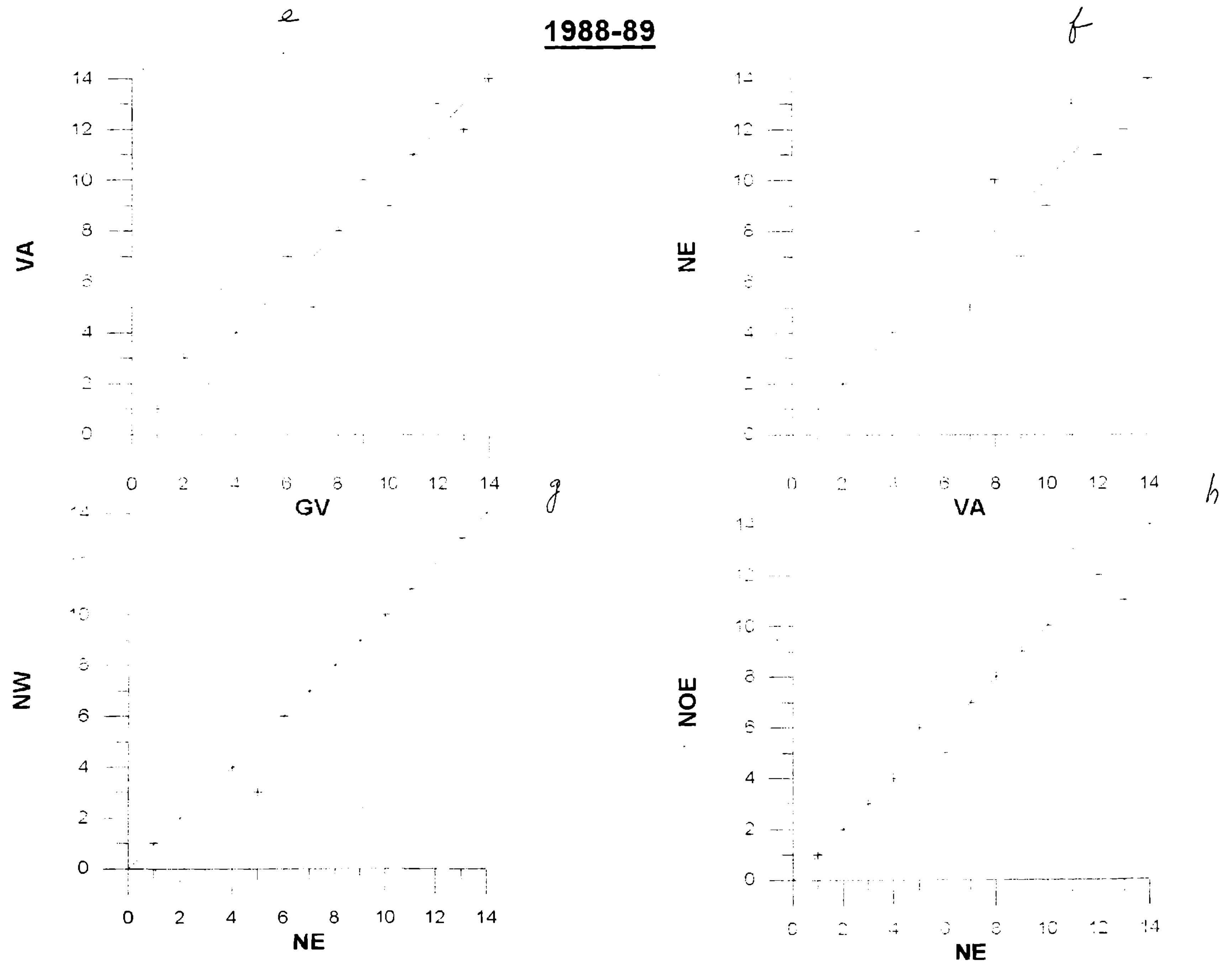
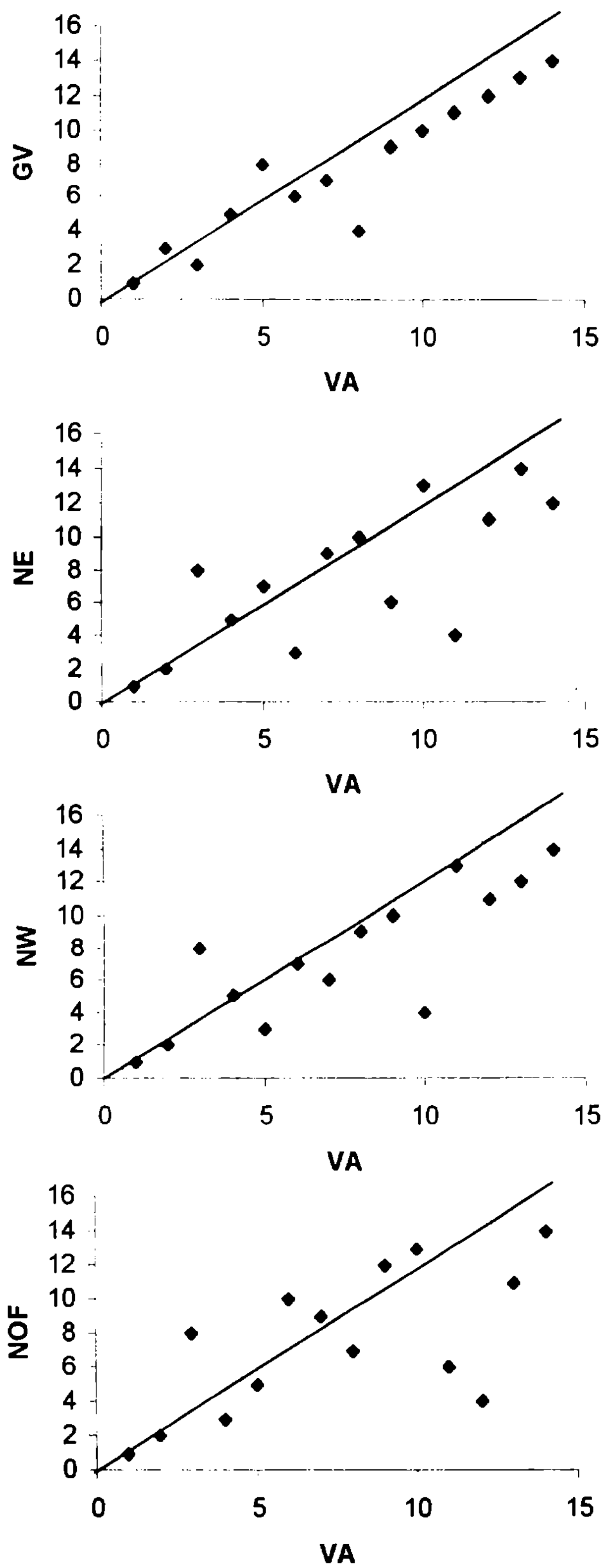


Fig. 3.5



RANKING OF THE STATES 1993-94



a

b

c

d

Fig. 3.6

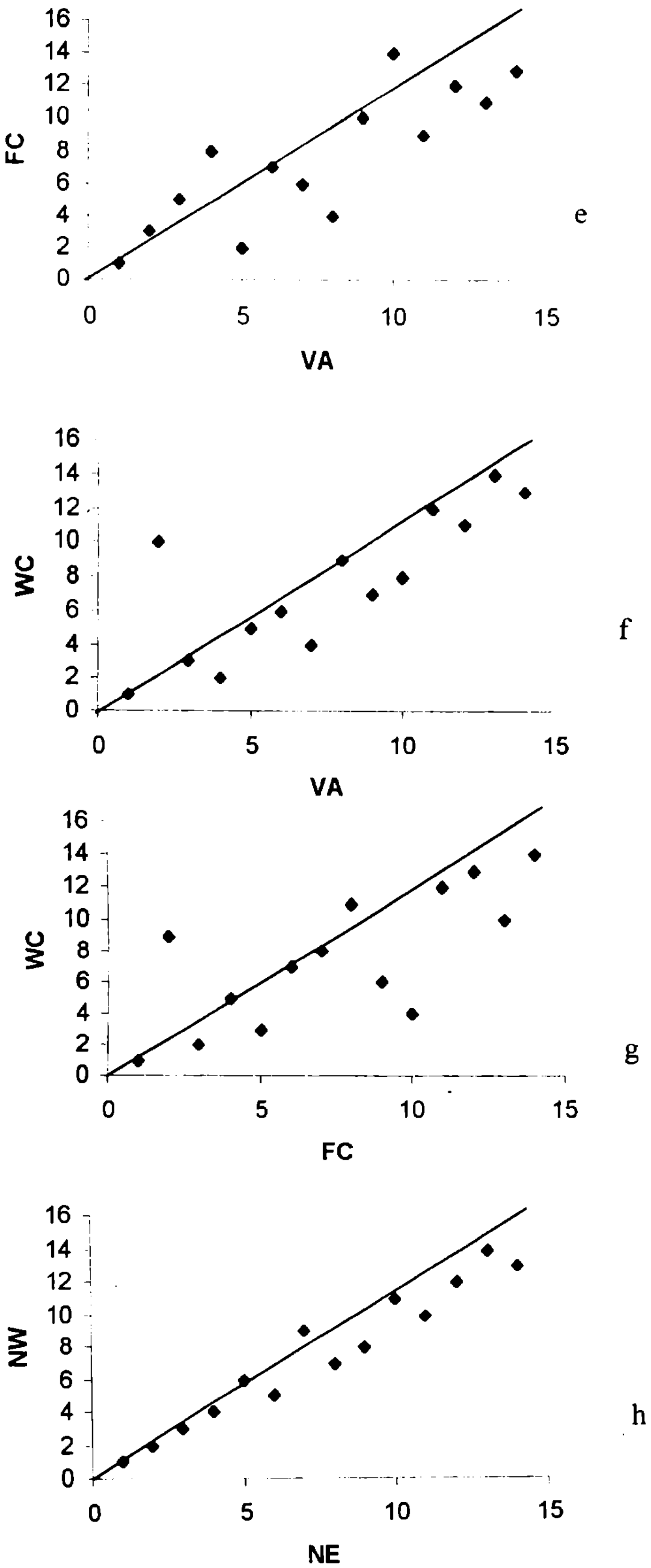


Fig. 3.6

RANKING OF THE STATES 1998-99

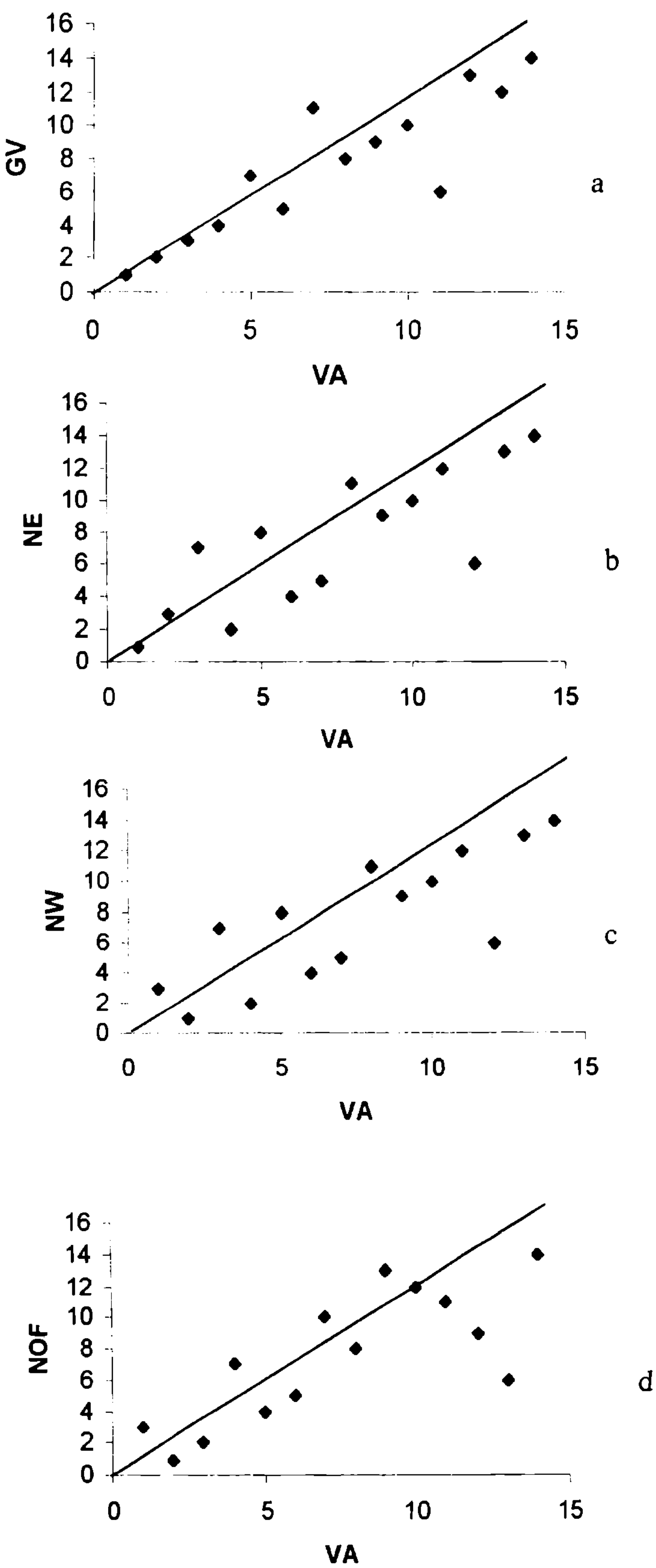


Fig. 3.7

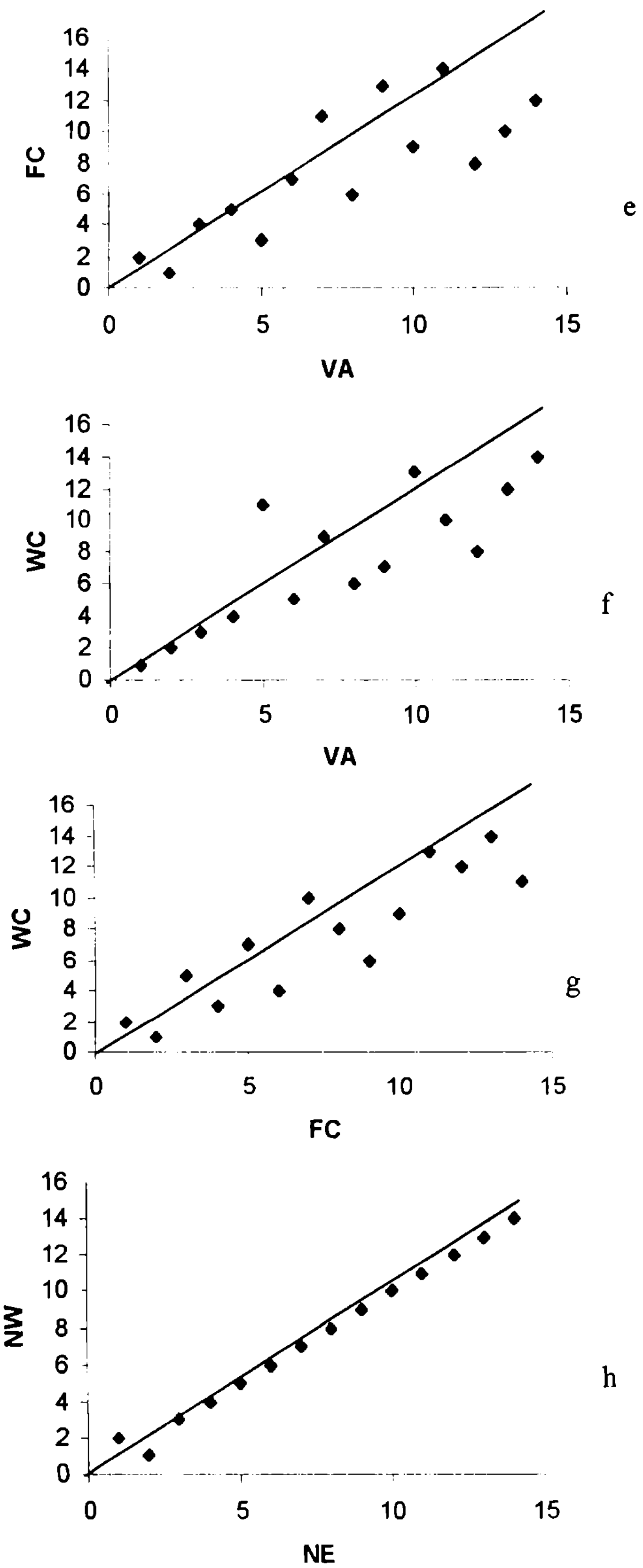
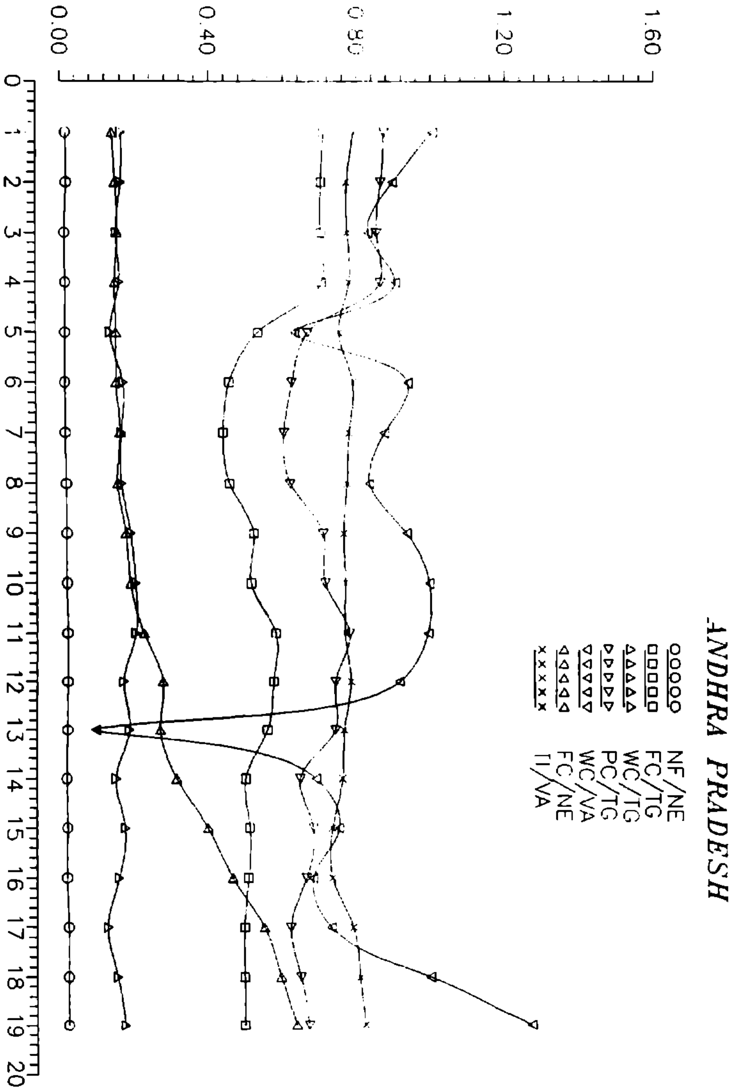


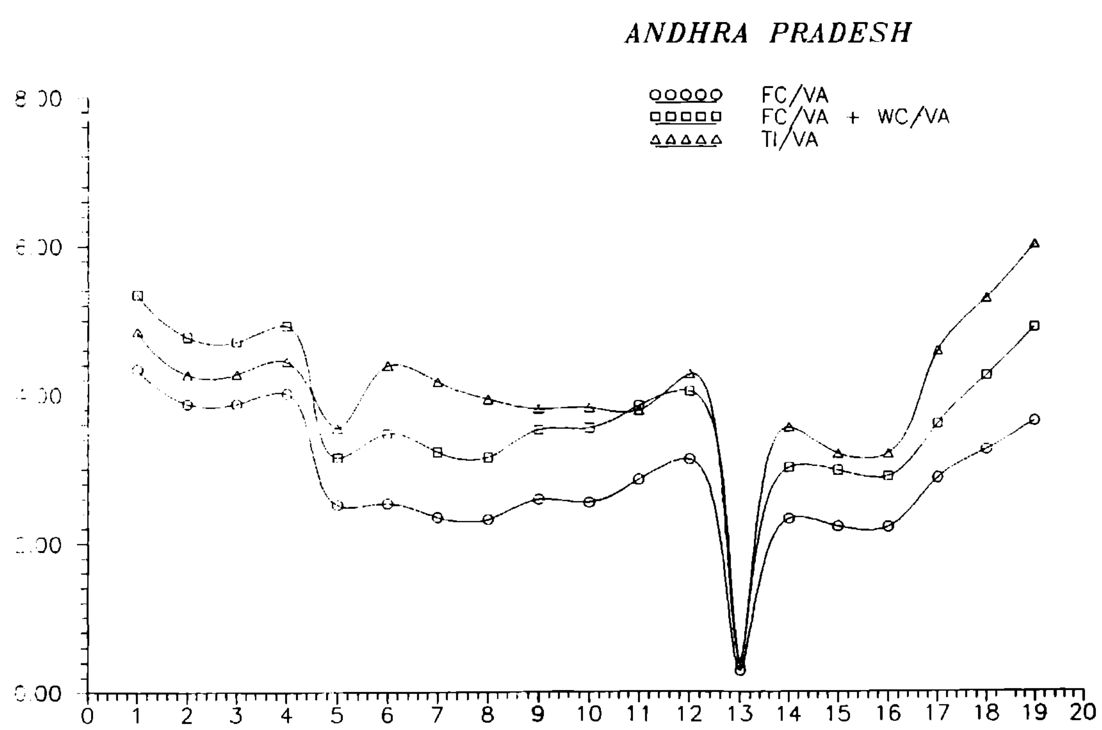
Fig. 3.7

Fig. 3.1 a



ANDHRA PRADESH
NF/NE
FC/TG
WC/TG
PC/TG
WC/VA
FC/NE
TI/VA
0.00
0.40
0.80
1.20
1.60
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Fig. 3.1 a


ANDHRA PRADESH
FC/VA
FC/VA + WC/VA
TI/VA
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

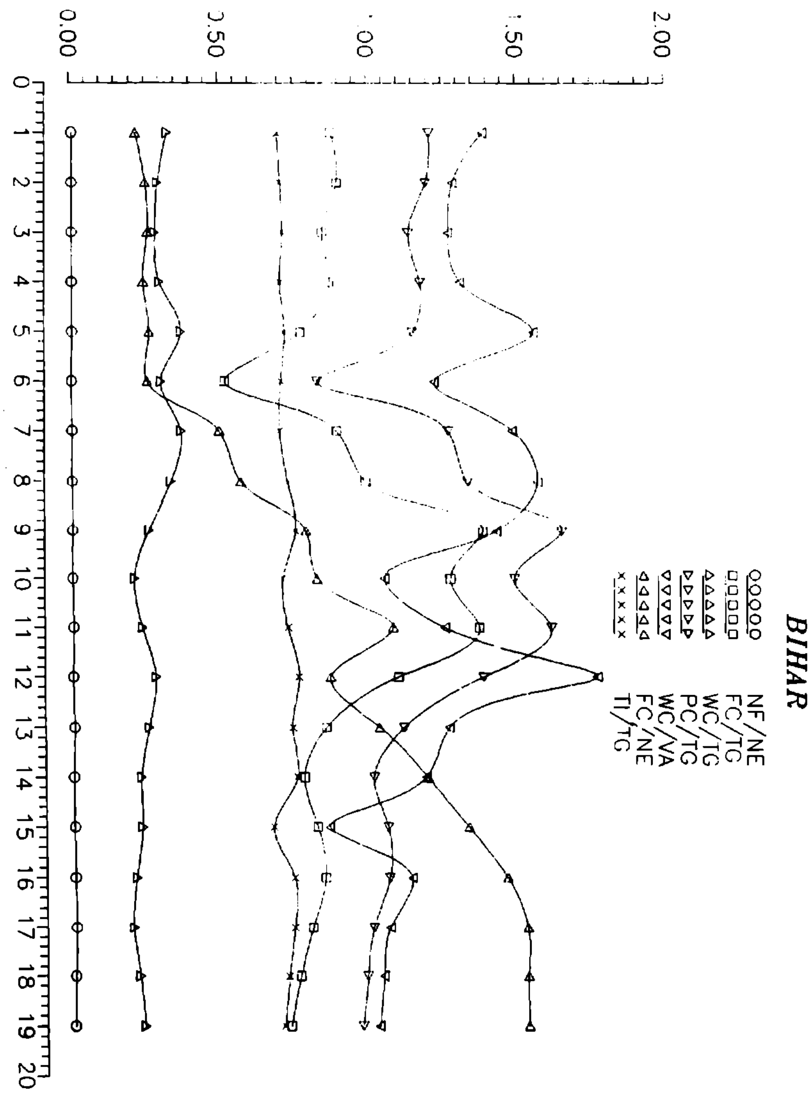

BIHAR
NF/NE
FC/TG
WC/TG
PC/TG
WC/VA
FC/NE
TI/TG
0.00
0.50
1.00
1.50
2.00
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Fig. 3.2 a

Fig. 3.2 a

BIHAR

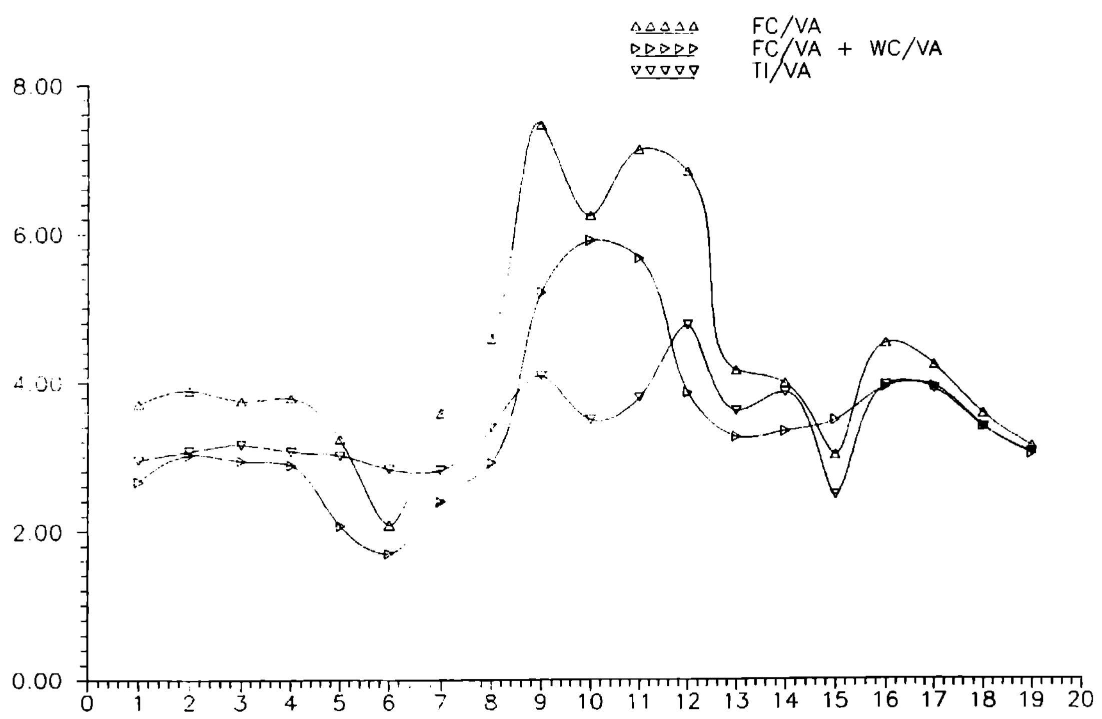


Fig 3.3 a

HARYANA

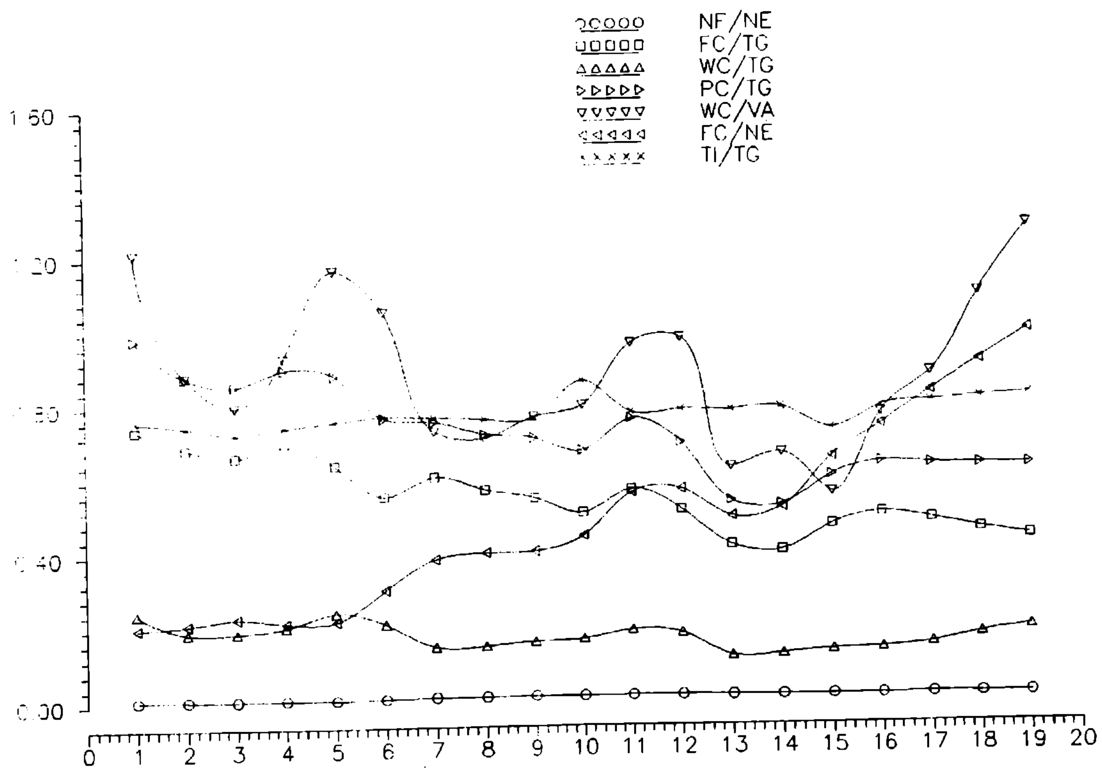


Fig. 3.3 a

HARYANA

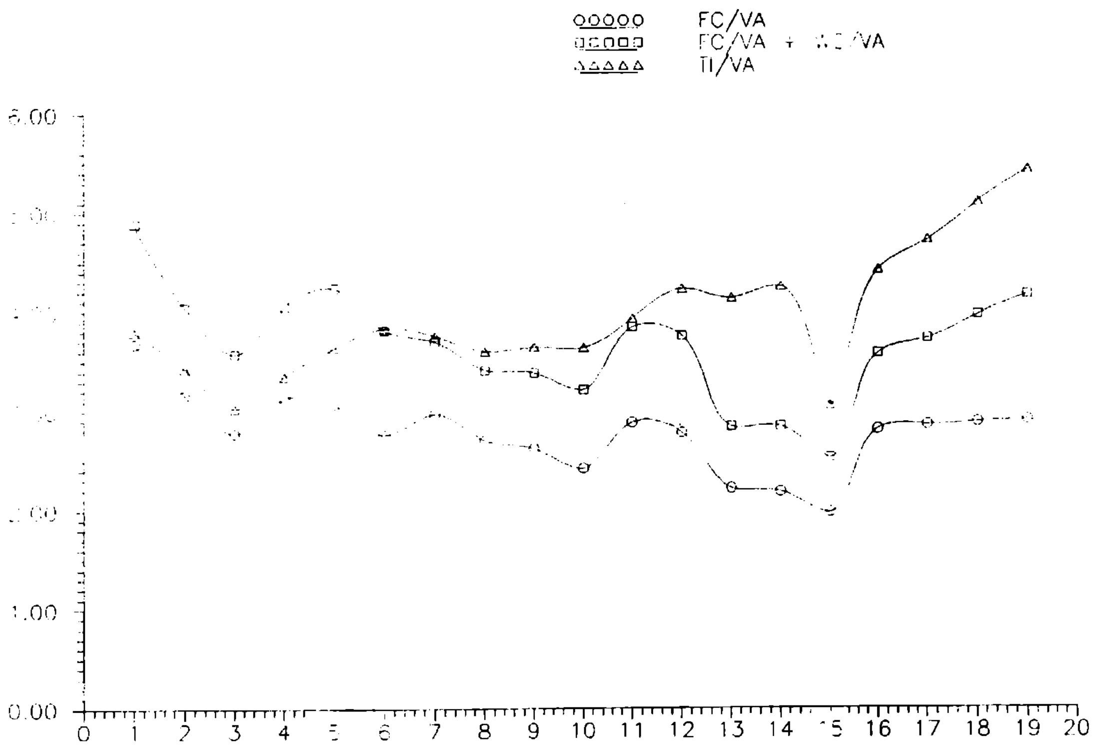


Fig. 4 a

GUJARAT

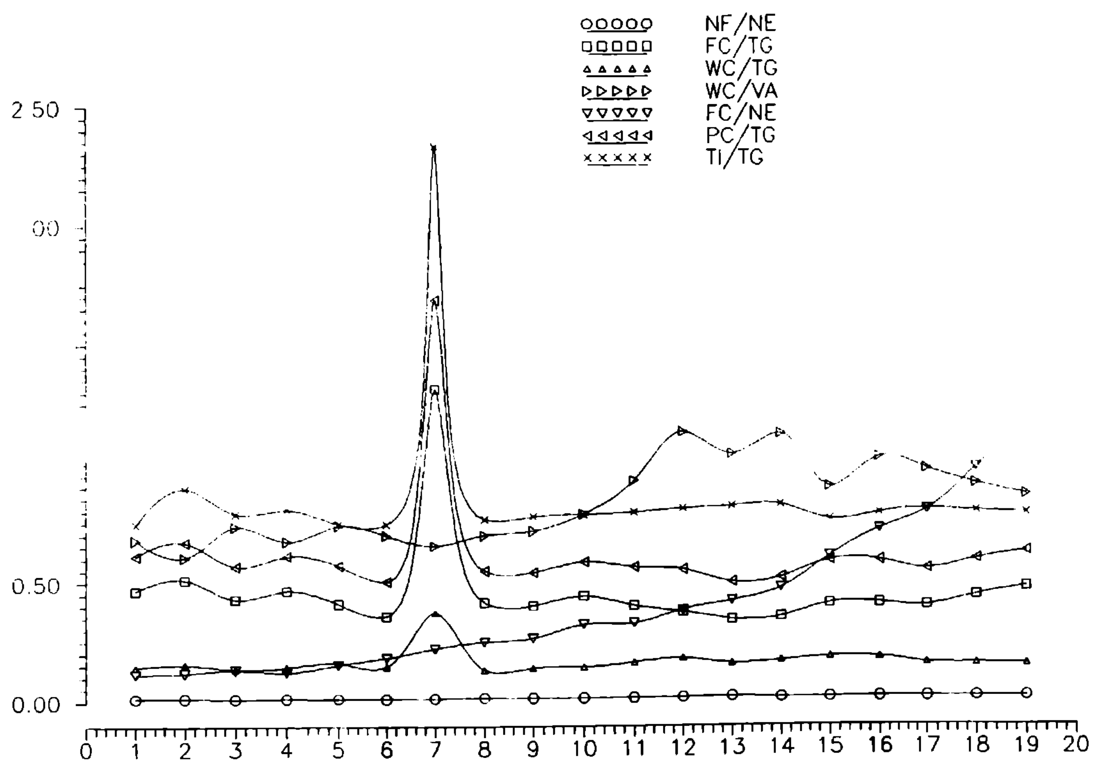


Fig. 4 a

GUJARAT

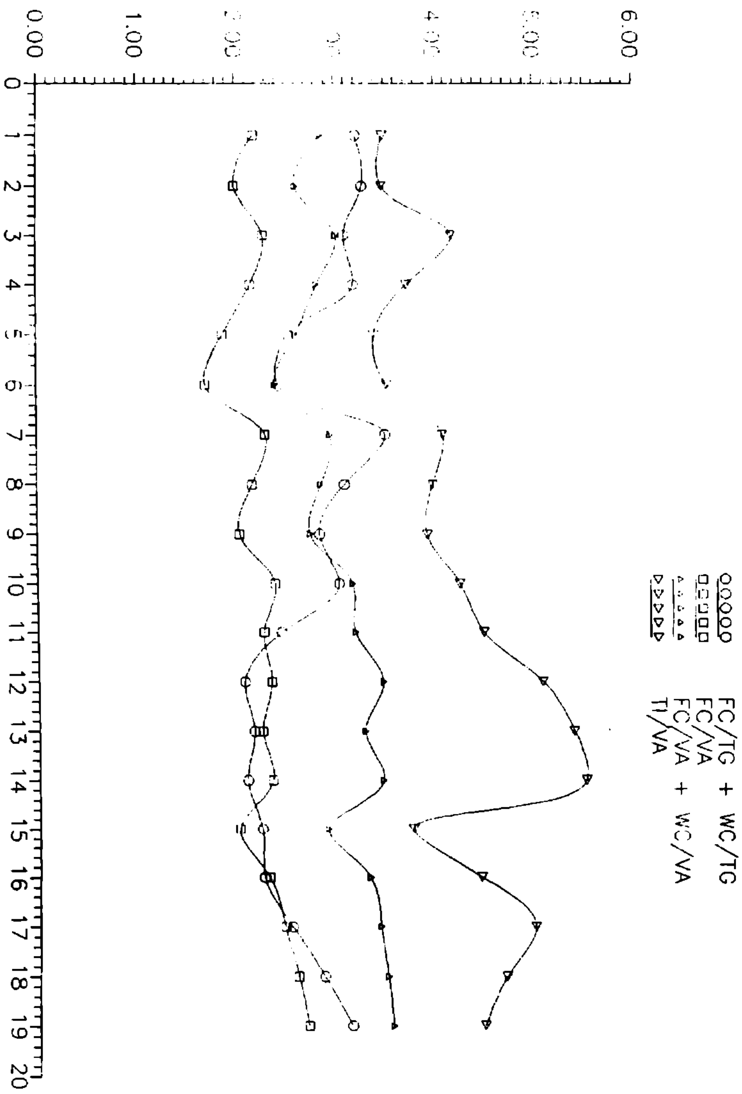


Fig. 5 a

KARNATAKA

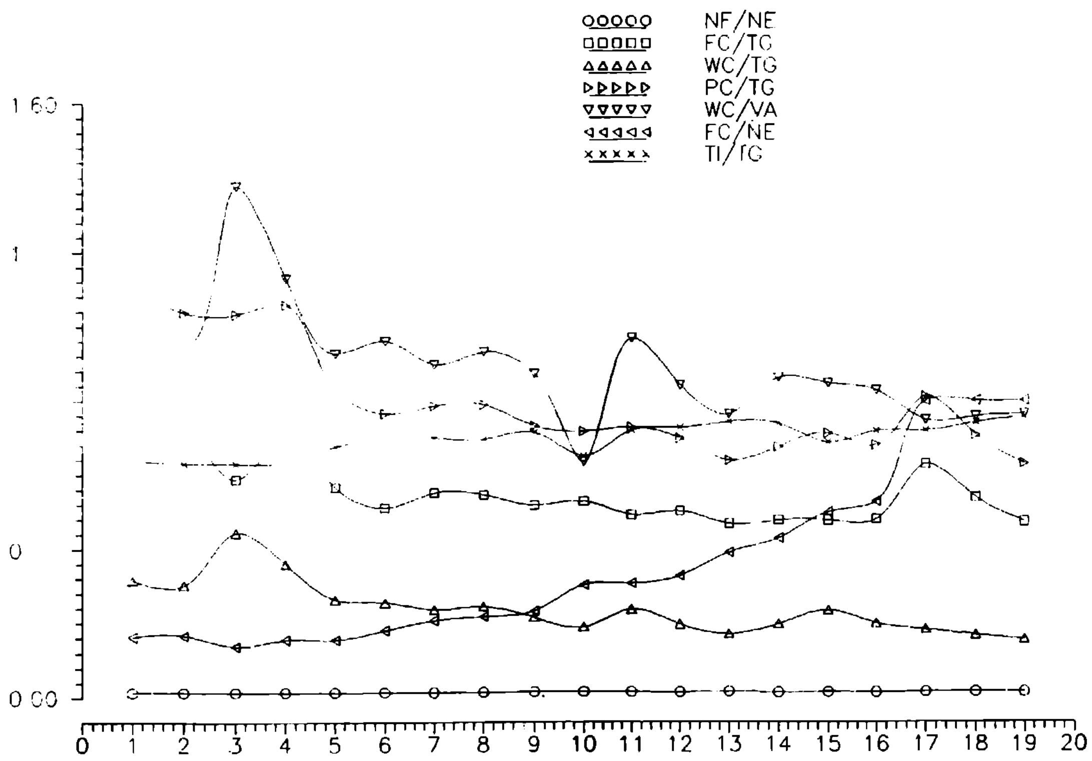
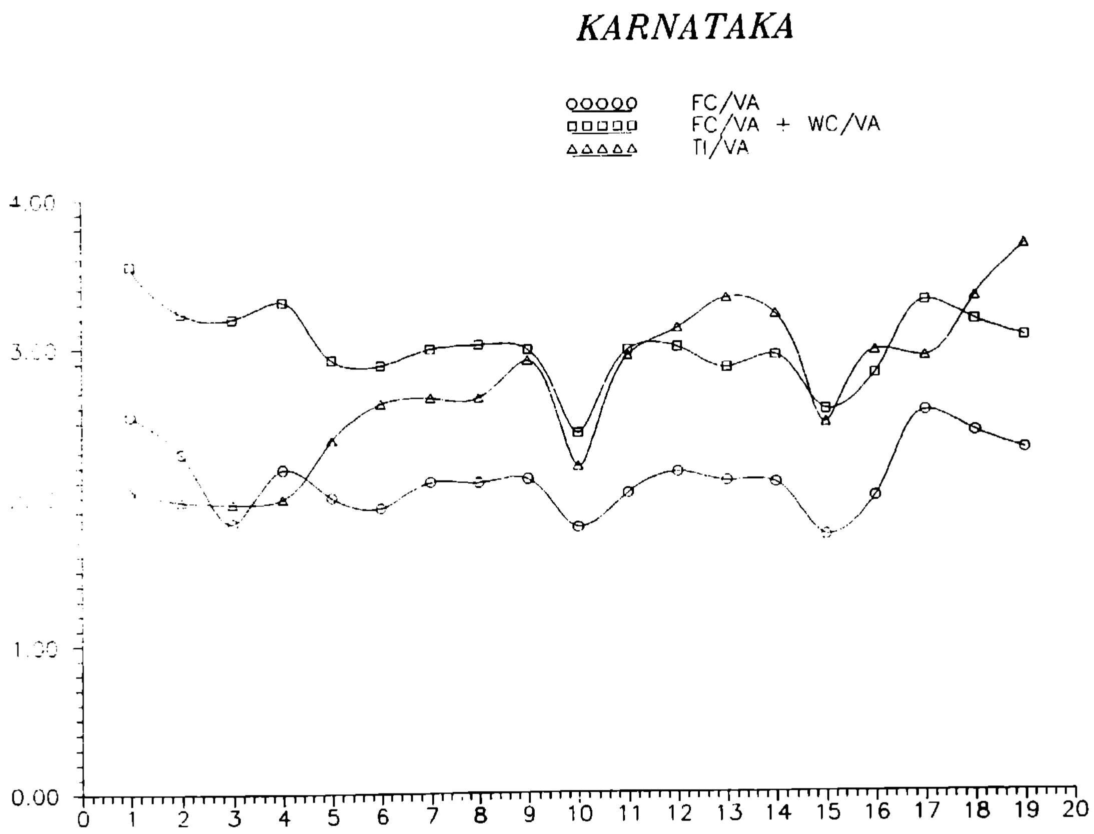


Fig 5 a



KARNATAKA
FC/VA
FC/VA + WC/VA
TI/VA
4.00
3.00
1.00
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Fig. 6 a

KERALA

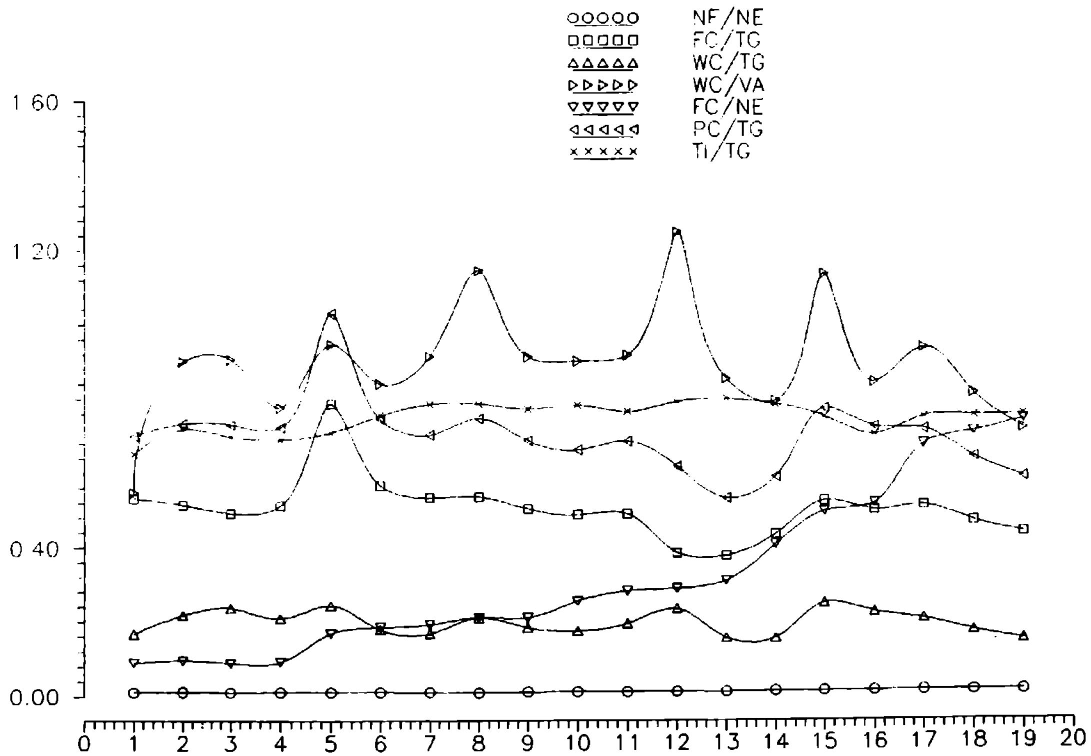


Fig. 6 a

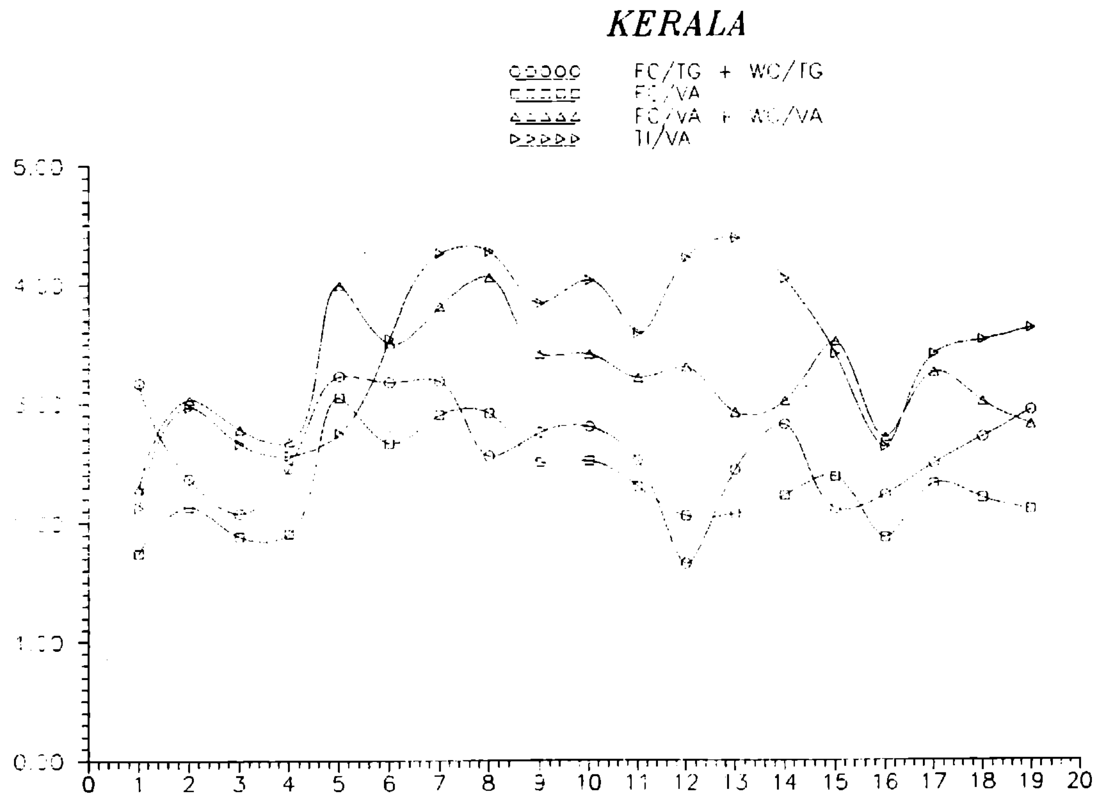
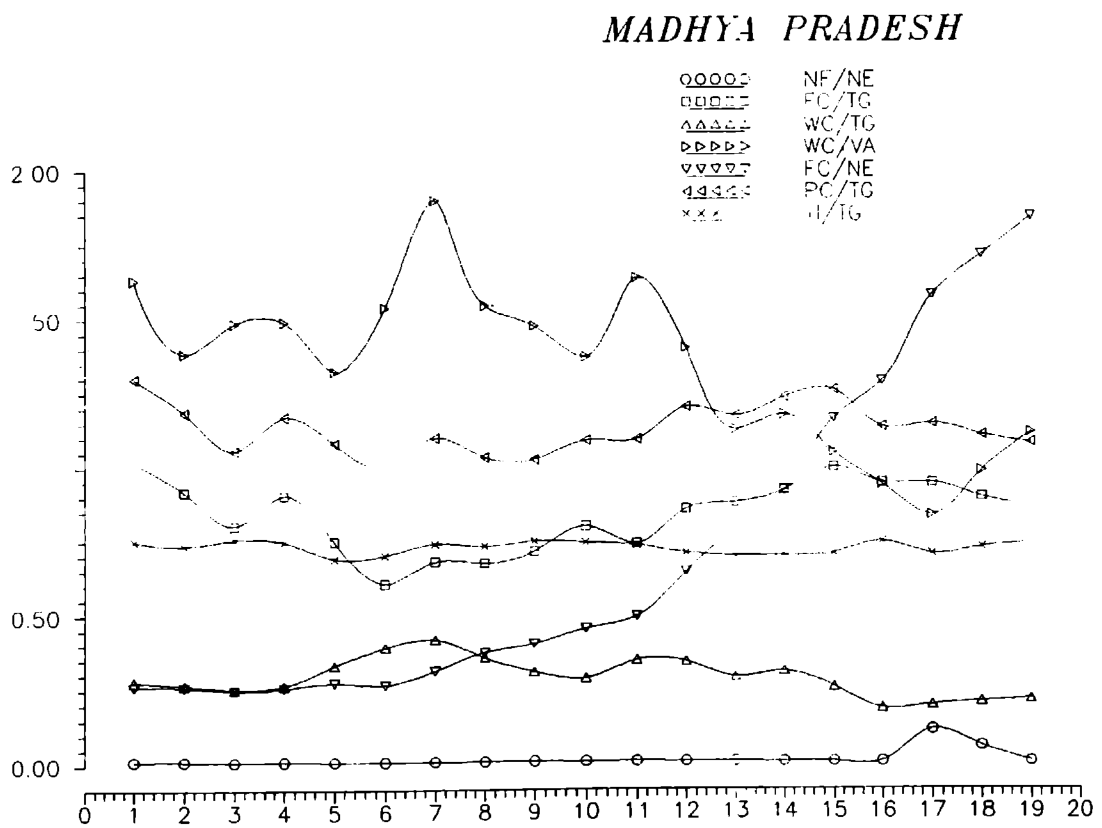

KERALA
FC/TG + WC/TG
FC/VA
FC/VA + WC/VA
TI/VA
5.00
4.00
1.00
0.00
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Fig. 7 a



MADHYA PRADESH
NF/NE
FC/TG
WC/TG
WC/VA
FC/NE
PC/TG
2.00
50
0.50
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Fig. 7 a

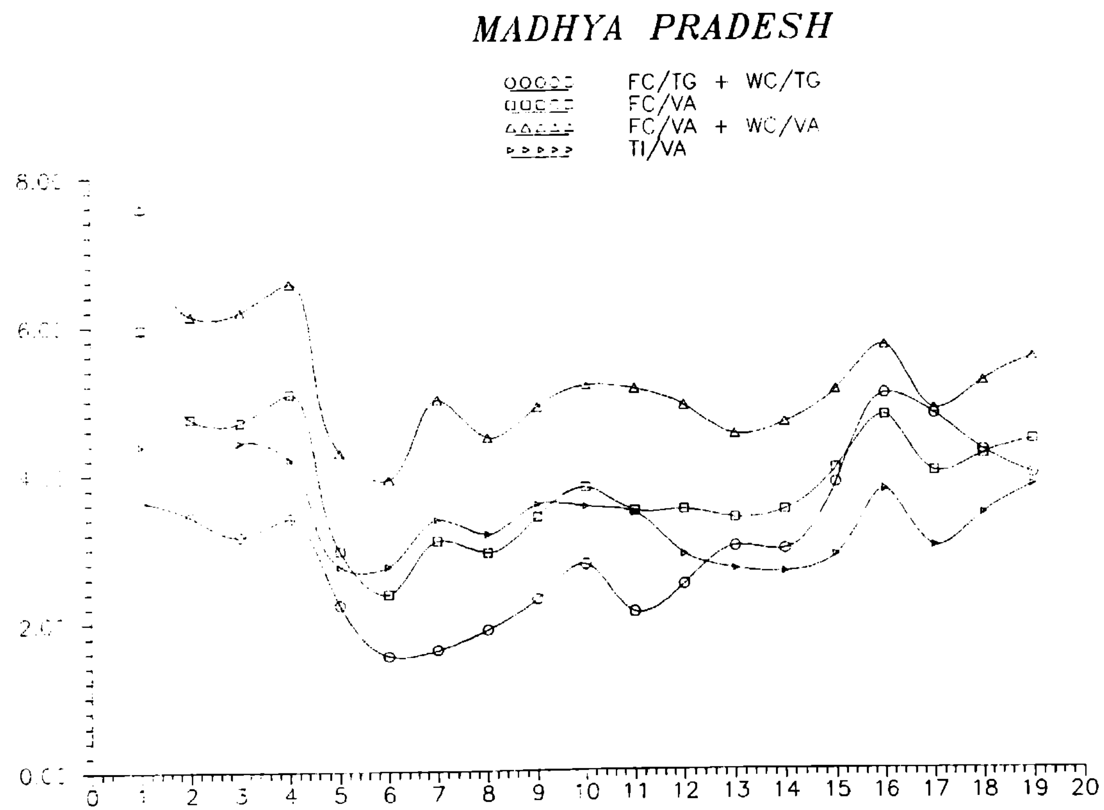

MADHYA PRADESH
FC/TG + WC/TG
FC/VA
FC/VA + WC/VA
TI/VA
8.00
6.00
2.00
0.00
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Fig. 8 a

MAHARASHTRA

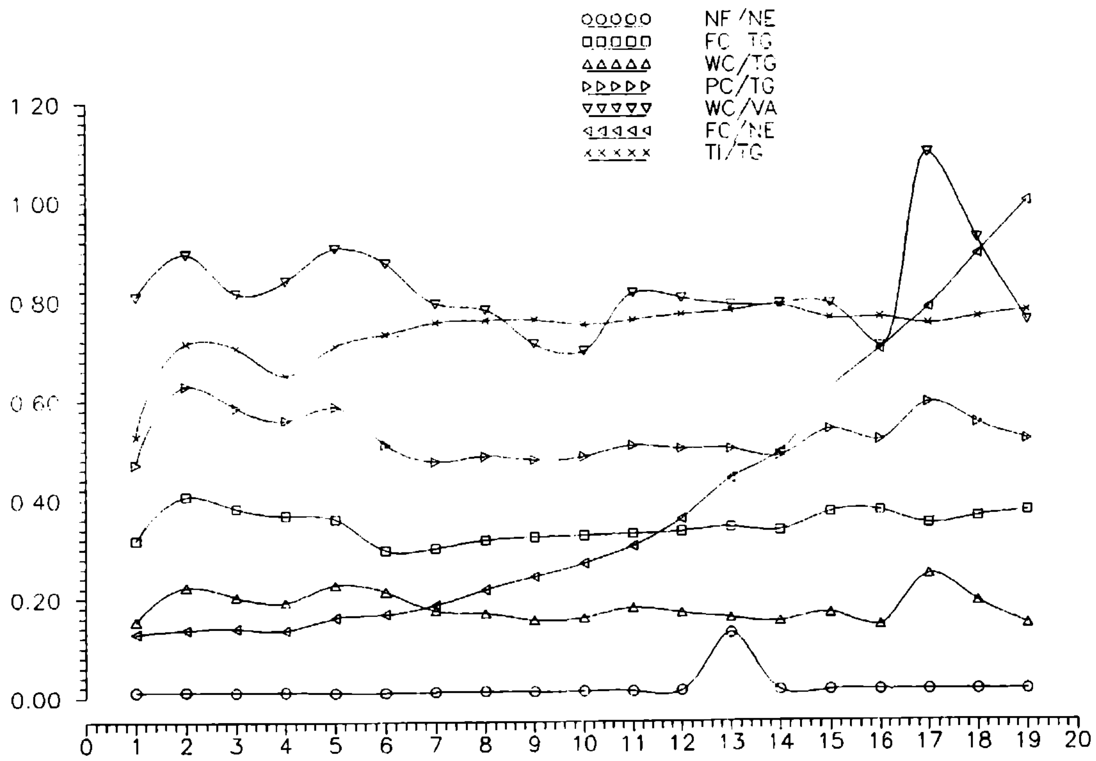


Fig. 8 a

MAHARASHTRA

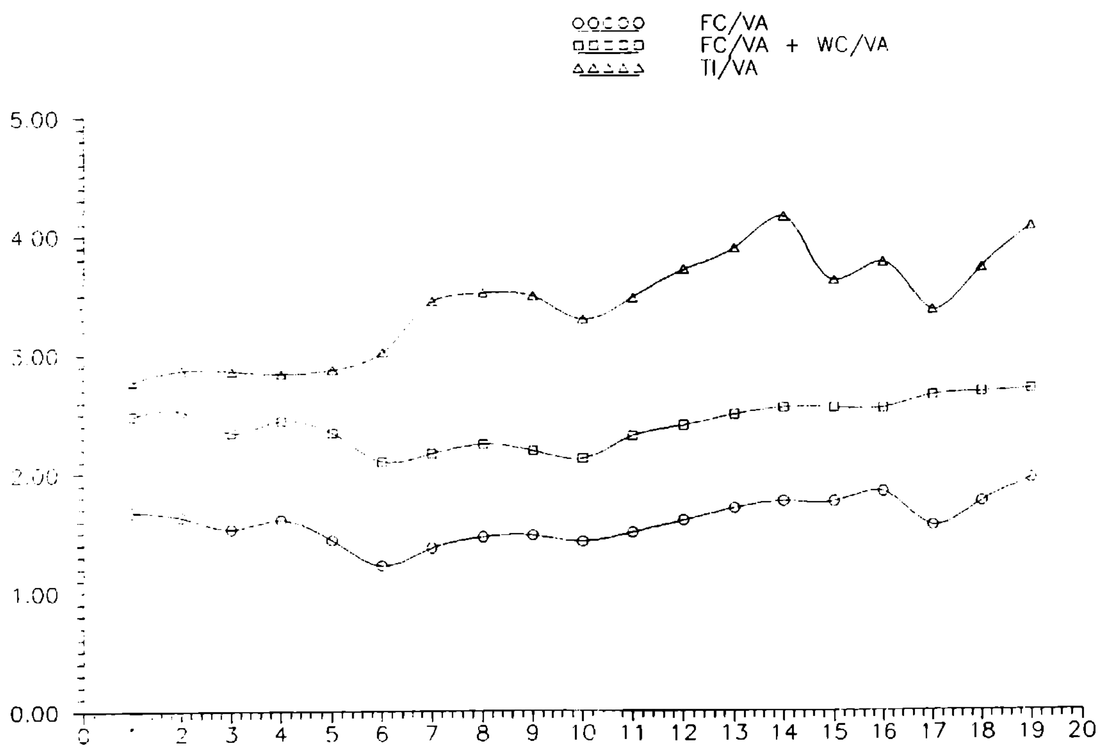


Fig. 9 a

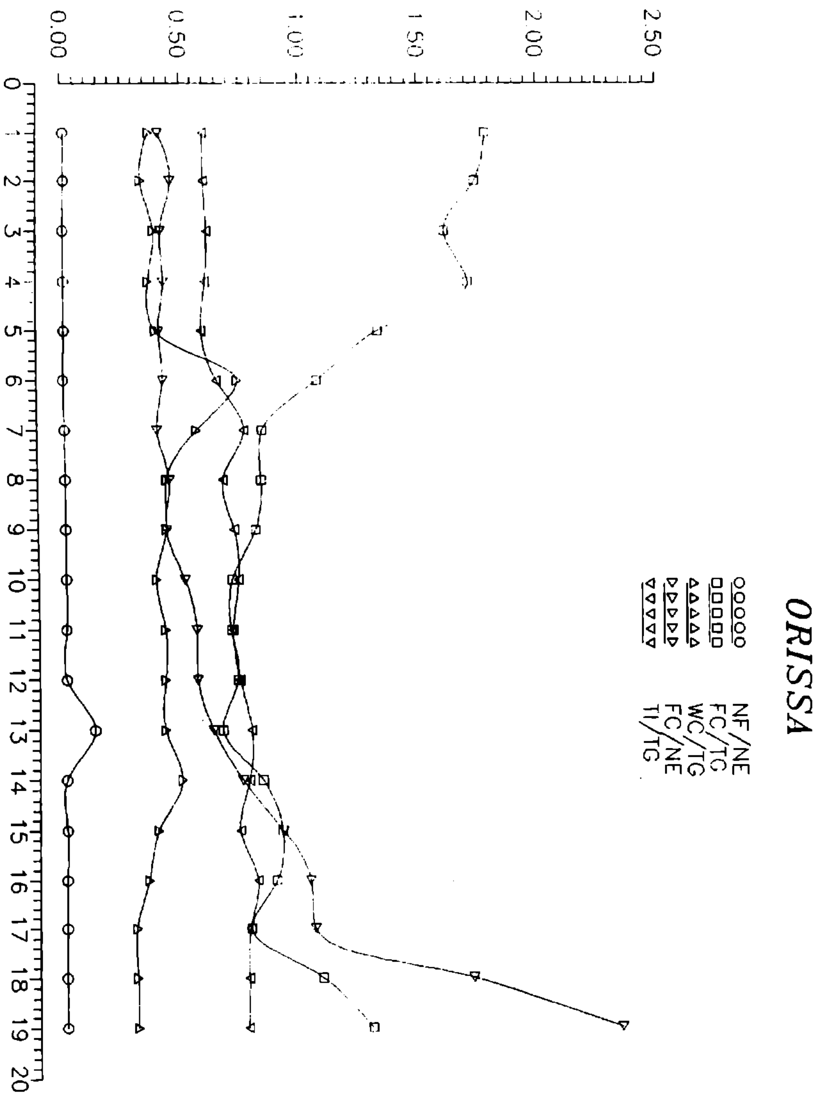
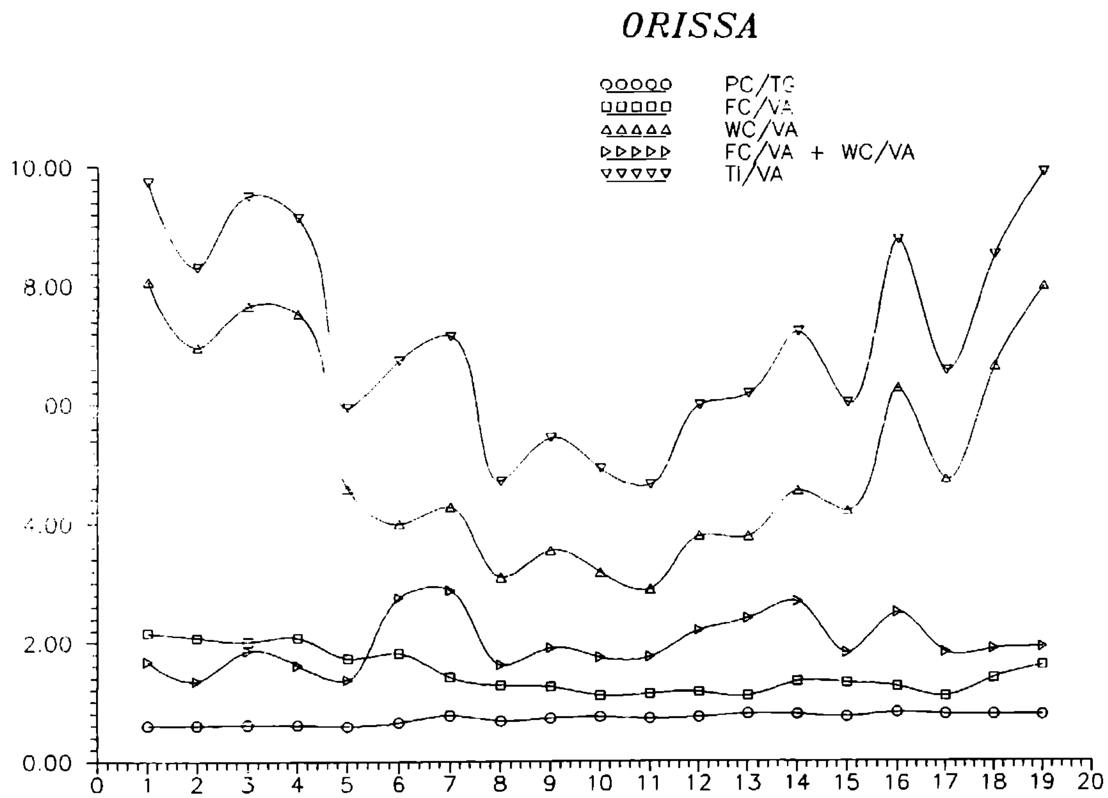

ORISSA
NF/NE
FC/TC
WC/TG
FC/NE
TI/TG
0.00
0.50
1.00
1.50
2.00
2.50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Fig. 9 a


ORISSA
PC/TC
FC/VA
WC/VA
FC/VA + WC/VA
TI/VA
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8.00
00
4.00
2.00
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

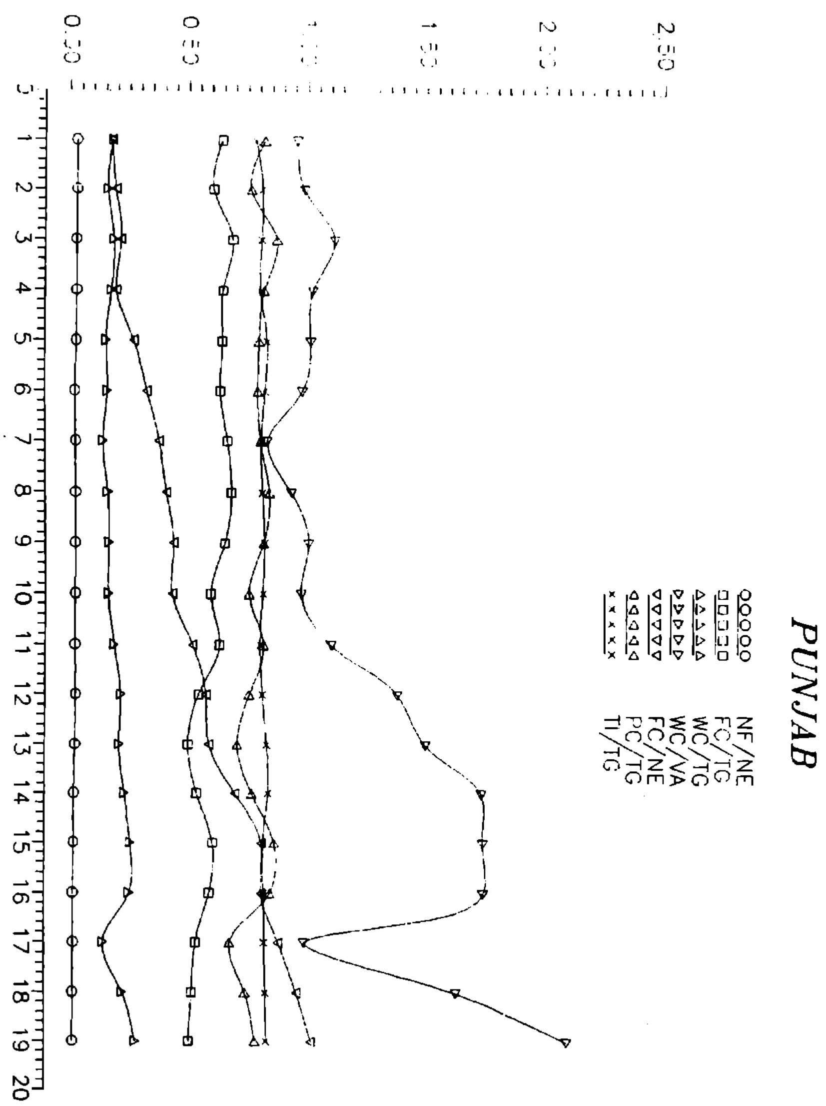
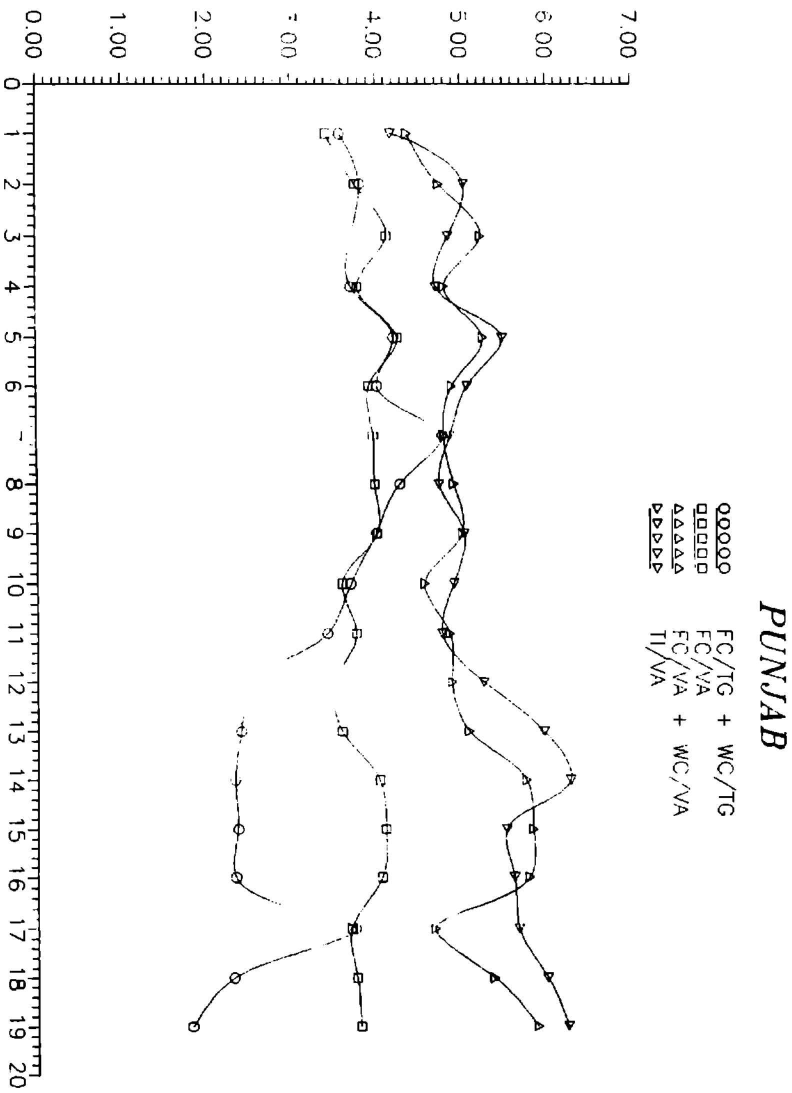

PUNJAB
NF/NE
FC/TG
WC/TG
WC/VA
FC/NE
PC/TG
TI/TG
0.00
0.50
1.00
1.50
2.00
2.50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Fig. 10 a

Fig. 10 a


PUNJAB
FC/TG + WC/TG
FC/VA
FC/VA + WC/VA
TI/VA
0.00
1.00
2.00
4.00
5.00
6.00
7.00
0
1
2
3
4
5
6
8
9
10
11
12
13
14
15
16
17
18
19
20

96 mm

Fig. 11 a

RAJASTHAN

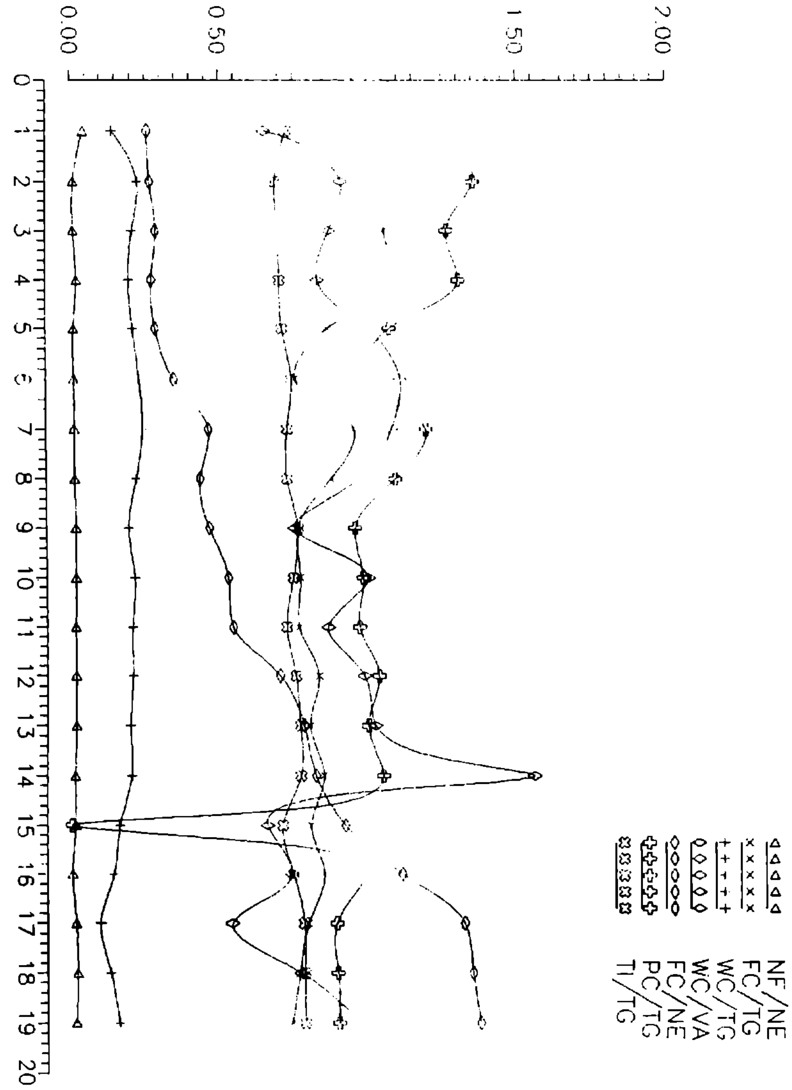


Fig. 11a

RAJASTHAN

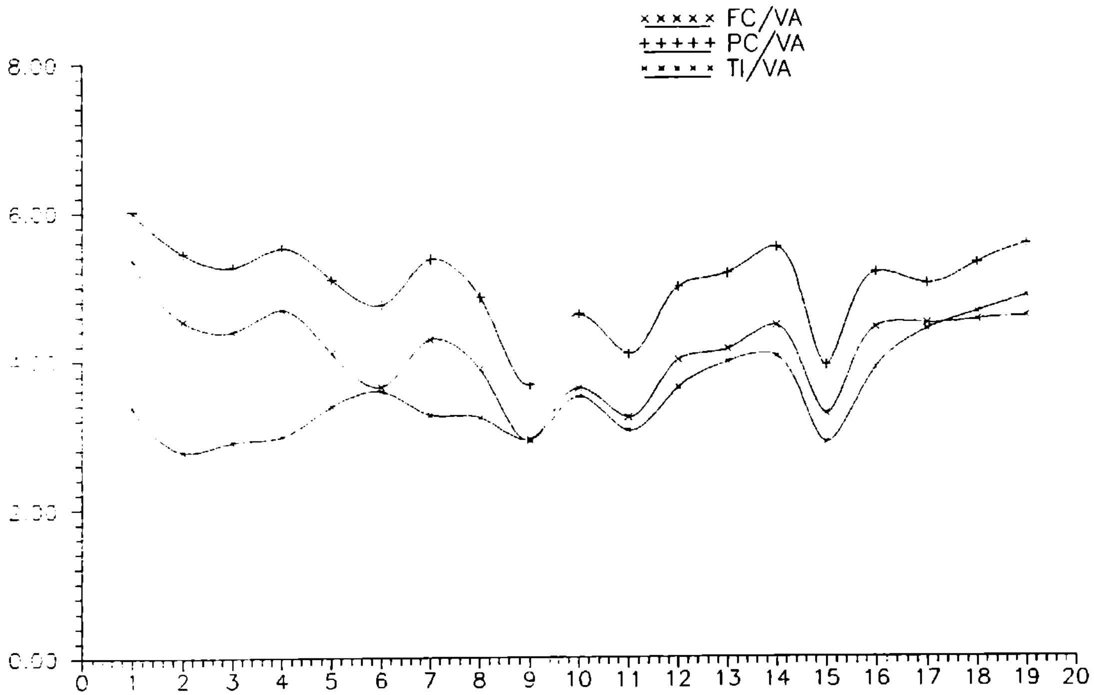


Fig. 12 a

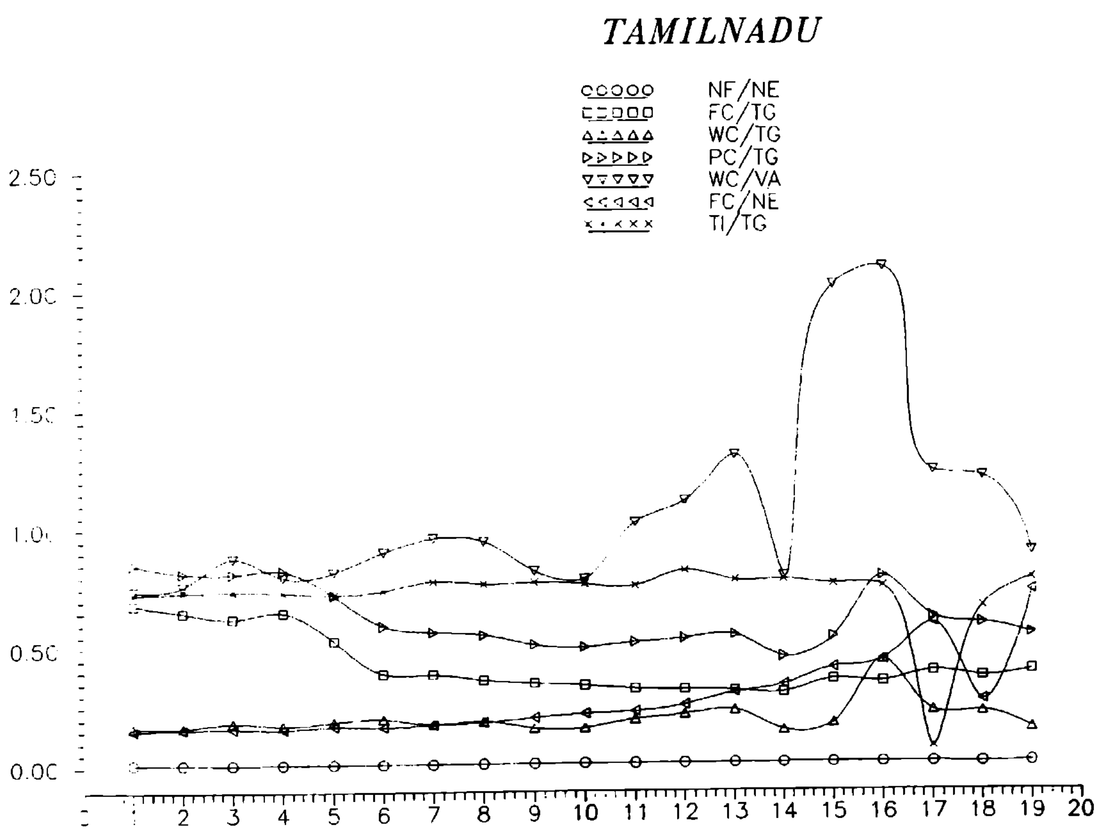

TAMILNADU
NF/NE
FC/TG
WC/TG
PC/TG
WC/VA
FC/NE
TI/TG
2.50
2.00
1.50
1.00
0.50
0.00
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Fig 12 a

TAMILNADU

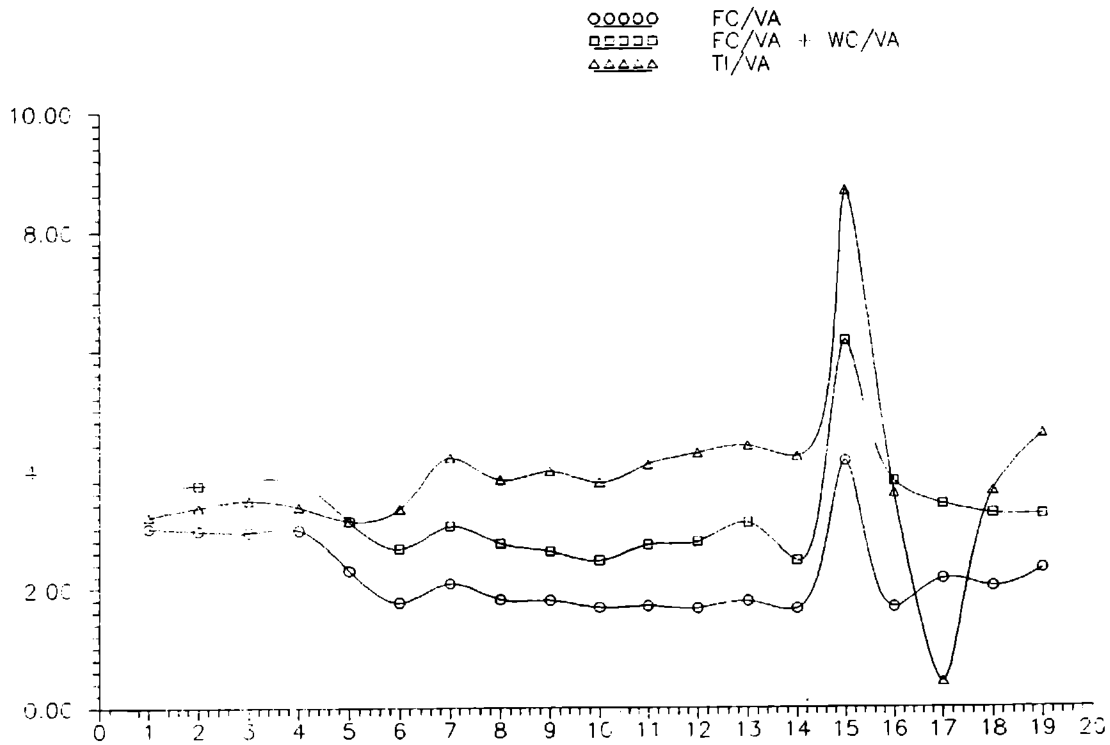


Fig. 13 a

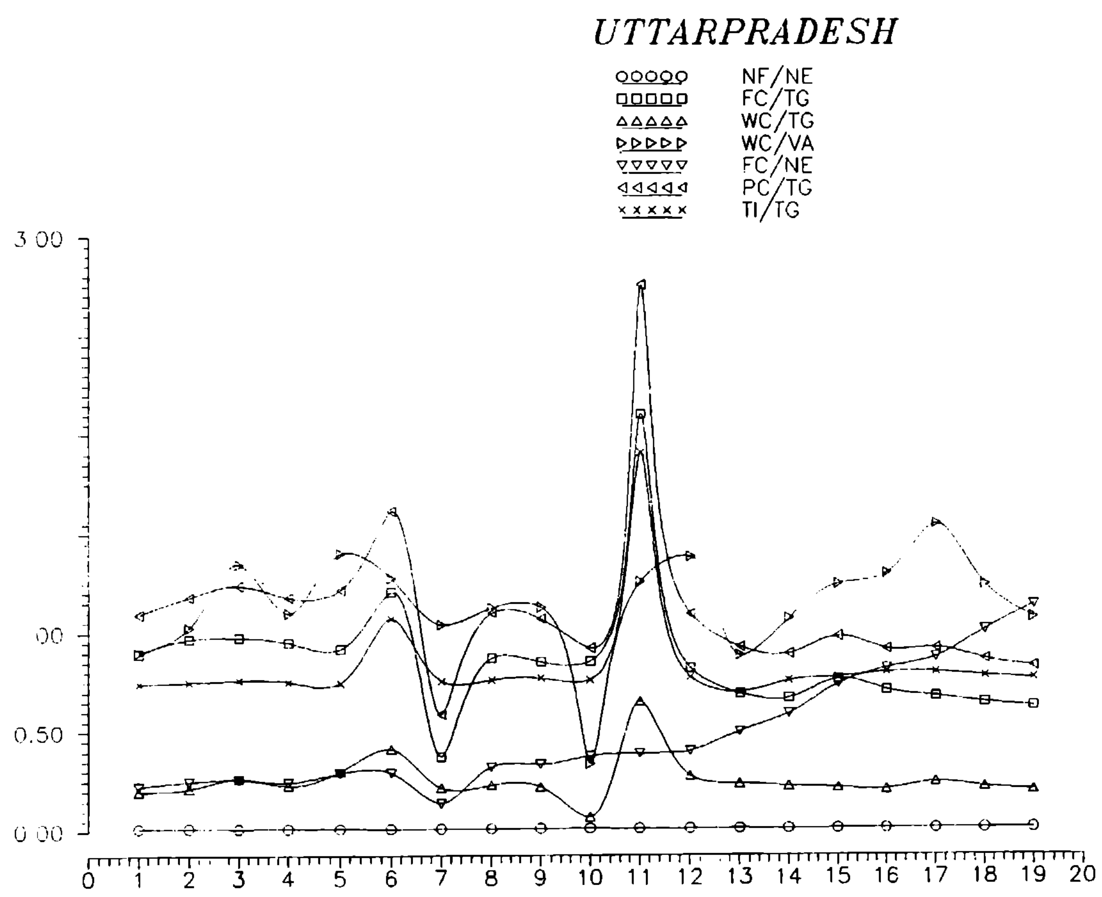

UTTARPRADESH
NF/NE
FC/TG
WC/TG
WC/VA
FC/NE
PC/TG
TI/TG
3.00
.00
0.50
0.00
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Fig. 13 a

UTTARPRADESH

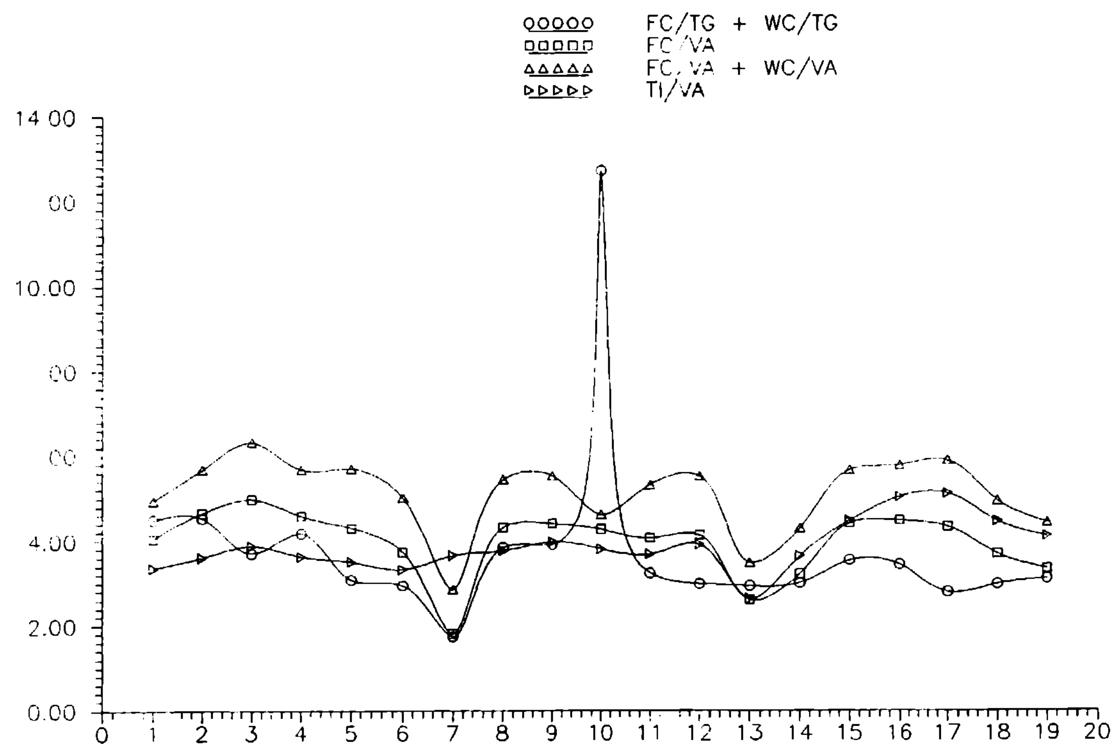


Fig. 3.1 b

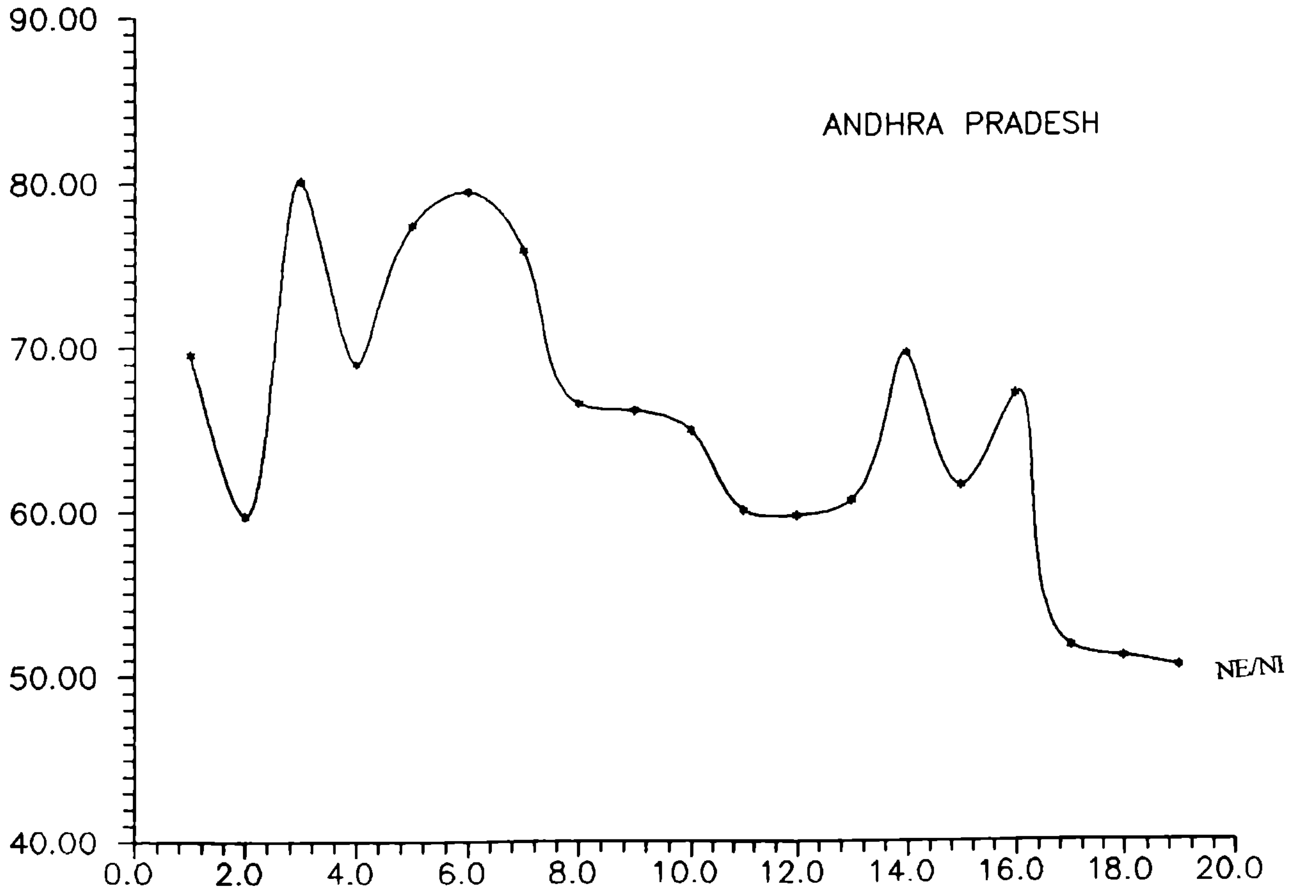

ANDHRA PRADESH
90.00
80.00
70.00
60.00
50.00
40.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
NE/NI

Fig. 3.1 b

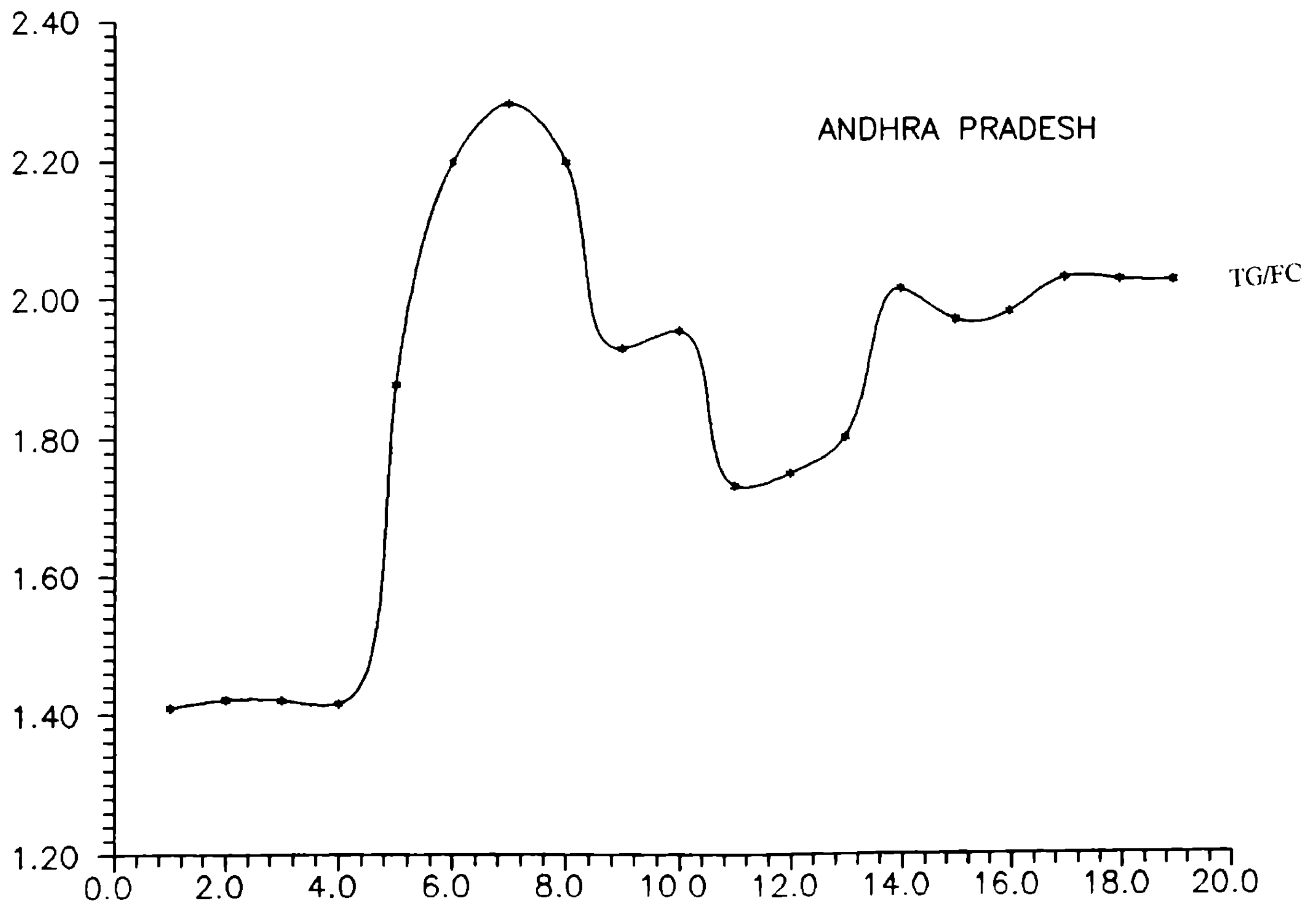
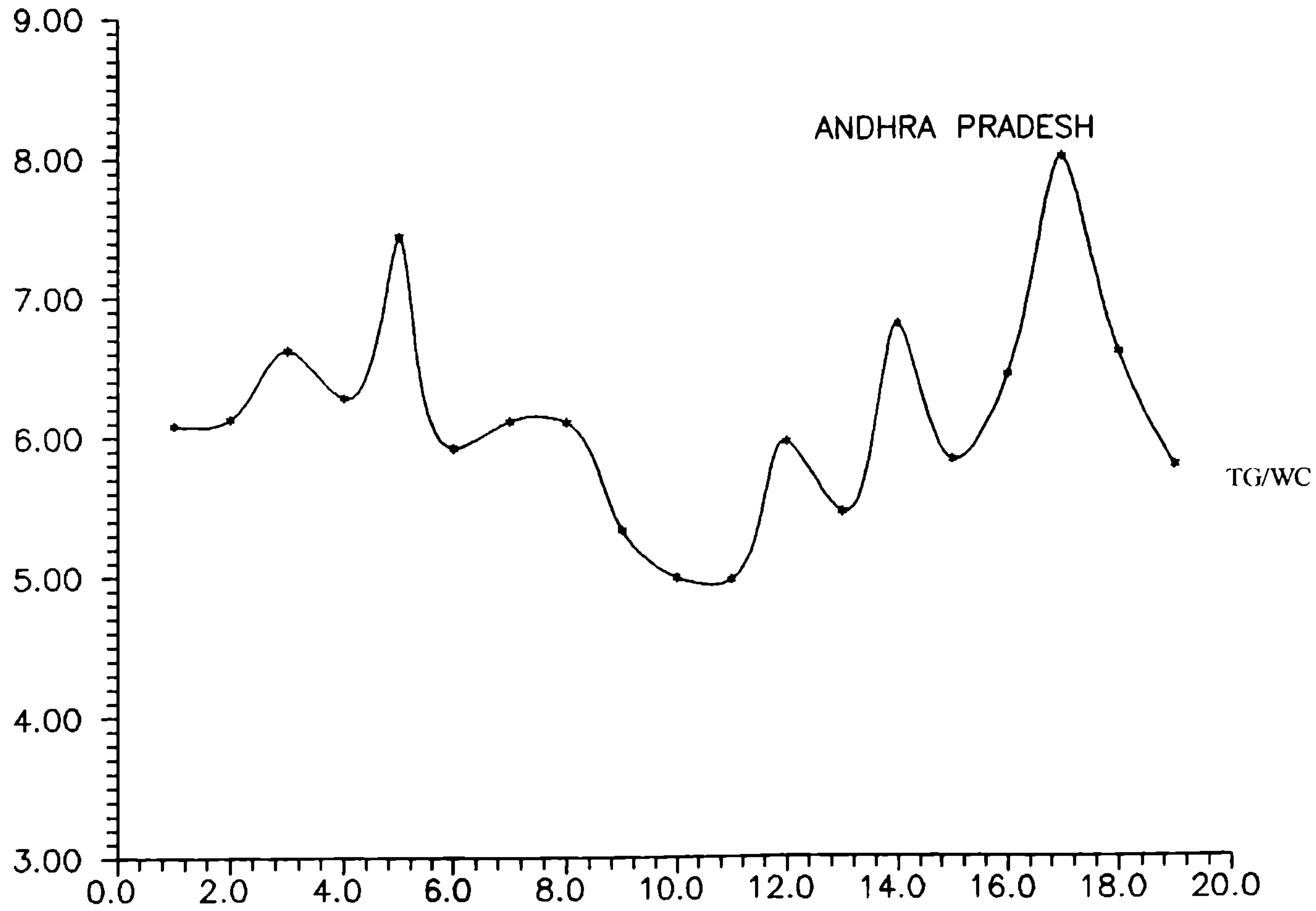

ANDHRA PRADESH
TG/FC
2.40
2.20
2.00
1.80
1.60
1.40
1.20
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0

Fig. 3.1 b



ANDHRA PRADESH
9.00
8.00
7.00
6.00
5.00
4.00
3.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
TG/WC

Fig. 3.1 b

ANDHRA PRADESH

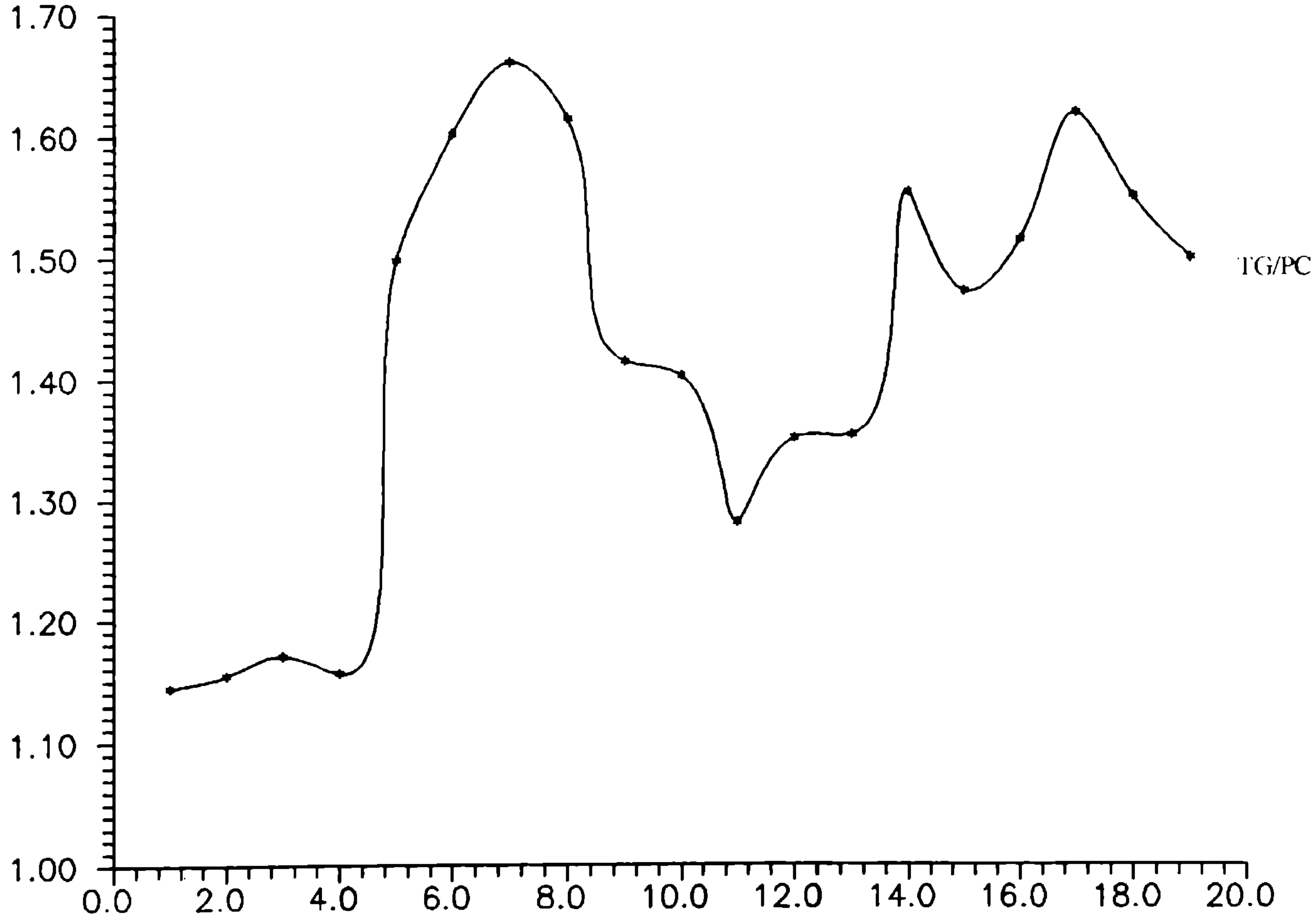


Fig. 3.1 b

ANDHRA PRADESH

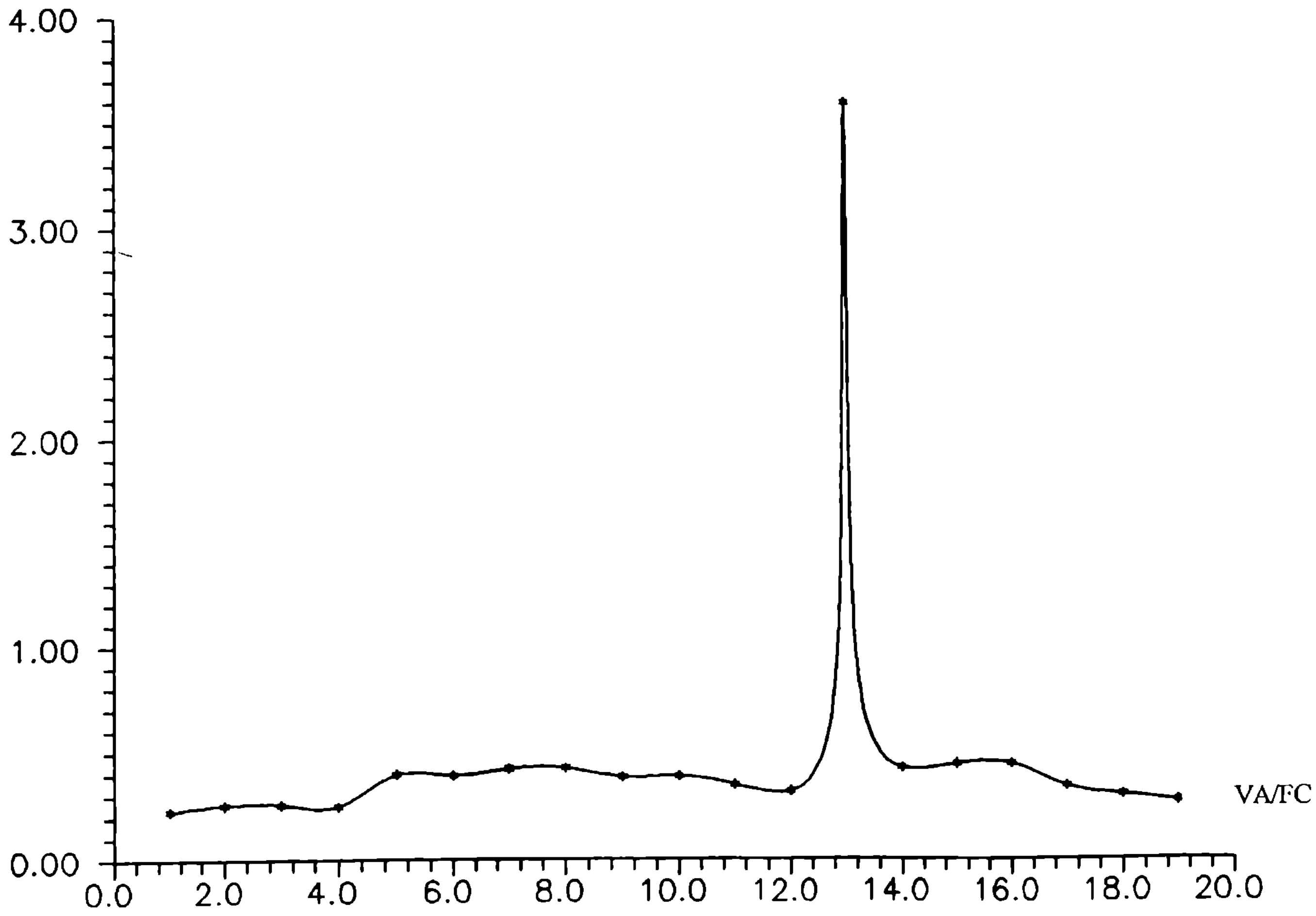


Fig. 3.1 b

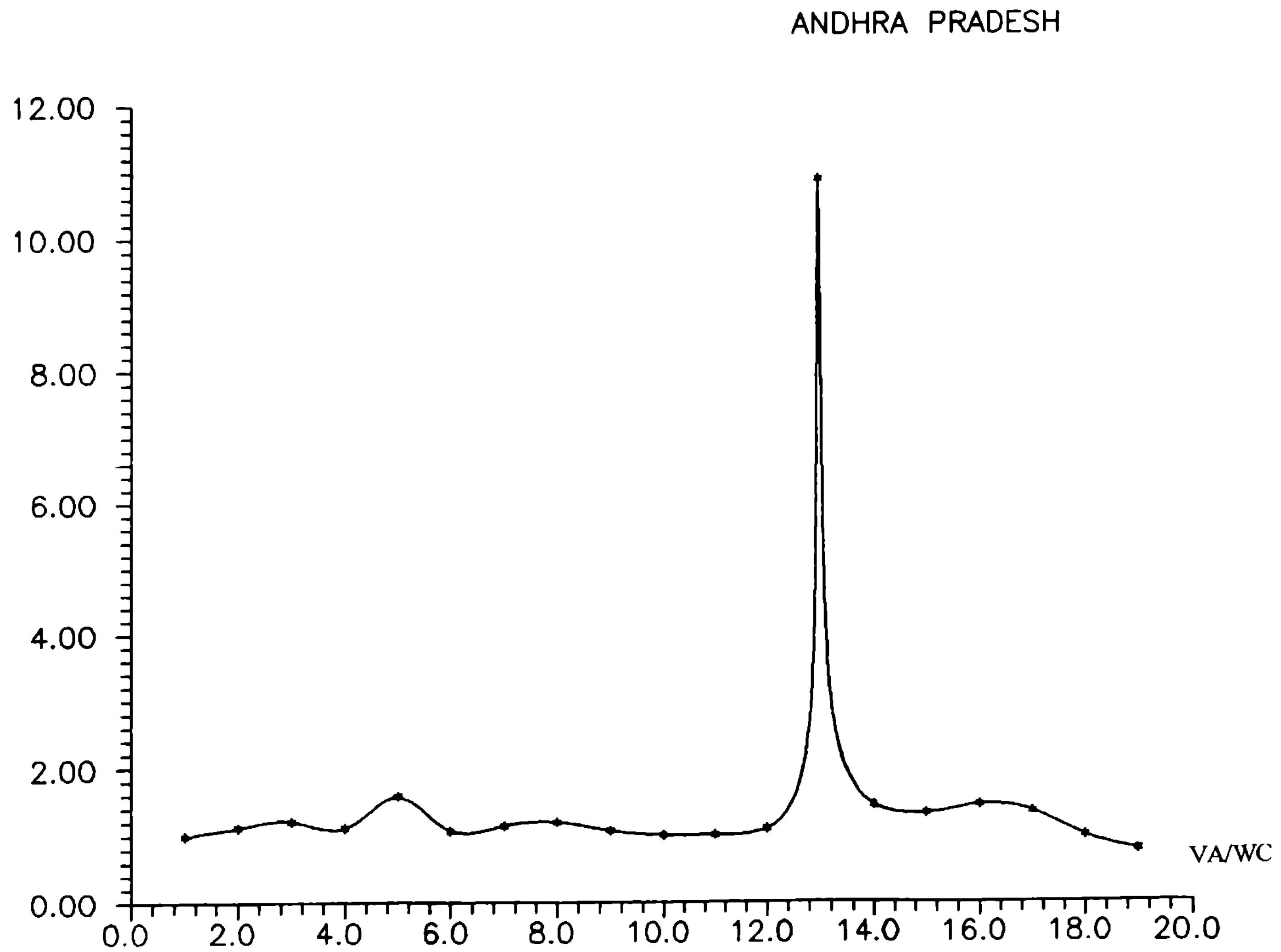

ANDHRA PRADESH
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
VA/WC

Fig. 3.1 b

ANDHRA PRADESH

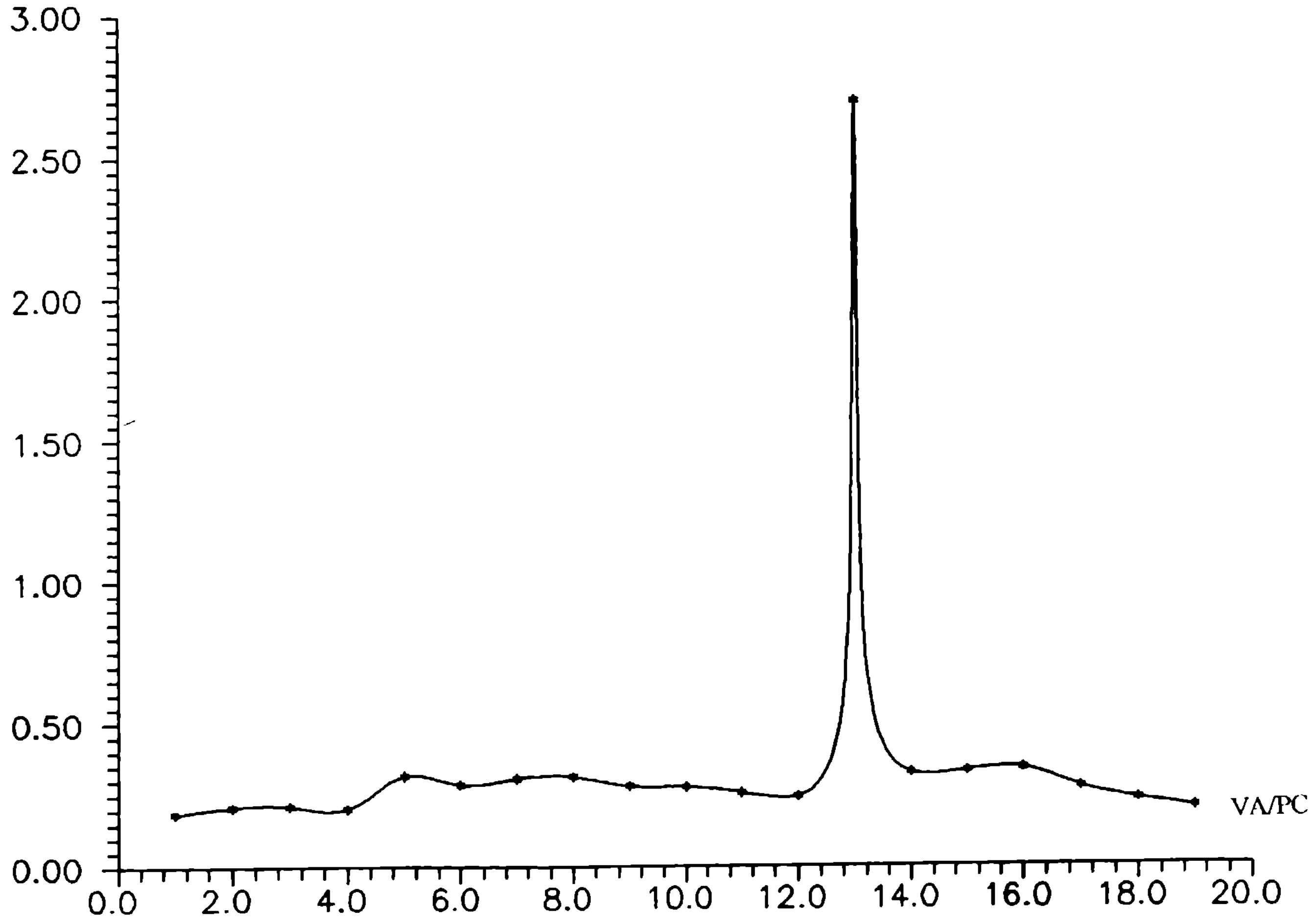


Fig. 3.1 b

ANDHRA PRADESH

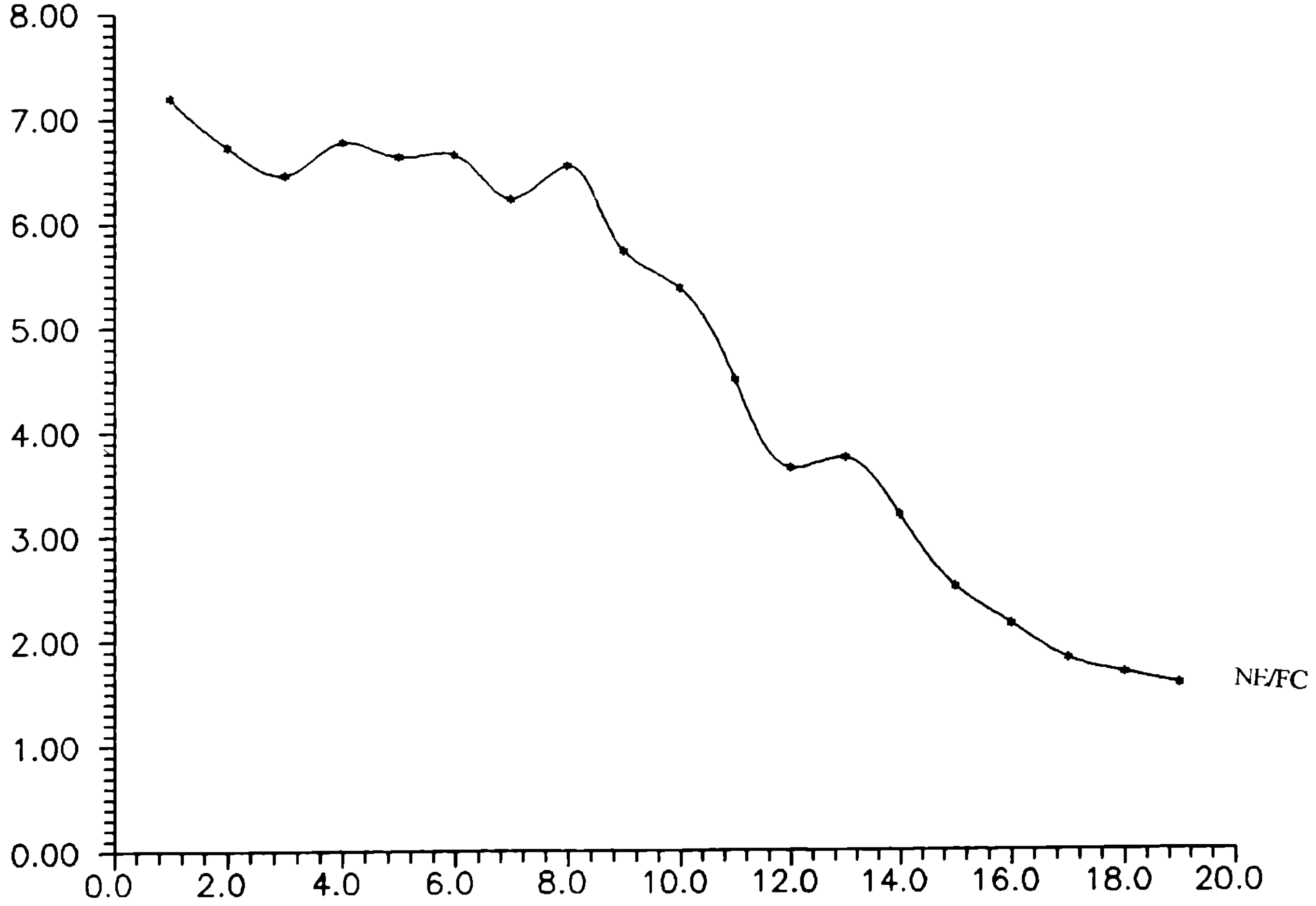


Fig. 3.1 b

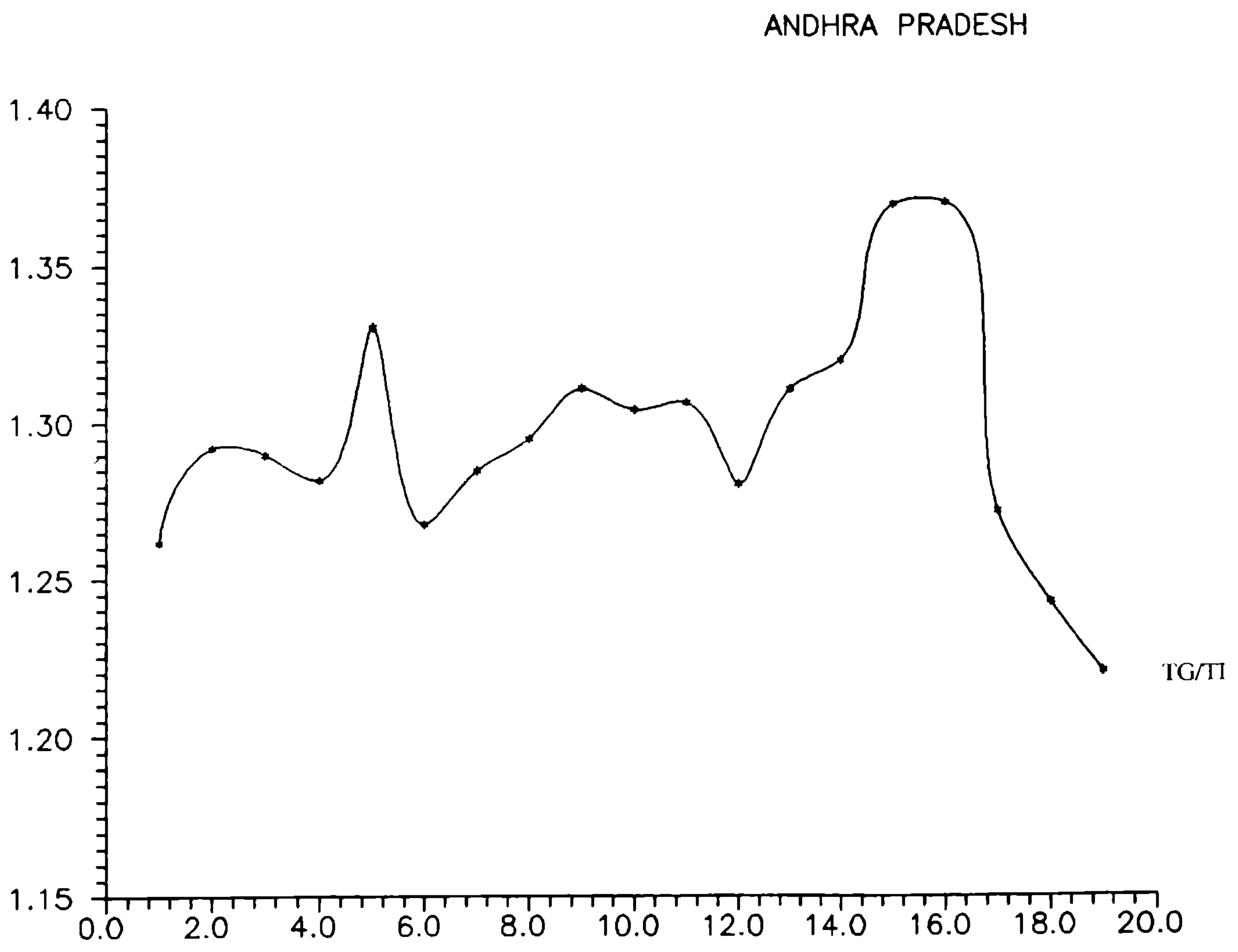

ANDHRA PRADESH
1.40
1.35
1.30
1.25
1.20
1.15
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
TG/TI

Fig. 3.1 b

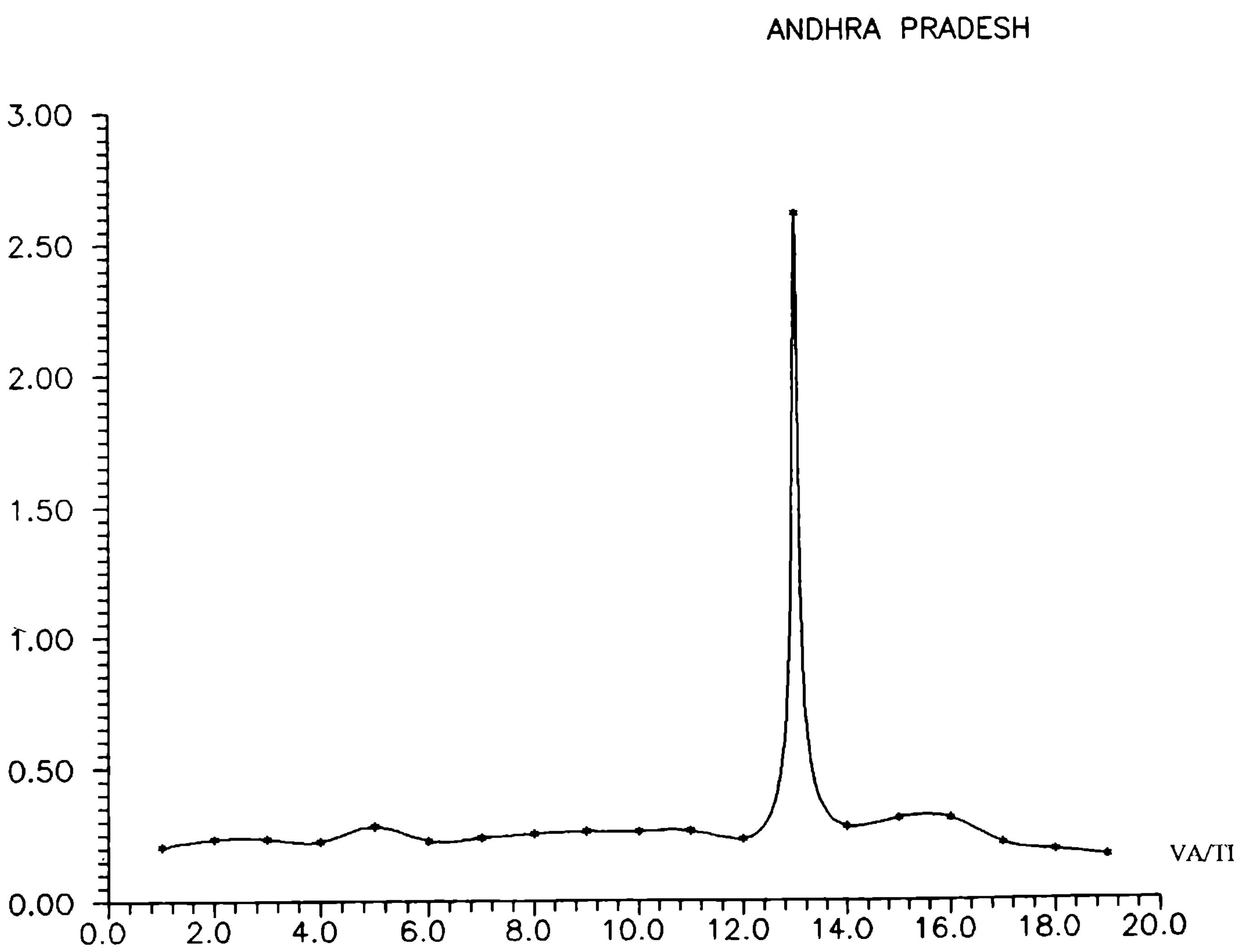
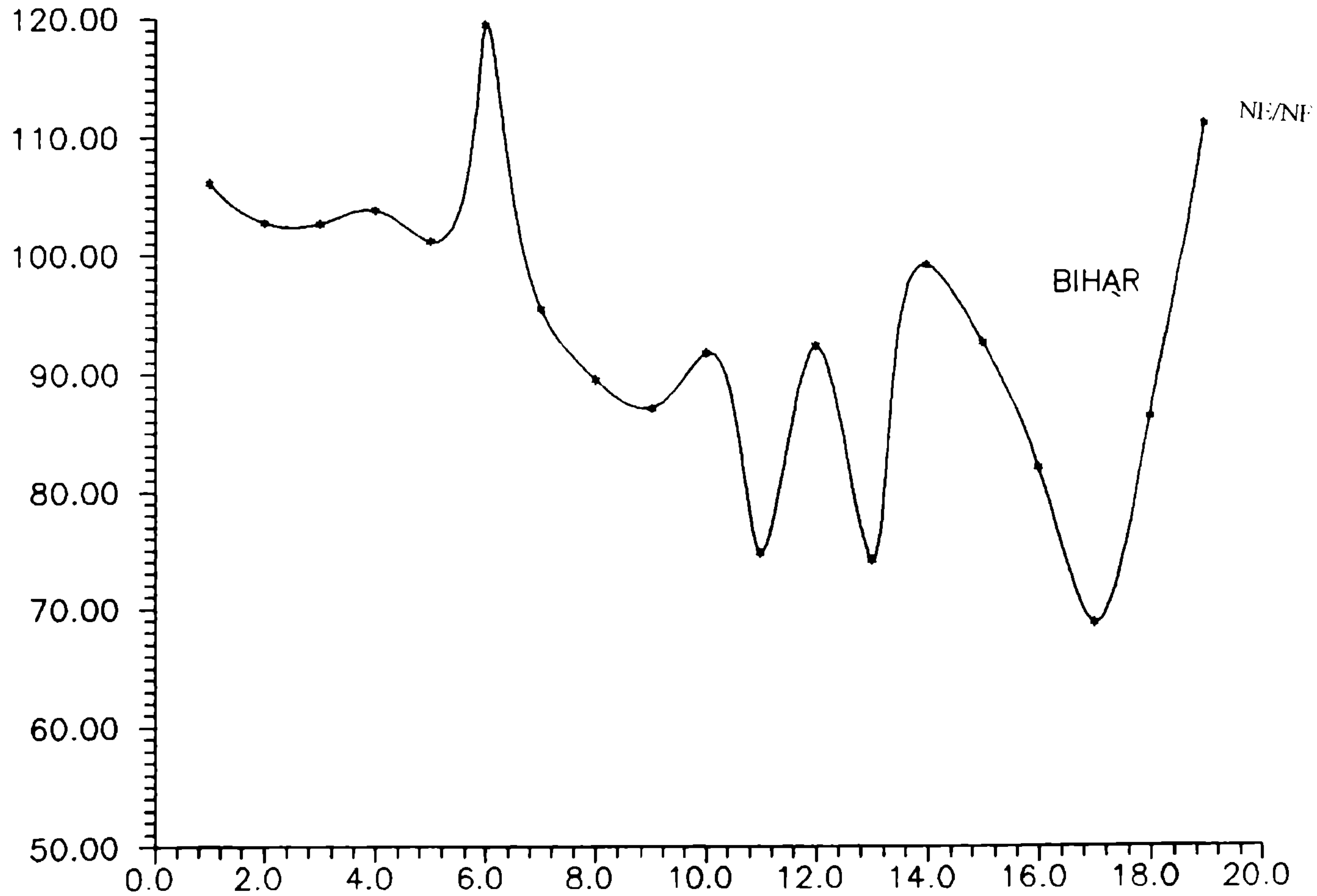

ANDHRA PRADESH
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
VA/TI

Fig. 3.2 b



120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
BIHAR
NE/NF

Fig. 3.2 b

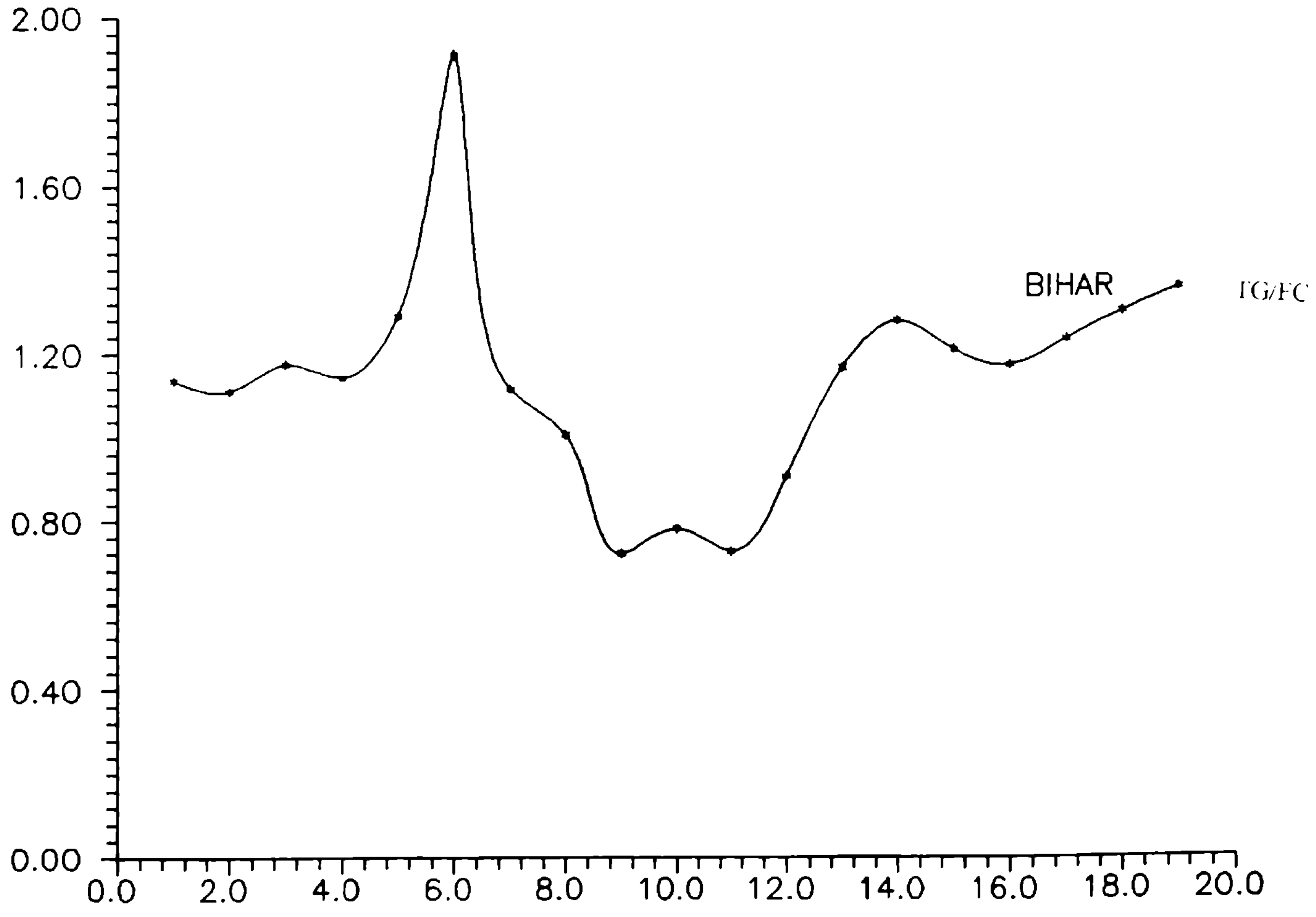
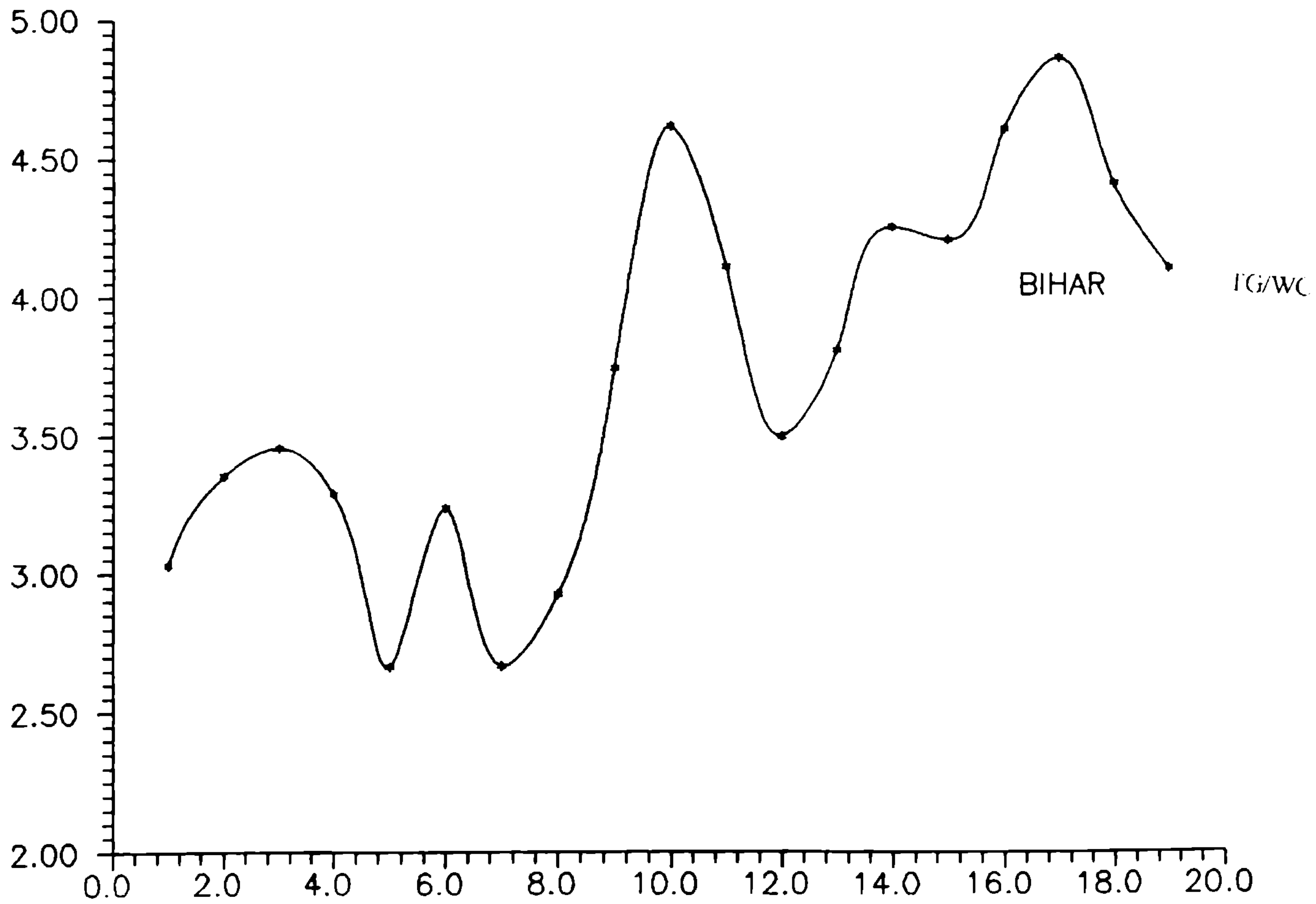

2.00
1.60
1.20
0.80
0.40
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
BIHAR
FG/FC

Fig. 3.2 b



5.00
4.50
4.00
3.50
3.00
2.50
2.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
BIHAR
TG/WC

Fig. 3.2 b

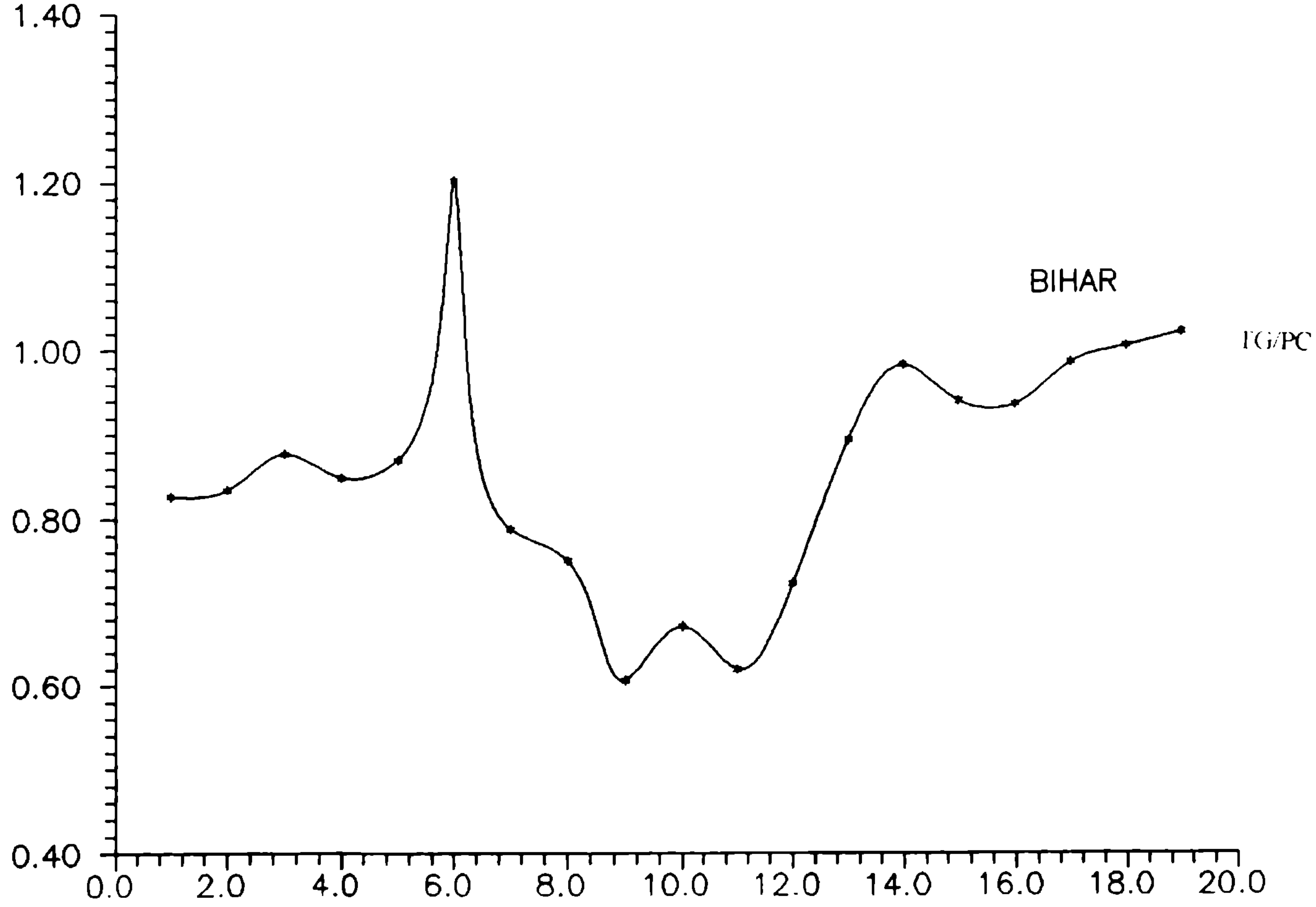
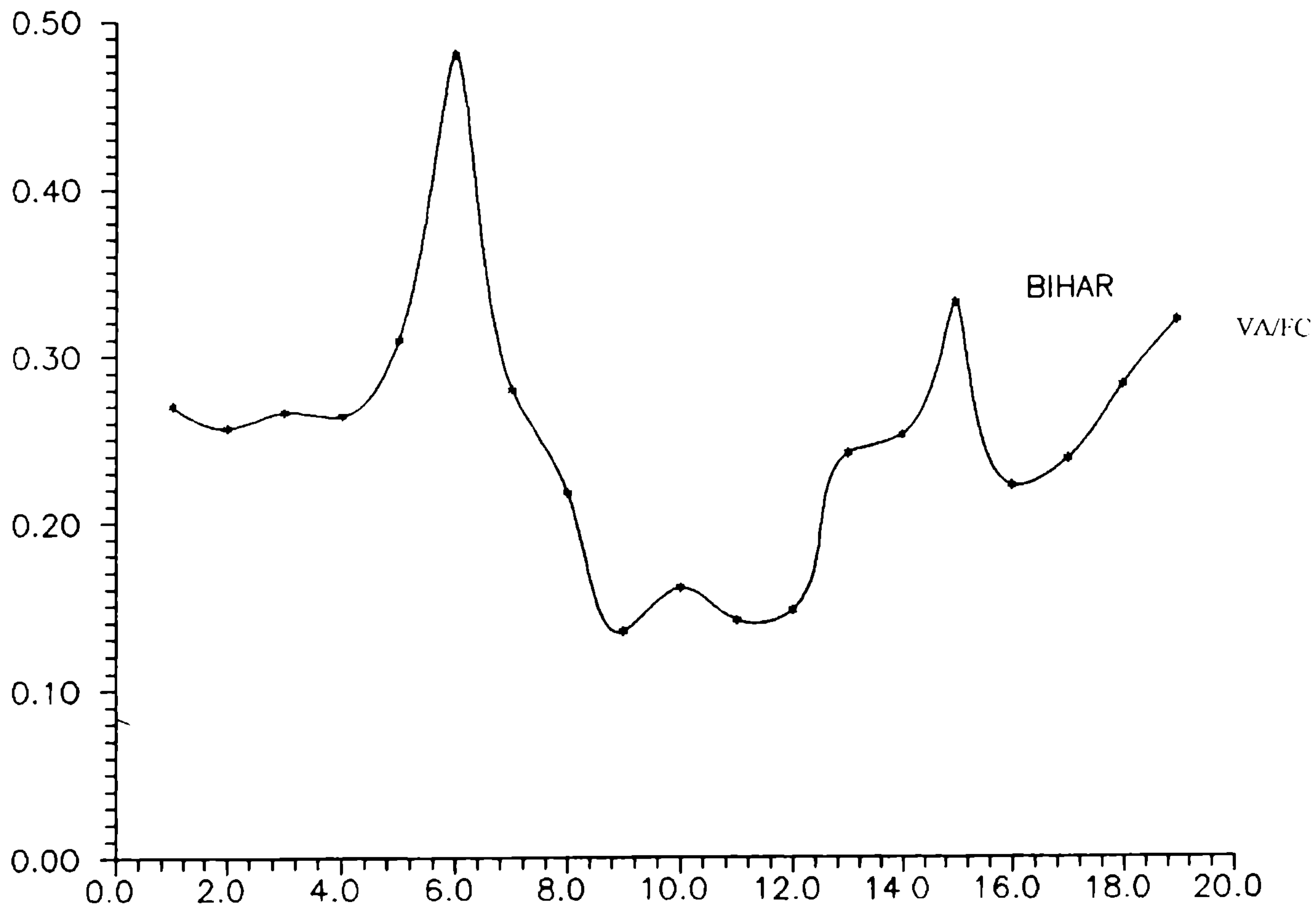
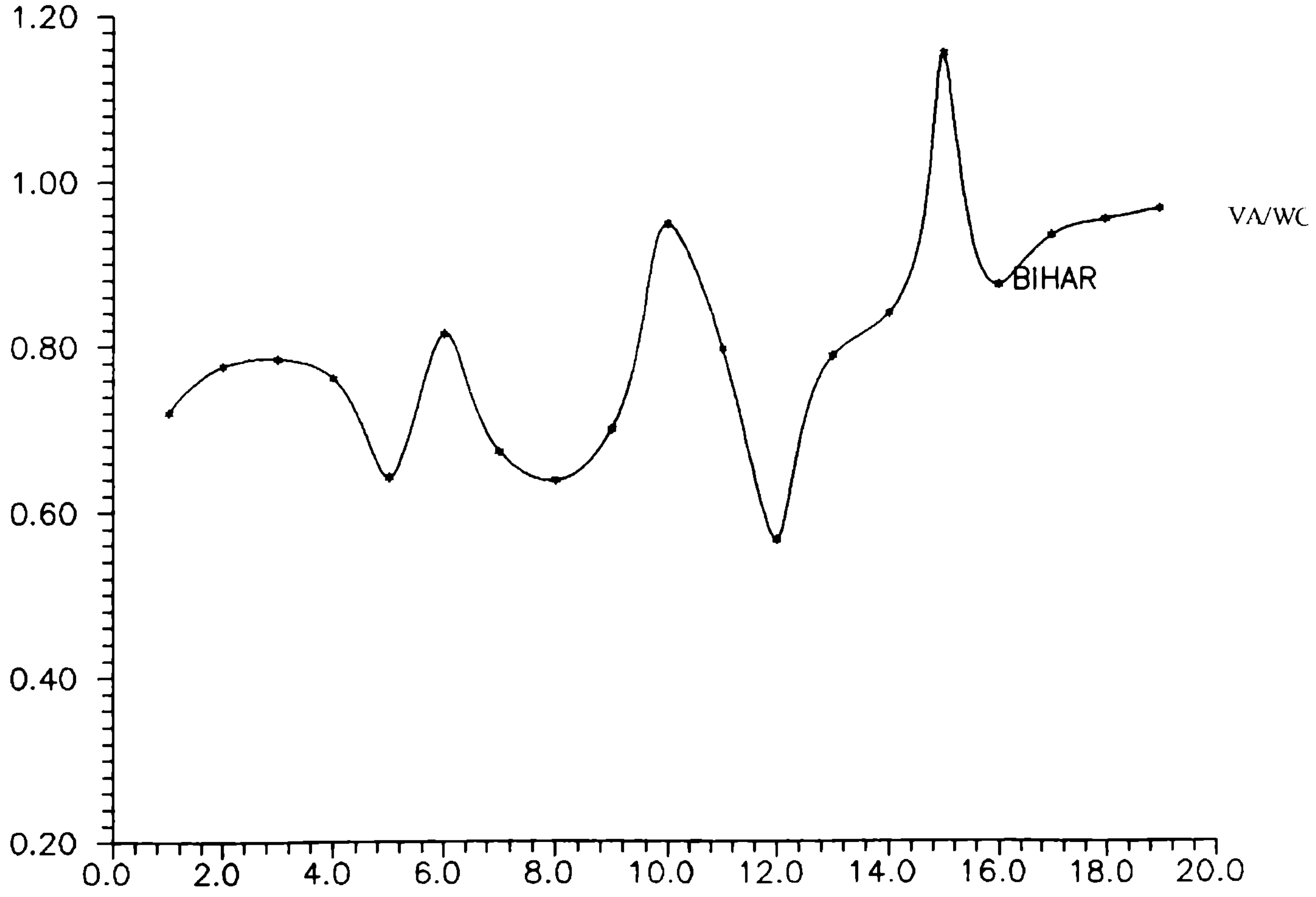

1.40
1.20
1.00
0.80
0.60
0.40
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
BIHAR
FG/PC

Fig. 3.2 b



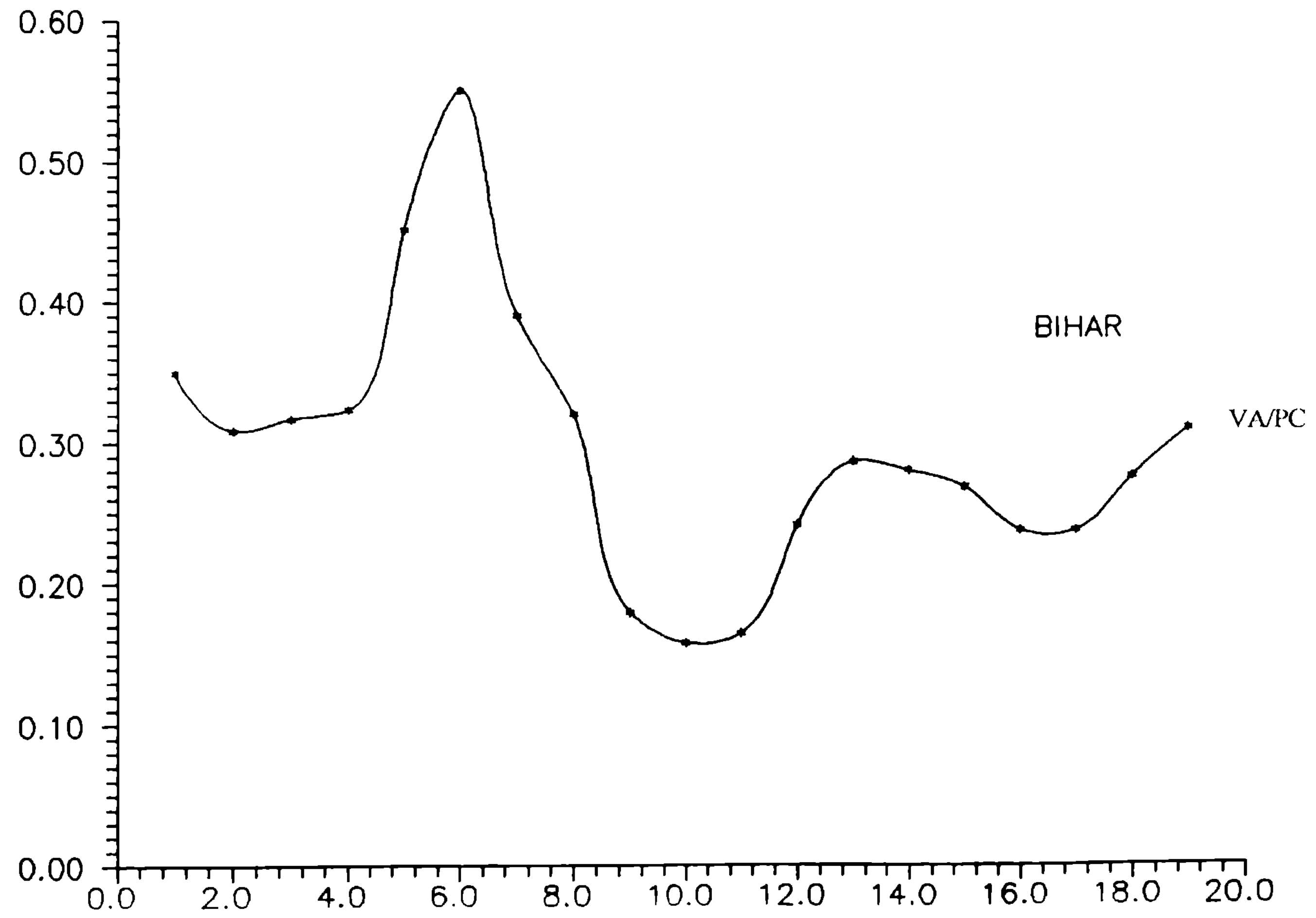
0.50
0.40
0.30
0.20
0.10
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14 0
16.0
18.0
20.0
BIHAR
VA/FC

Fig. 3.2 b



1.20
1.00
0.80
0.60
0.40
0.20
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
BIHAR
VA/WC

Fig. 3.2 b


0.60
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0.30
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0.10
0.00
0.0
2.0
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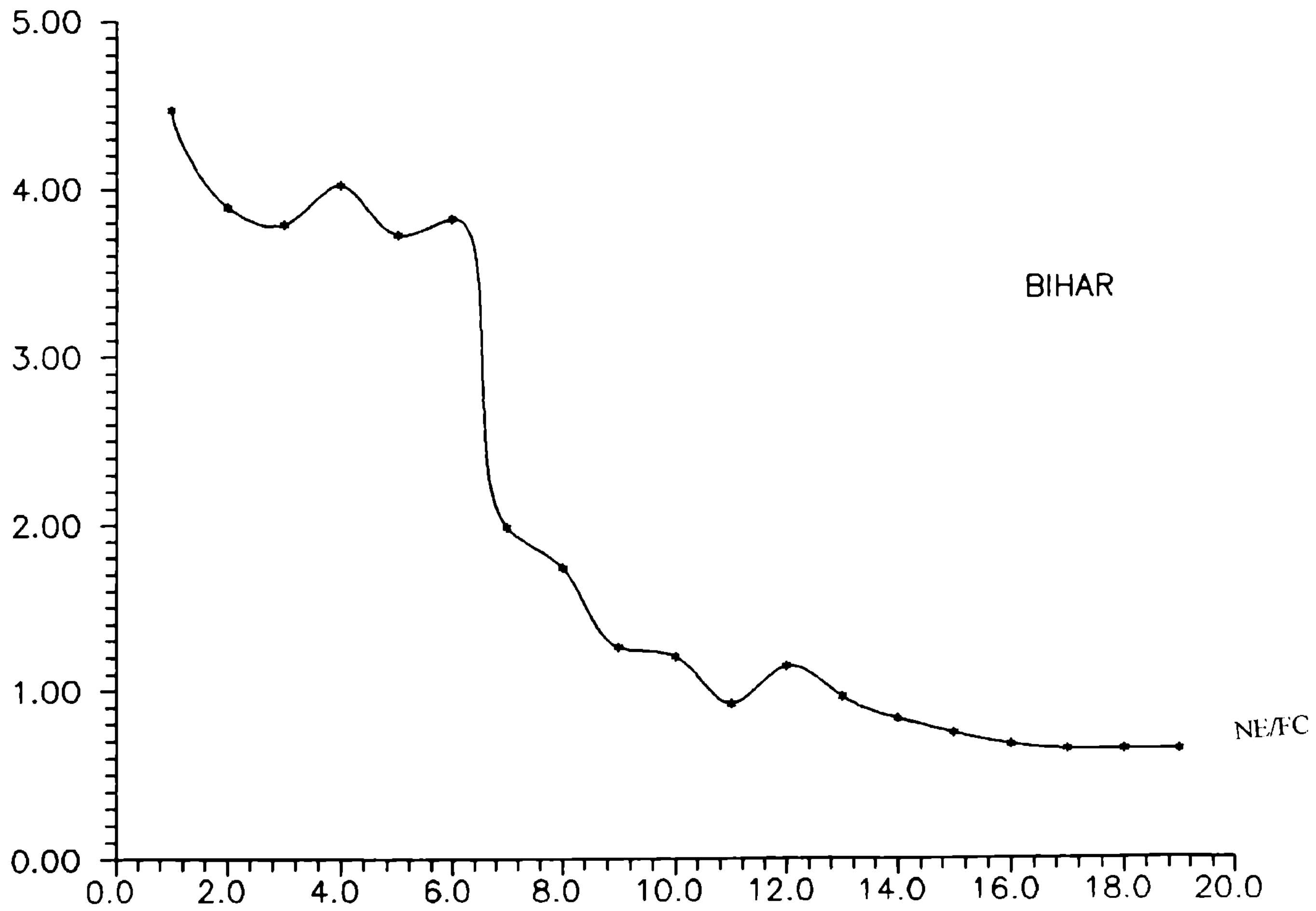
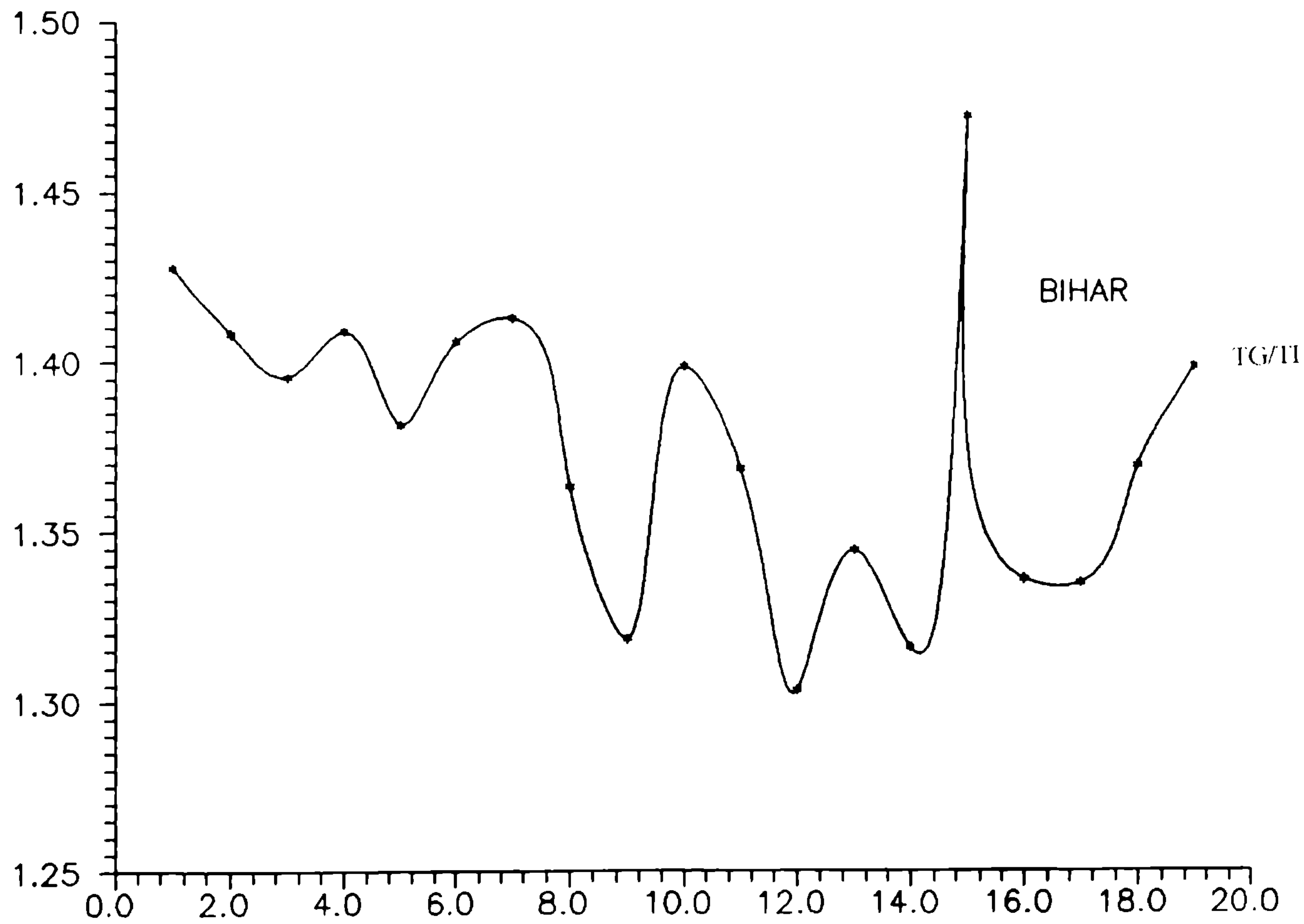
10.0
12.0
14.0
16.0
18.0
20.0
BIHAR
VA/PC

Fig. 3.2 b



BIHAR
NE/FC
5.00
4.00
3.00
2.00
1.00
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0

Fig. 3.2 b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1.45
1.40
1.35
1.30
1.25
0.0
2.0
4.0
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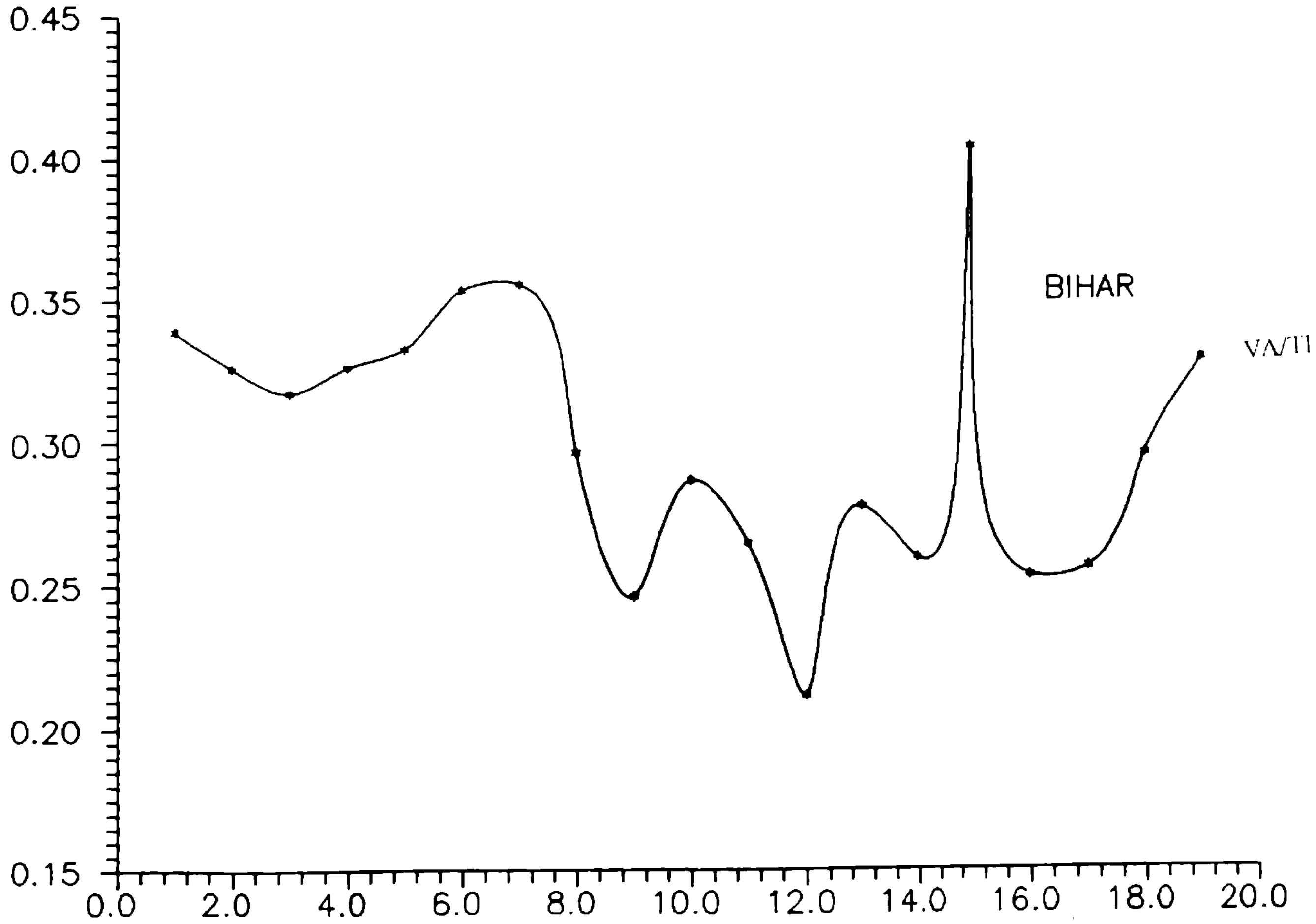
10.0
12.0
14.0
16.0
18.0
20.0
BIHAR
TG/TI

Fig. 3.2 b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0.40
0.35
0.30
0.25
0.20
0.15
0.0
2.0
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6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
BIHAR

Fig. 3.3 b

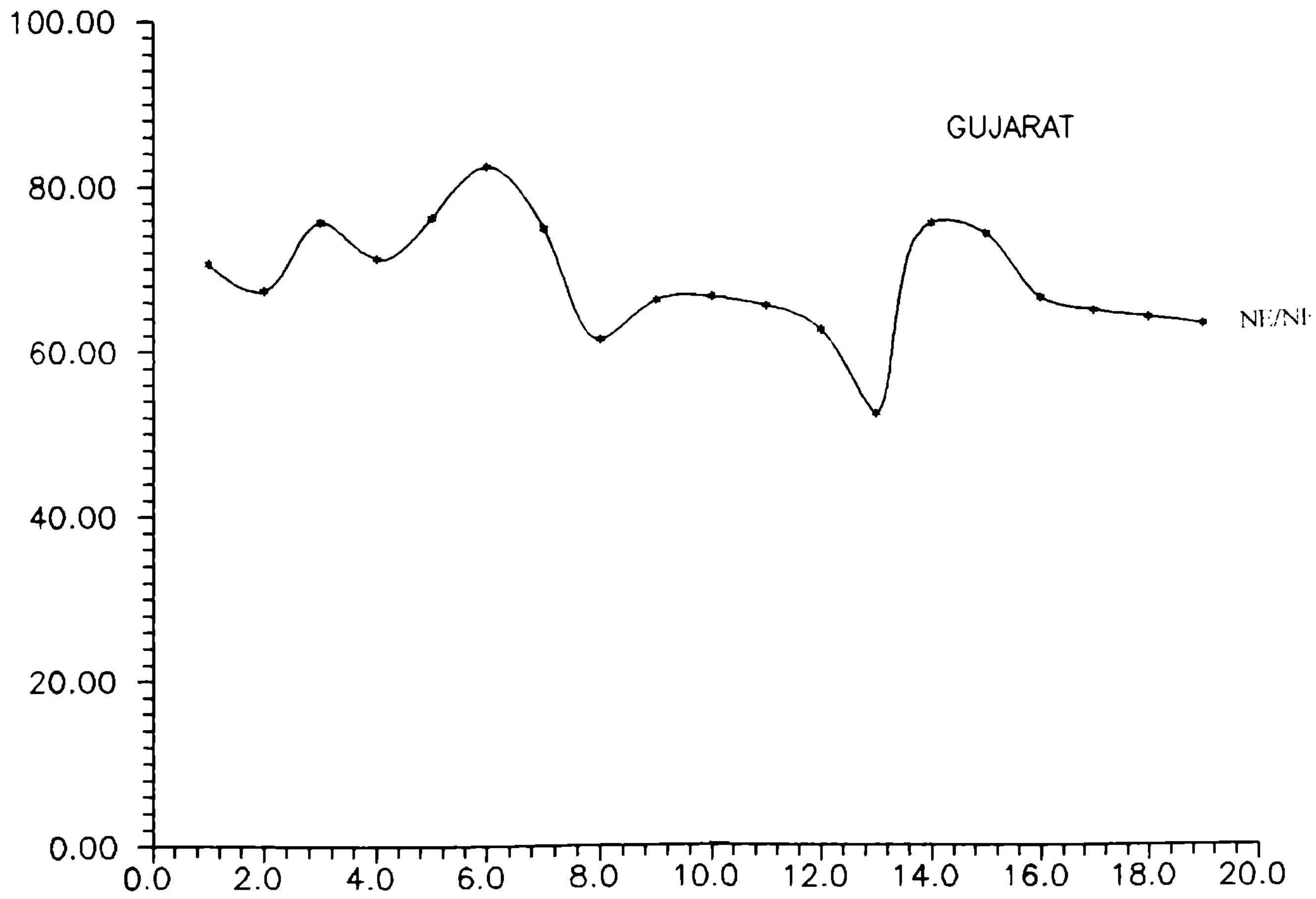

GUJARAT
NE/NE
100.00
80.00
60.00
40.00
20.00
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0

Fig. 3.3 b

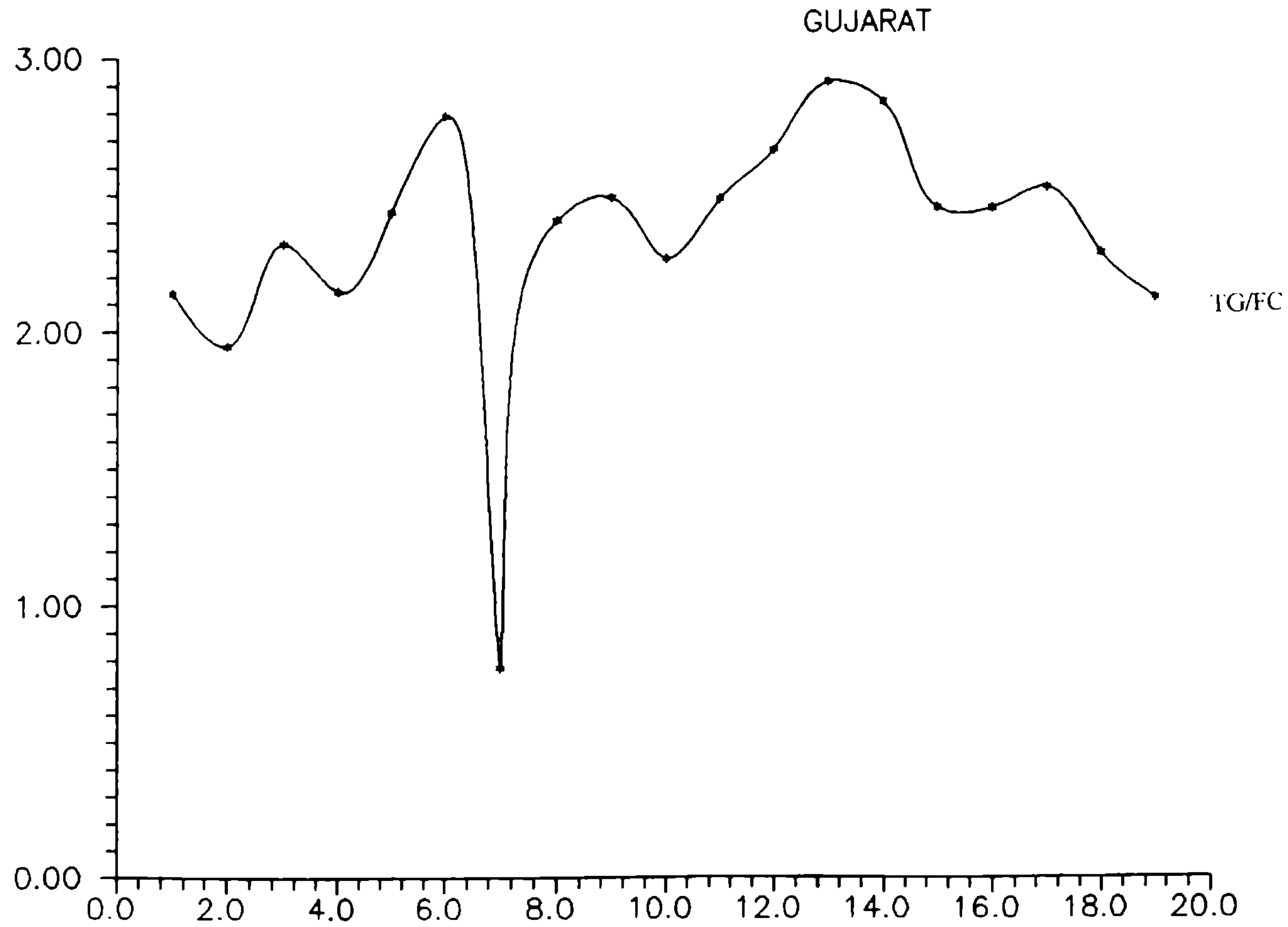

GUJARAT
3.00
2.00
1.00
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
TG/FC

Fig. 3.3 b

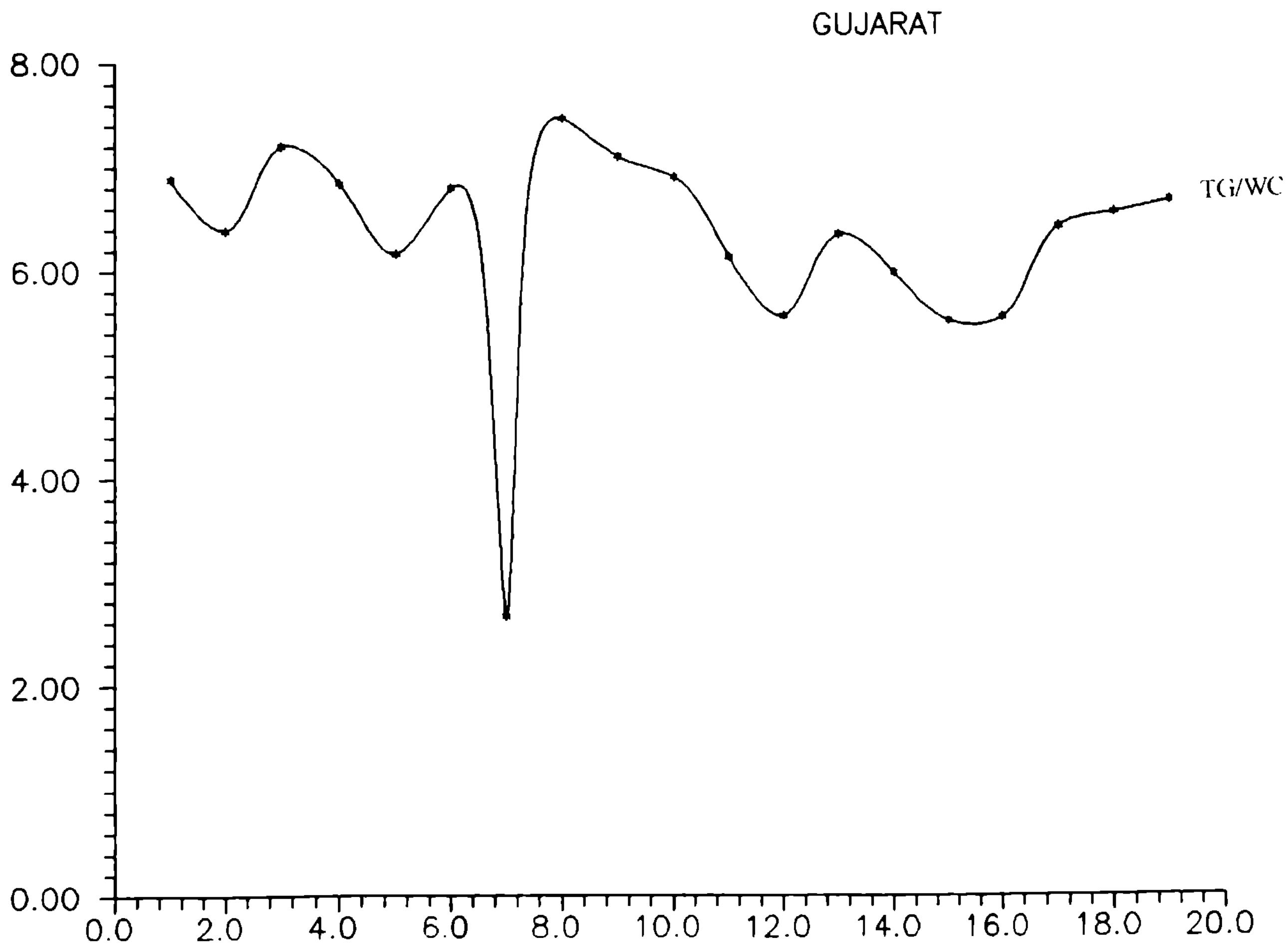

GUJARAT
TG/WC
8.00
6.00
4.00
2.00
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0

Fig. 3.3 b

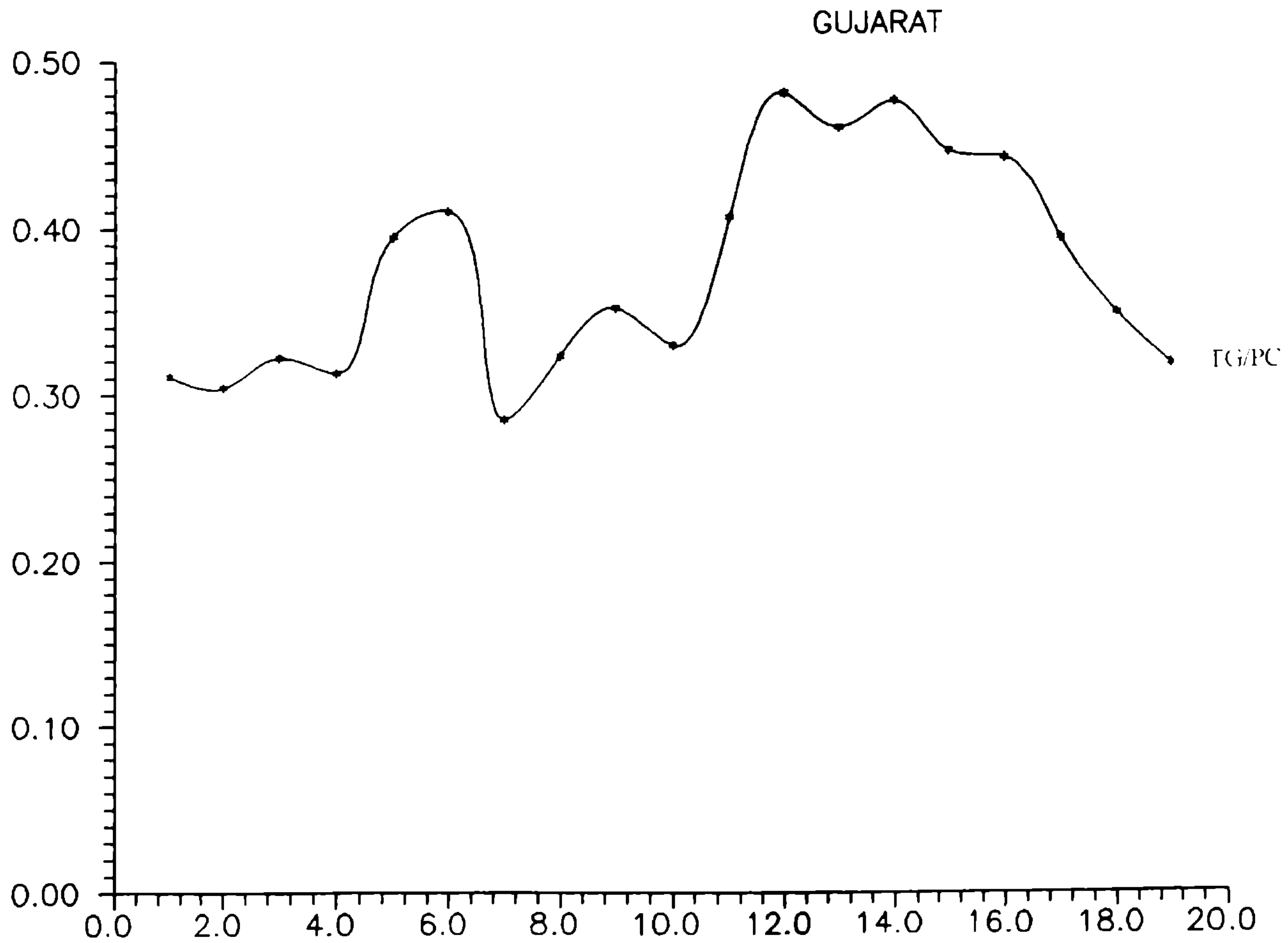

GUJARAT
TG/PC
0.50
0.40
0.30
0.20
0.10
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0

Fig. 3.3 b

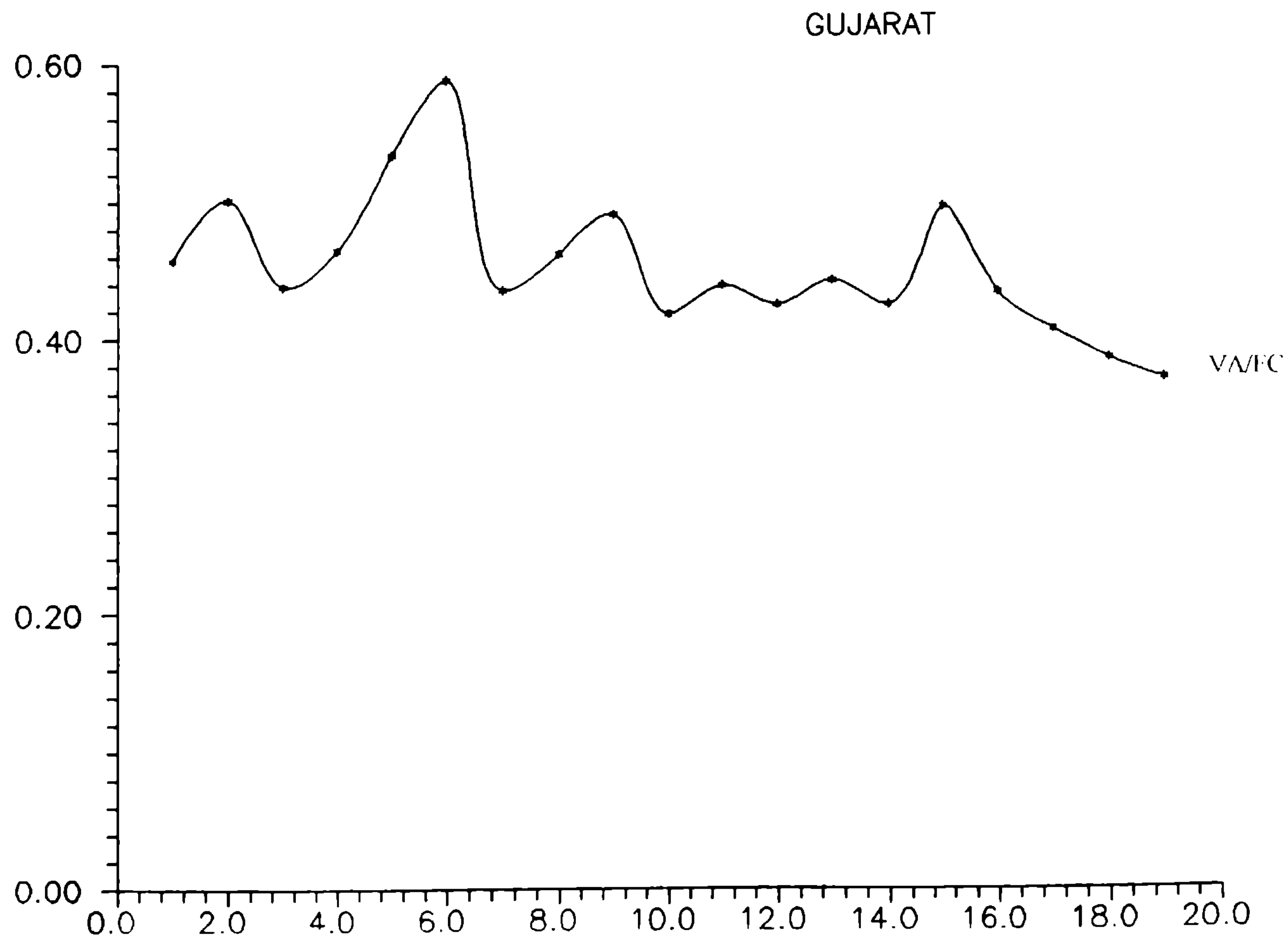

GUJARAT
0.60
0.40
0.20
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
VA/FC

Fig. 3.3 b

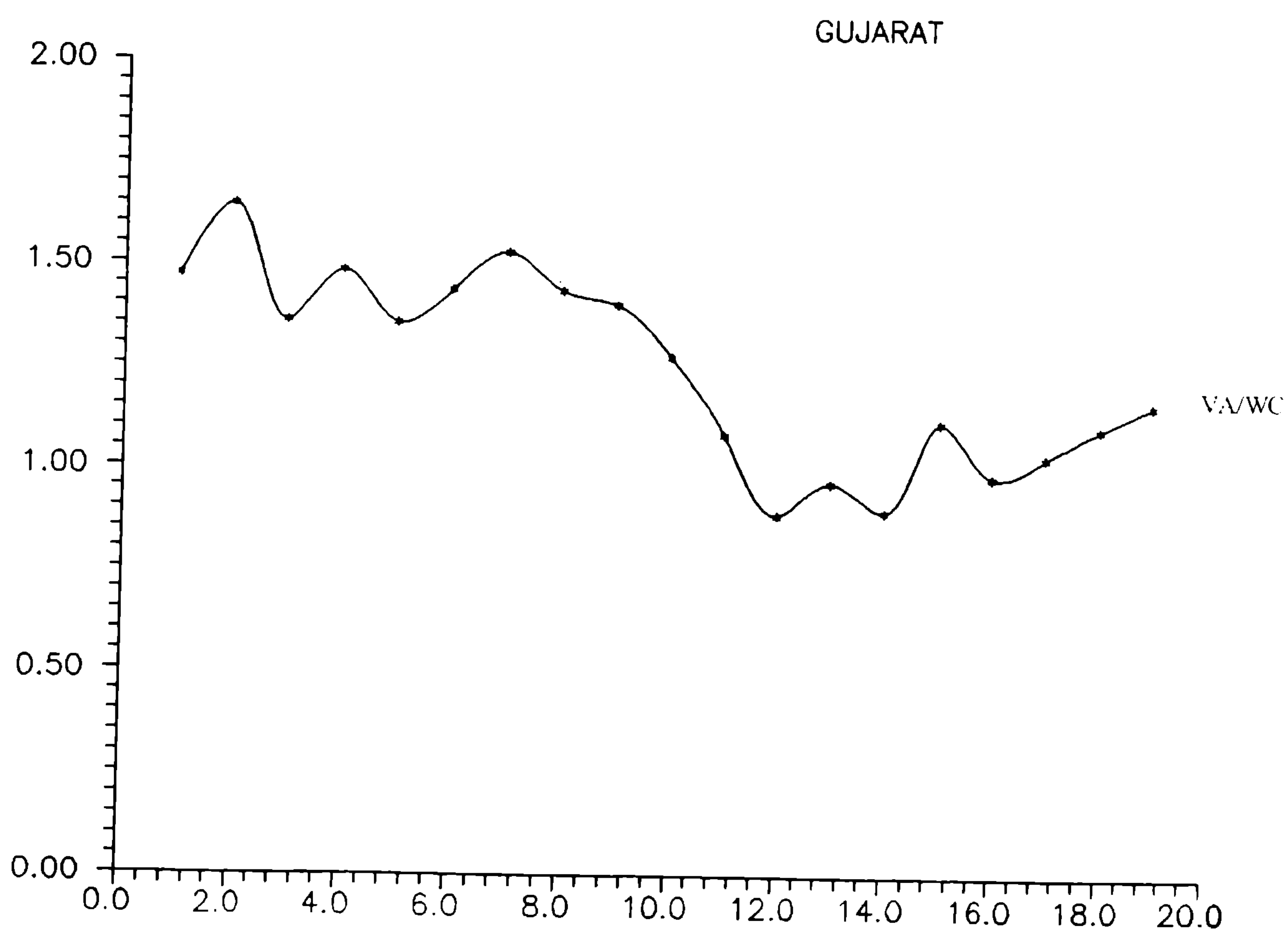

GUJARAT
2.00
1.50
1.00
0.50
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
VA/WC

Fig. 3.3 b

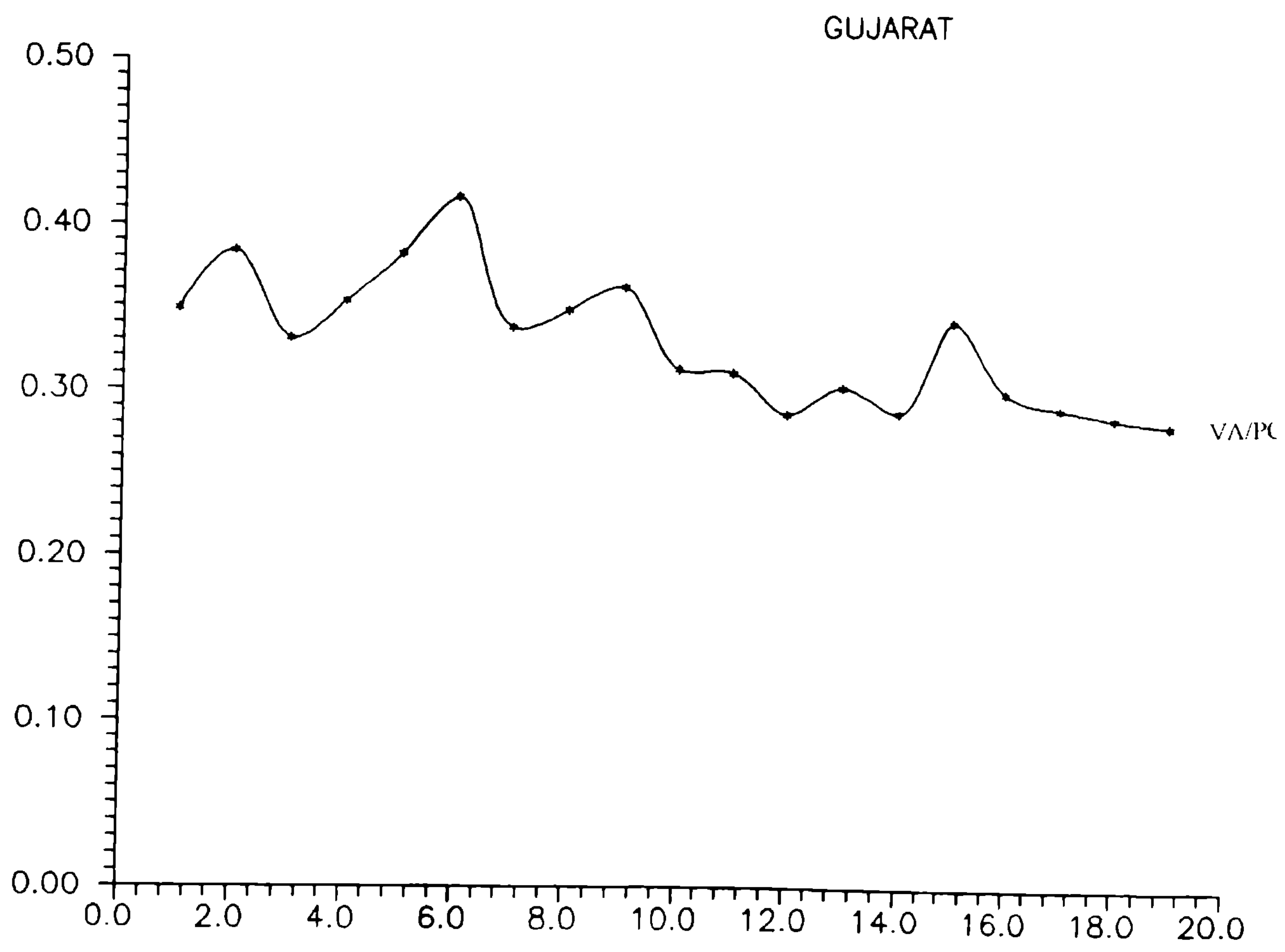

GUJARAT
0.50
0.40
0.30
0.20
0.10
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
VA/PC

Fig. 3.3 b

GUJARAT

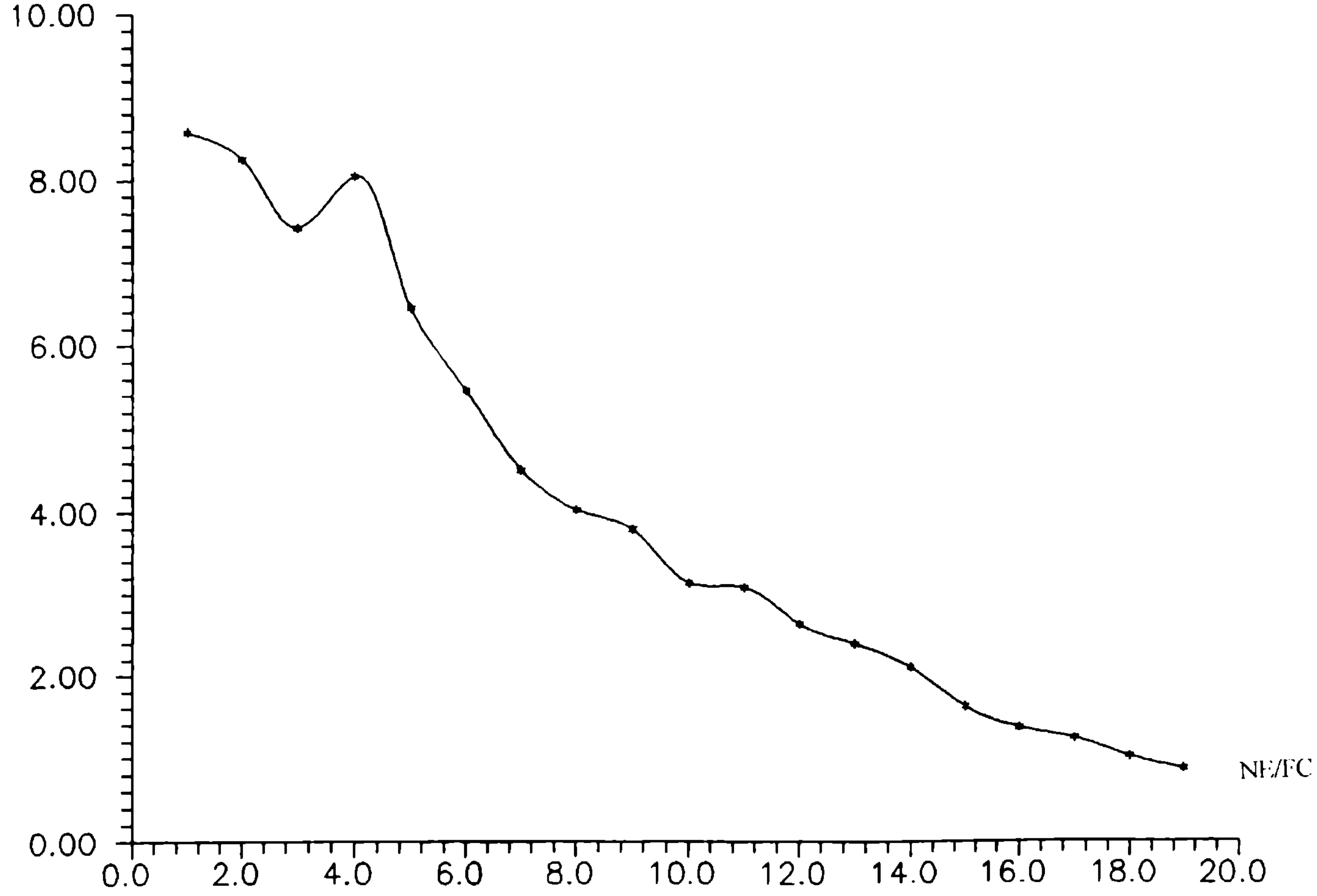


Fig. 3.3 b

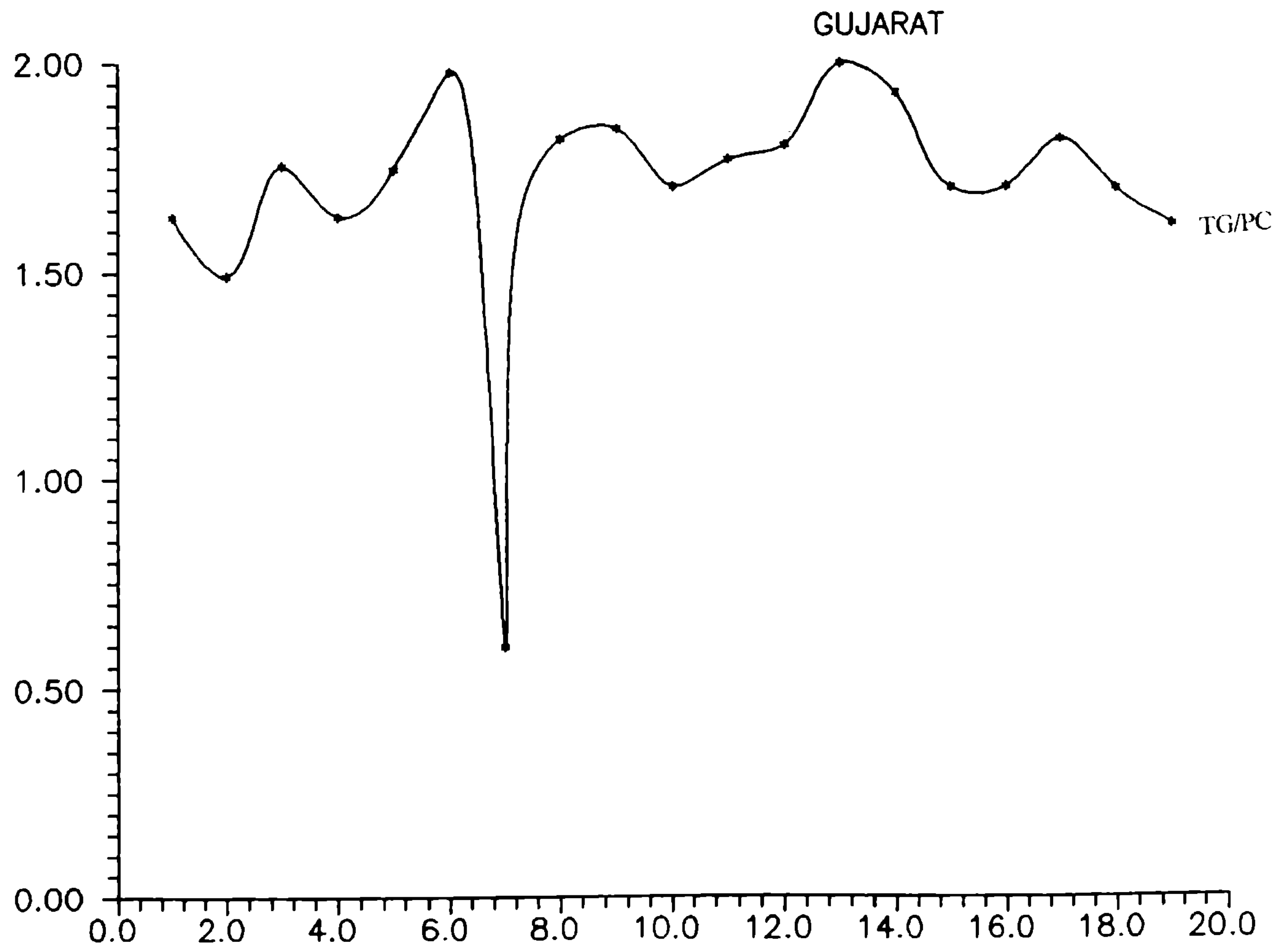
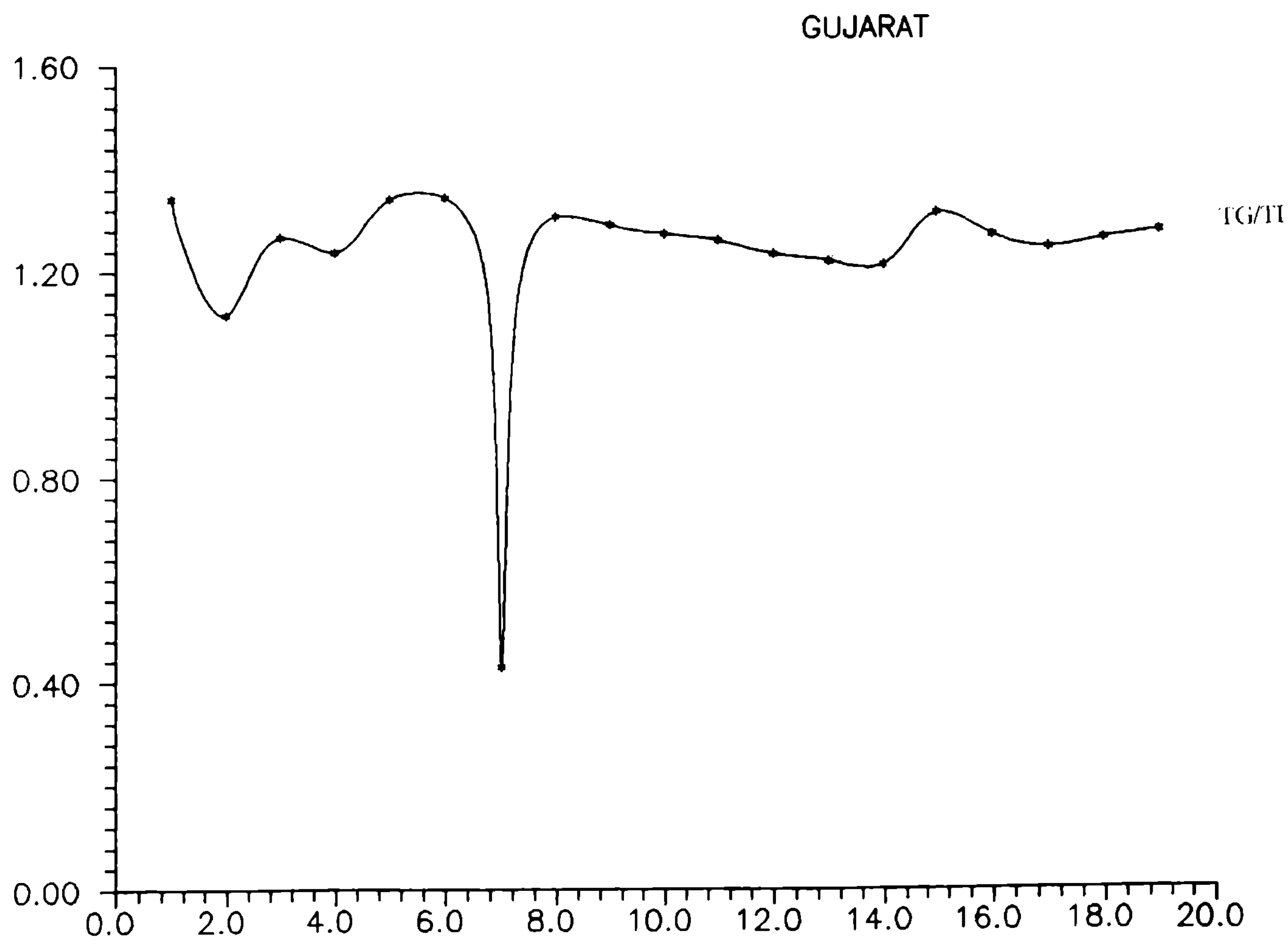

GUJARAT
TG/PC
2.00
1.50
1.00
0.50
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0

Fig. 3.3 b



96 www

Fig. 3.3b

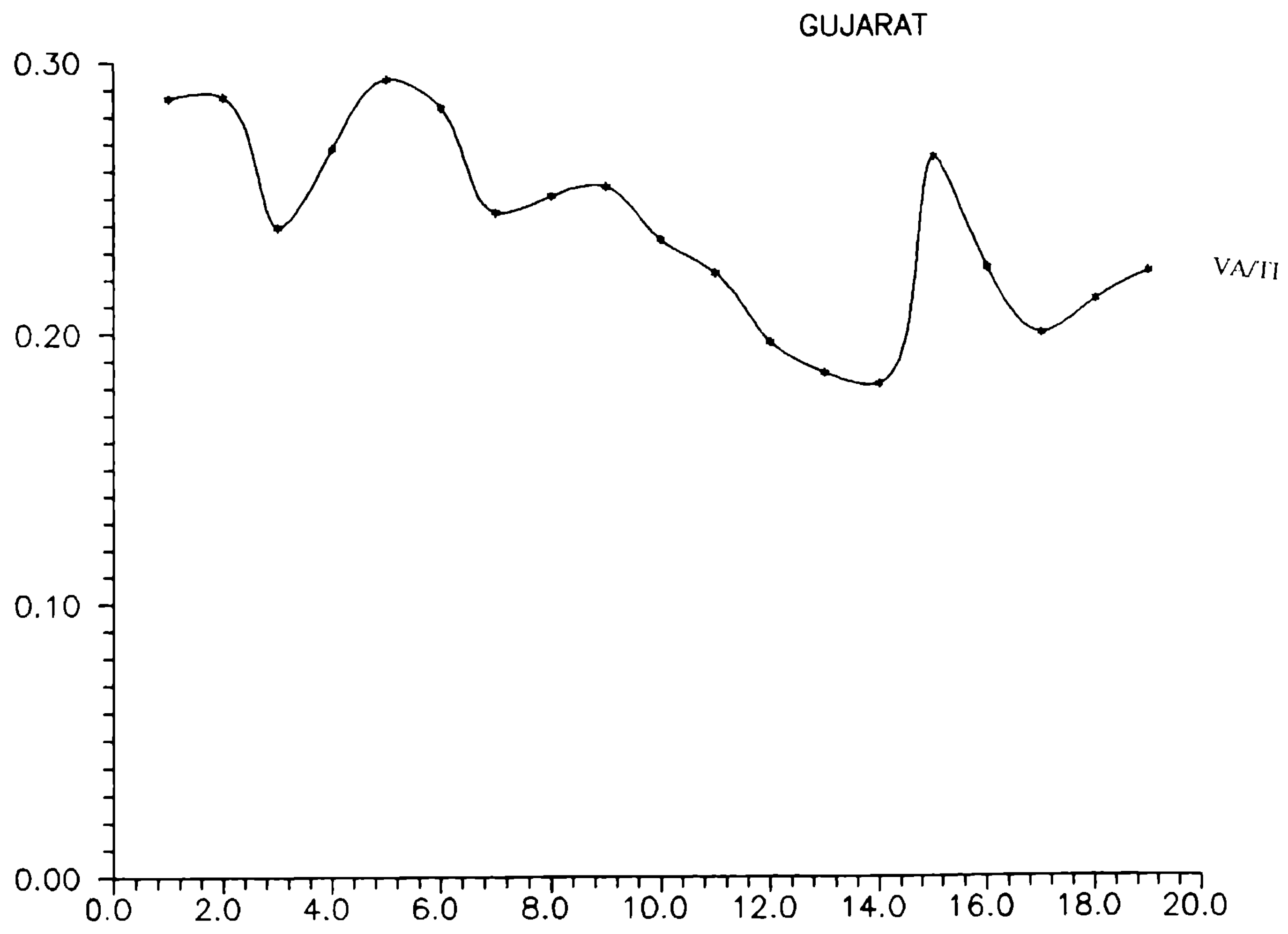
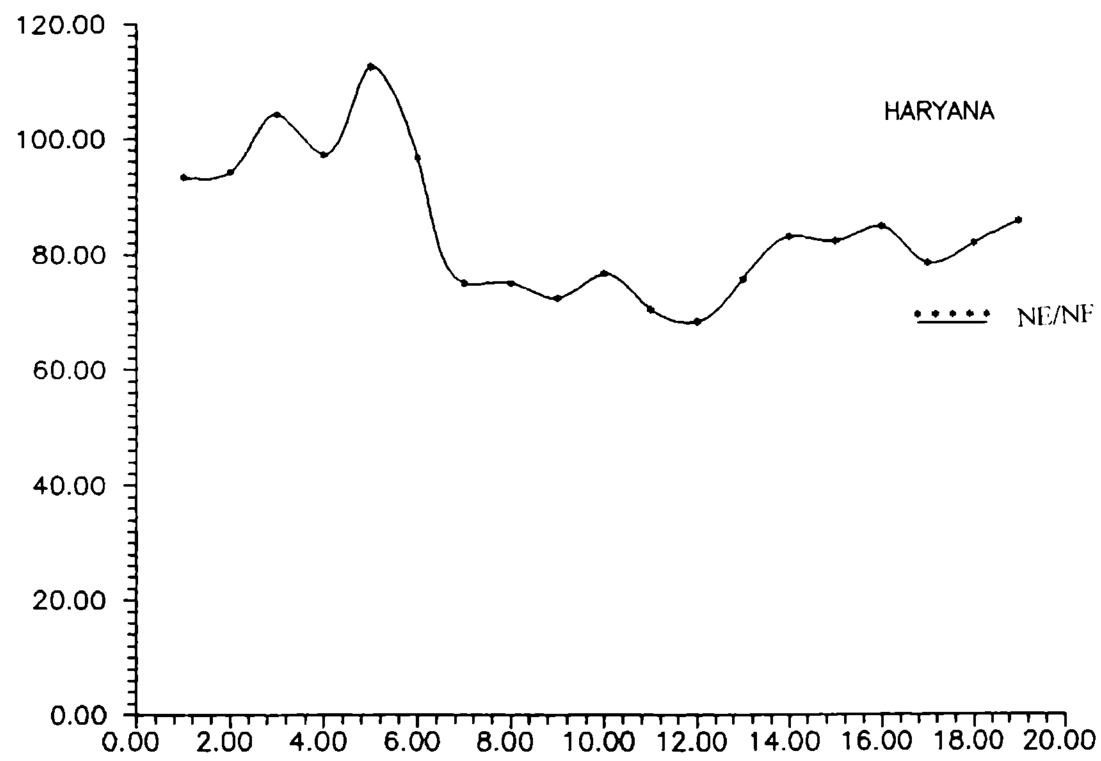
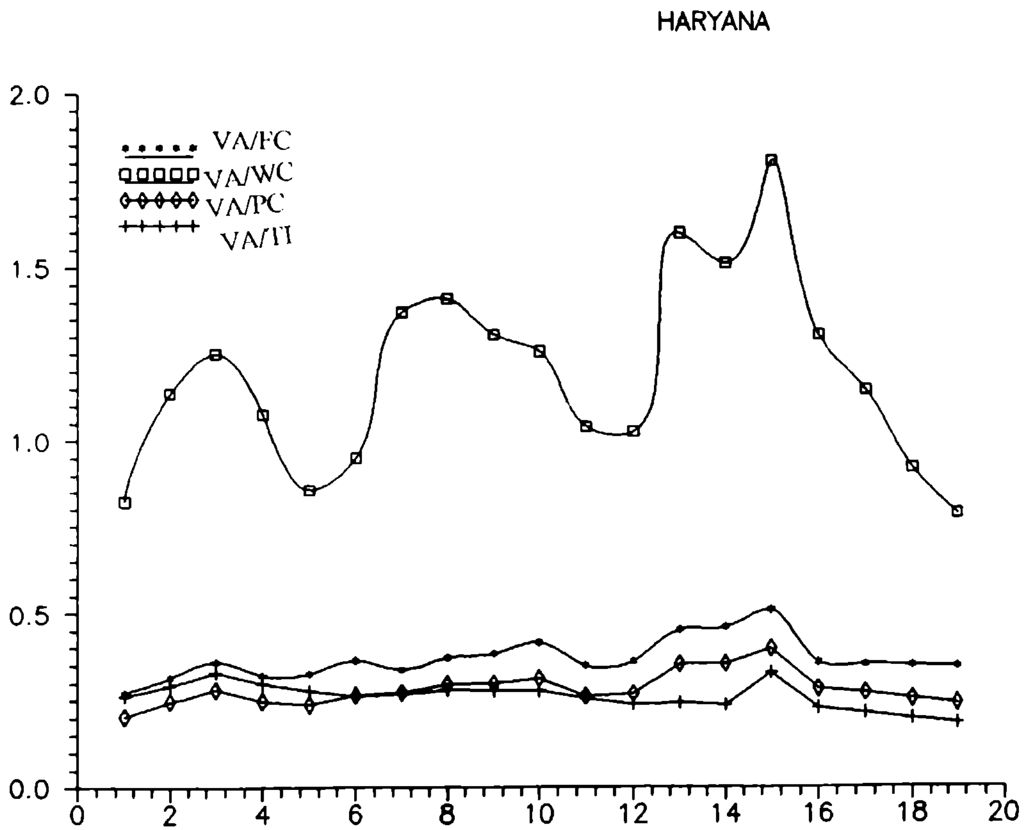

GUJARAT
0.30
0.20
0.10
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
VA/TI

Fig. 3.4 b



HARYANA
NE/NF
120.00
100.00
80.00
60.00
40.00
20.00
0.00
0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00 18.00 20.00

Fig. 3.4 b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VA/FC
VA/WC
VA/PC
VA/TI
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1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20

Fig. 3.4 b

HARYANA

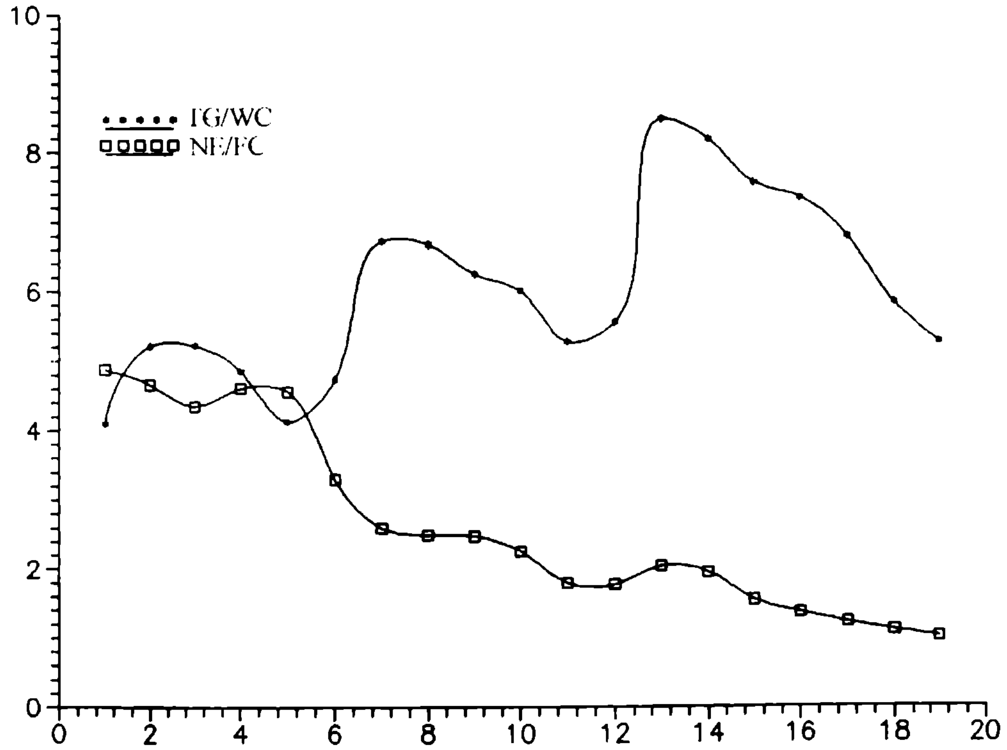
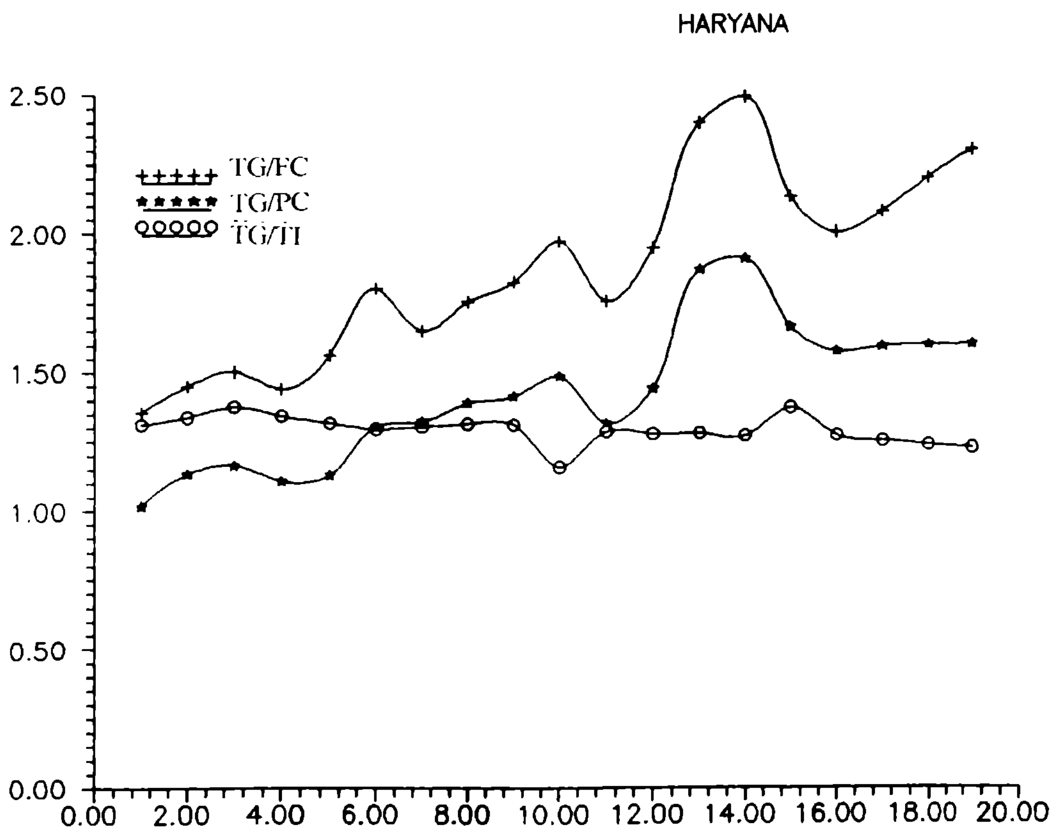


Fig. 3.4 b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TG/FC
TG/PC
TG/TI
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0.50
1.00
1.50
2.00
2.50
0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00 18.00 20.00

Fig. 3.5 b

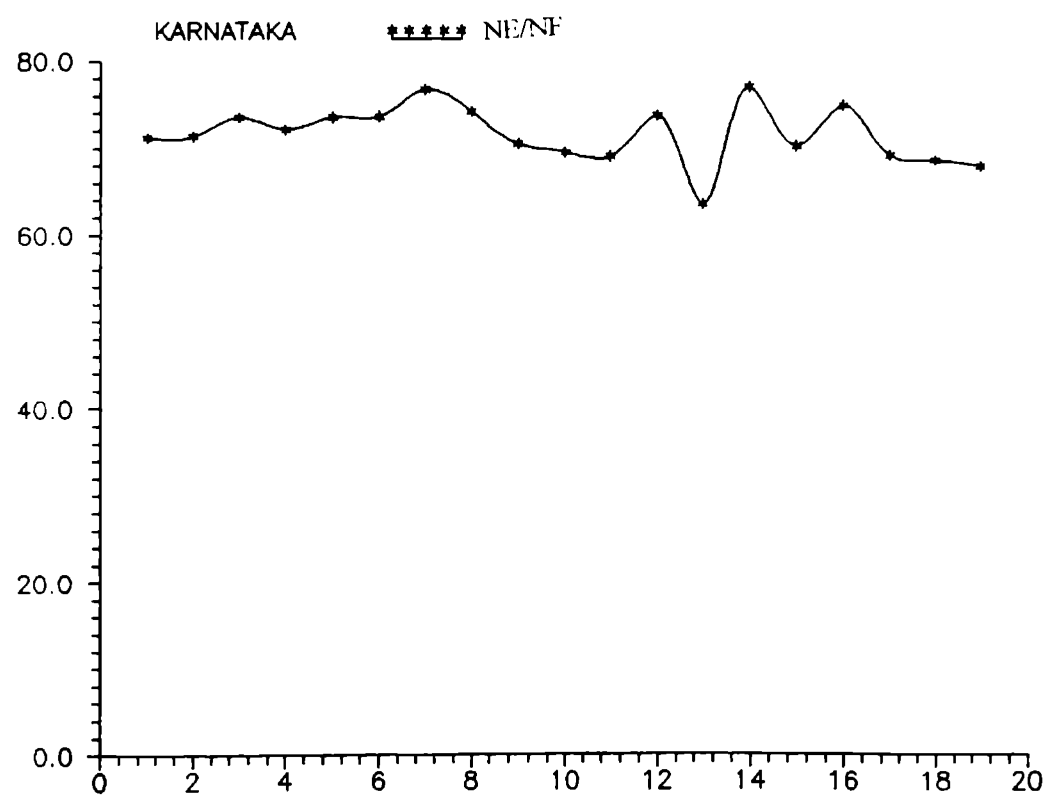
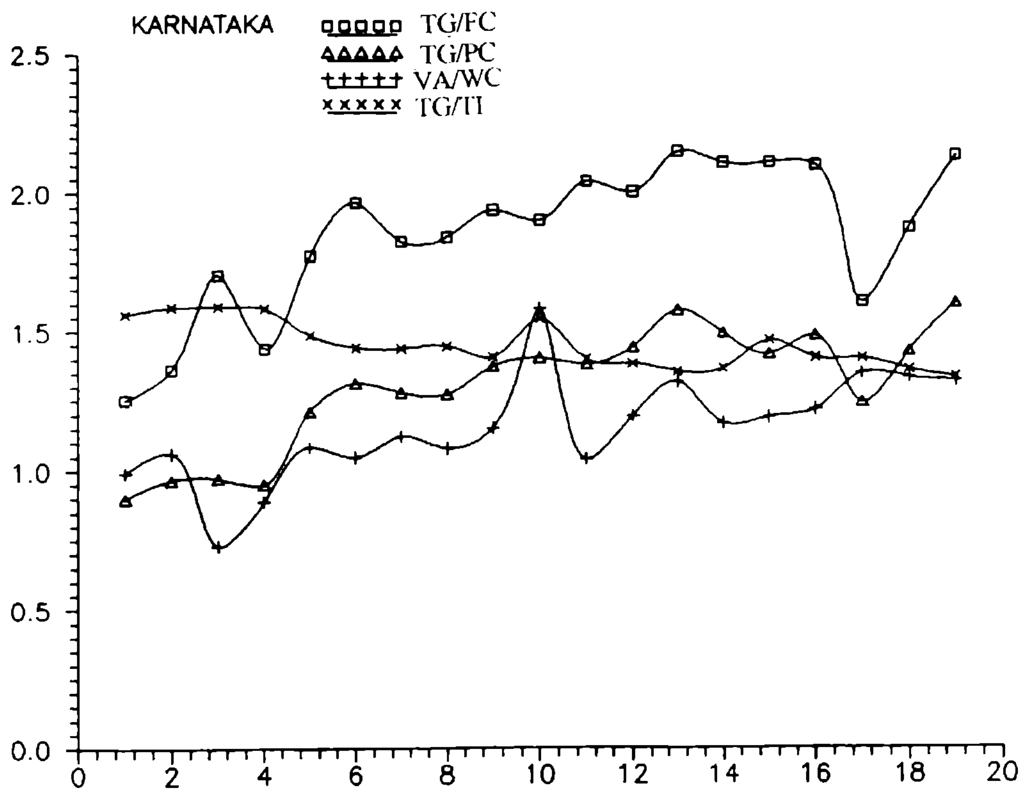


Fig. 3.5 b


KARNATAKA
TG/FC
TG/PC
VA/WC
TG/TI
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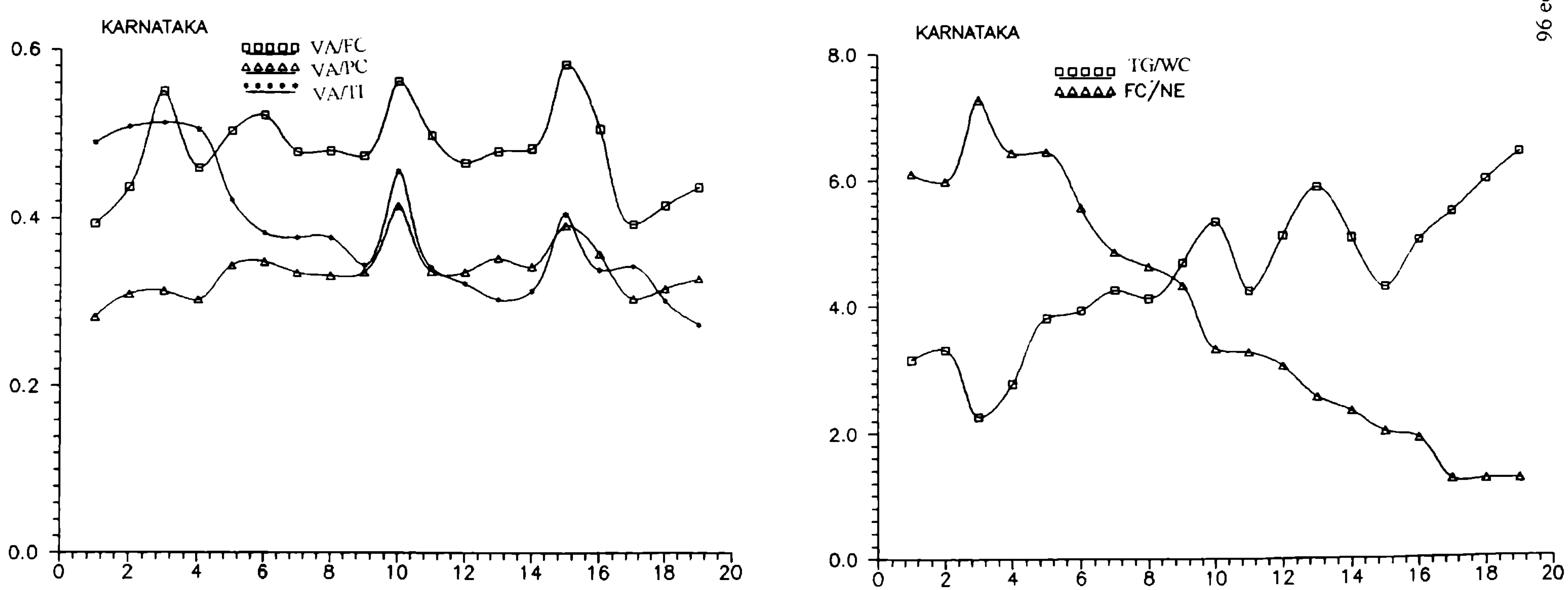
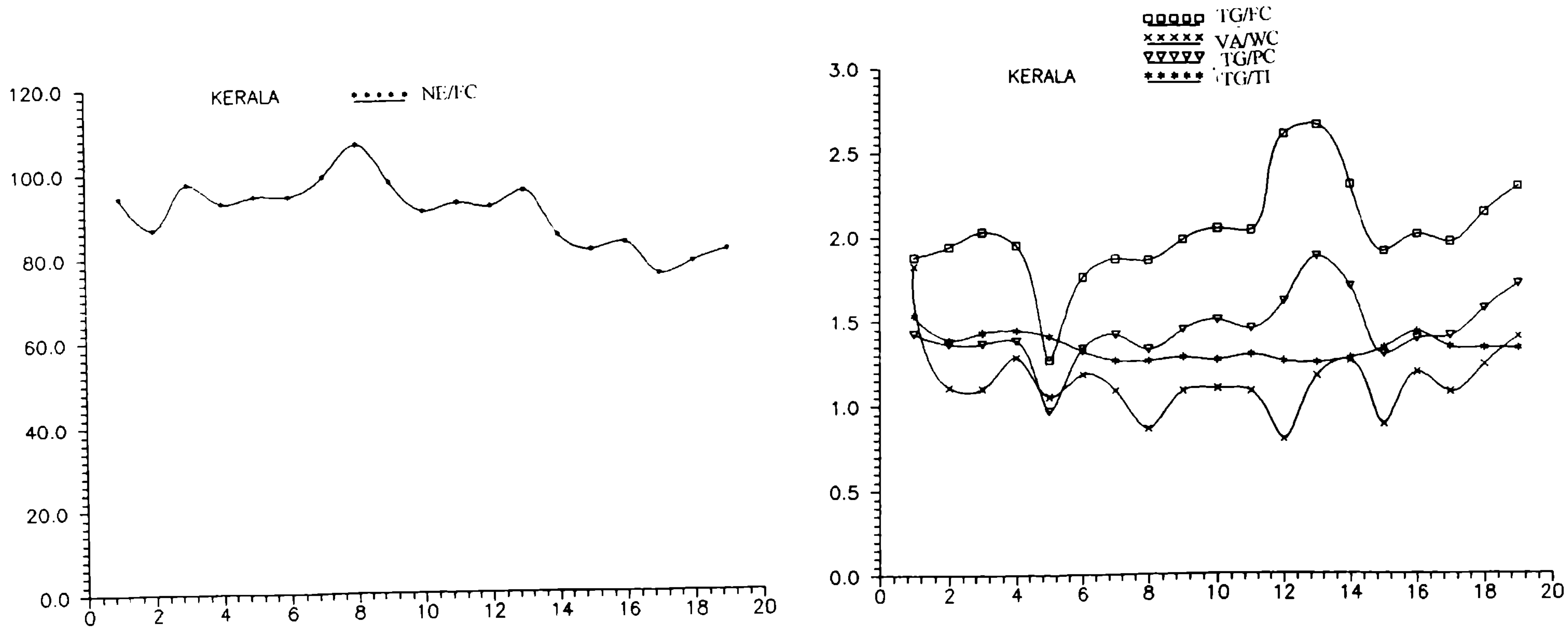
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20

Fig. 3.5 b



KARNATAKA
VA/FC
VA/PC
VA/TI
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
16
18
20
KARNATAKA
TG/WC
FC/NE
8.0
6.0
4.0
2.0
0.0
0
2
4
6
8
10
12
14
16
18
20

Fig. 3.6 b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NE/FC
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100.0
80.0
60.0
40.0
20.0
0.0
0
2
4
6
8
10
12
14
16
18
20
KERALA
TG/FC
VA/WC
TG/PC
TG/TI
3.0
2.5
2.0
1.5
1.0
0.5
0.0

Fig. 3.6 b

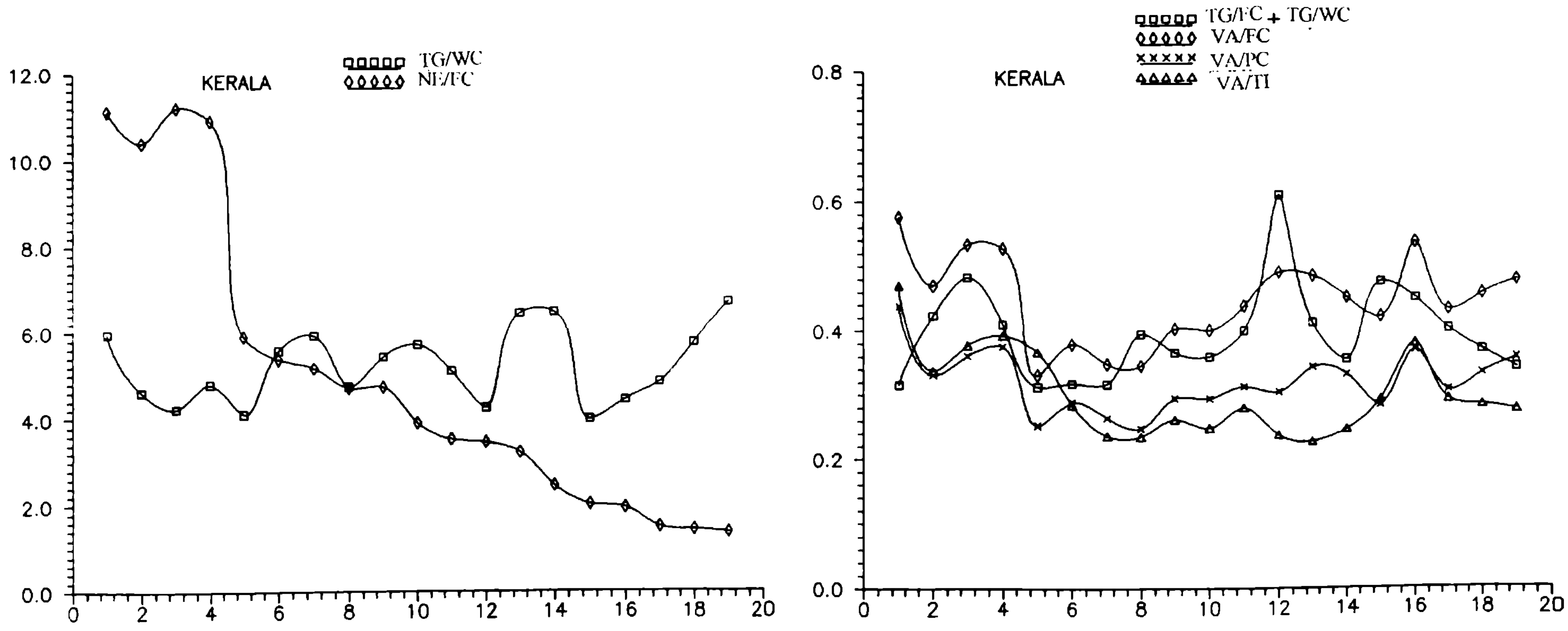
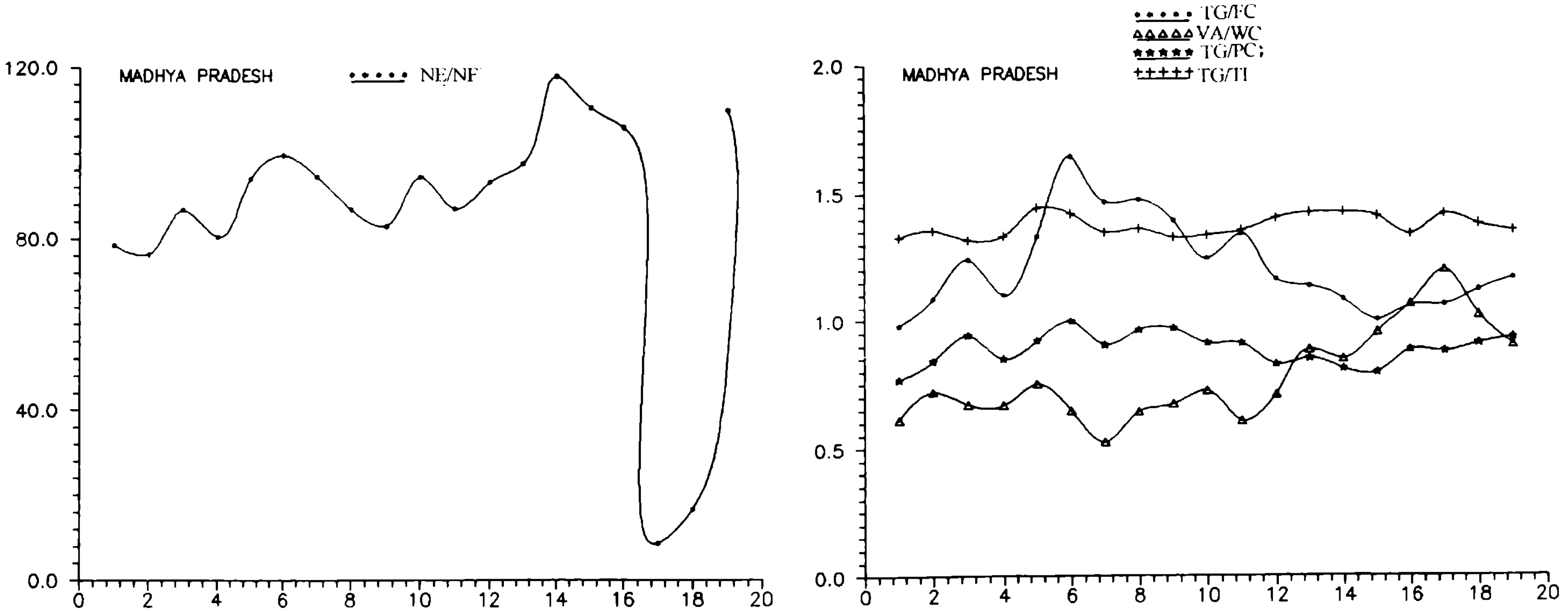
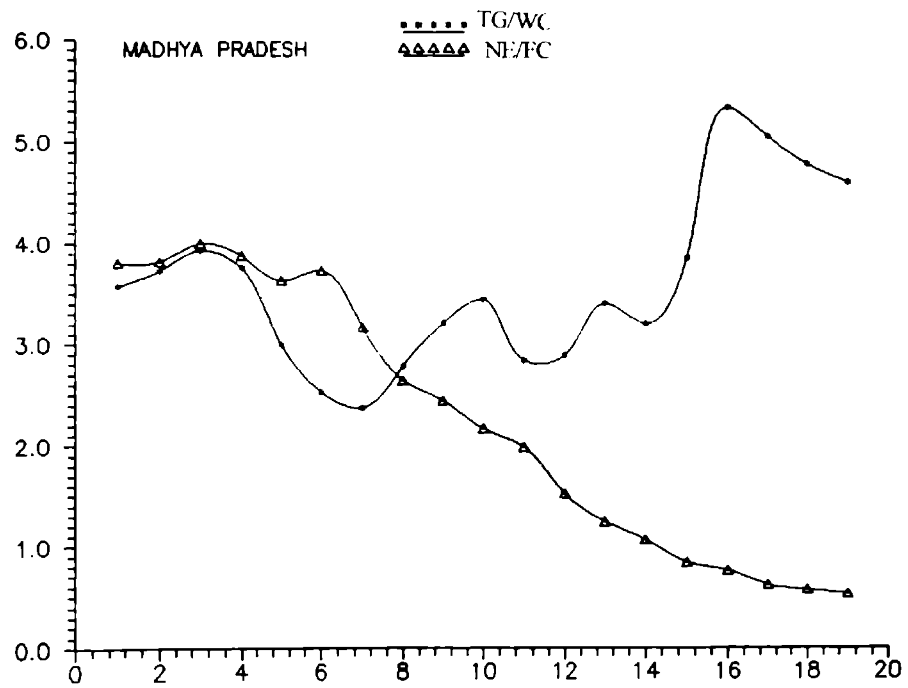


Fig. 3.7 b

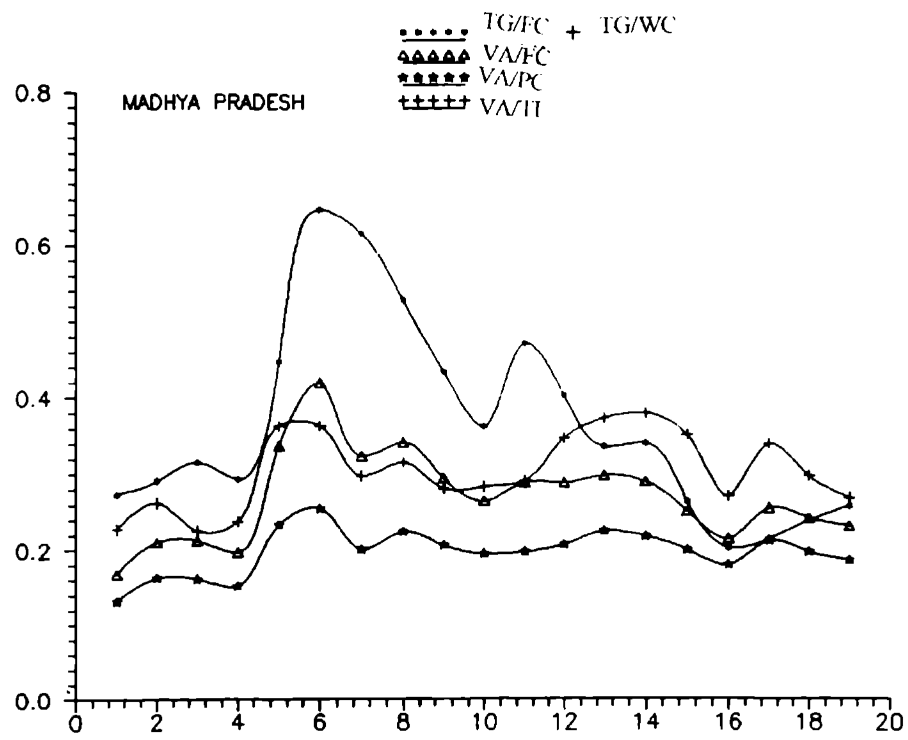


MADHYA PRADESH
NE/NF
120.0
80.0
40.0
0.0
0
2
4
6
8
10
12
14
16
18
20
MADHYA PRADESH
TG/FC
VA/WC
TG/PC;
TG/TI
2.0
1.5
1.0
0.5
0.0

Fig. 3.7 b



MADHYA PRADESH
TG/WC
NE/FC
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
2
4
6
8
10
12
14
16
18
20



MADHYA PRADESH
TG/FC + TG/WC
VA/FC
VA/PC
VA/FT
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
16
18
20

Fig. 3.8 b

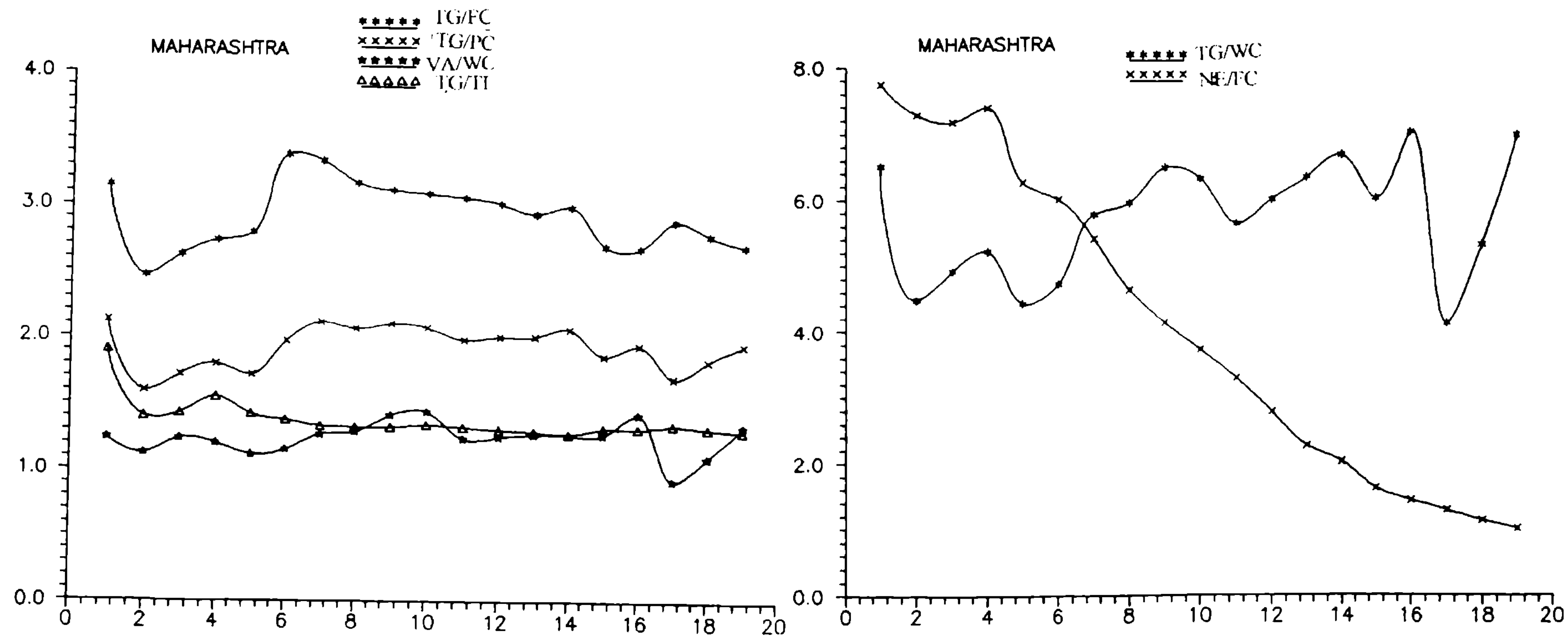


Fig. 3.8 b

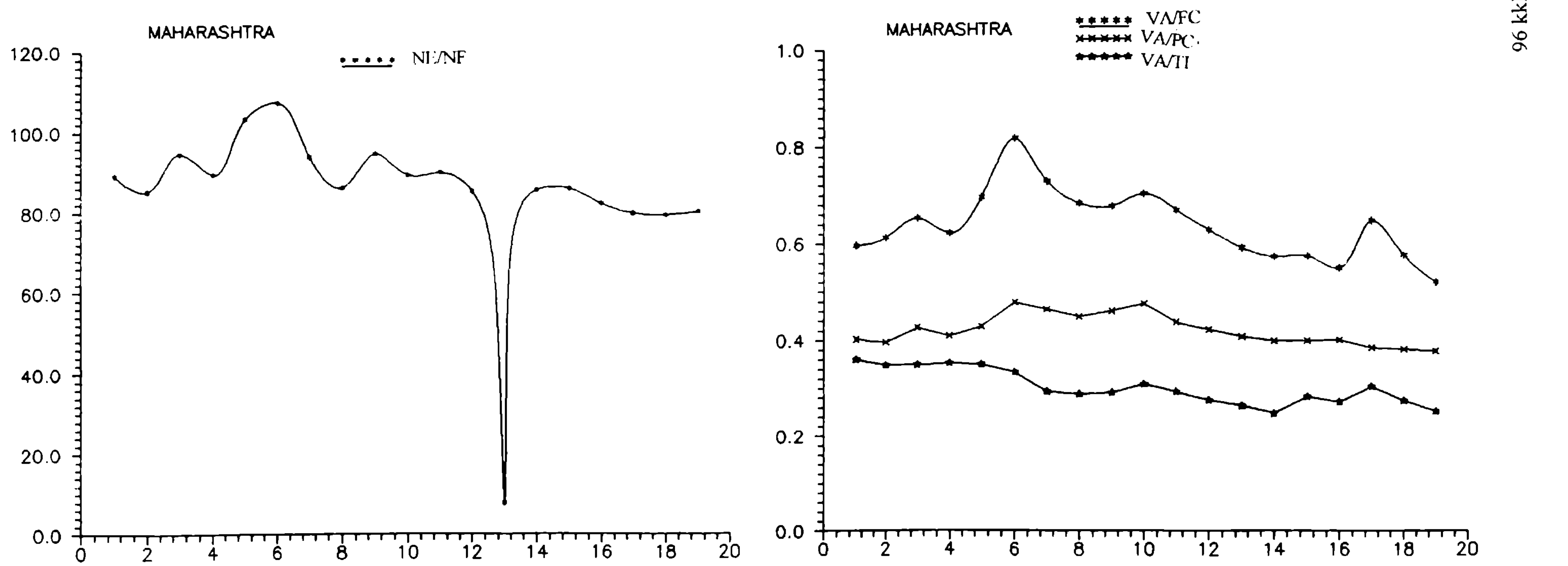
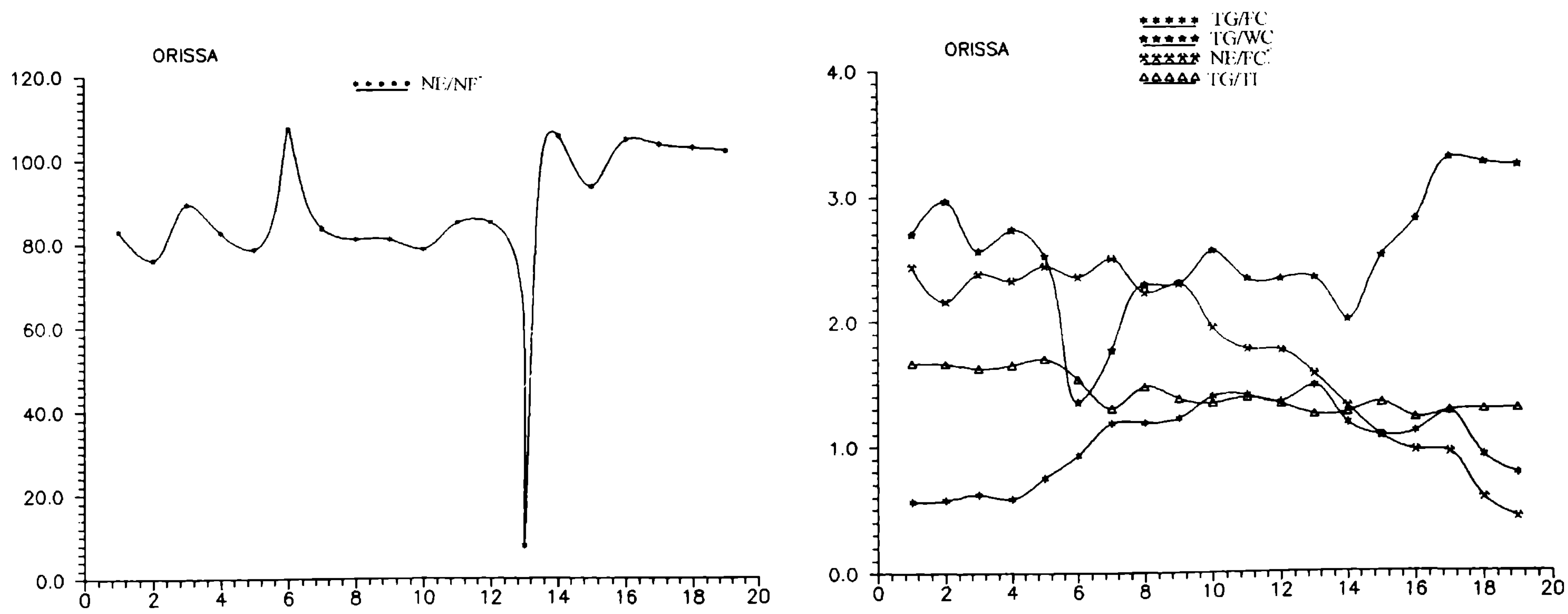


Fig. 3.9 b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NE/NF
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100.0
80.0
60.0
40.0
20.0
0.0
0
2
4
6
8
10
12
14
16
18
20
ORISSA
TG/FC
TG/WC
NE/FC
TG/TI
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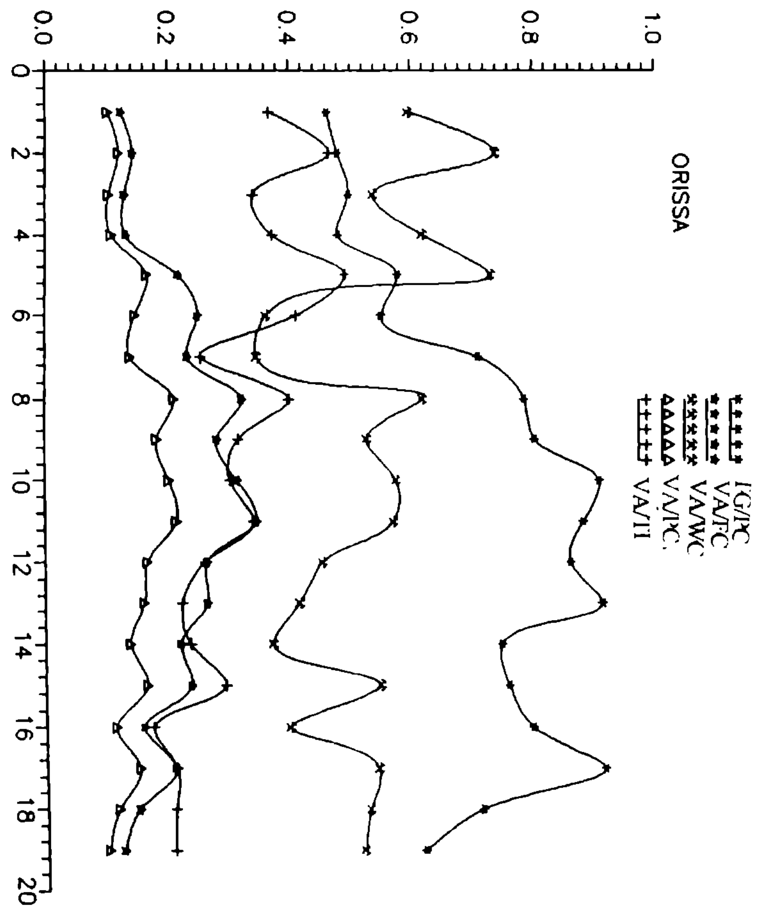
3.0
2.0
1.0
0.0
0
2
4
6
8
10
12
14
16
18
20


ORISSA
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0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10
12
14
16
18
20
FG/PC
VA/FC
VA/WC
VA/PC
VA/TI

Fig. 3.9 b

Fig. 3.10 b

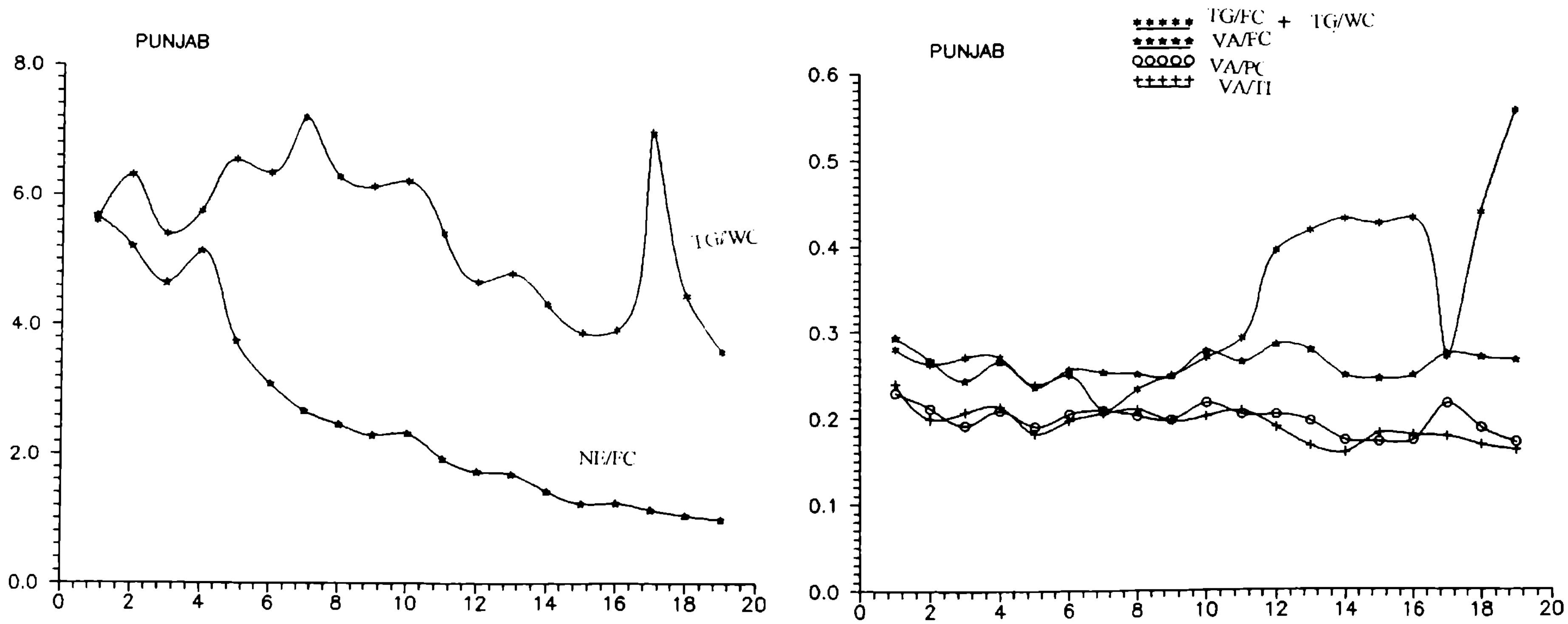


Fig. 3.10 b

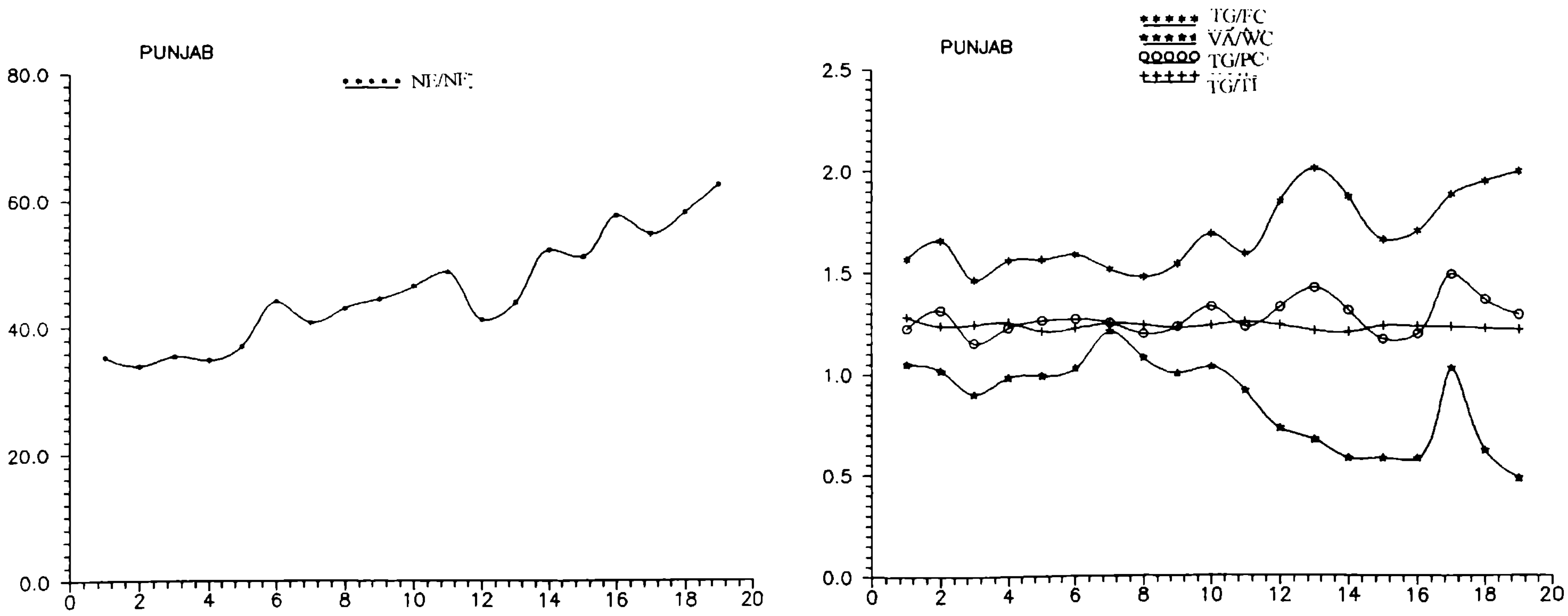
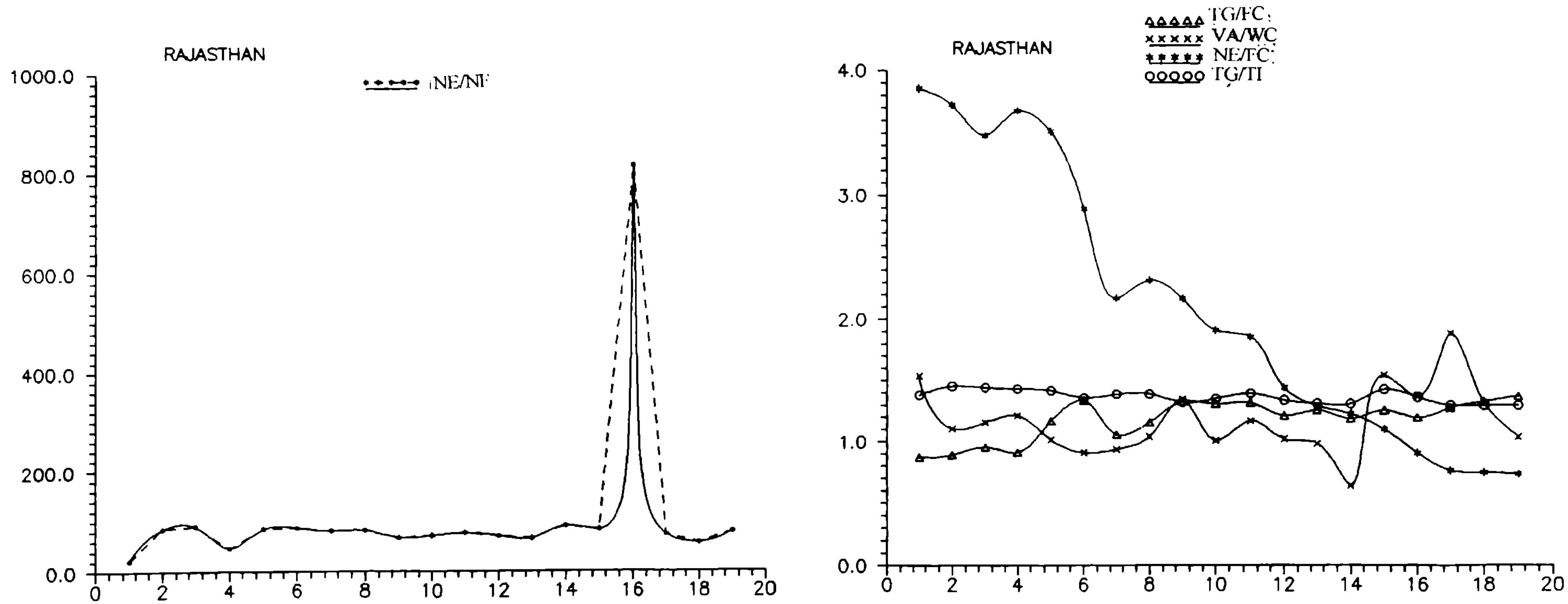
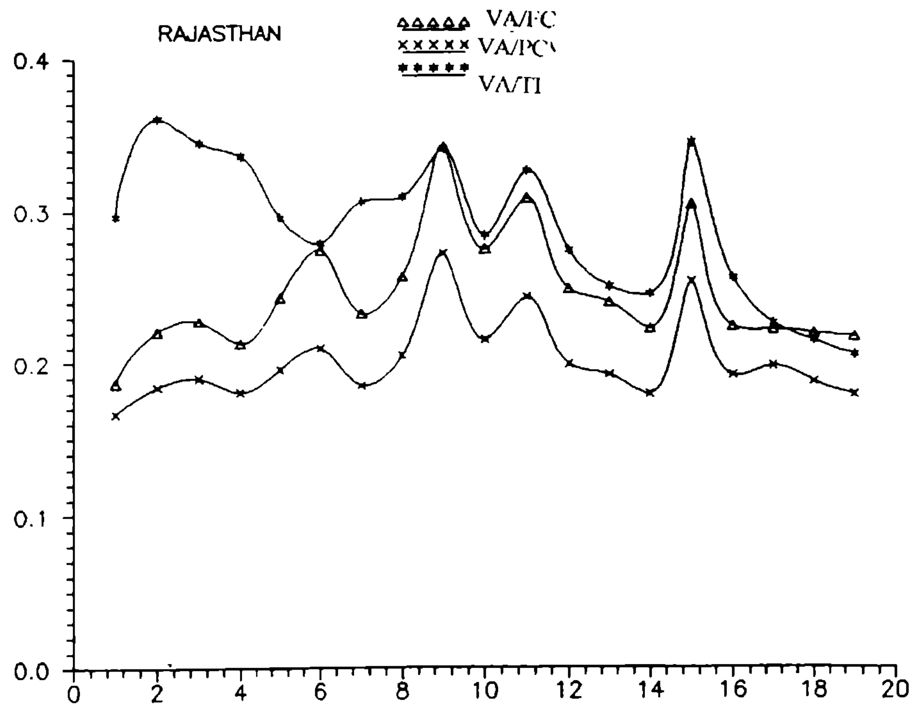

PUNJAB
NE/NE
80.0
60.0
40.0
20.0
0.0
0
2
4
6
8
10
12
14
16
18
20
PUNJAB
TG/FC
VA/WC
TG/PC
TG/TI
2.5
2.0
1.5
1.0
0.5
0.0

Fig. 3.11 b



RAJASTHAN
NE/NF
1000.0
800.0
600.0
400.0
200.0
0.0
0 2 4 6 8 10 12 14 16 18 20
RAJASTHAN
TG/FC
VA/WC
NE/FC
TG/TI
4.0
3.0
2.0
1.0
0.0
0 2 4 6 8 10 12 14 16 18 20

Fig. 3.11 b


RAJASTHAN
VA/FC
VA/PC
VA/TI
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0.3
0.2
0.1
0.0
0
2
4
6
8
10
12
14
16
18
20

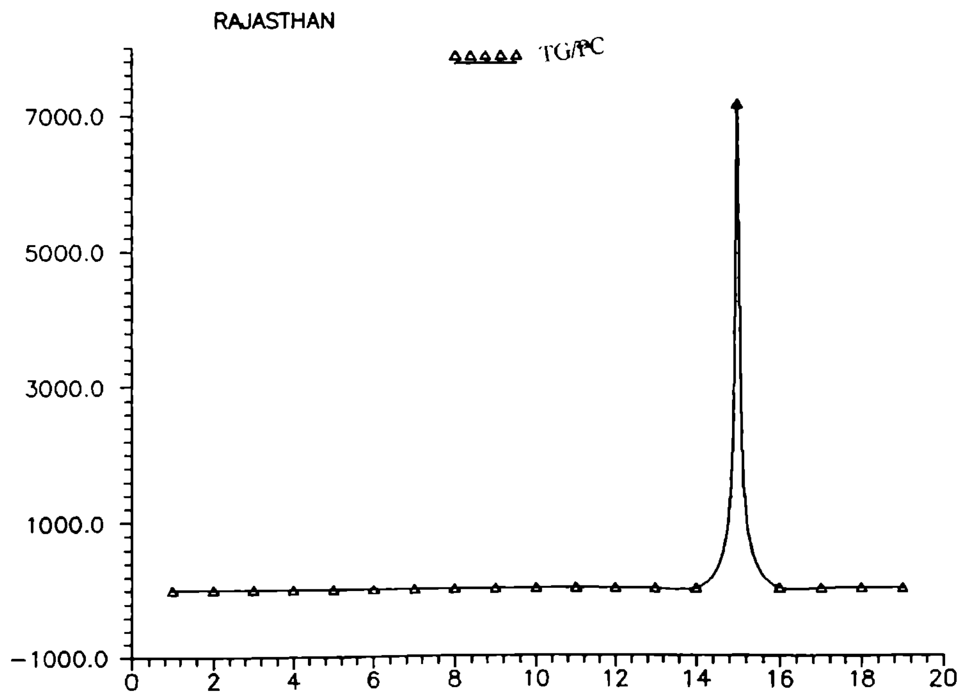
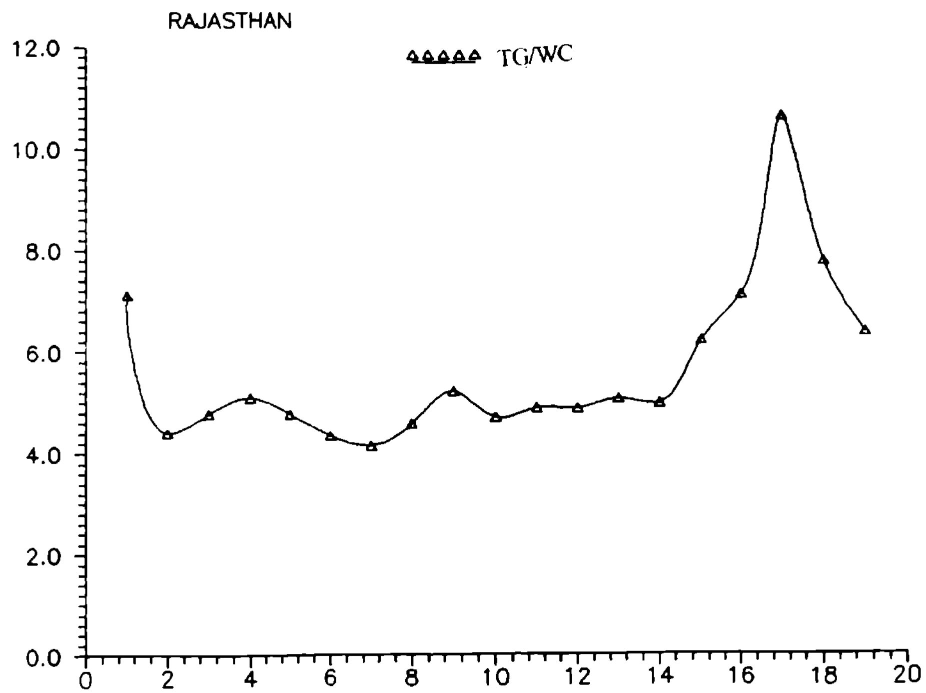

RAJASTHAN
TG/PC
7000.0
5000.0
3000.0
1000.0
−1000.0
0
2
4
6
8
10
12
14
16
18
20

Fig. 3.11 b



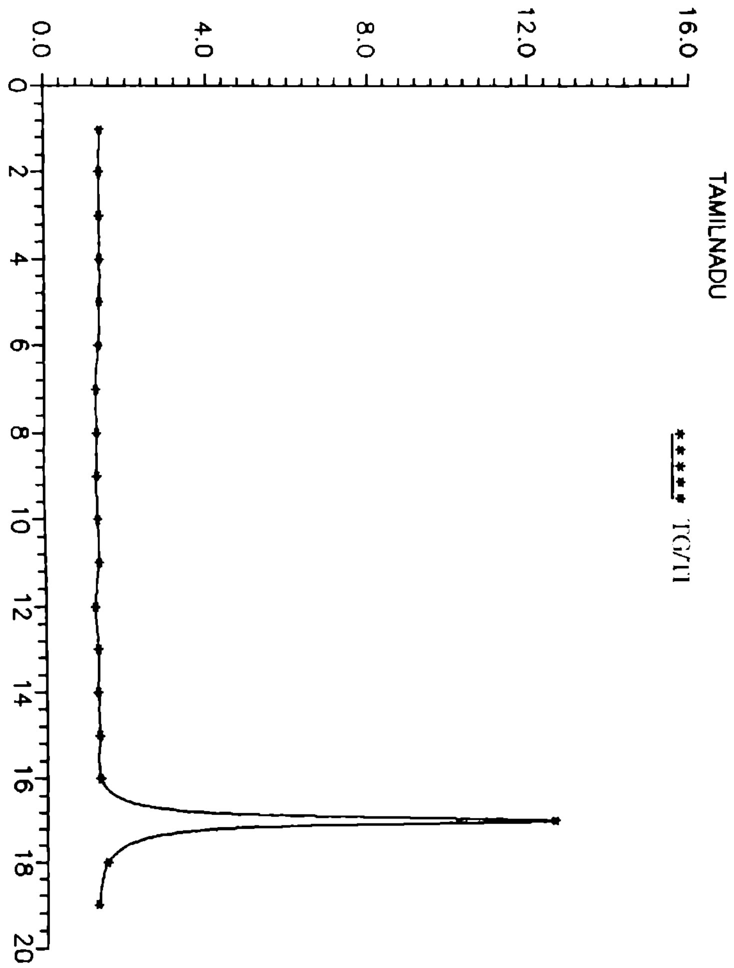


Fig. 3.12b

Fig. 3.12 b

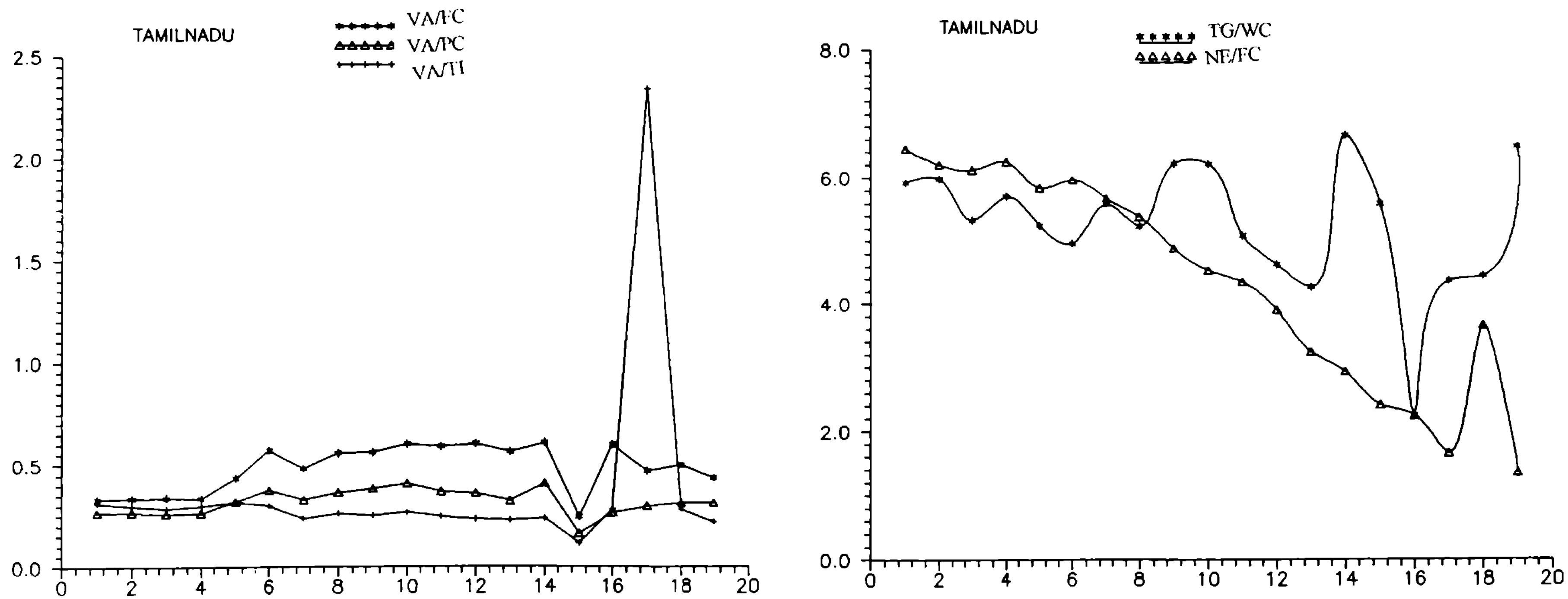

TAMILNADU
VA/FC
VA/PC
VA/TI
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20
TAMILNADU
TG/WC
NE/FC
8.0
6.0
4.0
2.0
0.0
0
2
4
6
8
10
12
14
16
18
20

Fig. 3.12 b

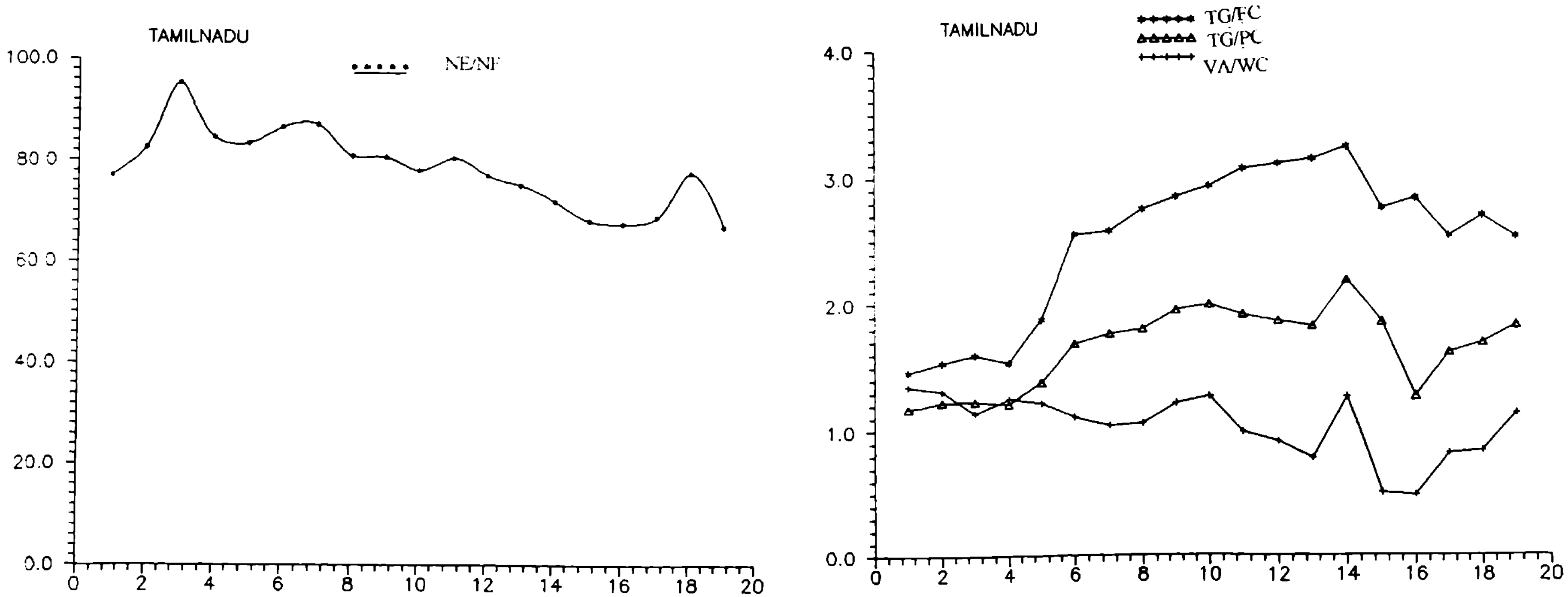

TAMILNADU
NE/NF
100.0
80.0
60.0
40.0
20.0
0.0
0
2
4
6
8
10
12
14
16
18
20
TAMILNADU
TG/FC
TG/PC
VA/WC
4.0
3.0
2.0
1.0
0.0

Fig. 3.13 b

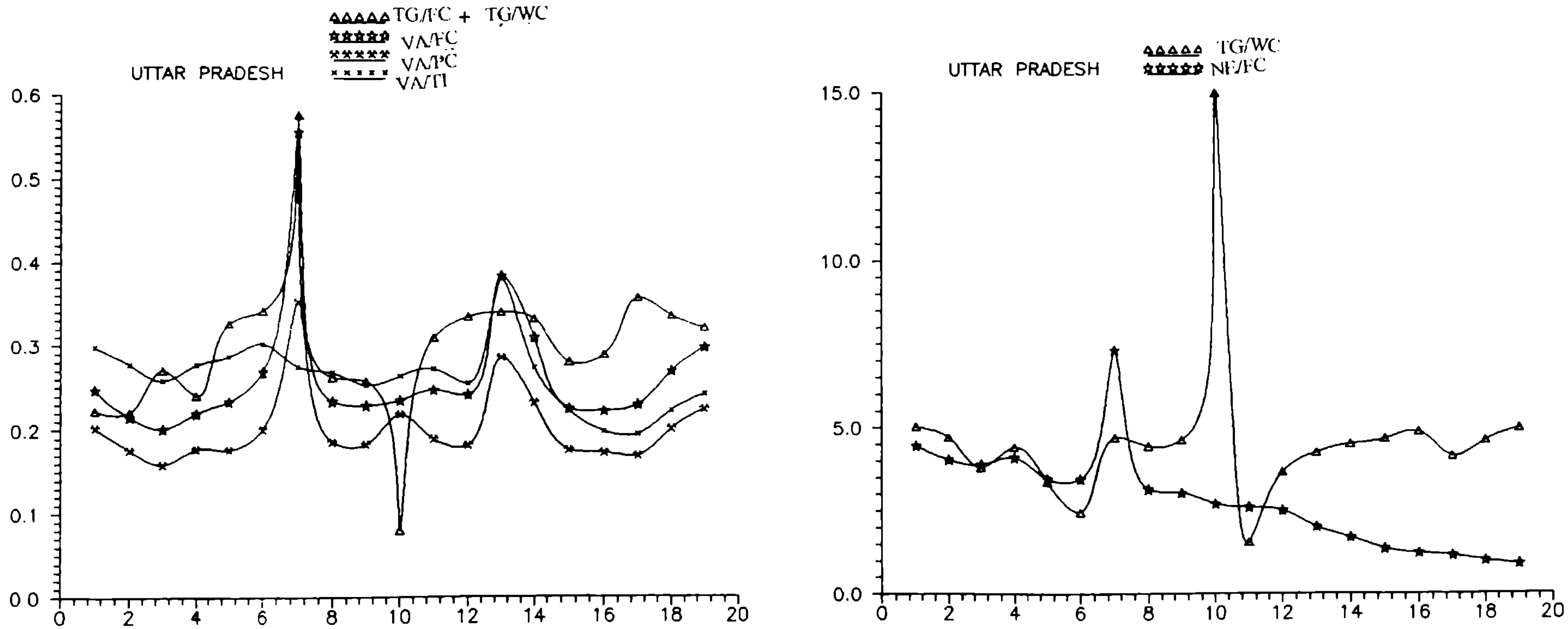
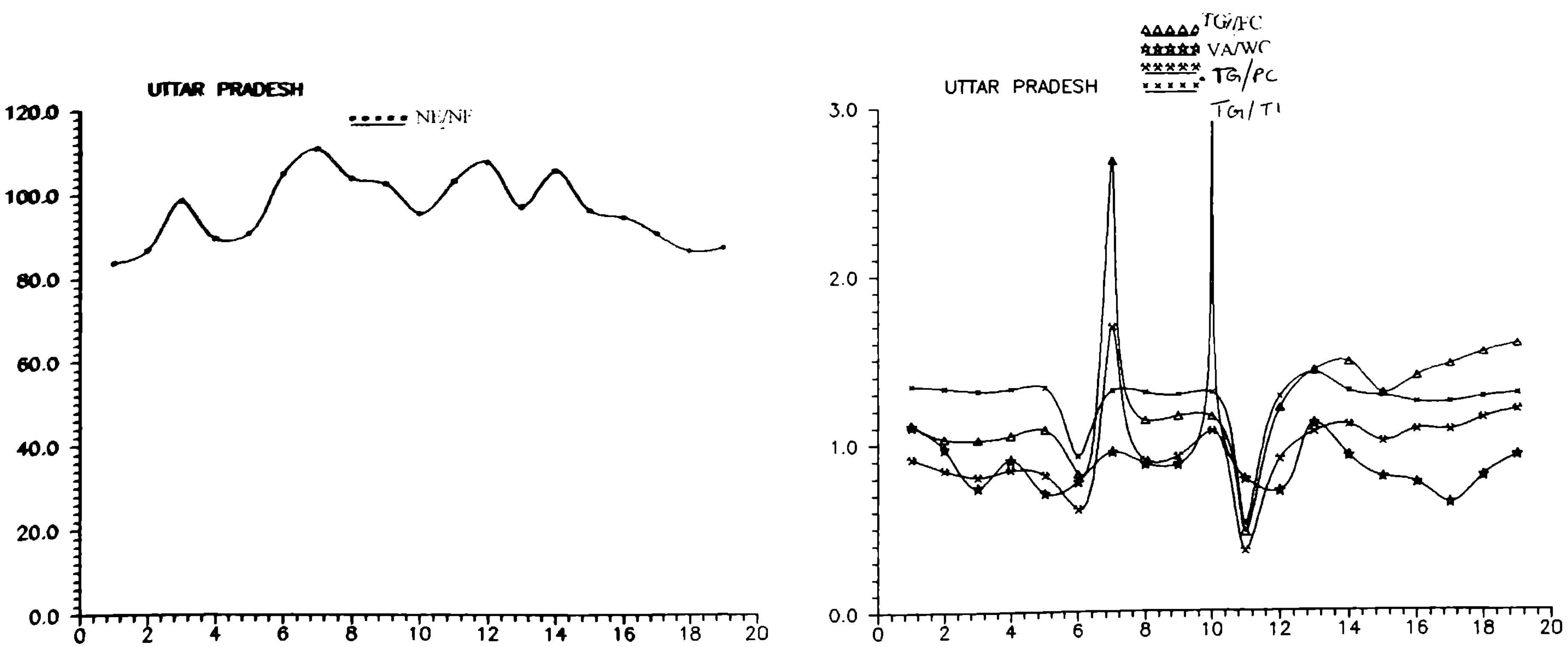

UTTAR PRADESH
TG/FC + TG/WC
VA/FC
VA/PC
VA/TI
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
2
4
6
8
10
12
14
16
18
20
UTTAR PRADESH
TG/WC
NF/FC
0.0
5.0
10.0
15.0

Fig. 3.13 b



UTTAR PRADESH
NE/NF
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0
2
4
6
8
10
12
14
16
18
20
TG/FC
VA/WC
TG/PC
TG/TI
UTTAR PRADESH
3.0
2.0
1.0
0.0

CHAPTER IV

INTER-STATE VARIATIONS IN PROUDUCTIVITY

It was noted in the preceding chapter that intra-regional variations were one of the leading factors of regional disparity in Indian industry. The level of industrialisation displayed a fact that extremely ranked states had been continued to be so over time. Whether productivity variation was responsible for this was hinted, but not elaborated in chapter 3. This was due to two important reasons. Firstly, the variables used to measure productivity were expressed in current values, which do not represent the real change. Secondly, productivity was computed by applying simple ratios. They were not able to catch minor variations in productivity. Hence this chapter is devoted to measure productivity in real terms by employing more efficient tools.

4.1.0 Productivity and its measurement

There are two types of measurement of productivity, partial productivity and total factor productivity (Felipe, 1999). Partial productivity shows the ratio between output and input. The significance of partial productivity lies with its simplicity in computation and theoretical neutrality(Felipe, 1999). Though it can explain efficiency relating to a single input and single output situation, it is sometimes incapable to catch efficiency phenomenon with multiple inputs. It is noted that productivity of an input may increase through substitution of another input. The empirical result regarding the performance of Indian manufacturing showed that labour productivity increased with capital deepening (Ahluwalia, 1985;1991). To overcome this difficulty, economists suggest total factor productivity (TFP) which considers all inputs to measure productivity In a multi- input model, productivity index is expressed as output per inputs (Felipe, 1999). If T stands for TFP, it can be shown as:

$$T = \frac{Q}{F}$$

where T, Q and F represent TFP, value added in real terms and weighted average of capital and labour respectively. Assignment of weight depends on a particular model or specific assumptions when TFP becomes theoretically non-neutral (Felipe, 1999).

There are two forms in which TFP can be conceptualized: index or production function form. The former one presented either in arithmetic index (Abramovitz, 1956; Kendrick, 1961) or in geometric index (Jorgenson and Grilches, 1967).

The most popular measure of TFP in the stream of production function is the Solow's index. It assumes an aggregate production function that is continuous, twice differentiable and linearly homogeneous. The function can be written as

$$Q_t = F[K_t, l_t, t] \text{ -------------------------- } (1)$$

The above function shows value added as a function of the stock of capital, employment and a shift factor (t). The last term represents the effects of technical progress (TP) and is assumed to be separable from K and L That is,

$Q_t = A_t\,F(K_t,L_t)$ and then,

$$A_t = \frac{Q_t}{F(K_t,L_t)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1a)$$

Economists are interested in the study of TP for several reasons. Firstly, it enhances efficiency in production so that it minimises cost (Heathfield, 1987). Secondly, it contributes to productivity growth and thereby helps to boost standard of living (Balakrishnan and Pushpangadan, 1998). Thirdly, it changes the nature of factor demands (Felipe, 1999). TP most often reduces the demand for labour rather than the demand for capital. Fourthly, TP has also implication for return of factors. This refers to the changes in wage and interest earnings The last two points consider the question of biased as well as neutral technical progress.

There are three kinds of neutrality, i.e. Hicks, Harrod and Solow (Stoneman, 1982; Hiethfield 1987). Hicks neutral TP keeps a fixed factor ratio provided factor prices remain unchanged. That is

$$K/L = N_1\,(P_k / P_L).$$

Harrod neutrality is associated with capital output ratio and the price of capital symbolically,

$$K/Q = N_2\,(P_k).$$

It demands constant capital output ratio if the price of capital (Pk) remains the same.

Solow neutrality refers to the constancy of labour-output ratio if the wage is fixed.

$$L/Q = N_3 (P_L).$$

4.1.1 Issues in Productivity Estimation

One of the major issues in the study of productivity growth is its estimation. There are two important methods of estimating productivity growth. They are the growth accounting and the econometric estimation of production function. As the present study follows the former, the estimation procedure of growth accounting can be discussed further. Growth accounting method has the following important assumptions:

Existing of aggregate production function i.e., a single composite product;

homogeneity of degree one;

positive but diminishing returns to inputs;

perfect competition and profit maximisation; and

factors elasticities equal the factor shares in output.

Consider the following aggregate production function:

$$Q = F (K,L,T)$$

As TP or TFP represents total change irrespective of a change in input, we can find the total differential and express it in growth rate terms.

$$dQ = \frac{\delta Q}{\delta K} dK + \frac{\delta Q}{\delta L} dL + t'$$

$$\frac{dQ}{Q} = \frac{\delta Q}{\delta K}\frac{dK}{Q} + \frac{\delta Q}{\delta L}\frac{dL}{Q} + \frac{t}{Q}$$

$$Gq = r\frac{dK}{K}\frac{K}{Q} + w\frac{dL}{L}\frac{L}{Q} + \frac{t}{Q}$$

$$= r\frac{K}{Q}Gk + w\frac{L}{Q}Gl + At$$

where 'r' and 'w' represent prices of capital and labour respectively.

Due to the assumption of perfect competition, factor elasticities equal factor shares in output

$$Gq = (1 - at)\ Gk + at\ Gl + At \text{ ----------------------- } (2)$$

It is assumed that 'at' and (1-at) are labour and capital shares respectively. Labour share is taken as the ratio between total emoluments and value added in the national income accounts. Hence this method is known as growth accounting. TFP or TP can be estimated by solving eq. (2) for At

$$At = Gq \quad (1\text{-}at)\ Gk\ - at\,Gl$$

$$= Gq \quad Gk + at\ Gk \quad at\ Gl$$

$$= (Gq - Gk) \quad at\ (Gl - Gk) \text{ --------------------------- } (3)$$

Thus TFP is the residual of value added after assigning the shares and growth rates of labour and capital. Hence it is also known as the 'measure of ignorance' The weighted sum of growth rates [(at Gl and (1-at) Gk)] is known as 'Divisia Index', a method used by Solow. Equation (3) tells us the magnitude of economic growth due to input growth and technical progress. 'Solow-residual' reoriented the issues of growth policy from capital formation to factors like education, R and D, better management and so on. (Felipe, 1999). India has not been fruitfully on this path other than the import of technology (Subrahmanian, 1995). Before discussing the determinants of TFP in India (see Chapter 5) we shall consider the logic of deflation, which is very important to understand the real source of growth.

4.1.2 Single Vs Double deflation method

A serious issue in the computation of productivity growth is value added in real terms. It is argued by Bruno (1978) and, Balakrishnan and Pushpangandan (1994) that changes in the relative price of material inputs can affect the measure of real value added and the productivity growth. There are two ways of expressing value added in real terms: single deflation and double deflation methods. In the former method, both the values of output and input are deflated by the price index of output. The obtained value added is known as value added at single deflation (VA_{SD}). The double deflation method requires to deflate value of output by an output price index and the value of input by an input price index. The resultant value added is known as value added at double deflation (VA_{DD}). Following Bruno, Balakrishnan and Pushpangadan, we can incorporate the two deflationary methods in a production function.

Let the production function be

$$Q = f(L,K,N) \text{ --------------------- } (4)$$

where N stands for material inputs. The real value added q will be

$$q = Q - \pi nN$$

where πn = Pn/P (price of material/price of output). Assuming the marginal value product of the material input equals its price, we can write

$$q = f(l, k, \pi n) \text{ ---------------------------- } (4a).$$

we may differentiate the above function w.r.t. time to understand the effect of a change in the relative price of the material inputs on value added. Then we can obtain the growth rate form of the function

$$\frac{dq}{dt} = \frac{\delta q}{\delta l}\frac{dl}{dt} + \frac{\delta q}{\delta k}\frac{dk}{dt} + \frac{\delta q}{\delta \pi n}\frac{d\pi n}{dt} \text{ --------------------- } (4b)$$

Under conditions of profit maximisation

$$\frac{\delta q}{\delta l} = \frac{w}{p},\ \frac{\delta q}{\delta k} = \frac{r}{p},\ \frac{\delta q}{\delta \pi n} = -N$$

where w and r stand for wage rate and return on capital. By substituting above, marginal conditions in equation (4b) and express in growth terms, we get

$$\frac{dq/dt}{q} = \frac{wL}{p}\frac{dL/dt}{L} + \frac{rk}{pq}\frac{dk/dt}{k} - \frac{\pi nN}{pq}\frac{d\pi n/dt}{\pi n}$$

$$q^{\cdot} = \frac{wL}{pq} l^{\cdot} + \frac{rk}{pq} k^{\cdot} \quad \frac{\pi nN}{pq} \pi^{\cdot} n$$

where $$\frac{wL}{pq} = \frac{wL}{p(q-\pi nN)} = \frac{wL}{(Pq-PnN)} = \frac{wL/PQ}{(1-PnN/PQ)} = \frac{\alpha}{(1-\beta)}$$

where α = share of labour in the value of output and β = share of material in the value of output.

Similarly, $\frac{rk}{Pq} = \frac{\lambda}{(1-\beta)}$ and $\frac{\pi nN}{Pq} = \frac{\beta}{(1-\beta)}$

where λ is the share of capital in the value of output. Thus,

$$q^{\cdot} = (1-\beta)^{-1}(\alpha l^{\cdot} + \lambda k^{\cdot}) - (1-\beta)^{-1}\beta\ \pi^{\cdot}n$$

$$= (1-\beta)^{-1}[(\alpha l^{\cdot} + \lambda k^{\cdot}) - b]$$

$$\text{where } b = (1-\beta)^{-1}\ \beta\ \pi^{\cdot}n$$

Bruno calls '-b' as the 'technical regress' term, which is a function of the change in the relative price on TFP. Putting $(1-\beta)^{-1}(\alpha l^{\cdot} + \lambda k^{\cdot})$ as '$s^{\cdot}$' and we can write

$$s^{\cdot} = q^{\cdot} + b$$

Above equation throws light on the effect of relative price of materials on productivity, via the real value added. We can trace out three such cases (B-P, 1994).

a) If $\pi^{\cdot}n = 0$ (relative price is stable), b will be zero. As a result, both net output due to factor accumulation and the real income (VA_{SD}) are the same. In this context, the relative price effect on measured productivity is absent.

b) If $\pi^{\cdot}n > 0$, the rise in net output due to factor accumulation is underestimated if single deflation is followed. B-P argues that the underestimation is proportional to the rate of change of the price of raw materials. This can cause a push down in measured productivity without a corresponding change in the real productivity.

c) The opposite result can experience if $\pi^{\cdot}n < 0$

Considering the above arguments, the two methods will be followed in the computation of productivity in this study.

4.1.3 Convergence -Divergence and Regional Level Productivity

We discussed the efficiency Vs equity issue in Chapter 2. In fact, total factor productivity measures efficiency while equity issue can be represented in many dimensions. One of such dimensions, currently very popular, is the deliberations on country wise and regional level industrialisation.

Debates on international comparison of economic growth of various countries led to the emergence of the concept 'Convergence' (Harrod- Domar,1948; Solow,1991, Zhirmai,1997; Ray, 1998). There are two kinds of convergence: Unconditional and Conditional. The concept of unconditional convergence mainly revolved round Harrod- Domar and Solow's growth models (Ray, 1998). If there is no symptom of difference in the rates of technical progress, savings, population growth and capital depreciation in the long run, the Solow model postulates that capital efficiency per unit of labour converges to almost a single value in all countries. This is known as unconditional convergence which is depicted in the following figure.

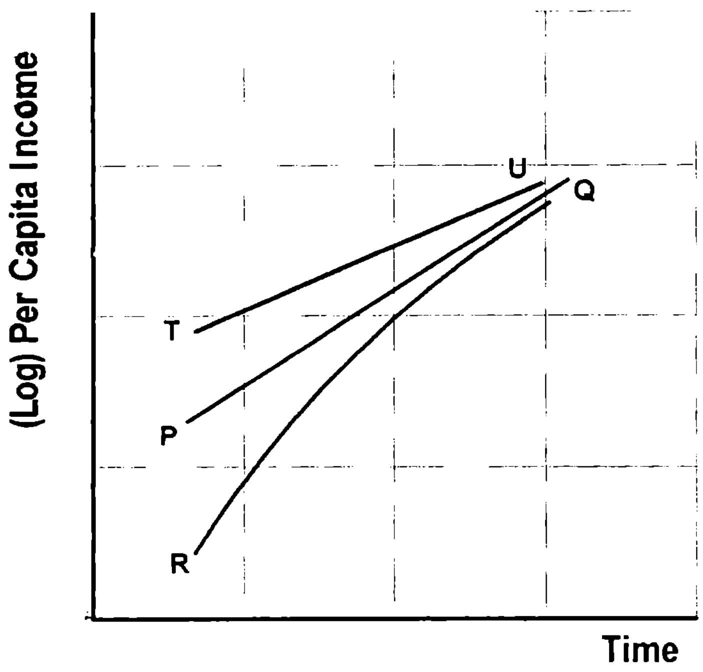


Fig. 4.1

Unconditional Convergence

PQ in the figure represents the time path of (log) per capita income at the steady state. RQ stands for a country that lies below steady state but it has higher growth rate than steady state in the initial stages. Later it will converge to the steady rate. The country that is above steady state (TU) will have a lower growth rate which flattens to converge at Q. Thus convergence implies a negative relationship between growth rates of per capita income and the bench mark value of per capita income (Ray, 1998). In the neo-classical theory of growth, poor countries will grow faster than the rich countries and thereby the world will move to a level of convergence. It is also named as catch-up theory in the sense that low income countries can level with high income countries in the long run (Zhirmai,1997). Catch-up is generally expressed in GDP per person or GDP per hour worked.

But empirical studies did not display a strong correlation between growth rates of per capita income and base period value of per capita income (Long, 1988; Barro 1991). Harrod-Domar predicted the neutrality of growth rates with respect to per capita income, based on the assumption of constant return to capital. Further, Solow model, which also stands for convergence across countries, predicts the presence of deceleration, emanating from rapid growth of per capita capital and output; because this model assumed diminishing returns to capital. It may be difficult to accept the contention of convergence co-existing with diminishing returns when empirical results are not in favour of constant return to capital. At this juncture, the Harrod-Domar model seemed to be more appropriate as far as convergence was concerned (Ray, 1998). To settle the varying assumptions of constant returns to capital in the Harrod-Domar model and diminishing returns to capital in the Solow model, the deliberations turned to conditional convergence.

Conditional convergence assumed different steady states for various countries due to disparity in technical knowledge, the rate of savings, the rate of population growth and the rate of depreciation. This is known as the weaker hypothesis of convergence. There is no common line of steady states under conditional convergence. It is assumed that various countries have dissimilar steady-state time paths. Each country can have either slower or higher growth rate which may converge with the steady-state in the long run. This is illustrated in the figure given below:

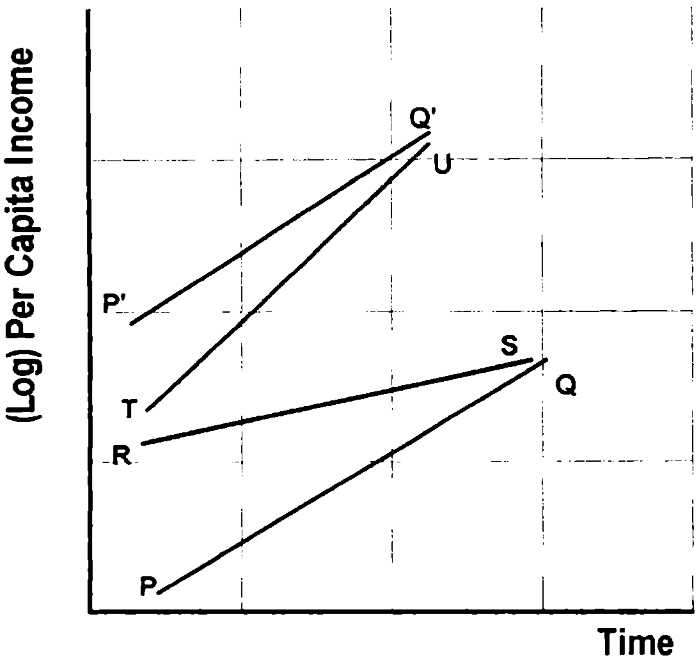


Fig. 4.2

Conditional Convergence

PQ and P'Q are two parallel lines representing steady-states of two countries. They are parallel because of the assumption of the same rate of technical progress across countries; but they vary in the cases of other parameters like saving, population growth etc.

Suppose one county is above the steady path (PQ) at R. The country will display a slower growth and may converge with steady-state PQ later. The second country has a level lower than (T) its steady path P'Q This country will have a faster growth like TU and will converge upward at Q' Here one has to iron out or condition the country specific variations and hence it is known as conditional convergence. This is pointed out as the major reason for difference in growth in China, South Korea and Taiwan (Zhirmai,1997). Thus the world order is not in the model of a uniform convergence. In fact, divergence persists with changes in the socio-economic and institutional factors. This is the essence of conditional convergence. It says that convergence exists only within a group of countries and divergence is the order between groups (Barro, 1989; Mankiw, Romer and Weil, 1992; Wolff and Gittleman, 1993; Zhirmai,1997). Conditional convergence is found in terms of fertility rates, investment rates, human capital formation and so on. This line of explanation is mainly titled as The New Growth Theory. It is also admitted by Solow (1991) in his re-formulation of neo-classical growth theory. His contention is that world wide convergence is absent due to the institutional and socio-cultural barriers to diffusion of technology. Above arguments can be adapted to the state (region) level comparison in India.

The survey of theoretical connotations of productivity conducted in the preceding pages set a background for analyzing the empirical results. Based on the level of industrialisation and the share in the all India manufacturing, six states were selected for detailed analysis they are Maharashtra, W Bengal, Gujarath, Tamil Nadu, Bihar and Kerala. They roughly represent more than fifty percent of the value added in the all India manufacturing these states are ranked in the order shown in the 1906s (Ch.3). the first four states are industrialized while Bihar and Kerala belong to middle and bottom range state respectively. Thus Bihar and Kerala facilitate comparative analysis with other four industrialized states.

The following variables are considered are empirical analysis;

a) Gross value added at single deflation and double deflation (GVA_{SD} and GVA_{DD});

b) Total factor productivity (TFP) both at SD and DD;

c) Partial productivities of a labour (APL) and capital(APK).Both are computed in single and double deflation method ,

d) Growth rates of lobour capital and inputs; and

e) Capital intensity (K/L) and input intensity (GVA/In) at SD and DD.

Growth rate of GVA can explore regional manufacturing growth. It can also help to understand the extend of 'stagnation' and 'turn around' at the region level. Efficiency especially technical progress, is expressed in total factor productivity growth (TFPG), which can over come the intricacies of factor substitution. Partial productivity enables as to understand the source of growth emanating from factor accumulation. It also throws light on the level of industrialisation and convergence-divergence phenomenon The growth rates of labour, capital and input would catch the magnitude of factor accumulation and input contents. Capital intensity reveals the bias in technical progress while input intensity makes an indirect reference to productivity.

Output and wages are deflated by the wholesale manufacturing price index. Fixed capital is deflated by the price index of machinery and tools. Input price index has been taken from B-P (1994) up to 1988-89 and the same index for the rest of years is calculated on the line suggested by B-P (1994). If it is not specified, explanations are based on values at double deflation. Accounting system of UNO prefers this. Further, current main stream debates on productivity are based on double deflation

Analysis of the empirical result for each state is arrange in the following form. The study considers the growth of GVA along with changes in TFPG and partial productivity. In order to understand the factor contribution to growth, growth rates of factors are analyzed along with partial productivity. Finally, capital intensity and input intensity are analyzed.

The analysis starts with the comparative position of all states in terms of different variables mentioned above. The behavior of the same variables are treated separately for each state for a closer look. The present chapter also deals with an analysis on convergence-divergence issues. Certain factors responsible for the specific behavior of each state are considered in the last sections, giving special emphasis to W.Bengal. Now we take up the comparative issues of various states.

4.2.0. Comparative Position of the Six States- Analysis of the Empirical Results

Gujarat and Tamil Nadu recorded higher growth in terms of GVA and TFP in manufacturing among the six states under consideration during 1960-1998-99. This was instrumental for these two states to rally behind Maharastra in the level of industrialization (See 3.2). Though Kerala had an impressive growth, its rank in terms of value added, employment and fixed capital was the lowest. The most disquieting performance was that of Bengal, an industrialized state. Its growth was around one per cent and negative in the case of TFP during the 1960s. It implies that the seeds of the later decline of Bengal were sown in the 1960s itself. The negative TFPG implies the over all inefficiency of manufacturing in Bengal (see 4.4.4)

Table-4.1.1 Annual Growth Rates of Gross Value Added (GVA) and Total Factor Productivity (TFP) at Single Deflation (SD) and Double Deflation (DD) During 1960 to 1998-99

States	**Growth Rate (Percent per annum)**			
	GVA		TFP	
	SD	DD	SD	DD
Kerala	5.58	7.74	2.22	4.89
Bihar	4.77	6.48	1.34	3.07
Gujarat	6.5	8.87	2.17	4.39
Maharashtra	5.31	7.39	1.87	3.37
Tamil Nadu	6.47	8.71	2.92	4.51
W. Bengal	1.45	3.58	0.60	2.20

Compared to the 1960s, GVA and TFP had an enhanced growth during the next decade (Decade wise analysis is given in the ensuing sections). Bengal, though at the bottom in the 1970s, showed better performance than the 1960s. The position of Maharastra was relegated to the fifth in the 1970s and Kerala continued to remain at the top in terms of TFP as in the first decade. However, Kerala could not keep its top position in the growth of GVA in the 1970s. Gujarat and Tamil Nadu were pushed to higher levels as a result of their high pace of industrialization.

There was lower growth of GVA and TFP in the 1980s compared to their growth in the previous decade. Meanwhile, a paradox can be noted in Kerala. The state experienced higher growth in GVA and productivity and, the low level of industrialization in the 1960s and 1980s. Bihar and Bengal showed lower growth with relatively higher level of industrialization during the same period. In short, growth in output and productivity was not in order of the degree of industrialization. Further, the ranking in terms of growth in GVA did not strictly apply to the ranking in terms of TFP

The growth rate of GVA and TFP was almost in consonance with the ranking of states in industrialization in the early 1990s. There was no such trend in the previous decades. That is, the paradox of lower growth and high level of industrialization disappeared in the early part of the previous decade. Gujarat had a celebrated growth in GVA and TFP Maharastra also did well, especially in GVA. It is found that these two state economies had the highest growth in state domestic product during the post-reform period (Ahluwalia, 2000). Performance of Bengal deserves appreciation as it experienced higher growth in the early 1990s from near stagnation in the 1980s. The most disquieting performance was displayed by Bihar, which registered negative growth in both GVA and TFP The general economic performance of Bihar was very pathetic during the 1990s (Ahluwalia, 2000). This also questions the generally applauded growth effects of economic liberalization in India (Bhagawati,1994; Joshi and Little, 1996). The higher negative growth of TFP showed the total inefficiency of the manufacturing sector in Bihar. The growth of Kerala was also poor in the early 1990s.

GVA growth in manufacturing was slightly declined in three leading states (Gujarat, Maharashtra and Tamil Nadu) for the 1990s. There was pronounced decline in Gujarat in terms of TFP It declined in Maharashtra and Tamil Nadu also. It can, therefore, be deduced that the tempo of manufacturing growth came down in the three leading industrialized states in the late 1990s. Meanwhile, the growth scenario improved in the other three states, especially in Kerala during the same period.

Manufacturing Growth and Deflationary Effects

As the present study also aims at the issues relating to deflationary methods and its impact on manufacturing growth, we can consider such issues in the regional context.

Generally GVA and TFP at DD were higher than these variables at SD for all states during 1960 to 1998-99. Decade wise analysis ratified the argument of B-P (1994) and Rao (1996) that TFP at DD in India was lower in the 1980s than the same in the 1970s. However this was not seen in uniformly in all the states in all decades. In this context, the cases of Gujarat and Bihar were notable for the 1960s, and, 1980s and 1990s respectively. More cases could be traces for the early 1990s.

There was not much difference between the growth rates of GVA and TFP at SD and DD respectively in the 1960s. It reminds us for the argument of BP (1994) that there had not been much difference between the rising trends in the prices of output and input in the 1960s. However it is a confusing fact that the divergence in the growth at SD and DD came down in the 1980s even if the difference between the prices of output and input continue in the 1980s. The growth of GVADD has more than double in all states except in Bihar in the 1970s. TFPDD also had enhanced growth. The bias of double deflation, as argued by Rao (1996), might have partially contributed to the higher growth of GVADD in the second decade (see 2.4). Lower growth of GVA and TFP in the 1980s was found in Gujarat compared to their growth in the previous decade even if single deflation was followed. Bihar and Bengal had such an experience in the growth of GVA. This finding is contrary to the hotly debated argument of Ahluwalia (1991) about 'turn around' of Indian manufacturing in the 1980s. It is already argued in sections 1 and 2 that Indian manufacturing had a face out from stagnation to growth in the 1980s. The expected lower value GVA and TFP at DD, as argued by Rao (1996) was not seen for distant period from the base period (i.e., 1970-71). This is evident from the higher values at DD for all states except in Bihar in the 1990s.

Change in the deflationary methods reflected in average productivity (APL and APK) also. In general, average productivity improved in the late 1970s and it was pronounce at double deflation. While comparing the TFPDD index series of B-P (1994) and average productivity in the late 1970s, one can conclude that the higher TFPDD in the 1970s than the same variable in the 1980s were mainly attributed to the achievements in the late 1970s.

A special feature of capital productivity at SD was its higher value than APL in Maharashtra and Bengal during the first two decades of analysis. APKSD was lower with lower level of industrialization. Though APLDD became greater than APKSD by the late 1970s, it might have been mainly due to the fall in the growth of employment. In addition, APLDD overtook APLSD mainly after 1973 and APL itself scored more than APKSD by the end of 1970s. It may be noted that the input prices had a spurt since the early 1970s. The above trends generally continued in the next two decades.

4.2.1 Labour Productivity and Capital productivity

Partial productivity is more realistic to reflect the level of industrialisation in the 60s, unlike the ranking in terms of growth rates of GVA and TFP (decade wise results are reported in the state wise analysis given below). Maharashtra has the second largest level of labour productivity and is the highest in capital productivity. Though Bihar is first in labour productivity, it is low in the order of industrialisation. Meanwhile, its capital productivity is slated at the fifth position. Tamil Nadu, Gujarat and Bengal register labour productivity between 5 and 6 on average. Bengal scores better in terms of capital productivity. It is a special feature that the two top industrialised states have higher capital productivity than labour productivity. These two states were top in investment also.

Kerala was at the bottom in APL and APK though it is at the top as far as growth rates of GVA and TFP are concerned, especially in the early 60s. APL and APK in Kerala increase in the late 60s. Thus partial productivity somewhat levels with the ranking in regional industrialisation. This gives the idea that partial productivity is a better concept to understand the level of industrialisation.

As the degree of industrialisation revealed, Maharashtra is prominent both in labour productivity and capital productivity in the 70s. In addition, Maharashtra and Bengal have higher APK than APL. It seems that these two states have an advantage in industrialisation due to higher capital productivity (Bengal loses the advantage later). Both productivities increase in Maharashtra while capital productivity at SD declined in

Bengal. The relative increase in labour productivity and capital productivity at DD is marginal. This accounts for the decelerated industrial activity in Bengal. Bihar slipped to second position in labour productivity. Partial productivity improved in Gujarat and Tamil Nadu. In both APL and APK, Kerala was at the bottom.

Maharashtra and Bihar were at the top in labour productivity in the 1980s. But, Bihar was at the bottom in the case of capital productivity. Gujarat and Tamil Nadu were just behind Maharashtra in terms of labour productivity and APK. Both these states seemed to be catching up with Maharashtra both in terms of growth rates in GVA and partial productivity. Bengal dipped to sixth and fourth positions in APL and APK respectively. The performance of 'catching up' states and 'falling behind' state (eg. Bengal) signifies the early argument that capital productivity improves with the level of industrialisation. Kerala once more remained at the lower level of industrialisation. A general trend in the 1980s was an enhanced level of productivity in all states, especially in APL. As noted in the decade wise analysis below, negative growth in employment and less input intake might have contributed to this phenomenon. It is noticeable that APLDD had a jump in growth during the 1980s. There was divergence among states in APL and APK; there was also significant differences in APKDD.

The picture of partial productivity in the 1980s was somewhat a repetition of the previous decade. Maharashtra was at the top for APL and APK. The ranks of Bihar, Gujarat and Tamil Nadu were behind that of Maharashtra in terms of APL. The position of Gujarat and Tamil Nadu are better than Bihar considering the APK. This can be part of the catching up process. Bengal, on the other hand further slipped in APL, but had a better position in APK. Compared to the 60s and 70s, capital productivity in Bengal was lower in the 1980s. Meanwhile, Tamil Nadu and Gujarat did better in APK with a higher level of industrialisation. Another interesting feature was the general increase in partial productivity in all these six states. The increase was appreciable in the highly industrialised states of Maharashtra, Gujarat and Tamil Nadu. Further, the difference between APL and APK was lessened in the catching up states. However capital productivity gradually declined in Bengal with its slippage in ranking compared to Gujarat and Tamil Nadu.

There was a general spurt in partial productivity except in APK in Bengal in the early 1990s. Once more it is revealed that capital productivity is a better indicator of the level of industrialisation. For instance, Bihar was second and third in APLSD and DD respectively while Bengal was at the bottom. But Bihar was a middle rank state in the level of industrialisation. Meanwhile, Bengal had a better position (4) in terms of capital productivity. Other states maintained status quo. The spurt in partial productivity marginally fell down in leading industrial states (Maharastra, Gujarat and Tamil Nadu) in the late 1990s due to the fall in the growth of GVA.

4.2.2 Capital Intensity

A clear pattern has evolved as far as capital intensity is concerned. High ranking states like Maharashtra and Bengal had low capital intensity (less than one) and low rank states like Kerala and Bihar had relatively high capital intensity (around 3) in the 1960s(tables are provided in the concerned states below). The catching up states, Gujarat and Tamil Nadu had a medium level. It gives the idea that capital intensity became low with the level of industrialisation. It can also be interpreted that employment increased faster than the increase in investment. Capital intensity increased for Maharashtra and Bengal while the opposite happened in other states in the 1970s. This showed a kind of convergence among states and it continued till the mid-eighties. Capital intensity increased in all states in the late 1980s and the same trend continued in the 1990s. The low rank states had capital intensity more than 2 and others had less 2 in the 1990s. In this sense, there was convergence of capital intensity among states in the last decade. The experience of industrialised and catching up states did not ratify the theoretical argument that capital intensity increased the industrial growth.

4.2.3 Growth of Employment, Capital and Input

The two catching up states, Tamil Nadu (3.56) and Gujarat (2.66), registered the highest growth rates in employment during 1960-1998-99(table 4.1.2). Bihar did better than Maharashtra. Maharashtra's medium position is justifiable while considering its top rank in absolute employment. The most disturbing fact was that Bengal experienced a low level of growth both in labour productivity and employment.

Table-4.1.2 Annual Growth Rates of Employment (L) Capital (K) And Input (In) during 1960-1998-99

States	Growth Rate (Percent per annum)		
	L	K	In
Kerala	1.45	0.85	5.66
Bihar	1.53	2.27	4.11
Gujarat	2.66	3.29	6.76
Maharashtra	1.27	3.96	5.54
Tamil Nadu	3.56	2.69	6.54
W.Bengal	-0.57	1.82	1.37

We could examine the decade wise experience in these states. It is important to know which decade had a greater influence on the overall growth. The catching up states recorded the highest growth in employment in the 1960s. Tamil Nadu was at the top always except in the 1970s and 1990s. Gujarat was second during the 1970s and the 1980s in terms of growth and it was second or third in the growth of employment. Bihar was first and second during the 1970s and the 1980s respectively and at other periods at the bottom. That is, Bihar painted a very poor picture during 1980-94. Maharashtra generally kept the fourth position in growth except in the 1970s (5) but simultaneously showed either first or second position in labour productivity. But Bengal's relative position progressively declined decade after decade. The relative position of Kerala in employment growth gradually declined but improved to second position in the early 1990s. All the states except Tamil Nadu registered negative growth in employment in the 1980s. Bihar and Bengal continued the same trend in the early 90s, but Bengal at a lesser degree. Thus Tamil Nadu excelled in employment growth while Bengal and Bihar put up a poor show. It is interesting to note the argument of Goldar (2000) that increase in industrial employment in the 1990s mainly occurred in the small-scale sector. It is generally believed that employment has not grown evenly in all regions as a result of liberalization. In addition, employment declined in Kerala, Bihar and Tamil Nadu in the late 1990s. There was phenomenal growth of employment with "accelerated growth of industry" in Gujarat (Ahluwalia, 2000) at the same period.

Growth rate of capital

Though employment growth did not represent the level of industrialisation, growth in capital reflected the same during 1960-1998-99(table-4.1.2). Maharashtra, Gujarat and Tamil Nadu occupied the first three positions in terms of growth of capital. This almost synchronized with the ranking of these states in industrialisation. Bengal and Kerala were 5th and 6th in the order, while Bihar had the fourth position.

A look at the impact of decennial performance on the overall growth in capital is more reveling. Maharashtra enjoyed the top position in all decades except in the 1970s and 1990s (2). The growth of capital had been faster since 1980. Gujarat had a different story to tell. It graduated from the fourth position in the 1960s to first position in the 1990s. Though there was a continuous elevation of the rank of Gujarat in the growth of capital, Tamil Nadu slipped to the fourth position in the 1970s. For other decades, Tamil Nadu was at the third position. Bengal was relegated to the fifth position in the 1970s and the19 80s. It position got better (4) in the 1990s. The growth of capital in Bengal was always was very low and it is one of the factors that pushed back the state to its low level of industrialisation. Gujarat, Tamil Nadu and Kerala had sustained high growth in capital decade after decade. There was an overall growth in capital in the early1990s compared to the preceding decade. Another notable feature was the enhanced growth of capital in the 1980s relative to that of 1970s. Employment registered a negative or reduced growth (in Tamil Nadu only) during the same period. Both capital and employment grew at an increasing rate (except in Bihar) in the early 1990s. Bihar, thus, became the ill-fated state in the 1990s as Bengal was in the 1960s and the 1980s.

Input Growth

The catching up states, Gujarat and Tamil Nadu, once again came to the forefront in the case of input growth during 1960-1998-99(table-4.1.2). Maharashtra stood fourth (in employment also) just behind Kerala. It may be noted that Maharashtra was top as far as the growth of capital was concerned. But the catching up states had better rating (normally first or second position) in the growth of employment, capital and input. As a laggard state in industrialisation, Bengal was at the bottom in input growth. Meanwhile, the catching up states as well as Bengal registered a continuous decline in input growth from the second decade onwards. Bihar and Kerala also showed a similar trend since 1980. The bottom ranking states in terms of input growth, Bihar and Bengal experienced a negative growth in the early 1990s. Thus the general tendency had been to use less input till the early 1990s. However, the trend reversed in the late 1990s. The use of inputs grew in all states except in Bihar, which had a poor show in manufacturing at that time.

Generally speaking, there are basically three factors accounting for state level differences in manufacturing growth and productivity. They are (a) the paradox of lower growth and high level of industrialization, (b) decade wise fluctuations and (c) the nature of the deflator used. This requires detailed discussions at the state level. Let us first take up the case of Kerala.

4.3.0. Kerala

General Scenario

The overall growth of manufacturing in Kerala was comparable to leading industrial states like Gujarat, Maharashtra and Tamil Nadu during 1960-1998-99. TFP also moved with GVA showing a positive co- relation between these two variables (Table 4.2.1).

Table-4.2.1. Annual Growth Rates of Gross Value Added (GVA) and Total Factor Productivity (TFP) at Single Deflation (SD) and Double Deflation (DD) in Kerala

Period	Growth Rate (Percent per annum)			
	GVA		TFP	
	SD	DD	SD	DD
1960s	9.04	9.44	6.70	6.35
1970s	5.93	12.36	3.82	9.42
1980s	7.18	5.11	6.71	4.30
Early 1990s	1.53	3.24	-2.16	0.56
1980-81 to1993-94	5.72	5.18	3.54	3.49
1990s	7.00	8.83	-7.34	3.03

Along with total factor productivity, average productivity is also analyzed to understand the impact of the growth of primary factors on productivity. Average labor productivity (APL) was more than that of capital (APK) during the whole period of analysis. APL gradually increased and reached the maximum in the late 1980s and declined thereafter (Table 4.2.2). It further increased in the late 1990s. APK also gradually increased like APL and the former reached its zenith in the late1990s. Unlike labour, capital experienced a steady growth throughout the period along with a gradual rise in capital productivity. It shows growth in value added with the accumulation of a primary factor.

Capital intensity did not show much volatility. Input growth initially rose in the 1970s and it doubled in the 1980s. But its growth in the early 1990s was just a quarter of input intensity in the 1970s. It increased considerably in the late 1990s. Input intensity reduced considerably after 1980. It might also be noted that APLDD was at a higher rate in the 1980s and 1990s. This pointed to the low input intake till the early 1990s.

Decade Wise Analysis

Decennial growth showed three phases in manufacturing growth in Kerala during 1960-1998-99. The first phase marked continuous growth during 1960-1979-80. Kerala registered the highest growth in terms of GVA and TFP during this period. This represented a paradox of high rate of growth with low level of industrialization. In the third phase, the manufacturing sector regained growth in the late 1990s. The interim period represented the second phase This phenomenon was equally applicable to the growth of GVA and TFP The overall efficiency of manufacturing in Kerala was low in the 1990s. This was evident from the then low value of TFP then.

Nature of Growth and Deflationary Methods

As there was not much difference between output prices and input prices in the 1960s, there was not much divergence in the growth between GVASD and GVADD. This was seen in the case of TFPG. Divergence occurred for other decades due to the differing nature of output prices and input prices. The divergence was more pronounced in TFPG than in the growth of GVA. GVASD and TFPSD were higher than their corresponding value at DD only in the 1980s. This can occur when only input prices are higher than out prices (B-P, 1994). Meanwhile, the adverse impact of double deflation as argued by Raό (1996) for distant period was not seen in the 1990s (The base year of input prices are taken as 1970-71).

The deflationary effect reflected in average productivity also. Both of APL and APK at DD had been larger than that at SD since 1973. This seemed to be a reflection of higher growth in GVADD, which, in turn, was influenced by rise in the relative index of material prices. One interesting result was the increasing rate of APL and APK at double deflation compared to that at single deflation. Variation in average productivity can be related to input intensity as well. Input intensity at SD was higher than the same variable at DD till 1973. A fact noted for average productivity was the reverse of this. That is, APL and APK at DD became higher than factor productivity at SD since 1973. This transition is observed after the 'oil shock' in the early 1970s.

4.3.1. Labour Productivity and Capital Productivity

Labour Productivity (APL) was more than capital productivity (APK) in the 1960s (table-4.2.2.). Both APL and APK showed rising trends in general, labour productivity continued to be higher than capital productivity in the 1970s also.

Table-4.2.2. Labour productivity (APL) and Capital productivity (APK) at SD and DD in Kerala

Year	APL_SD	APL_DD	APK_SD	APK_DD
1960	3.20	3.12	1.01	0.98
1961	3.41	3.13	1.10	1.01
1962	3.53	3.12	1.16	1.02
1963	3.46	2.98	1.17	1.00
1964	2.93	2.64	1.04	0.94
1965	3.66	3.74	1.34	1.37
1966	4.42	4.61	1.59	1.66
1967	5.46	4.63	1.82	1.54
1968	4.84	4.17	1.70	1.47
1969	6.40	6.66	2.36	2.46
1970	5.04	5.34	1.70	1.80
1971	4.72	4.27	1.80	1.63
1972	4.62	3.99	1.80	1.56
1973	4.16	4.45	1.67	1.79
1974	4.47	5.71	1.78	2.28
1975	4.15	5.15	1.65	2.05
1976	4.57	6.27	1.86	2.55
1977	4.85	7.00	2.18	3.15
1978	5.71	9.26	2.38	3.86
1979	7.32	11.11	3.17	4.82
1980	5.63	9.54	2.47	4.18
1981	5.54	10.54	2.61	4.96
1982	7.13	13.55	2.95	5.61
1983	7.86	13.16	3.02	5.06
1984	8.81	14.01	3.32	5.28
1985	8.49	14.16	3.00	5.01
1986	9.34	15.11	3.13	5.06
1987	10.52	16.32	3.80	5.89
1988	11.00	17.61	3.76	6.01
1989	13.48	20.10	5.01	7.47
1990	9.75	16.43	3.81	6.43
1991	12.32	20.16	4.88	7.98
1992	9.62	16.54	4.39	7.55
1993	9.45	16.59	4.00	7.02

1994	8.96	14.58	4.44	7.22
1995	25.96	33.02	11.14	14.17
1996	12.29	22.96	5.46	10.21
1997	11.91	24.12	5.56	11.26
1998	18.16	33.98	6.74	12.62

Labour Productivity reached the maximum in the late 1980s but declined in the early 1990s. The negative growth rate of employment might have partially contributed to the enhanced level of labour productivity in the 1980s. Though both the productivities were higher compared to the first two decades, labour productivity continued to be higher than capital productivity in the 1980s. Higher capital productivity co-existing with higher growth rate of capital is a noteworthy feature.

APL remained at a higher level than APK in the 1990s too. APL declined during the early 1990s compared to the late 1980s. Positive growth in NOE might have pulled down the productivity in the early part of this decade. Low growth of GVA was an added factor to the declined level of APL.

4.3.2. Growth of Employment, Capital and Input

Growth rate of employees (NOE) was more than the rate of growth of capital (K) in the first decade of analysis (table-4.2.3). It is notable that average productivity increased along with the increase in primary factors. Input growth was several times the growth of K (16 times) and L (6 times).

Table-4.2.3. Annual Growth Rates of Employment (L) Capital (K) and Input (In) in Kerala

Period	Growth rate (percent per annum)		
	L	K	In
1960s	1.88	0.47	7.55
1970s	2.82	0.64	8.36
1980s	-1.96	1.00	4.32
Early 1990s	4.94	1.14	2.17
1980-81 to 1993-94	0.83	1.08	4.98
1990s	2.77	1.69	6.57

Average productivity increased along with the primary factors in the next decade also. Employment growth rate in manufacturing registered 50 percent growth in the 1970s compared to the previous decade. However, there was only a marginal increase in the growth of capital during the corresponding period. Like employment, input also grew during the 1970s relatively to the previous decade. It was interesting to note that TFPDD increased at a higher rate even if input grew at an enhanced rate.

Growth rates of employment and capital were the highest during the early 1990s. Capital had been displaying continuous and increased growth rate decade after decade in Kerala. Though the rate of growth of input was on the rise during the 1970s, it gradually came down later. The growth rate even shrunk to a quarter in the early 1990s compared to the same in the 1970s. Employment declined in the late 1990s while input grew considerably

4.2.3. Capital Intensity and Input Intensity

Capital intensity is a straight and simple method to know the bias in technology. Capital intensity (K/L) had a fluctuating tendency during the 1960s. The fluctuating tendency of the same turned to a general decline in the next decade. It was the result of slow and high growth of capital and labour respectively (table-4.2.4.). Thus manufacturing in Kerala was biased to labour in the 1970s.

Table-4.2.4. Capital Intensity (K/L) and Input Intensity (In/ GVA) at SD and DD in Kerala

Year	K/L	IN/GVA SD	IN/GVADD
1960	3.18	2.43	2.49
1961	3.10	2.60	2.83
1962	3.05	2.59	2.93
1963	2.96	2.69	3.14
1964	2.83	3.30	3.65
1965	2.73	2.36	2.31
1966	2.78	2.27	2.18
1967	3.00	2.44	2.87

1968	2.84	2.92	3.39
1969	2.71	1.92	1.84
1970	2.96	2.91	2.74
1971	2.62	2.78	3.07
1972	2.56	2.89	3.35
1973	2.48	2.75	2.57
1974	2.51	3.32	2.59
1975	2.51	4.13	3.33
1976	2.46	3.96	2.89
1977	2.22	3.66	2.53
1978	2.40	3.83	2.36
1979	2.31	2.68	1.77
1980	2.28	3.67	2.22
1981	2.12	3.74	1.97
1982	2.42	3.17	1.66
1983	2.60	2.63	1.57
1984	2.65	2.23	1.40
1985	2.83	2.98	1.78
1986	2.99	3.16	1.96
1987	2.77	2.86	1.84
1988	2.93	3.18	1.98
1989	2.69	2.43	1.63
1990	2.56	3.12	1.85
1991	2.53	2.83	1.73
1992	2.19	3.35	1.95
1993	2.36	3.02	1.72
1994	2.02	2.37	1.45
1995	2.33	1.08	0.85
1996	2.25	3.24	1.73
1997	2.14	3.60	1.78
1998	2.69	2.79	1.49

Capital intensity was higher in the mid-eighties compared to the beginning and the end of 1980s. It may be noted that certain selective sectors were partially liberalized in the mid-eighties. At the same time, there was a negative growth in employment during this period. It implies a slight tilt to capital oriented production.

As growth in capital and employment increased in the early 90s, capital intensity continued generally at the old level. In short, K/L ratio remained more or less the same in all decades except in the mid-eighties. The trend continued in the late 1990s also.

Input intensity (In/ GVA) provides an indirect indication of the efficiency of the manufacturing sector. A decline in this ratio can be considered as an indication of increase in efficiency. In /GVA ratio was higher in the early 1960s compared to the late 1960s in Kerala. It further increased in the 1970s. This ratio at DD had been less than at SD since the 1970s. It could have been due to an increase of material prices in the 1970s. Another aspect of this ratio was its periodical fluctuations in the three decades. Hence there was on an average no difference in the level of In /GVA. Though this ratio remained at comparable level during the first two decades of analysis, input growth declined by half in the 1980s compared to the previous decade. The ratio at SD was almost similar in the 1980s and 1990s. The same ratio at DD declined during 1980-81 to 1998-99. Before that both were somewhat comparable. The implication is that input use had drastically come down in Kerala since 1980. Slow growth of manufacturing was a major reason for this. Fall in input intensity can also be taken as an indicator of increase in efficiency. However, the input intake and output increased in the late 1990s.

4.3.0. Bihar

General Performance

Let us now make a quick survey on the general performance of manufacturing in Bihar during 1960 to 1998-99. It seemed that the overall growth in GVA in Bihar was mainly influenced by the high growth rate in the 1970s. We can draw the following broad conclusions relating to manufacturing sector in Bihar (table 4.3.1).

Table-4.3.1. Annual Growth Rate of GVA and Total Factor Productivity (TFP) at SD and DD in Bihar

Period	Growth Rate (Percent per annum)			
	GVA		TFP	
	SD	DD	SD	DD
1960s	3.22	3.90	1.52	1.75
1970s	7.33	12.39	1.98	6.93
1980s	3.92	3.25	2.10	1.52
Early 1990s	-1.44	-0.99	-3.52	3.24
1980-81to1993-94	3.31	3.28	1.29	1.33
1990s	3.30	2.71	0.58	-0.39

1. GVA and TFP moved in the same direction;
2. The best performance of manufacturing in Bihar was found in the 1970s;
3. The most disquieting period was the early 1990s. All the variables except capital accounted for a negative growth during this period. As noted earlier, Kerala also registered poor growth in manufacturing in the early 1990s. The scenario improved in both the states in the late 1990s;
4. Input growth was higher than the growth of employment and capital throughout the period except in the early 90s. Input intensity at DD became lower after 1973;
5. Average productivity increased along with the growth in primary factors;
6. Labour productivity was higher than capital productivity during the whole period of analysis.
7. The trend in capital intensity showed a rise and fall in Bihar. K/L ratio declined in the 1970s and reached original level in the early 1990s. It increased further in the late 1990s. Negative employment growth in the 1980s and the 1990s could be a reason for the increase in capital intensity; and
8. There had been a simultaneous contribution to GVA both from factor accumulation and technological change, as seen in Kerala.

Decade wise Analysis

Growth of GVA and TFP

There was a positive correlation between GVA and TFP. This kind of relation continued in the 1970s also. There was remarkable progress in manufacturing in Bihar in the second decade. Slow down in growth started in the 1980s. Inefficiency clearly manifested in the early 1990s in the form of negative growth of GVA. TFP also moved in the direction of GVA. There was marginal improvement in the growth of GVA and TFP in the late 1990s.

Growth and Deflation Effect

The growth in GVA and TFP at DD was higher than their growth at SD during the whole period of analysis. The growth rates in GVA at SD and DD were closer in the 1960s signifying no much difference between output and input prices. Similar trend was found in Kerala. This was also reflected in TFP The widely discussed 'turn around' thesis of Ahluwalia (1991) was not applicable to Bihar in the 1980s. That is, the growth of GVASD in the 1980s was less than its growth in the 1970s. Moreover, the growth rate of GVASD became only marginally greater than GVADD in the 1980s.

Deflationary effect was reflected in average productivity (APL and APK) too. In general, the average productivity at SD was more than the same variable in the first decade. Because of the higher growth of GVADD in the second decade, average productivity at DD scored over the same at SD.

4.3.1. Average Productivity of Labour and Capital

Bihar seems to be an odd case of high labour productivity with low growth in value added. Average productivity of labour was higher than capital productivity in the 1960s (table-4.3.2).

Table-4.3.2. Labour Productivity (APL) and Capital Productivity (APK) and SD and DD in Bihar

Year	APL_SD	APL_DD	APK_SD	APK_DD
1960	7.46	7.21	2.65	2.56
1961	7.93	7.14	2.95	2.65
1962	9.54	8.47	3.13	2.78
1963	9.09	7.93	3.03	2.64
1964	10.07	9.37	3.33	3.09
1965	9.24	9.42	3.62	3.69
1966	10.20	10.60	3.51	3.64
1967	10.51	9.29	3.55	3.14
1968	8.91	7.76	2.90	2.53
1969	8.85	9.30	3.45	3.63
1970	8.94	9.40	3.52	3.70
1971	8.42	7.61	3.39	3.06

1972	7.99	6.89	3.17	2.73
1973	7.00	7.49	2.68	2.87
1974	9.04	10.84	3.84	4.60
1975	10.12	11.53	4.65	5.30
1976	9.31	11.54	4.18	5.19
1977	8.20	11.02	3.85	5.18
1978	10.95	14.79	5.02	6.79
1979	10.11	14.74	4.22	6.15
1980	15.81	19.91	6.63	8.35
1981	11.71	18.26	5.09	7.94
1982	11.35	20.98	4.80	8.87
1983	13.66	21.33	5.30	8.27
1984	14.40	23.26	5.26	8.50
1985	14.81	22.89	5.31	8.22
1986	13.53	20.59	4.81	7.32
1987	15.25	21.81	5.86	8.38
1988	20.01	27.33	7.34	10.03
1989	19.73	28.47	6.78	9.78
1990	18.54	28.65	6.41	9.90
1991	19.60	29.51	6.50	9.79
1992	16.43	25.89	5.47	8.61
1993	19.80	30.58	5.88	9.08
1994	19.33	31.22	5.54	8.95
1995	21.99	33.45	6.01	9.15
1996	27.75	40.40	7.25	10.56
1997	38.67	55.39	9.14	13.09
1998	25.55	36.03	5.39	7.60

One of the aspects of Bihar's industrialisation was its high labour productivity coupled with its rank in the middle in the level of industrialization. Labour productivity was higher in Bihar than in Kerala. Capital productivity continued to be lower than APL in the 1970s and 1980s also.

Labour productivity reached the maximum in the early 1990s while APK recorded a fall. High labour productivity was a by- product of a negative growth in employment. Hence it cannot be taken as a symptom of improvement in manufacturing. That is, total factor productivity, which is the general measure of efficiency, became negative during this period. Further, there was a fall in capital productivity in consonance with growth in capital. Thus APK again remained at a lower level than APL. Both APL and APK increased in the late 1990s due to the growth in GVA and slow growth of capital and negative growth of labour respectively.

4.3.2. Growth of Labour, Capital and Input

Labour, capital and Input registered positive growth during the first decade of analysis. Input growth was at a faster rate than that of labour and capital, as found in the case of Kerala. There was remarkable progress in the growth of primary factors and input in Bihar in the second decade (table-4.3.3). Average productivity increased along with growth in primary factors. In fact, manufacturing in Bihar worked well in the 1970s in terms of productivity and absolute growth of primary factors.

Table-4.3.3. Annual Growth Rates of Employment (L) Capital (K) and Input (In) in Bihar

Period	Growth Rate (Percent per annum)		
	L	K	In
1960s	1.35	1.15	2.70
1970s	4.87	3.15	5.60
1980s	-0.46	1.81	5.09
Early1990s	-1.64	2.87	-3.65
1980-81 to1993-94	-0.27	2.05	4.30
1990s	-2.80	2.58	-2.86

The scenario drastically changed in the 1980s. As noted earlier, there was decelerating trend in the growth of GVA in Bihar in this decade. It was the result of two features in the growth of primary factors. That is, employment growth became negative in the 1980s, while capital growth was only 57 per cent of what had been achieved in the 1970s. This, in turn, raised the average productivity of both labour and capital.

The picture of Bihar was not rosy in the early 1990s either. All the variables except capital marked negative growth. It connoted that capital formation took place without any real impact in the industrial front in the early 1990s. Labour productivity reached the maximum in the early 1990s probably due to the enhanced negative growth in employment. Input growth not only declined marginally in the 1980s but also became negative in the early 1990s. This points to the very low level of industrial activity in this state. Input use also declined in Kerala during this period. Thus Bihar displayed a dismal picture of manufacturing in the early 1990s. Employment level further worsened in the late 1990s while the growth of capital declined marginally. Despite this, GVA recorded positive growth.

4.3.3. Capital Intensity and Input intensity

Capital intensity in Bihar had a comparable level with Kerala in the 1960s. It showed a bias towards labour as the K/L ratio declined by the late 1970s. Capital intensity gradually increased in the 1980s and 1990s (table-4.3.4). This occurred due to the negative and positive growth of employment and capital respectively. In this sense, manufacturing in Bihar became more oriented to capital-intensive production in the last two decades compared to the 1970s. Kerala also experienced increase in capital intensity in mid-1980s. It shows that the first dose of liberalization was in favour of capital oriented production.

Table-4.3.4. Capital Intensity (K/L) and Input Intensity (In/GVA) at SD and DD in Bihar

Year	K/L	In/ GVASD	In/ GVADD
1960	2.81	2.44	2.53
1961	2.69	2.78	3.08
1962	3.05	2.23	2.51
1963	3.00	2.28	2.61
1964	3.03	2.15	2.31
1965	2.55	2.29	2.25
1966	2.91	2.17	2.09
1967	2.96	1.95	2.20
1968	3.07	2.84	3.26
1969	2.56	2.38	2.26
1970	2.54	2.52	2.39
1971	2.48	2.82	3.12
1972	2.52	2.92	3.38
1973	2.61	2.82	2.64
1974	2.36	2.37	1.97

1975	2.17	2.38	2.09
1976	2.23	2.56	2.07
1977	2.13	2.83	2.11
1978	2.18	2.15	1.60
1979	2.40	2.37	1.63
1980	2.38	1.41	1.12
1981	2.30	2.32	1.49
1982	2.37	2.98	1.61
1983	2.58	2.19	1.40
1984	2.74	2.32	1.43
1985	2.79	2.43	1.57
1986	2.81	2.68	1.76
1987	2.60	2.23	1.56
1988	2.72	1.93	1.42
1989	2.91	2.19	1.52
1990	2.89	2.49	1.61
1991	3.01	2.25	1.49
1992	3.01	2.68	1.70
1993	3.37	2.18	1.41
1994	3.49	2.32	1.44
1995	3.66	2.08	1.37
1996	3.83	1.70	1.17
1997	4.23	1.52	1.06
1998	4.74	1.32	0.93

Input intensity (In/ GVA) almost leveled with capital intensity in the 1960s. This ratio did not show much difference at SD and DD. This was the reflection of the stability of the relative index of material prices in the first decade. Input intensity at SD remained more or less the same in the 1970s but it at DD started declining continuously since 1973. This was the result of the increase in material price in the second decade. It declined later also due to the fall in value added at DD. Higher growth in GVADD superseded the growth of input and thereby input intensity declined. Negative growth of input also contributed to it. This cannot be taken as an indication of efficiency as there was only low level of industrial activity in the 1990s.

4. 4.0: GUJARAT

General Performance

Gujarat recorded the highest growth in GVA during 1960-1998-99 (table-4.1.1). TFP also had higher growth along with Kerala and Tamil Nadu at the same period. The higher growth of GVA and TFP was mainly influenced by their greater values in the 1970s and the early 1990s. The better growth of these two variables helped Gujarat to catch up with Maharashtra in the level of industrialisation. As in Bihar and Kerala, a positive relation between GVA and TFP was also seen in Gujarat.

Table-4.4.1. Annual Growth Rates of GVA and Total Factor Productivity (TFP) at SD and DD in Gujarat

Period	Growth Rate (Percent per annum)			
	GVA		TFP	
	SD	DD	SD	DD
1960s	4.39	4.75	2.39	1.94
1970s	6.42	13.24	2.99	8.64
1980s	5.43	4.65	1.88	1.35
Early 1990s	16.45	13.38	8.19	6.44
1980-81 to1993-94	6.36	6.01	2.19	1.92
1990s	11.14	12.31	-2.34	2.79

As in Kerala and Bihar, average productivity had two important characteristics. Firstly, APL was always greater than APK. Secondly, contribution from primary factors increased along with their absolute growth except labour in the 1980s. Labour productivity showed sharp rise in the third decade in the event of negative employment growth. In short, the source of manufacturing growth originated from both factor accumulation and TFP Despite the sharp rise in labour and capital, APL and APK continued the upward strides in the 1990s. This happened due to the phenomenal growth of GVA.

Capital intensity in Gujarat differed from that in Kerala and Bihar in one respect. It was lower in Gujarat with a decline till the early parts of the 1980s. A rise in capital intensity later was attributed to the decline in employment in the 1980s and the growth of capital. Similar trend was noted in Kerala and Bihar in the mid 1980s. This also underscores the capital biased nature of technology in the era of liberalization. As noted in the case of the other two states, input intensity at DD started falling after 1973 in Gujarat also. Mean while In/GVADD remained at a particular level. This divergence was the result of high price of inputs (slow growth of inputs) and the growth of GVADD. This also indicated that 1973 became a crucial time in Indian manufacturing in the context of oil price hike. This might have caused to the low intake of inputs. This trend changed in the late 1990s. GVADD increased even if input growth attained its peak level like employment and capital during that period. This marked the vibrancy of manufacturing in Gujarat.

Decade wise analysis

Growth of GVP and TFP

Manufacturing in terms of GVA and TFP picked up momentum in Gujarat in the 1970s compared to that of the previous decade. There was, more or less, a positive relation between GVA and TFP (Table 4.4.1). However, TFP did not have a better growth in the late 1990s. Gujarat displayed stupendous growth of manufacturing in alternate decades (1970s and 1990s)

The growth of manufacturing came down in the 1980s in Gujarat. That is, there was no 'turn around' in Gujarat as against the postulations of Ahluwalia (1991) in the case of Indian manufacturing. It is evident from table 4.4.1 that growth rates of GVA and TFP declined under the two methods of deflation.

It may be argued that sort of a 'turn around' occurred in the early 90s in Gujarat. A two-digit growth rate of GVA was observed and this growth might have been an over estimation due to an inadequate number of observations. However the growth of GVA and TFP is observed to have a positive correlation with the trend in average productivity (APL and APK) as discussed below. In addition, the growth of GVA and TFP for 1980-81 to 1993-94 showed a higher value than that for the 1980s alone. The accelerated growth of manufacturing in Gujarat continued during the late 1990s also.

Growth and Deflationary Effects

The growth in gross value added and total factor productivity at DD was higher than the same variables in Gujarat during 1960-1998-99 as was found in Kerala and Bihar. The main influencing factor was the greater values in the 1970s. Apart from the deflationary bias in the second decade, the difference of values at SD and DD had been very small.

As noted in Kerala and Bihar, Gujarat also showed only small differences in the growth of both GVA and TFP at DD and SD in the 1960s due to the stability of relative index of material prices.

The growth of both GVA and TFP came down in the third decade. That is, there was no 'turn around' in Gujarat as was shown by Ahluwalia (1991) in the case of Indian manufacturing. It is evident from table 4.4.1 that growth rates of GVA and TFP declined under the two methods of deflation. Though growth of GVA and TFP at SD was higher than that at DD in the 1980s, they had been below the corresponding values in the previous decade. The growth of the both variables at DD slipped considerably in the third decade as argued by B-P (1994) and Rao (1996). Once again TFP moved with GVA except in the late 1990s.

Average productivity (APL and APK) at SD and DD was of a criss-cross nature in the 1960s. However, they at DD became greater than the same variables at SD after the early 1970s. As argued earlier, this was due to the high growth of GVADD and it, in turn, was influenced by slow growth in input.

4.4.1. Average productivity of labour and capital

Average productivity increased in the late 1960s along with the growth of employment and capital (tables-4.4.2 and 4.4.3). Labour productivity was higher than capital productivity throughout the period. The "effect of 1973" as seen in the case of GVA is reflected in the level of average productivity also.

Table-4.4.2. Labour Productivity (APL) and Capital Productivity (APK) at SD and DD in Gujarat

Year	APL_SD	APL_DD	APK_SD	APK_DD
1960	5.56	5.43	3.74	3.65
1961	5.63	5.22	3.99	3.70
1962	4.99	4.32	3.56	3.09
1963	5.53	4.70	3.93	3.34
1964	5.56	5.05	4.07	3.70
1965	5.94	6.12	4.40	4.53
1966	6.06	6.38	4.33	4.56
1967	6.81	5.65	4.85	4.02
1968	5.91	4.93	4.37	3.65
1969	6.62	7.06	5.05	5.38
1970	6.84	7.28	5.41	5.76
1971	6.17	5.36	4.91	4.26
1972	6.73	5.63	5.52	4.61
1973	6.68	7.18	5.63	6.05
1974	6.89	8.64	6.02	7.55
1975	6.32	7.60	5.63	6.77
1976	7.11	9.36	6.29	8.27
1977	7.85	10.95	7.32	10.20
1978	8.20	12.64	7.66	11.81
1979	7.11	11.95	6.99	11.75
1980	7.37	12.38	7.17	12.04
1981	11.57	18.83	10.06	16.37
1982	8.24	17.16	8.04	16.74
1983	10.54	18.29	9.83	17.05
1984	10.07	19.12	8.09	15.36
1985	11.43	20.03	8.49	14.87
1986	12.13	20.11	8.77	14.53
1987	12.65	20.47	8.87	14.36
1988	14.98	24.02	10.10	16.19
1989	13.69	23.77	9.38	16.29
1990	15.16	26.99	9.06	16.13
1991	14.22	26.58	7.96	14.88

1992	20.64	33.10	11.85	19.00
1993	20.35	34.41	11.17	18.88
1994	24.00	38.93	12.83	20.82
1995	26.15	42.47	13.17	21.39
1996	28.56	46.66	13.11	21.55
1997	5.70	12.28	9.30	20.17
1998	26.92	53.89	10.10	20.21

Average productivity increased in the 1980s even though there was a fall in the growth of GVA. This requires some clarification. The growth of APL and APK was due to the growth of primary factors and the consequent growth in GVA in the 1970s. Negative growth in employment was responsible for the increase in labour productivity in the 1980s. In addition, slow grow of input might have contributed to raise the level of GVADD and APLDD. The positive side was the increase in APK along with the growth of capital.

The 'turn around' effect observed in the early 1990s got reflected in average productivity. APL reached its zenith in the 1990s. Unlike in the 1980s, labour productivity increased along with a rise in employment. There was also a steady rise in capital productivity along with the growth of capital. High growth of GVA plus average productivity showed the remarkable performance of Gujarat manufacturing in the early 1990s, unlike the negative growth and slow growth in Bihar and Kerala respectively. (The scenario improved in both states in the late1990s).

4.4.2. Growth of Employment, Capital and Input

Compared to the growth of labour and capital, inputs grew faster in the 1960s (table-4.4.3). This is true of Kerala and Bihar as well. In the second decade growth in primary factors was a little more than double that in the previous decade. This was followed by increase in productivity. Unlike in the other two states, input growth registered a marginal fall in the 1970s. Thus Gujarat manufacturing displayed higher productivity with less growth in input. This may be interpreted as a rise in relative efficiency in manufacturing.

Table-4.4.3.Annual Growth Rates of Employment (L) Capital (K) and Input (In) in Gujarat

Period	Growth Rate (Per cent per annum)		
	L	K	In
1960s	2.08	1.20	7.27
1970s	4.48	2.12	6.63
1980s	-0.68	3.82	5.99
Early 1990	3.91	6.21	5.67
1980-81 to 1993-94	-0.10	4.57	6.13
1990s	8.95	8.79	9.18

It is noticeable that a fall in the growth of GVA was reflected in TFP and not in average productivity in the 1980s. The rise in labour productivity was partially due to a negative employment growth. In spite of this, capital grew at an enhanced rate along with an increase in its productivity. Growth in capital occurred though there was a fall in the growth of the inputs. However, the scenario suddenly changed in the early 1990s. There was a steep rise in average productivity along with growth in primary factors. The average productivity increased while there was a positive relation between GVA and TFP Growth of employment became positive and capital grew at a very high level. Input growth further declined. Thus capital recorded a continuous rise and input a consistent decline in growth. Both these factors might have turned Gujarat into a vibrant industrial state. The picture was a little different in the late 1990s. The magnitude of TFPG was not at the same level as of growth in GVA. Input had tremendous growth along with the growth in labour and capital. It implies that growth in GVA was mainly due to the growth in primary factors.

4.4.3. Capital intensity and Input Intensity

Contrary to the general belief Gujarat did not show much capital deepening in the 1960s. But, the low industrialized states like Kerala and Bihar showed relatively higher capital intensity. K-L ratio virtually fell at the end of the 1960s (table-4.4.4). Capital intensity continued its declining trend and almost reached unity at the end of the 1970s. However, the first dose of liberalization started reflecting around mid-eighties when capital intensity began to rise in Gujarat. A negative growth in employment and an increased growth in capital were responsible for this. A similar trend was seen in Kerala and Bihar. Capital deepening continued in the 1990s also. This occurred due to the rapid growth of capital, despite an increase in employment.

Table-4.4.4. Capital Intensity (K/L) and Input Intensity (In/GVA) at SD and DD in Gujarat

Year	K/L	In/ GVASD	In/ GVADD
1960	1.49	2.23	2.28
1961	1.41	2.35	2.54
1962	1.40	2.98	3.44
1963	1.41	2.86	3.36
1964	1.37	3.20	3.52
1965	1.35	2.77	2.69
1966	1.40	2.76	2.62
1967	1.40	2.74	3.30
1968	1.35	3.49	4.18
1969	1.31	3.00	2.82
1970	1.26	3.09	2.91
1971	1.26	3.83	4.41
1972	1.22	3.48	4.17
1973	1.19	2.97	2.76
1974	1.14	3.03	2.41
1975	1.12	3.47	2.88
1976	1.13	3.38	2.56
1977	1.07	3.24	2.32
1978	1.07	3.33	2.16
1979	1.02	3.52	2.10
1980	1.03	3.69	2.20
1981	1.15	2.60	1.60
1982	1.03	3.80	1.83
1983	1.07	2.86	1.65
1984	1.25	3.39	1.78
1985	1.35	3.35	1.91
1986	1.38	3.37	2.03
1987	1.43	3.20	1.98
1988	1.48	3.19	1.99

1989	1.46	3.65	2.10
1990	1.67	3.56	2.00
1991	1.79	3.86	2.07
1992	1.74	2.81	1.75
1993	1.82	2.76	1.63
1994	1.87	2.35	1.45
1995	1.99	2.49	1.53
1996	2.17	2.36	1.45
1997	0.61	4.05	1.88
1998	2.67	3.21	1.61

Input intensity in Gujarat was comparable to other states in the 1960s. The impact of material prices was visible in the early 1970s as seen in the other two states. The ratio at DD became less than the variable at SD. The same trend continued in the 1980s and 1990s. Slow growth in input pulled down the input-GVA ratio. As argued earlier, this was the reflection of a rise in relative efficiency. However, the phenomenal growth of input in the late 1990s did not raise the value of input intensity. A higher growth of GVADD was responsible to this.

4.5.0. Maharashtra

General performance

The paradox of low growth and high level of industrialization, as argued earlier, was applicable to Maharashtra also. Considering the industrial base of this state, Maharashtra had a comfortable growth in all variables during 1960-1998-99 (4.5.1). As noted in other states, GVA grew along with capital and input. TFP also moved in the direction of GVA.

Table-4.5.1. Annual Growth Rates of GVA and Total Factor Productivity (TFP) At SD and DD in Maharashtra

Period	Growth Rate (Percent per annum)			
	GVA		TFP	
	SD	DD	SD	DD
1960s	4.26	4.68	1.83	1.82
1970s	4.22	9.81	1.20	6.22
1980s	5.87	5.09	2.65	1.45
Early1990s	9.73	8.35	4.07	2.07
1980-81 to1993-94	6.43	6.14	2.65	1.80
1990s	6.70	8.32	0.89	1.87

Unlike the three states discussed earlier, capital productivity was higher than labour productivity in Maharashtra in the first two decades of analysis. Average productivity at DD was higher in later decades because of greater growth in GVADD. Like Gujarat, average productivity was relatively high in the 1980s and the 1990s in Maharashtra.

Though Maharashtra was not top in the growth of GVA and TFP, it registered the highest growth in employment and capital. However, employment had a negative growth in the 1980s and capital had relatively slow growth in the 1970s. Input growth also pushed up initially but declined after the early 1980s. Slow growth in input was noted in Kerala, Bihar and Gujarat. This indicated rising efficiency of manufacturing provided there was a growth in GVA.

Like Gujarat, Maharashtra also experienced a low level of capital intensity. Considering the high growth of employment in Maharashtra, it was quite natural. It also implies that employment increased along with the level of industrialization. K-L ratio increased in the 1980s and 1990s in Maharashtra displaying non-neutral technology However, this state had no specific significance in input -GVA ratio while comparing with other states.

Decade wide analysis

Growth of GVA and TFP

As the most industrialized state in India, Maharashrta's growth of GVA and TFP was remarkable in the 1960s (table-4.5.1). TFP moved in line with GVA with hand in hand. But, this phenomenon disappeared in the 1970s. The performance of Maharashtra assumes significance while considering a negative growth of TFP in Bengal (second rank industrialized state) in the first decade. The positive relation between GVA and TFP was noted in the 1980s also.

The performance of manufacturing further improved in Maharashtra during the early 1990s. This was in line with Gujarat. Both of GVA and TFP had comfortable growth at that time. However, TFP growth declined in the late 1990s.

Growth and Deflationary Effects

Though TFP moved in the direction of GVA, they did not change in the same magnitude when different deflators were used. It is pointed out that double deflation has a tendency to raise the computed value of the base period. The base period is 1970-71 in the present study. This argument is very much applicable in Maharatra, along with other three states. Though the overall growth of TFPDD was greater than TFPSD, the former had a larger difference than the latter in the 1970s. Hence the results have to be accepted only with this fact in mind.

There was clear divergence between GVASD and GVADD, and, this difference was more prominent in the case of TFP at SD and DD in the second decade (not much in the 1960s). This trend reversed in the 1980s and it was in line with the national experience. That is, GVA at SD was higher than that at DD and the former was greater than its corresponding value in the 1970s. In short, larger difference of values under the two deflationary methods was seen only in the period (1970s), which was taken, as the base period. This was found for the other three states.

As noted earlier, APKSD was more than APL in the 1960s, both in Maharashtra and Bengal. Labour productivity became greater than capital productivity in the second decade. Initially APLDD became greater than APKSD since 1979. This was noted in the case of Bengal as well. Thus capital productivity at SD was higher than APL till the late 1970s in the two old industrialized states. Double deflation effect was felt in 1973 as in other states because APLDD became more than APLSD. Average productivity at DD (APL and APK) became greater than that at SD due to either higher growth in GVADD or slow growth in input during the last two decades (1980s and 1990s).

4.5.1. Average Productivity of Labour and Capital

A special feature of Maharashtra and Bengal (top ranking states) was higher capital productivity at SD than labour productivity in the 1960s (table-4.5.2). The other three states experienced just the opposite. It signifies the argument that the level of industrialization was determined by capital productivity in the early decades of development.

Table-4.5.2. Labour Productivity (APL) and Capital Productivity (APK) at SD and DD in Maharashtra

Year	APL_SD	APL_DD	APK_SD	APK_DD
1960	6.30	6.16	9.53	9.32
1961	6.80	6.29	9.99	9.25
1962	7.43	6.66	11.11	9.95
1963	7.67	6.67	11.21	9.76
1964	7.85	7.29	11.71	10.88
1965	8.07	8.27	11.93	12.23
1966	8.02	8.42	11.50	12.07
1967	8.41	7.16	11.64	9.92

1968	7.77	6.71	10.71	9.24
1969	8.16	8.68	11.44	12.17
1970	9.48	9.97	13.56	14.27
1971	9.32	8.47	13.44	12.21
1972	9.40	8.19	13.66	11.90
1973	8.78	9.34	12.85	13.67
1974	8.67	10.55	13.05	15.88
1975	8.57	10.06	12.57	14.75
1976	9.29	11.75	13.94	17.64
1977	9.68	13.13	14.06	19.07
1978	11.22	16.07	16.23	23.26
1979	10.06	15.33	14.84	22.61
1980	9.19	14.22	13.01	20.15
1981	9.99	17.18	13.28	22.84
1982	11.29	20.68	14.37	26.32
1983	15.98	24.63	18.43	28.42
1984	18.36	27.77	20.09	30.39
1985	15.64	24.71	15.96	25.22
1986	15.25	23.76	14.87	23.17
1987	14.85	23.62	14.02	22.30
1988	17.83	27.02	16.02	24.27
1989	20.27	32.14	16.14	25.60
1990	21.37	35.33	16.88	27.91
1991	21.26	33.65	15.52	24.56
1992	22.70	35.88	16.45	26.00
1993	26.56	41.97	18.34	28.97
1994	26.48	43.92	17.22	28.55
1995	26.46	45.25	17.68	30.24
1996	28.79	47.81	16.28	27.03
1997	28.84	52.66	15.88	29.00
1998	27.51	51.26	15.40	28.69

There was only marginal increase in factor productivity along with growth in primary factors in the first decade. However, Maharashtra and Bengal had no comparison in terms of the growth of GVA and TFP The growth of GVA was marginal and TFP was negative in Bengal in the 1960s. Labour productivity started to surpass capital productivity in the 1970s.

Improvement in labour productivity can be mainly attributed to the negative growth of employment in the 1980s. The slow growth of input was also responsible for higher level of APL DD. As a result, labour productivity at double deflation crossed

APKDD by the late 1980s. Higher level of capital productivity than APL till the late 1970s and the reversing trend at SD later were common features for Maharashtra and Bengal. Average productivity at DD was higher due to the higher growth of GVADD. There was no change in the trend of average productivity in the 1990s. However, it reached its zenith during this period as seen in Bihar and Gujarat. It is noteworthy that average productivity reached at the top along with growth in primary factors.

4.5.2. Growth of employment, capital and input

The most important question relating to the growth of primary factors is their impact on productivity. There was growth in primary factors along with marginal increase in factor productivity in the 1960s (table-4.5.3). Though Maharashtra had a comparable level of growth of employment and capital with Bengal, input growth was not so. May be due to the marginal growth of manufacturing in Bengal, there was only a low level of input growth in relation to Maharashtra. Growth of primary factors continued in the 1970s also. Employment growth improved further while the growth of capital remained more or less the same. Meanwhile APLDD became greater than capital productivity at SD probably because of the declined growth of input and the consequent growth of GVADD.

Table-4.5.3. Annual Growth Rates of Employment (L) Capital (K) and Input (In) in Maharashtra

Period	Growth Rate (Percent per annum)		
	L	K	In
1960s	1.82	2.78	6.72
1970s	2.92	2.71	4.99
1980s	-1.55	4.51	6.22
Early 1990s	2.55	6.66	2.61
1980-81 to1993-94	-0.47	5.17	6.27
1990s	2.57	6.98	6.30

As a general feature of other states and the nation as a whole, Maharashtra also registered negative growth in employment in the 1980s. But capital had enhanced growth showing the impact of the first stage of liberalization. Fall in the growth of employment and enhanced growth of capital partially accounted for increase in labour productivity over capital productivity in the 1980s. Unlike Gujarat, Maharashtra and Bengal experienced increased growth of input. The employment scenario changed in the early 1990s. Employment turned to positive, still labour productivity reached the maximum. Capital continued to grow along with increase in capital productivity. Thus growth in primary factors had a favorable effect on factor productivity. May be a part of rising efficiency, input growth reached the lowest level in the early 1990s. Despite the growth of labour, capital and input, average productivity (APL and APK) went up the peak level in the late1990s.

4.5.3. Capital intensity and Input Intensity

Contrary to the general belief, capital intensity was lower in industrialized states like Maharashtra, Bengal and Gujarat in the first decade. Considering the high ranking of these states in capital, it can be argued that employment level increased along with more investment. In contrast, capital intensity was higher in low ranking industrialized states. There was a marginal decline in capital intensity except 1970s (table-4.5.4). Enhanced growth of labour and stationary growth of capital contributed to this phenomenon. Owing to the influence of the first dose of liberalization, capital intensity in Maharashtra also started to rise in the 1980s. It may be noted that employment growth became negative and capital had an enhanced growth in this decade. After the opening up of the economy in the 1990s, capital intensity reached the maximum in Maharashtra. This was expected due to the high growth of capital. Thus Maharashtra enjoyed non-neutral technology in the event of liberalization.

Table-4.5.4. Capital Intensity (K/L) and Input Intensity (In/GVA) at SD and DD in Maharashtra

Year	K/L	In/ GVASD	In/ GVAD D
1960	0.66	2.23	2.28
1961	0.68	2.43	2.63
1962	0.67	2.32	2.59
1963	0.68	2.49	2.86
1964	0.67	2.43	2.62
1965	0.68	2.42	2.36
1966	0.70	2.57	2.45
1967	0.72	2.39	2.81
1968	0.73	2.92	3.39
1969	0.71	2.96	2.78
1970	0.70	2.56	2.43
1971	0.69	2.68	2.95
1972	0.69	2.74	3.14
1973	0.68	2.55	2.40
1974	0.66	2.58	2.12
1975	0.68	2.97	2.53
1976	0.67	2.83	2.24
1977	0.69	2.93	2.16
1978	0.69	2.66	1.86
1979	0.68	2.71	1.78
1980	0.71	2.97	1.92
1981	0.75	2.98	1.74
1982	0.79	2.92	1.59
1983	0.87	2.11	1.37
1984	0.91	1.93	1.28
1985	0.98	2.58	1.64
1986	1.03	2.86	1.84
1987	1.06	3.06	1.92
1988	1.11	2.72	1.80
1989	1.26	2.90	1.83
1990	1.27	2.98	1.80
1991	1.37	2.59	1.64
1992	1.38	2.70	1.71
1993	1.45	2.32	1.47
1994	1.54	2.48	1.50
1995	1.50	2.83	1.65
1996	1.77	2.46	1.48
1997	1.82	2.90	1.59
1998	1.79	2.77	1.49

Unlike capital intensity, input – GVA ratio in Maharashtra was comparable to all other states in the 1960s. The 1973 phenomenon appeared in Maharashtra also in the case of input intensity. It was already discussed in the context of other states that value added at DD started diverging from GVA at SD due to the rise in relative index of material prices. Thus In/GVA ratio at DD became less than that ratio at SD after 1973. This trend continued during the 1980sand the 1990s also.

4.6.0: Tamil Nadu

General Performance

As a catching up state, Tamil Nadu claimed the second largest manufacturing growth in GVA and TFP during 1960-1998-99. There was a positive trend between the growth of GVP and TFP The performance of the manufacturing was mainly affected by the growth in the 1970s and 1990s (table 4.6.1).

Table-4.6.1. Annual Growth Rates of GVA and Total Factor Productivity (TFP) at SD and DD in Tamil Nadu

Period	Growth Rate (Percent per annum)			
	GVA		TFP	
	SD	DD	SD	DD
1960s	5.99	6.32	2.50	1.68
1970s	6.19	12.61	2.55	8.28
1980s	7.75	6.45	4.80	3.14
Early 1990s	7.11	8.19	1.72	2.87
1980 to 1993-94	8.15	7.38	4.60	3.61
1990s	5.81	8.06	0.55	2.58

Unlike the top industrialized states during the first two decades of analysis labour productivity at DD was higher than APK throughout the period. Labour productivity doubled and tripled in the first fifteen years and the next fifteen years respectively.

Capital productivity also had such a trend during the same period. The difference between APL and APK was on the rise during the 1990s. The enhanced growth of capital was the major reason for the slow rise in APK in the previous decade. The consistent progress in the growth of labour productivity coupled with slow growth in employment partially contributed to the relatively high APL in the 1980s. Capital productivity also showed consistent but gradual progress.

Average productivity increased along with the growth in primary factors Tamil Nadu had a unique achievement in the 1980s as far as employment was concerned. It was the only state that registered a positive growth in employment in this study in the 1980s. However, the growth of employment was the minimum in this decade. Compared to the growth of employment, capital was at a slow pace (<2 per cent) till 1980 and boosted up later. Unlike capital, input growth was declining from a high growth of more than 8 per cent in the 1960s. This slow growth of input might have helped to enhance average productivity at DD. Compared to Bengal, Tamil Nadu had a high growth in input that implied faster growth in manufacturing. APL and APK increased irrespective of high growth of labour and capital in the early 1990s. However, APK grew only at slow pace due to the higher growth of capital compared to that of labour in the late 1990s.

We have already seen that capital intensity was low in Maharashtra and Bengal in the first two decades of analysis. As a catching up state, it was at a medium level in Tamil Nadu. Slow growth in capital and higher growth in employment moulded capital intensity at a moderate level. It gradually declined and touched less than one in the early 1980s. It started to rise again since 1985, mainly due to the influence of the partial lifting of controls over certain fields. It was argued earlier that employment declined in the 1980s. Capital intensity continued to rise in the 1990s due to the relatively higher growth of capital than employment. Mean while, input intensity at SD and DD remained at a comparable level in the first decade due to the relative stability of the material price index. The intensity at DD declined at a faster rate later showing the slow in take of input.

Decade wise analysis

Manufacturing had a reasonable growth in the first decade of analysis (table 4.6.1). The growth momentum continued in the 1970s as seen in the other states. Output increased in the 1990s, after a decline in the growth of GVA in the third decade. Though there was a positive relation between the growth of GVA and TFP, the rate of growth of the latter was at a low level during the last two decades. This marked a decline in the over all efficiency of manufacturing in Tamil Nadu.

Growth and Deflationary Effect

There was larger difference in growth between GVADD and GVASD than between TFPDD and TFPSD in Tamil Nadu during 1960-1998-99. The maximum difference was found in the 1970s as in other states. This was, as noted earlier, the result of bias of double deflation (see section 2). The difference was marginal in the first decade of analysis due to the stability of relative index of material prices. The divergence in the growth under the two methods of deflation was less in the last two decades of analysis. Further, GVASD became greater than GVADD, which was a national phenomenon in the 1980s. TFP also behaved in the same manner. However, the disadvantage of double deflation for distant period was not seen in Tamil Nadu (see Rao (1996) section 2).

The stability of the relative index of material prices was reflected in average productivity in the first decade, as there was a criss-cross relation with APL at SD and DD. The 1973 phenomenon placed APLDD over APLSD showing relatively slow growth of input. APKDD also became greater than APKSD in the late 1970s. Average productivity (APL and APK) at DD was more than the same variable at SD in the 1980s and 1990s.

4.6.1 Labour productivity and capital productivity

Average productivity increased along with the growth of primary factors (table-4.6.2). Unlike in Maharashtra and Bengal, labour productivity was more than capital productivity, a special feature of relatively low level of industrialization then. This trend continued in the 1970s also. The tendency of rise in average productivity along the growth of primary factors continued in the 1980s and 1990s when TFP registered a decline. The higher value of APKDD over APLSD in the later decades would probably show the elevated level of industrialization in Tamil Nadu. It can be noted that Maharashtra and Bengal registered higher capital productivity than labour productivity in the first two decades of analysis. The slow rise in APK compared to APL was due to the relatively high growth of capital in the late 1990s.

Table-4.6.2. Labour Productivity (APL) and Capital Productivity (APK) and SD and DD in Tamil Nadu

Year	APL_SD	APL_DD	APK_SD	APK_DD
1960	5.12	4.99	2.93	2.86
1961	6.01	5.54	3.46	3.19
1962	6.51	5.74	3.85	3.39
1963	5.98	5.14	3.86	3.32
1964	6.08	5.58	3.99	3.66
1965	6.28	6.46	4.35	4.48
1966	6.08	6.43	4.36	4.60
1967	6.43	5.35	4.65	3.87
1968	5.38	4.48	4.07	3.39
1969	6.72	7.15	5.02	5.33
1970	6.59	7.01	5.36	5.70
1971	6.28	5.57	5.13	4.55
1972	6.62	5.63	5.35	4.55
1973	6.52	6.98	5.21	5.58
1974	6.36	7.98	5.39	6.76
1975	5.52	6.79	4.88	6.00
1976	6.83	8.87	6.39	8.29
1977	7.50	10.47	7.10	9.91
1978	8.07	12.10	7.35	11.03
1979	6.96	11.39	7.21	11.79
1980	6.71	10.94	6.84	11.15
1981	7.18	13.04	7.36	13.37
1982	8.32	15.67	8.47	15.95
1983	8.72	14.95	8.38	14.37
1984	9.43	15.90	9.59	16.18
1985	9.30	15.78	8.89	15.09
1986	9.79	15.79	9.05	14.61
1987	9.74	15.88	9.15	14.90
1988	11.61	18.13	10.50	16.39
1989	12.40	19.78	11.26	17.96
1990	13.77	21.80	12.18	19.27

1991	13.07	21.32	11.67	19.03
1992	12.84	20.84	11.69	18.97
1993	14.58	23.95	13.07	21.48
1994	14.84	26.27	12.46	22.06
1995	15.24	26.09	13.25	22.68
1996	15.69	27.41	12.89	22.53
1997	14.25	27.69	11.79	22.92
1998	15.38	29.64	10.84	20.89

4.6.2 Growth of Employment, capital and Input

As noted in above, the growth of primary factors had a positive impact on average productivity. Employment registered reasonably high growth (6 per cent) while capital had only a low growth (1.53) in the 1960s (table 4.6.3). Slow growth in capital contributed to the steady rise in capital productivity at SD. May have been due to the vigorous initial stages of industrialization, Tamil Nadu recorded high growth of input (8.31).

Table-4.6.3. Annual Growth Rates of Employment (L) Capital (K) and Input (In) in Tamil Nadu

Period	Growth Rate (Percent per annum)		
	L	K	In
1960s	4.97	1.53	8.31
1970s	4.45	1.88	6.60
1980s	1.69	3.20	6.88
Early1990s	5.59	4.97	6.44
1980-81 to1993-94	2.49	3.69	6.82
1990s	3.61	5.66	6.80

Growth in the primary factors continued in the second decade also. The improvement in average productivity was mainly due to the deflation effect. Employment growth remained more or less the same, while there was only a marginal growth in capital. The rise in input prices caused a down ward shift in input growth. In one sense it indicates an improvement in efficiency. Tamil Nadu has the unique credit of positive growth in employment in the 1980s. Yet labour productivity (GVA/L) increased as in other states, which virtually registered negative growth in employment. Capital had enhanced growth along with the increase in APK. Though input growth marginally improved, it was less than its growth in the 1960s. The positive relation between average productivity and growth of primary factors continued in the 1990s. There was commensurable growth in employment while capital growth moderately improved in the early 1990s. Input growth remained at levels comparable to the 1960s and the 1980s. As a result, GVADD was more than GVASD in the last decade. There was a slow down of employment in the late 1990s while capital grew further.

4.6.3 Capital Intensity and input intensity

Because of the high growth of employment and slow growth of capital, capital intensity in Tamil Nadu was slow and often declining in the first decade. The same factors kept capital- labour ratio down and it even went below unity (table4.6.4). High growth of employment might have contributed to this. This trend continued till the early 1980s and gradually increased by the end of that decade. This was a reaction to the partial lifting of controls at that time. In other words, relatively small growth of employment and enhanced growth of capital acted as strong factors for raising capital intensity. The influence of capital seemed to be strong as capital intensity increased in the 1990s irrespective of relative growth in employment. In short, the ups and downs in capital intensity imply non-neutral type technology in Tamil Nadu as seen in other states also. Tamil Nadu, being a catching up state, K/L remained at a medium level.

Table-4.6.4. Capital Intensity (K/L) and Input Intensity (In/GVA) at SD and DD in Tamil Nadu

Year	K/L	In/ GVASD	In/GVADD
1960	1.75	2.64	2.71
1961	1.74	2.53	2.75
1962	1.69	2.60	2.95
1963	1.55	2.70	3.15
1964	1.52	2.87	3.12
1965	1.44	2.68	2.60
1966	1.40	2.98	2.82
1967	1.38	2.73	3.28
1968	1.32	3.58	4.30

1969	1.34	2.92	2.75
1970	1.23	3.12	2.93
1971	1.23	3.31	3.73
1972	1.24	3.20	3.77
1973	1.25	2.82	2.64
1974	1.18	3.03	2.41
1975	1.13	3.94	3.20
1976	1.07	3.18	2.45
1977	1.06	3.25	2.33
1978	1.10	3.08	2.05
1979	0.97	3.29	2.01
1980	0.98	3.42	2.10
1981	0.98	3.39	1.86
1982	0.98	3.10	1.65
1983	1.04	2.78	1.62
1984	0.98	2.59	1.53
1985	1.05	3.10	1.83
1986	1.08	3.14	1.95
1987	1.07	3.26	2.00
1988	1.11	2.97	1.90
1989	1.10	2.95	1.85
1990	1.13	2.66	1.68
1991	1.12	2.81	1.72
1992	1.10	2.90	1.79
1993	1.12	2.57	1.57
1994	1.19	2.90	1.64
1995	1.15	2.84	1.66
1996	1.22	2.78	1.59
1997	1.21	3.31	1.70
1998	1.42	2.98	1.54

It was already pointed out that input growth was high in real terms in the first decade. As a result, input intensity at DD became higher than that at SD. Owing to the decelerated growth of input in the 1970s, input intensity at DD became lower than it at SD. A fall in the ratio can be taken as an indicator of efficiency. This tendency continued in later periods too.

4.7.0 West Bengal

General Performance

As seen in the chapter 3, Bengal had a unique experience of sliding from the second position to the fifth during the period of analysis (1960-1998-99). This drastic shift was the result of slow growth of GVA and the occasional negative growth of TFP In fact, the seeds of poor industrial performance in Bengal were already in its womb in the 1960s itself. It was evident from the relative low growth of GVA and negative growth of TFP in Bengal (Table-4.7.1). The decline became in its stagnation in the 1980s after the recovery in the second decade. The era of liberalization (1990s) had a favorable impact on manufacturing growth. It is evident from high growth of GVA and TFP from near stagnation in the 1980s.

Table-4.7.1. Annual Growth Rates of GVA and Total Factor Productivity (TFP) at SD and DD in West Bengal

Period	Growth Rate (Percent per annum)			
	GVA		TFP	
	SD	DD	SD	DD
1960s	0.64	1.24	-1.64	-1.22
1970s	1.75	7.14	0.30	5.42
1980s	-0.07	0.05	1.22	0.12
Early 1990s	4.80	3.85	2.87	1.00
1980 to 1993-94	1.52	1.62	1.56	0.72
1990s	4.32	4.89	2.17	2.65

As seen in the case of Maharashtra, capital productivity was higher than labour productivity in Bengal also. It continued till the early 1980s. This phenomenon was reversed after that. Labour productivity increased gradually, mainly due to the fall in the growth of labour. Capital productivity also increased in the 1990s even if capital had an enhanced growth at that time.

Capital intensity was low initially and then started to rise consistently since the late 1970s. This pattern emerged out of the changing trends in the growth of employment and capital. As noted above, employment growth was negative during 1960-98-99 mainly due to the negative growth during 1980-93-94. This trend came down in the early 1990s. Employment growth, further, turned to positive by the late 1990s. There was a decline in the growth of capital in the 1970s but picked up later especially in the early 1990s. It may be noted again that the first dose of liberalization facilitated the growth of capital at the expense of employment. Input intake was at a lower rate probably due to the slow growth of manufacturing in Bengal. It even became negative in the early 1990s and turned positive in the late 1990s. Input intensity was comparable to that in other states. It came down drastically in the 1980s and early 1990s due to the very slow growth of input. The positive growth of employment and input was a direct reflection of picking up the growth of manufacturing in Bengal.

Decade wise analysis

Growth of GVA and TFP

Maharashtra and Bengal were the two top industrialized states in India in the 1960s. Unlike in other states, there was no positive relation between GVA and TFP in Bengal during this decade. This might have probably been due to a very low rate of growth of GVA. The low rate of growth of GVA and the negative growth of TFP referred to the presence of the seeds of decline in the 1960s in Bengal, as noted in general appraisal above. Further, the growth of manufacturing became near stagnation in the 1980s. The poor performance of manufacturing in the 1960s and the 1980s pushed back Bengal to the fifth position from second in the level of industrialisation.

Manufacturing growth in value added terms picked up in Bengal during the 1970s. As a general case in India and certain states, GVA DD had a boost during the same decade. This was partially a reflection of the double deflation. The over all efficiency also improved in this state in this decade. It is evident from a positive growth of GVA and TFP Such a positive relation between GVA and TFP was not seen in the first decade. The positive trend of the 1970s virtually disappeared in the third decade of analysis. In fact, manufacturing displayed a poor performance in Bengal during the 1980s. In value added terms the state experienced stagnation during this period. It is clear from the fact that GVASD turned out to be negative and GVADD declined to near zero growth (0.05) from 7.14 per cent in the previous decade.

It seemed that Bengal improved its performance in manufacturing in the early 1990s. As argued in the case of Gujarat, the state enjoyed in a way 'turn around' then. That is, Gujarat was scaled up from a moderate growth of GVADD (4.65) in the 1980s to a double-digit growth in the 1990s. Though the growth of manufacturing in Bengal was not so marvelous as in Gujarat during the same period, the state could achieve moderate growth of GVA (4.89) in the 1990s from near stagnation in the previous period. In this sense, there was a 'turn around' in the growth in Bengal. TFP also moved in the same direction of GVA. The scenario was better during the late 1990s.

Growth and Deflationary Effect

West Bengal was the only state where the growth of TFP was negative under the two methods of deflation in the 1960s (table 4.7.2). The growth of GVA was also marginal. Therefore, it was argued earlier that the decline in the level of industrialization in Bengal started in the 1960s itself.

The presence of 'turn around' (Ahluwalia, 1991) and the 'absence of turn around' (B-P, 1994) were not seen in Bengal. As per the 'turn around' approach, the growth of TFPSD in the 1980s was higher than the same growth in the 1970s. The second line of argument was that the growth of TFPDD was higher in the 1970s than its growth in the 1980s. However, it is found that GVASD and TFPSD had better growth only in the 1990s. Thus, both the arguments were applicable in the case of Bengal. A higher and positive trend in GVA and TFP manifested itself under the two methods of deflation in the 1990s. It also implies that different methods of deflation need not change the broad conclusions always.

Different deflation methods have their own impact on average productivity also. As a result of the stability of the relative index of material prices, there was no practical difference between average productivity at SD and DD. The phenomenon of 1973, as in other states, was seen in Bengal also. Due to the slow growth of real inputs (inputs at constant prices) in the 1970s, average productivity (APL and APK) at DD was above the corresponding variable at SD after 1973. The higher labour productivity at DD than APKDD in the last two decades was also due to the negative employment growth coupled with positive growth in capital. This was found in other states also.

4.7.1 Average productivity of Labour and Capital

It is interesting to note that the two top industrialized states (Maharashtra and Bengal) registered higher capital productivity than labour productivity in the 1960s(table 4.7.2). This phenomenon continued in both the states till the mid 1980s. However, one of the weaknesses of manufacturing in Bengal was its slow growth on average productivity. APL and APK doubled within first fifteen years in Maharashtra and Tamil Nadu. It took twenty years to double APL and APK in West Bengal. Such slowness in the growth of average productivity continued for the rest of the period. A negative growth of employment was a factor that raised the level of APL compared to APK in the last two decades.

(APK) at SD and DD in Bengal

Year	APL_SD	APL_DD	APK_SD	APK_DD
1960	5.20	5.07	7.30	7.12
1961	5.52	5.03	7.78	7.09
1962	5.70	4.95	7.90	6.85
1963	6.23	5.34	9.08	7.78
1964	6.37	5.90	9.57	8.86
1965	6.04	6.20	9.38	9.63
1966	5.44	5.74	8.12	8.57
1967	5.68	4.77	7.95	6.67
1968	5.17	4.39	6.73	5.72
1969	4.68	5.05	6.18	6.66
1970	5.88	6.20	7.45	7.87
1971	5.76	5.22	7.54	6.83
1972	5.73	5.00	7.55	6.58
1973	5.27	5.59	7.01	7.45
1974	5.56	6.61	7.12	8.46
1975	5.63	6.49	7.48	8.63
1976	5.61	7.15	7.00	8.92
1977	5.28	7.25	6.93	9.50

1978	6.71	9.33	8.67	12.06
1979	6.00	8.94	7.92	11.80
1980	5.94	8.79	7.52	11.11
1981	6.14	10.12	7.37	12.15
1982	6.72	11.46	8.12	13.84
1983	6.66	10.94	7.60	12.49
1984	6.90	11.51	7.71	12.85
1985	7.79	12.50	7.26	11.65
1986	7.56	11.98	6.72	10.65
1987	9.47	14.05	7.95	11.80
1988	7.86	12.40	6.79	10.71
1989	7.59	13.04	6.09	10.46
1990	9.42	15.38	7.39	12.07
1991	9.06	14.86	6.79	11.12
1992	9.14	14.98	6.55	10.73
1993	11.34	17.93	7.62	12.04
1994	10.54	17.50	7.04	11.69
1995	9.11	15.90	6.17	10.76
1996	10.80	18.80	7.03	12.24
1997	10.25	18.98	7.10	13.16
1998	13.69	22.27	8.70	14.15

The experience in terms of average productivity in the early 1990s was a repetition of the trend in the late 1980s. However, the composition of the influencing factors changed a little bit. As shown above, APL increased in the 1980s mainly due to the fall in the growth of employment. This phenomenon got drastically reduced in the early 1990s. Negative growth in input can be taken as an added factor. There was no appreciable improvement in capital productivity as there was enhanced growth of capital during this period. However, one cannot find growth in output along with the simultaneous growth of both primary factors in the 1980s and 1990s

4.7.2 Growth of employment, capital and input

Though average productivity gradually increased along with the growth of primary factors, it marginally declined in the late 1960s (table-4.7.3). Such a trend was seen in other states except Kerala. It might have worked as a cause of deceleration of industrial growth in the 1980s. The slow and often negative industrial growth had more adverse impact on employment than on capital. That is, the growth of employment was less than the growth of capital. Input growth was very moderate.

Table-4.7.3. Annual Growth Rates of Employment (L) Capital (K) and Input (In) in West Bengal

Period	Growth Rate (Percent per annum)		
	L	K	In
1960s	1.79	2.36	2.48
1970s	1.11	1.06	1.57
1980s	-3.80	1.75	2.58
Early 1990s	-0.85	4.27	-1.22
1980-81 to 1993-94	-2.57	2.44	2.37
1990s	0.27	2.60	1.32

Primary factors also increased along with average production at DD. In fact, the growth rates of labour and capital were very low compared to Bihar and Kerala. Input growth registered a positive but falling rate. If one reads the increased average productivity at DD and the reduced growth of primary factor and inputs together, it can be concluded that lower input intake might have raised the GVA and TFP at DD. That is, less input in real terms enhance the value of GVADD. Further it can be the bias of the double deflation. The bias is also revealed from the fact that GVA and TFP at SD marked only minor growth rates compared to the same at DD. As argued earlier, manufacturing had a bad shape in the 1980s. As a result of stagnation of manufacturing in Bengal, there was sharp decline in employment growth. One way this was a reflection of first dose of liberalization. That is, capital grew at the expense of employment. However, Bengal seemed to be a case of stagnation with fall in employment. Others did not display such a phenomenon. It was also pathetic that input grew in the event of stagnation in manufacturing. There were positive trends in the early 1990s. As in value added and average productivity, the negative trend in the growth of employment declined. Capital growth reached its maximum during this period. Growth of capital might have contributed to the growth in value added, but it was not reflected in TFP, especially at DD. It is paradoxical that input growth existed with stagnation in manufacturing in the 1980s while the growth of input became negative with growth in the early 1990s. This raises serious questions on efficiency. The higher growth of capital in the early 1990s reflected in the form of positive growth in employment and input in the late 1990s.

4.7.3 Capital intensity and input intensity

As an industrialized state Bengal experienced low capital intensity as did Maharashtra. This meant more employment generation along with the use of capital. Capital intensity had a marginal rise in the second decade (table-4.7.4). It can be noted that the state started to show a falling tendency in industrialization. It was initially reflected in investment, as seen in the previous chapter. On the contrary, K/L ratio marginally declined in Maharashtra. The first dose of liberalization engulfed Bengal also in the 1980s. The negative growth of employment and higher growth of capital caused a hike in capital intensity. The intensity grew in the early 1990s mainly due to the enhanced growth in capital. This again underlined the fact that liberalization paved the way for capital-intensive method of production. The increase in capital intensity continued in the late 1990s also as the growth of capital was more than the growth of employment at that time.

Table-4.7.4. Capital Intensity (K/L) and Input Intensity (In/GVA) at SD and DD in Bengal

Year	K/L	In/ GVASD	In/ GVADD
1960	0.71	2.69	2.76
1961	0.71	2.84	3.11
1962	0.72	2.92	3.36
1963	0.69	2.72	3.17
1964	0.67	2.50	2.70
1965	0.64	2.64	2.57
1966	0.67	2.87	2.72
1967	0.71	2.60	3.09
1968	0.77	3.21	3.78
1969	0.76	3.57	3.31
1970	0.79	2.71	2.56

1971	0.76	2.76	3.05
1972	0.76	2.72	3.12
1973	0.75	2.48	2.33
1974	0.78	2.24	1.89
1975	0.75	2.63	2.28
1976	0.80	2.93	2.30
1977	0.76	3.05	2.22
1978	0.77	2.41	1.73
1979	0.76	2.54	1.70
1980	0.79	2.60	1.76
1981	0.83	2.69	1.63
1982	0.83	2.47	1.45
1983	0.88	2.50	1.52
1984	0.90	2.51	1.51
1985	1.07	2.69	1.68
1986	1.13	3.00	1.89
1987	1.19	2.51	1.69
1988	1.16	3.05	1.93
1989	1.25	3.55	2.07
1990	1.27	2.88	1.77
1991	1.34	2.84	1.73
1992	1.40	2.97	1.81
1993	1.49	2.32	1.47
1994	1.50	2.49	1.50
1995	1.48	2.97	1.70
1996	1.54	2.76	1.59
1997	1.44	2.99	1.61
1998	1.57	2.01	1.24

Similar to other states, input intensity in Bengal was comparable with other states. The rise in material prices reflected in the input intensity after 1973 when it was a critical year in other states also. It was clear from the fall in input intensity at DD (higher GVADD) after 1973 and slow growth of input in the 1970s. However, the intensity slated to rise from the late 1980s. This occurred in the event of negative growth in input. It connoted stagnation of valued added growth. The intensity started to decline in the late 1990s due to the moderate growth in GVA.

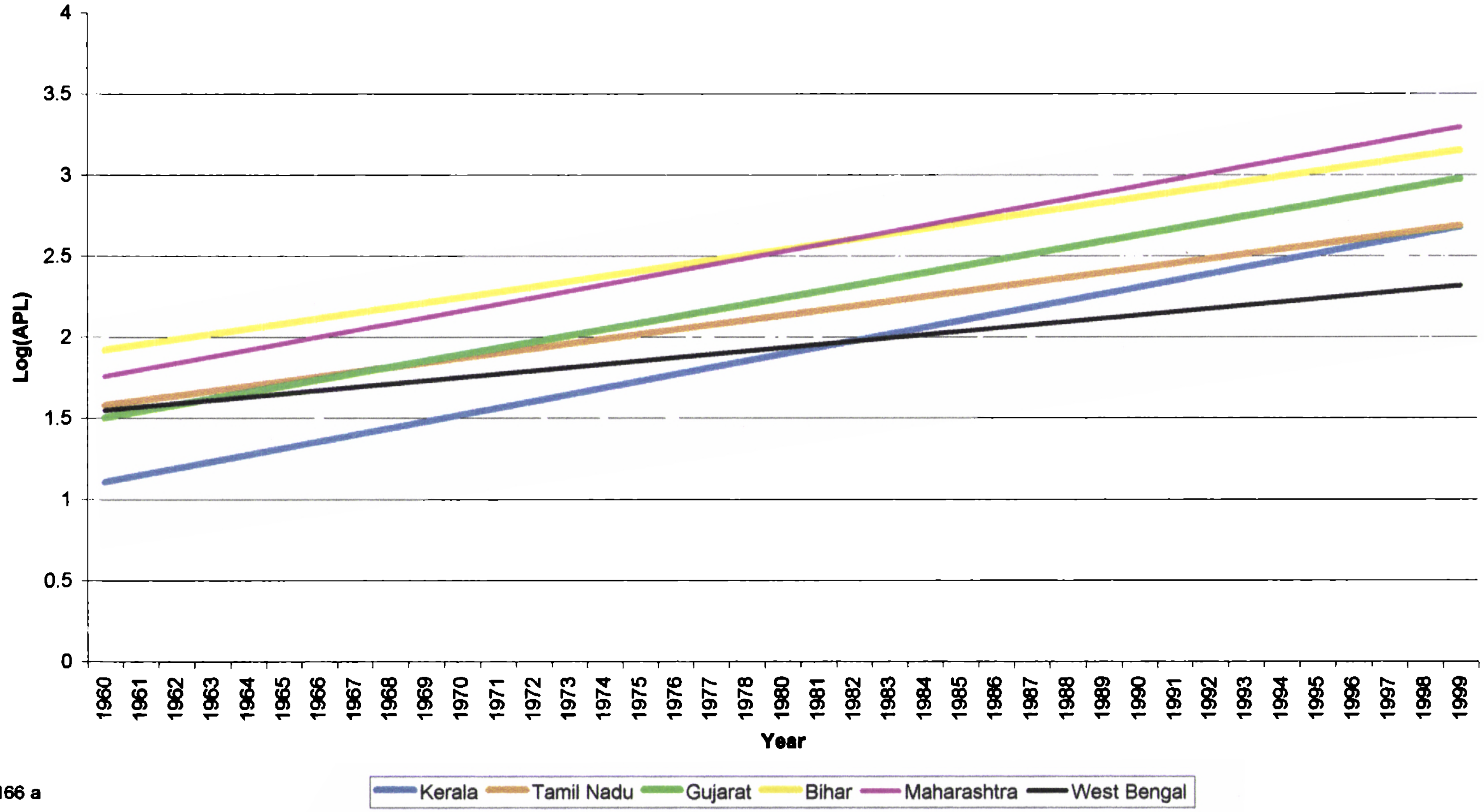
4.8.0. Convergence and Divergence of Regional Manufacturing in India

As discussed in the first chapter, there are two lines of argument relating to the regional (state level) convergence-divergence phenomenon in Indian industry. One set of study showed that inter-state disparity in industry had been declining overtime. The other studies showed that disparity came down among states belonging to a particular group; i.e., either industrialised or less industrialised states. At the same time, regional variation increased between the two groups. The arguments in the current literature (4.1.2) relating to convergence theory consider labour productivity as criterion for regional comparison. Hence labour productivity of six states considered in this study was plotted against time (Fig.4.3).

It was found that these states were formed into three groups. Tamil Nadu and Kerala happened to be at the middle level and the rest at a higher level except Bengal. Bengal initially converged with Kerala and became isolated after the early 1980s. Maharashtra and Gujarat except Bihar ranked top in terms of the level of industrialisation. Bihar was the odd state that converged with Maharashtra and Gujarat. In order to understand this odd behaviour, we plotted capital productivity against time (fig.4.4). It was found that Bihar remained at the lower level of industrialisation due to low capital productivity. Declining APK_{SD} or slow growth of APK_{DD} seemed to be responsible for the convergence of Bengal with Kerala and Bihar.

Fig . 4.3a

Trend in Average Productivity of Labour



Trend in Average Productivity of Labour (Double Deflated)

Fig . 4.3b

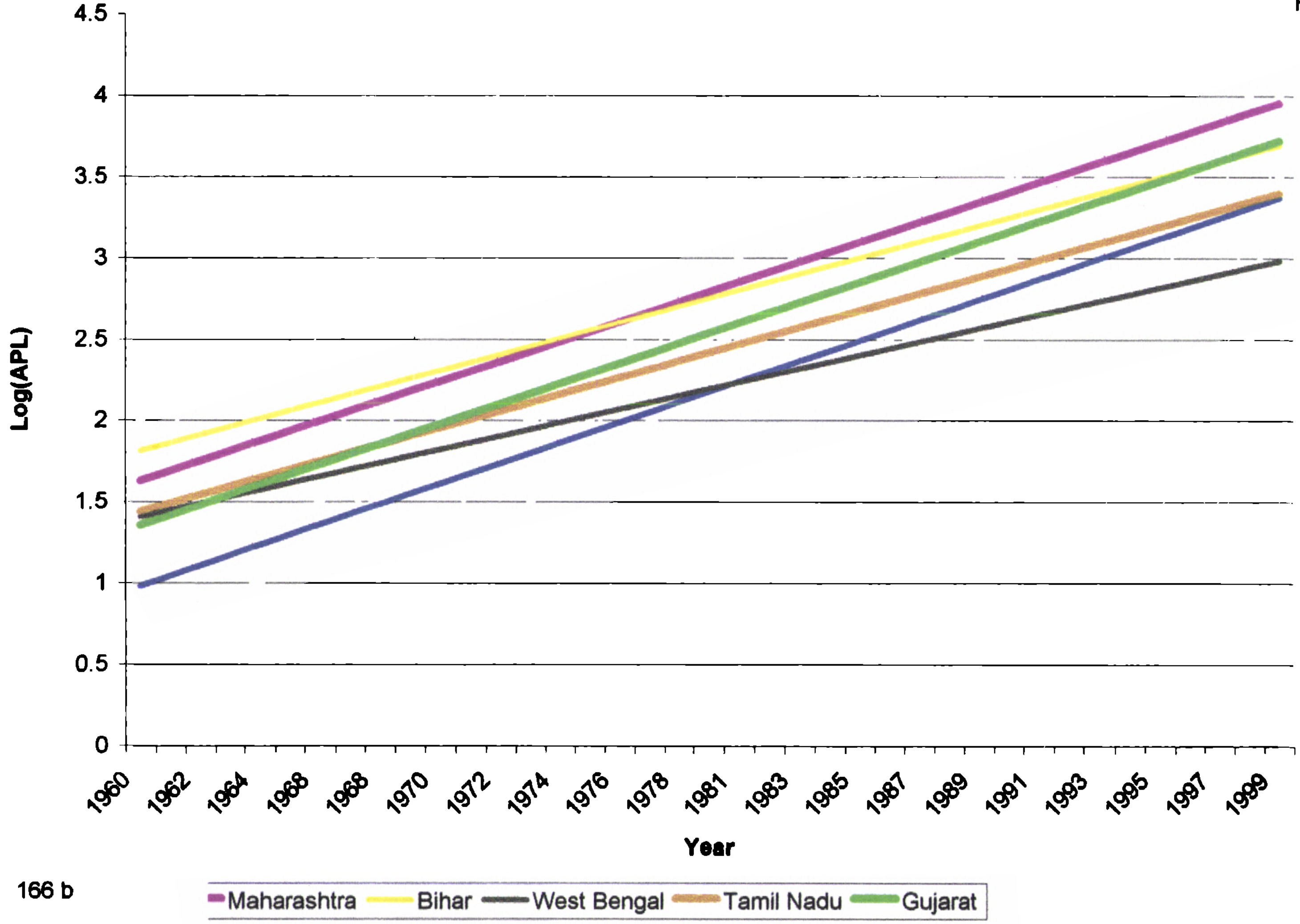


Fig . 4.4a

Trend in Average Productivity of Capital (Single Deflated)

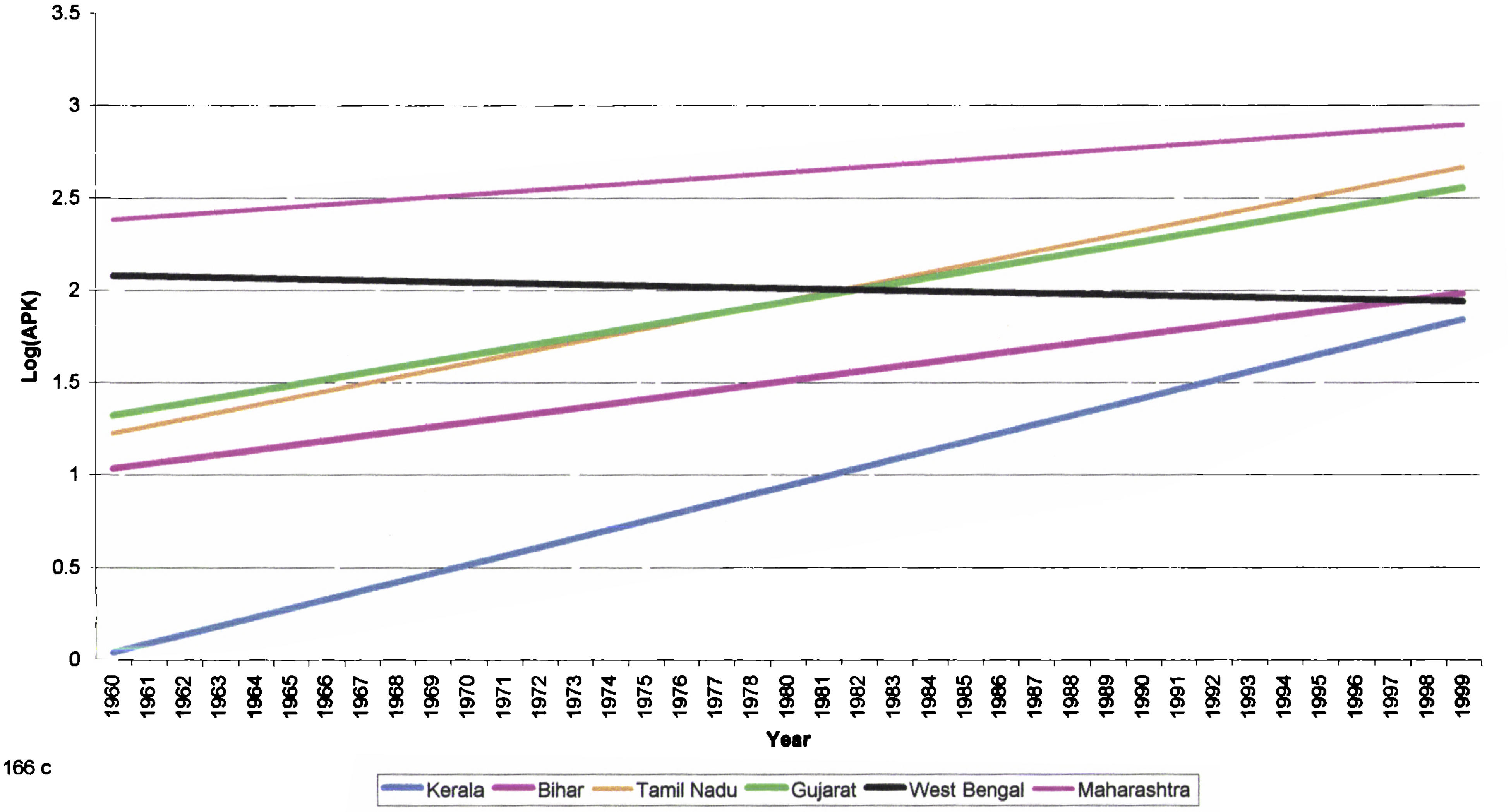
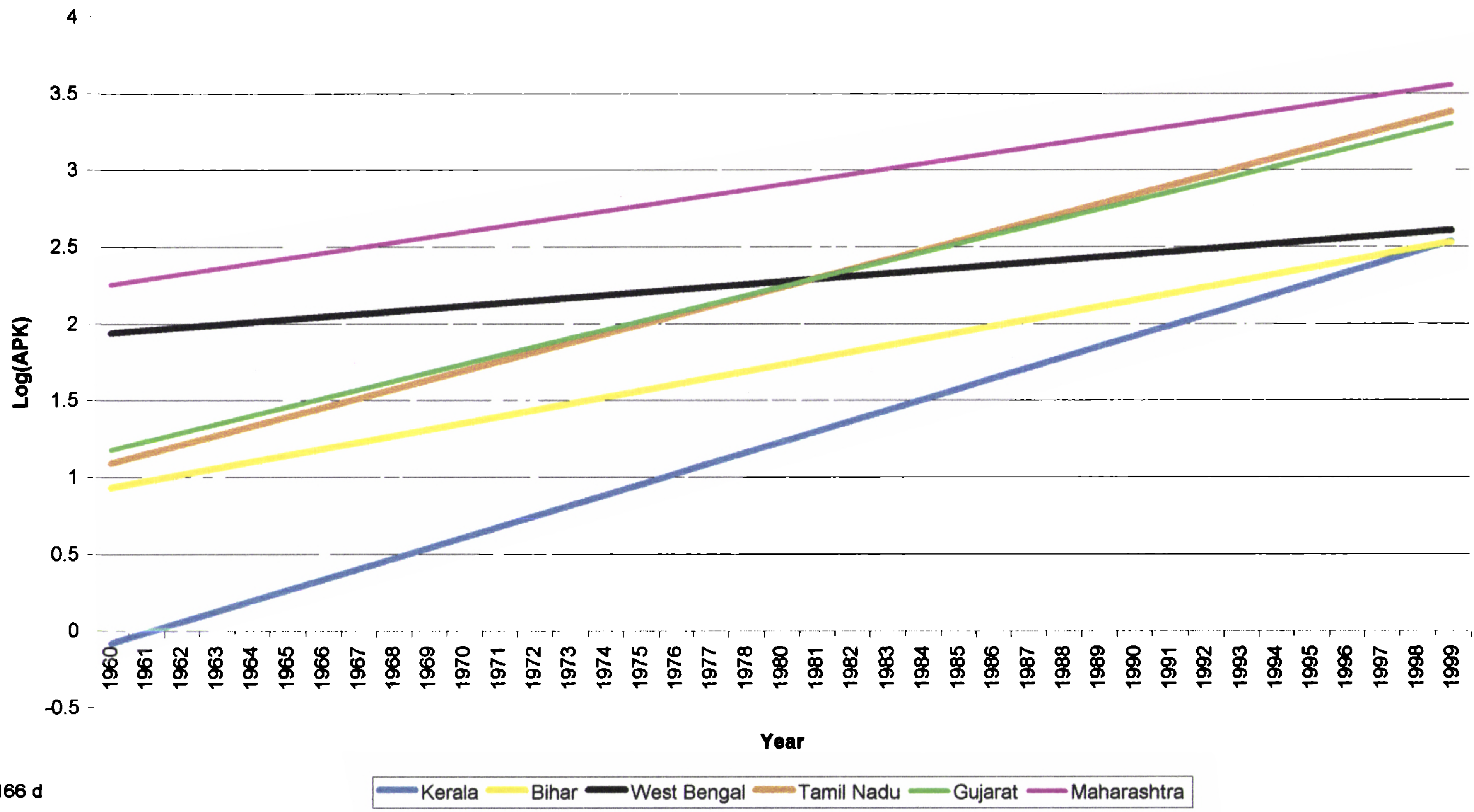


Fig . 4.4b

Trend In Average Productivity of Capital (Double Deflated)



All the states except Kerala started from more or less similar levels of labour productivity in the 1960s. Conditional convergence occurred from the 1970s onwards. Though Bihar was closer to Maharashtra, it was Gujarat and Tamil Nadu that moved simultaneously to catch-up with Maharashtra. This was reflected in capital productivity also.

As pointed out early, capital productivity could be taken as a better indicator of industrialisation in India. APK_{SD} in Bengal declined along with its sagging industrialisation. APK_{DD} of Bengal also was sluggish compared to labour productivity. Further, Bihar had low APK, even if its labour productivity was comparable with Maharashtra till the 1980s. Thus low capital productivity had a depressive effect on Bihar's industrialisation. Maharashtra had an appreciably high level of capital productivity till the 1980s. Tamil Nadu and Gujarat moved hand in hand. In fact, capital productivity had an upward movement except for Bengal that had a better picture in terms of APKDD than in AKPSD. The trend of divergence was pronounced in capital

One of the missing points in the theoretical discussion of convergence hypothesis is the case of relegated region or country. The theory refers to unconditional or conditional convergence assuming growth of the economies. The present study reveals that Bengal, an industrialised region, once shared more than 20 percent of value added in manufacturing in India. This dipped to 7 percent in the 1990s and converged with the bottom ranking state, Kerala. This points a paradoxical situation that convergence could also take place in the downward direction.

4.9.0 Factors for deceleration in West Bengal

A prolonged recession in the late 1960s was identified as the major reason for the retrogressed industry in West Bengal (Das Gupta, 1998;Raychaudhuri and Chatterji, 1998). The recession initially started along with the industrial stagnation at the national level in the middle of 1960s. The stagnation reduced investment which, in turn, generated less employment. The class-conscious industrial workers in West Bengal entered into the path of strikes and adopted other militant measures. In the regional context, major portion of capital was externally controlled (Dasgupta, 1998). The original owners were British and they later transferred the ownership to the Marwadis. The external control of capital coupled with labour unrest caused capital flight in West Bengal. As a policy instrument, the introduction of freight equalization, in the mid-1950s, was a stumbling block to industry in Bengal. The state enjoyed much location advantage for engineering industry due to the availability of basic raw materials like coal and iron (Dasgupta;Ray Chaudhuri and Chatterji). As a result, engineering industry went out of Bengal. Employment generation was reduced further and labour unrest erupted and continued. Meanwhile, political unrest occurred owing to the rise in food prices. Trade unions strongly adopted agitations to raise wages. Abhor of trade unions was so much that they tried and won in capturing political power. This paved the way for the intrusion of politics in labour relations (Dasgupta). The combined pressure of labour friendly government and trade unions could impose much restriction on management; sometimes, in the routine work of the employers. This culminated in further capital flight from Bengal.

This was an experience contrary to the Myrdal's 'cumulative causation' theory. Myrdal argues that a developed region can continuously attract new investment and enterprises. This may, sometimes, be at the cost of the less developed regions. A reverse process took place in Bengal. We have seen in the previous section that Bengal diverged from Maharashtra and converged to Kerala at the lower end as far as average productivity was concerned. Dasgupta quotes similar examples in North England (Masey, 1984) and Wallonia in Belgium (Carney, 1980).

Fall in investment transformed industries in Bengal to old and out of date. In addition, traditional industries like jute, cotton etc. also declined in the 1980s. Fluctuations in power supply and poor conditions of infrastructure also created hindrance in the growth of industry (Ray Chaudhuri and Chattrejee, 1998). They argue that sluggish growth of industry in Bengal had a political dimension. National government followed discriminatory policy in the distribution of strategic raw materials. Freight equalization policy also had a political dimension, as it was not applicable in the case of raw cotton. This was an indirect boom to Maharashtra. Dasgupta presents contradictory argument that political allegiance of the state government was an unfavourable factor to arrest the ruin of industry in Bengal. The prolonged rule of the non-congress government was not politically comfortable to the state as many investment decisions were taken at the political level. He also argues that the congress rule of 1971-76 was not favourable in the absence of influential leaders in Bengal. We may take up this point for further discussion a little later. One observation of Ray Chaudhuri and Chatterjee is strategically important that industry in Bengal became more oriented to small-scale productions in the 1980s. This was reflected by the near stagnancy of value added in the state (see section 4.2.7).

The environment was expected to be conducive in the 1990s. It was seen above that Bengal had a higher growth in terms of value added and TPF in the 1990s. Dasgupta identifies four favourable factors for the higher growth of industry in Bengal in the last decade. One was the de-licensing process in the context of new economic policy. The partial abrogation of freight equalization policy for steel was the second factor. The next factor was related to agriculture. It was argued earlier that the prolonged industrial recession occurred in Bengal partially due to the slump in agricultural production in the late 1960s. This scenario had changed with a 5.7 per cent growth in agriculture during 1983-84 and 1993-94. Improvement in power supply acted as another catalyst factor in Bengal.

Revival of industrial growth was discernible in West Bengal in the 1990s. The increased number of factories and enhanced flow of foreign direct investment in the state support the argument. It was shown in section 4.7.0 that West Bengal experienced higher growth in value added and TFP in the 1990s. Thus the new policy environment generated an investment friendly climate in West Bengal.

Dasgupta makes comparison with Maharashtra, which also had labour disputes. However, it did not disrupt the labour relations, as there was no intrusion of politics similar to West Bengal. Maharashtra could maintain an investment friendly approach. Political leaders like Y. B. Chavan were more acceptable to the national government. It is argued that employers are willing to settle normal labour disputes. Whenever it exceeds a limit, they try to shift to new areas. This happened in Maharashtra in a different dimension (Dasgupta). For instance, labour unrest was very strong in Bombay –Thane in the 1980s. Meanwhile many industrial units shifted to other districts of Maharashtra and Gujarat. In spite of this disadvantage, Maharashtra could maintain and prosper industrial base and relatively developed infrastructure.

Labour unrest was found in Kerala, especially in the 1960s and 1970s. There was also intrusion of politics to labour relations like in Bengal. Flight of industries to neighbouring states was noted in the state (Oommen, 1979). The contention of Dasgupta relating to non-congress governments in the state is not much relevant in Kerala. For instance, Kerala experienced higher growth in the industrial output while non-congress government ruled the state in the late 1960s. The state was ruled by congress governments from 1969 to 1987 expect in 1980-82. The position of Kerala slipped down in industrialisation during this period. The same argument is applicable for Bihar. Further, the barometer of labour unrest in Kerala had a downward trend during that period. The arguments of Subrahmanian (1990) and Thampi (1990) would not be out of place at this juncture. Subrahmanian argues that a well-conceived public policy (relating to industry) and its proper execution are lacking in Kerala. Thampi points to the operation of the Richardson's concept of psychic cost in the state. This concept says that risk factors of the past will have a shadow effect on the mind of the entrepreneurs later. Intrusion of politics to labour relation was strong in West Bengal and Kerala. Hence entrepreneurs were hesitant to invest more even if the unrest sank later. The industrialisation process was adversely affected so much.

CHAPTER FIVE

CERTAIN DETERMINANTS OF TFP IN INDIA

It was passively referred to in the previous chapter that total factor productivity could catch the contribution of several factors, other than labour and capital. Other factors include managerial capabilities and organisational competence, research and development (R and D), inter-sector transfer of resources, increasing returns to scale, embodied technical progress and diffusion of technology (Felipe, 1999). May be due to the varied nature of these factors that many economists called the outcome as 'measure of ignorance' (Branson, 1989), 'Manna from Heaven' (Stonman, 1983), 'residual factor' (Felipe, 1999) and 'black box' (Ray, 1998) etc. The new growth theory that emerged during the last two decades endeavours to capture the magnitude of TFPG. This theory endogenises many variables regarding the sources of growth (Ray, 1998). Qualitative changes in inputs could virtually reduce the share of TFP as a source of growth. (Denison, 1962). Two important aspects of the new growth theory are human capital and technical progress (Lucas, 1988; Barro, 1991, Mankiw, Romer and Weil, 1992; Barro and Sala-i-Martin, 1995).

Neo-classical theory of growth stipulates two factors of production: labour and capital. Human capital theory of growth makes two modifications in our conventional wisdom. It distinguishes as well as accommodates both skilled and unskilled labour force which is absent in the early growth theories. Skilled labour is the result of investment in education and training. It implies that savings are used for physical as well as human capital formation. The latter is the outcome of deliberate action and is not determined exogenously by population growth.

Ray (1998) points out four important implications of the model. Firstly, capital can be broadly defined to embody both physical and human components. Secondly, growth rate would be determined by the rates of savings and investment in human capital. Thus the pace of growth depends on these variables which are determined within the model. Hence they are named as endogenous growth theories. Thirdly, the overall growth of the economy can display diminishing returns as predicted by Solow, once the exogenous unskilled labour force is included in the model. Fourthly, large stock of human capital would facilitate better rate of return to physical capital. Fifthly, poor countries have a tendency to grow faster if proper adjustments are made on the level of human capital.

Endogenous growth theory postulates constant returns in all inputs due to the deliberate accumulation. Diminishing returns would set in due to the absence of such factors. To overcome this problem, the economy has to rely on technical progress (TP) to generate growth (Ray, 1998). TP normally takes place in two forms: deliberate and diffusion. (1) Resources are deliberately channeled for R and D activity to earn profits in the future. This would lead to product and process innovations (2) Technical knowledge can be transferred from the innovating sources in two ways. Firstly, others may either buy or absorb technology and be used for profitable opportunities. Secondly, an innovation can spur other innovations. In this context, Ray argues that the stock of human capital and its degree of utilisation in R and D affect the rate of TP

The new growth theory highlights the importance of technology, capital intensity and human capital (Timmer and Zhirmai, 1997). Technological leadership accelerated the growth of many developed countries (Nelson and Wright,1992). Timmer and Zhirmai argue that human and physical capital and technology transfers are intertwined. It is argued that low levels of education stand in the way of transfer of technology and efficient use of capital. It also arrests adaptation of foreign technology and capital goods and , thereby, stalls the generation of domestic technology. Abramovitz (1996) and Ray (1998) point that learning by doing can also improve the level of knowledge. Thus both capital and technology push up the catching up process.

5.1.0 Indian Scenario

The main source of technology in India is international technology transfer. Most oftern the transfer takes place along with excess flow of capital (Kidron, 1965; Balasubrahmanyam, 1971). It has two important connotations. One is the domination of foreign technology over domestic R and D. The second one is that TP in India cannot be considered without capital inflow. As the official data on manufacturing (ASI) does not consist of R and D expenditure and similar components, it is difficult to incorporate a variable directly linked to TP in Indian manufacturing. Based on the theoretical arguments made in the preceding section and the Indian experience, capital intensity is opted as a variable to consider the magnitude of TP

Human capital theory of growth emphasises the role of skilled labour force and the stock of knowledge in pushing up economic growth. Technically, it cannot constitute a part of disembodied technology. But TFP can catch the contribution of embodied technology if no adjustment is made for quality changes in inputs. In other words, the embodied knowledge in labour can have an impact on TFP as argued by Felipe (1999). This particular aspect is treated separately in the present study. The data supply information on the number of employees and workers, the difference between the two mainly consists of managerial and executive staff. It may be noted that empirical studies on new growth theory even treat schooling as part of human capital. Though ASI does not give details of the sub categories of skilled labour, a modest attempt is made to comprehend the impact of skilled labour on the residual factor. The influence of embodied technology can be identified to a limited extent.

As noted early, ASI does not provide us with certain crucial variables relating to technology. Hence we identified capital intensity and the ratio of skilled labour force to total employees as possible alternatives. It has been argued that input prices play a role in determining productivity. The price fluctuations of fuels have been prominent since the early 70s. Its influence is found in the changing trend of average productivity.

In addition, there have been global attempts to develop alternative energy technologies since then. It was seen in chapter 4 that input intake in certain states declined in recent decades. We proceed on the assumption that fuel intensity (Fuel/number of employees) has an indirect impact on technology and thereby on the magnitude of TFP Tewari (1999) also argues that energy intensity is related to technical progress and it varies from sector to sector. Thus fuel consumption is selected as a possible determinant of TFP

Hence the following functional form:

$$TFP = f(K/L, SK/L, Fu/L)$$

Where k/L SK/L and Fu/L stand for capital intensity, skilled labour to total employees and fuel intensity respectively.

Taking the logarithmic form, the function can be expressed as:

$$\ln TFP = b0 + b1 \ln K/L + b2 \ln SK/L + b3 \ln Fu/L$$

Regression estimation for the above equation is made for the six states both at SD and DD. Estimation is also made for three sub periods viz. 1960-1979, 1980-93-94 and the 1990s. The justification for the periodisation is the gradual opening up of the economy from the early 1980s. Altogether, there are 60 estimation results; however only significant estimations are discussed in detail.

5.1.1 Analysis of Empirical Results

The results are reported in table 5-1. Only fuel intensity had a significant relation with TFP at SD and DD during the 1960-94 and the 1990s. The coefficient of fuel intensity (b3) is positive under both methods. It is relatively higher at DD for all states. Thus fuel intensity emerged as an explanatory variable of TP at the regional level. The catching up states Tamil Nadu and Gujarat have shown significant relationship between TFP at SD and the three explanatory variables. The case of fuel intensity is already noted. Capital intensity does show a negative relation with TFP that was contrary to the theoretical expectation. It was argued in the previous chapter and the early part of the present chapter that TP would take place along with capital intensity. This contradiction might be due to several factors. One plausible explanation was the nature of data. Factory sector data consist of both census and sample sectors. The size of employment is relatively more in the latter, which could pull down the capital intensity. Secondly, the industry could have gone for labour substitution owing to its cheapness. In this context we could expect a positive relation between skilled labour per head and TFP A positive relation between capital intensity and TFP at SD is found in Bengal but it had a very low growth in TFP Though we expected a positive relation between skilled labour per head and TFP at SD, a significant and positive relation was noted only in Gujarat. The relation between them was negative in Tamil Nadu. The trend was also checked under DD. A significant relation of the three variables with TFP is only seen in Tamil Nadu. As a repetition of the SD, capital intensity and skilled labour per head had a negative relation with TFP at an enhanced level. Bihar also displayed a negative relation between capital intensity and TFP In short, capital intensity and skilled labour per head cannot be considered as two explanatory variables of TFP in Indian manufacturing at the regional level. Further categorisation of skilled workers is not possible because of the aggregated nature of the data.

An attempt has also been made to understand whether the periodisation adopted in the study has any impact on the nature of relationship. The three variables had no significant relation with TFP at SD in Kerala, Bihar and Bengal during 1960-79. Maharashtra showed a significant relationship between fuel intensity and TFP during the same period. The co-efficient is better than that for the whole period implying a better response of TFP to fuel intensity. Capital intensity is a significant variable as far as Gujarat is concerned. The coefficient of capital intensity worsens further while keeping the negative relation. As in the whole period case, the three variables are found significant in Tamil Nadu. Fuel intensity continues to be positive, but the co-efficient is low. Unlike the experience of Maharashtra, the response of TFP to fuel intensity is lower during the first break up period compared to the whole period. As noted early, capital intensity and skilled manpower per head are not only negative but the coefficient is more than the whole period. It had an implication that the response of TFP to K/L and SK/L was still poor during 1960-79.

Kerala and Bihar, which had not a single significant variable with TFP, portrayed reliable relationship between capital intensity and TFP_{DD} during 1960-79. The general tendency of negative relation between capital intensity and TFP was observed in these two states. The trend was true in the case of Maharashtra and Tamil Nadu at a higher level, compared to Kerala and Bihar for the whole period. It was only in Maharashtra there was a positive and significant relation between fuel intensity and TFP Others did show a similar trend but there was no significant relation. Tamil Nadu could provide us a different picture other than the negative relation between skilled man power to employees and TFP Bengal and Gujarat could not register any significant relation under DD. Bengal, in fact, continued the same story, while Gujarat was not so at SD.

We could also consider the behaviour of the three variables and TFP during the post-1980s. Fuel intensity was significant only in Kerala at SD. There was not a single case of significant relationship between skilled labour (Sk/L)and TFP Bihar and Tamil Nadu showed a positive relation between capital intensity and TFP This trend was a clear change from negative relation which was seen in other cases. This implied that TFP became more responsive to capital intensity with liberalisation at least in the case of Tamil Nadu and Bihar. The relation was strong in Tamil Nadu as the coefficient was more than two. Though the coefficient of capital intensity for other states was not significant, the values during the post-1980s improve over the same before that. It was unfortunate that all the states except Kerala did not show any significant relation with TFP at DD. Capital intensity and fuel intensity were significant in Kerala. The former and the latter had negative and positive relation with TFP respectively.

The overall position did not change in the two bottom rank states (Bihar and Kerala) during the 1990s. The other four states showed certain changes as a part of accelerated growth in industry Gujarat at DD and Tamil Nadu at SD experienced positive and significant relation with TFP during the last decade. Three states (Maharashtra, Tamil Nadu and West Bengal) showed better and significant relation between fuel intensity and TFP However, Maharashtra and Tamil Nadu showed positive relation between Fu/L and TFP The negative relation between skilled man power to L and TFP is a disquieting fact.

5.1.2 Findings

The analysis in the preceding section threw up certain interesting points. Fuel intensity was the only variable which had a significant relationship with TFP under single and double deflation during 1960-1994 and 1960-98-99. The corresponding coefficients were higher under DD. The catching up states, Tamil Nadu and Gujarat, had significant relationship between TFP at SD and K/L, SK/L and Fu/L during the same period. Tamil Nadu enjoyed the exclusive phenomenon of significant relationship between the three explanatory variables and TFP at SD and DD. The most striking case was the significant relation between capital intensity and TFP which was negative and was against the well established theoretical postulations. The limited cases of significant relation between skilled labour per employee and TFP were not helpful to arrive at a conclusion. Non availability of more disaggregated data seems to be the reason for this.

A look at the three sub periods (1960-79, 1980 to93-94 and the 1990s) did not help us to get any strong conclusion. The logic of this break up was to examine the impact of liberalisation. Only Tamil Nadu could show consistent relation with the three variables and TFP As per this, capital intensity and skilled labour per employee and TFP had negative relation both at SD and DD during 1960-79. Gujarat also displayed negative relation between K/L and TFP at SD. The over all position showed a negative relation between K/L and TFP Fuel intensity had a positive relation in Maharashtra both at SD and DD.

No particular trend was emerged during the second period. K/L and TFP had a positive relation in Tamil Nadu and Bihar. This was a marginal change as the both had a negative relation before 1980. Fuel intensity continued to have positive relation both at SD and DD in Kerala. No variable was found significant in any state except in Kerala at DD. Symptoms of modern industrial growth were shown in the last decade. Gujarat, with highest growth in industry, registered a positive relation between K/L and TFP Maharashtra and Tamil Nadu, better rank states, showed positive relation between fuel intensity and TFP W Bengal was more vigilant with fuel intensity and TFP In short, capital intensity, skilled labour per employee and fuel intensity were not the sufficient variables to explain the nature technical progress at the regional level in Indian manufacturing.

Multiple regression results

Table 5.1 A

Bihar

Period	B0	B1	B2	B3	R2	Sig T	Metod
1960-94	4.250901	157946	-.074587	.166251	.38147	Bo,b3(1%)	Sd
I	4.291631	122141	-.069933	.158408	.16681	Bo(1%)	Sd
II	3.713094	.985533	-.220464	-.210434	.48488	B0(1%)b1(5%)	Sd
1960-94	5.128052	-1.18469	-.05085	.787587	.66801	B0,b1,b3(1%)	Dd
I	5.511456	-.866638	175205	.314727	.52425	B0(1%)B1(5%)	Dd
II	4.570940	.622347	-.118840	-.175728	.24557	B0(1%)	Dd
1960-99	4.990	4.753	.354	.360	.529	Bo,b3(1%)	sd
1990s	6.660	.211	910	-.291	.249	B0(1%)	sd
1960-99	5.466	-.479	.593	.933	.719	B0,b3(1%)	dd
1990s	7.092	-8.64	.782	-.169	.169	B0(1%)	Dd

Table 5.1B

Gujarat

Period	B0	B1	B2	B3	R2	Sig T	Method
1960-94	5.773953	-.234794	.316019	.238989	.85908	B0,b3(1%) b1,b2(5%)	Sd
I	5.778544	-.433653	159866	.284189	.84628	B0,b1(1%)	Sd
II	6.666373	-.171545	.689932	-.060782	.48705	B0(1%)	Sd
1960-94	5.614112	-.154611	.336188.	.646664	.80275	Bo,b3(1%)	Dd
I	6.072511	-.684531	131275	.525338	.58397	Bo(1%)	Dd
II	6.689754	-.075092	.567138	-014812	.37831	B0(1%)	Dd
1960-99	5.305	.397	.300	184	.541	B0(1%)b1,b2, b3(5%)	sd
1990s	4.607	3.232	-.633	-.139	.583	B0(1%)	sd
1960-99	6.286	.347	.803	.372	.872	B0,b2,b3(1%)	dd
1990s	6.047	.446	.334	-1.26	.502	B0 (1%) b1(10%)	Dd

Table 5.1 C

Kerala

Period	bo	B1	B2	B3	R2	Sig T	Method
1960-94	5.362783	.247460	157152	.556444	.83712	Bo,b3(1%)	Sd
I	5.366217	.371637	.268767	.397870	.51280	Bo(1%)	Sd
II	5.810919	-.007627	.248163	.506365	.79332	B0,b3(1%)	Sd
1960-94	6.819781	-.452690	.422515	748622	.83469	B0,b3(1%)	Dd
I	6.286731	-.658781	195112	.471125	.61755	B0(1%)	Dd
II	7.525572	-.817142	.537686	.494172	.70233	Bo,b3(1%)	Dd
1960-99	5.614	-.449	.407	.400	.612	B0,b3(!%)	sd
1990s	3.605	.571	-.635	.226	.020		sd
1960-99	6.615	-.408	.330	.822	.872	B0,b3(1%)	dd
1990s	5.372	.397	2.463	.908	.756	B0,b3(5%)	Dd

Table 5.1 D

Maharashtra

Period	B0	B1	B2	B3	R2	Sig T	Method
1960-94	5.044939	.030765	.079128	.289397	.84339	B1(1%),b3(5%)	Sd
I	4.769389	-.535618	.046416	.325485	.80654	B0,b3(1%)	Sd
II	7.640172	-.262922	2.024460	.290384	.55569	Bo(1%)	Sd
1960-94	5.445491	.006021	.260261	.455160	.79842	Bo(1%)B3(10%	Dd
I	3.951244	-3.20720	.123893	.557557	.73471	B0(1%)b1,b3 (5%)	Dd
II	8.301520	-.245981	2.191490	.181116	.42141	B0(1%)	Dd
1960-99	4.948	-8.22	4.446	.349	.884	B0,b3(1%)	sd
1990s	4.703	-.259	3.047	.566	.789	B0,b3(1%)	sd
1960-99	5.356	-.119	.232	.510	.843	B0,b3(1%)	Dd
1990s	5.189	-.135	179	.569	.694	B0(1%), b3(10%)	Dd

Table 5.1E

Tamil Nadu

Period	bo	B1	B2	B3	R2	Sig T	Method
1960-94	4.334817	-.502531	-.450169	.708019	.88522	Bo,b2,b3(1%) b1(5%)	Sd
I	4.711444	-.841421	-.255777	.231426	.77899	B0,b1(1%)b2 (10%)b3(5%)	Sd
II	7.370850	2.709241	1.265519	.096200	.84113	B0(1%) b1(10%)	Sd
1960-94	3.553757	-1.99999	-1.09075	.883334	.87300	All (1%)	Dd
I	4.368374	-2.09924	-.598297	.116103	.68213	B0,b1(1%) b2(5%)	Dd
II	8.037771	2.414316	1.411068	-.054784	.66185	B0(1%)	Dd
1960-99	4.420	-.407	-.394	.697	.908	B0,b2,b3(1%) b1(5%)	Sd
1990s	3.996	-.605	-.984	.164	.696	B0(1%)b1,b2, b3(10%)	Sd
1960-99	3.742	-1.463	-.932	.994	.871	All at 1%	Dd
1990s	4.735	.251	-.597	.299	.787	B0(1%)b3(5%)	Dd

Table 5. 1 F

Bengal

Period	Bo	B1	B2	B3	R2	Sig T Method
1960-94	4.228272	.405196	-.043555	106763	.36106	Bo,b1(1%) sd
I	4.342861	130397	-.096682	-.015193	.11537	Bo(1%) sd
II	4.413508	.496144	113119	.045853	.40412	Bo(1%) sd
1960-94	5.289246	.021588	.232529	.430485	.67245	Bo,b3(1%) dd
I	5.858204	-.797821	.250319	-.107901	.35659	Bo(1%) dd
II	5.045297	.501074	.230290	-.147233	.34533	Bo(1%) dd
1960-99	4.713	.454	-1.82	-1.27	.470	B0,b1(1%) sd
1990s	4.610	.489	-.160	-.357	.678	B0(1%)b3(10%) sd
1960-99	5.600	.391	.380	187	.719	Bo (1%) b1(10%) Dd
1990s	4.010	.288	-.748	-.109	.582	B0(1%) dd

CHAPTER VI

REGIONAL INDUSTRIAL STRUCTURE

It was seen in the preceding chapter that TFP was mainly influenced by energy consumption. Other factors did not show any significant impact on TFPG. In this background, an attempt is made to understand the dynamics of the regional industrial structure and its possible impact on TFPG across states. The focus is mainly on the sub-sectors of manufacturing from which value addition takes place.

When one takes a look at the industrial scenario one finds that there is no uniformity in our understanding of the very concept of 'industrial structure' This has led to the emergence of many definitions (Devine **int. elia**, 1985). Generally speaking the 'Industrial structure' refers to the relative importance of individual industries or groups of related industries within an economy. In order to overcome the plurality of definitions of industrial structure, Government departments normally formulate official definitions of industries. This has come to be known as Standard Industrial Classification (SICs). These classifications are not without limitations, but they are generally acceptable. In India, an exercise is carried out by the Central Statistical Organization (CSO) under the title 'Annual Survey of Industries' (ASI). Industrial classification was made three times in India on the basis of International Standard Industrial Classification (ISIC) followed by United Nations. The first classification was followed under the title Standard Industrial Classification (SIC) prior to 1973-74. The National Industrial Classification (NIC) was then followed up to 1988-89 and NIC 1987 has been followed since 1989-90. It is the nature of its principal products of an industry that determining its classification in the factory sector. Major industrial classifications are made on the basis of major industrial activity and they are numbered in two digits. Hence they are known as two digit level industries. In fact, two digit industries are the bracketed (similar) industries at three digit level. Industrial classification as per SIC and NIC 1970 is broadly comparable at two digit level. But certain reclassifications have been made in NIC 1987 version. Details are given in the appendix of this chapter.

Let us now examine the structural change of manufacturing at the regional level.

6.1 Changing phase of manufacturing structure

One of the ways of evaluating the structural change is to express the share of manufacturing in the economy as a whole. It is given in the table 6.1 for 1980-81, 1991-92 and 1996-97.

Table 6.1: The share of manufacturing sector in the economy

	Agriculture			Manufacturing			Others		
	1980-81	91-92	96-97	80-81	91-92	96-97	80-81	91-92	96-97
Bihar	45.98	38.63	34.43	15.21	17.33	16.60	38.81	44.04	48.97
Gujarat	37.27	26.90	24.78	22.02	21.80	31.38	40.71	51.3	43.84
Kerala	36.57	35.66	34.21	14.54	16.00	14.31	48.89	48.34	51.84
Maharahtra	26.74	19.40	19.98	27.59	24.15	24.73	45.67	56.45	55.29
Tamilnadu	24.33	20.40	19.55	27.23	24.28	23.04	48.44	55.32	57.41
W.Bengal	30.06	40.38	34.04	21.73	16.10	15.84	48.21	43.52	50.12
India	38.1	31.3	27	17.7	17.4	19.4	44.2	51.3	53.6

Source: National Income Accounts, EPW Research Foundation, 1998.

It may be gauged from the table that the share of manufacturing in the regional (state) economy is on par with the level of industrialisation (see chapter3). Bihar and Kerala have the lowest share compared to Gujarat and Maharastra. Gujarat improved its share in manufacturing between 1980-81 and 1996-97 while the share of the Tamil Nadu in manufacturing declined. We already noted in the previous chapter that the over all efficiency of the Tamil Nadu had a set back in the early 1990s (see Tamil Nadu in chapter IV). Fall in productivity and falling share of manufacturing were discernible in

Bihar and Kerala. The cases of Maharashtra and west Bengal, the two top industrilised states in the 1960s, need special mention. Though the share of manufacturing declined in both the states, their over all economic structure did not transform in the similar way. In Maharashtra, the shares of both agriculture and manufacturing sectors slipped down and the resultant empty space was occupied by service sectors and others. The case of West Bengal was different. The gap created by the shrinking size of manufacturing was shared between agriculture and others. If a fall in the share of manufacturing and an increase in the size of agriculture take place simultaneously, it cannot be interpreted as a sign of economic progress. It enables us to argue that the negative growth in TFP and the near stagnation in value added in West Bengal pulled down its position from second to fifth in the level of industrilisation during the last four decades (See chapter IV).

We also proceed on the assumption that the performance of regional industrial economy was not in the same vigorous and efficiency in all states. Hence the structure of the respective state economy is examined on the basis of the relative shares of fixed capital (FC), employment (NE) and value added (VA). As noted earlier, the last two variables normally counted for international comparison. Fixed capital is also taken under two conditions (i) the value of industrial capital has almost a uniform pattern at the national level and (ii) capital productivity was noted as a major determinant of interstate disparity in industrialisation in India. (see section 4.3.1). Four time points are selected for understanding the structural change, viz. 1965, 1980-81, 1991-92 and 1997-98. The first three time points represent the so called 'stagnation', 'turn around' and 'liberalisation' phases in Indian Economy. The latest available data is for 1997-98. Let us start with the food processing industry.

6.2 Food Processing Industry (FPI)

The share of fixed capital (FC) declined in the low ranking states (West Bengal Bihar and Kerala) between 1965 and 1980-81 and it increased in the 1990s. The general feature of the high ranking states was a fall in the share of FC in the manufacturing in the 1990s. Maharashtra had ups and downs while Gujarat showed continuous decline. Tamil Nadu was stationary in the share of FC of FPI till the 1980s and it marginally declined in the 1990s. The share of food processing industry in terms of FC remained to be less than 10 percent in all states at the selected points. The relative shares of FC, NE and VA are reported in the table 6.2.

Table - 6.2 : Relative Share of Food Processing Industry in Selected States for Selected years (in %)

	Fixed Capital			
	1965	1980-81	1991-92	1997-98
Bihar	6.27	0.65	1.84	2.61
Gujarat	8.52	5.37	4.98	2.96
Kerala	16.36	3.37	6.77	9.34
Maharashtra	9.31	4.73	9.04	7.97
Tamil Nadu	9.81	9.46	7.77	7.31
W. Bengal	5.95	4.16	2.96	7.10

No. of employees

Bihar	12.87	16.91	5.77	6.48
Gujarat	7 .53	31.80	11.10	10.49
Kerala	5 4.41	43.72	34.58	35.87
Maharashtra	6.22	11.71	12.21	11.04
Tamil Nadu	11.07	19.23	12.96	12.33
West Bengal	6.68	7.71	7.79	4.42

Value Added

	1965	1980-81	1991-92	1997-98
Bihar	7.30	3.51	2.46	2.25
Gujarat	8.53	5.94	7.03	6.61
Kerala	27.81	10.82	15.05	21.25
Maharashtra	6.99	3.06	8.20	6.92
Tamilnadu	11.89	12.18	9.68	11.26
West Bengal	5.60	2.40	5.22	5.10

The share of employment in this industry increased between 1965 and 1980-81. Kerala was a unique state in generating employment in FPI. Its share was more than 50 percent in 1965 and settled at 35 percent in the 1990s. It is useful to recall the theoretical argument that food processing industry will be dominant in the early stages of industrilisation .Among the states under consideration, Kerala is the bottom ranked states in India. Meanwhile, FPI's share in employment seemed to be stabilised at around 10 percent in the 1990s in the high ranking states. Gujarat had a quantum jump in employment generation to 31.80 in 1980-81 from 7.53 in 1965.

Like employment, FPI is a major value added sector in Kerala. Its share in value added slipped to 10.82 in 1980-81 from 27.81 in 1965. The share gradually improved to 15.05 and in 21.25 in 1991-92 and 1997-98. However, employment did not improve with value addition which moved with FC. Considering the share of fixed capital, employment and value added of FPI in Kerala, this state could be named as a 'FPI' region. The share of catching up states like Tamil Nadu and Gujarat in value added showed only marginal changes, while Maharashtra experienced fluctuations along with FC. In short, the share of FPI in value added was between 5 and 12 percent for all states except Kerala. It seems that value added and FC have more responsiveness than employment.

6.3 Textile Industry

The evolution of the textile sector showed significant share in 1965, decline later and marginal improvement in the 1990s. The relative share of textile is expected to fall down with improvement in the level of industrilisation. The experience in India shows diverging trend at the regional level. Textiles were very prominent in 1965, especially in the four industrilised states (Gujarat, Maharashtra, Tamil Nadu and West Bengal). More than 50 percent of the employment and value added accounted for by textiles in that year. Moreover,36 percent of productive capital also was invested in this sector. Thus Gujarat had a textile based industrial economy in 1965. This was almost comparable with Kerala in terms of FPI. In short, the level of industrialisation was determined to a certain extent by the strength of textile industry. However, the share of productive capital was less (between 12 and 23) in Maharashtra, TamilNadu and West Bengal. This implies that textiles sector was more labour intensive in 1965.

Table – 6.3 :Relative share of textile industry in selected states for selected years (in %)

	1965	1980-81	1991-92	1997-98
Fixed Capital				
Bihar	0.71	0.43	.123	111
Gujarat	36.40	15.56	13.77	11.03
Kerala	17.98	10.28	5.75	8.73
Maharashtra	18.39	7.46	9.16	10.84
Tamil Nadu	24.70	19.40	28.2	25.76
West Bengal	12.79	10.92	9.5	13.92
Number of employees.				
Bihar	4.56	3.83	2.63	2.85
Gujarat	57.69	44.45	29.81	25.16
Kerala	27.65	10.56	10.1	10.48
Maharashtra	39.68	24.63	20.02	17.86
Tamil Nadu	34.75	24.99	26.5	32.36
West Bengal	35.48	34.16	30.09	28.78

Value Added

	1965	1980-81	1991-92	1997-98
Bihar	1.15	3.87	0.43	0.32
Gujarat	50.80	35.38	14.83	9.53
Kerala	18.18	13.40	6.54	9
Maharashtra	28.45	18.38	13.04	6.12
Tamil Nadu	27.11	24.33	20.13	22.94
West Bengal	23.04	25.89	15.94	25.43

The share of fixed capital (FC), number of employees (NOE) and value added (VA) reduced considerably later. Though a decline in the share was visible, it was more pronounced in Gujarat and Maharashtra. Tamil Nadu (mainly wearing apparels) and West Bengal (Jute) improved their shares in the 1990s. Thus Maharashtra and Gujarat behaved more like an industrilised region. Tamil Nadu mainly performed in the modern value added items like wearing apparels. There was a general dip in the relative share of textile sector in all these six states. Compared to FPI, textiles is not so a strong sector in Kerala. The share of the three variables improved in the 1990s compared to 1980-81. This sector did not have any comparable share in Bihar. Thus we cannot conclude that declining share of textile is a sign of progress in industrialisation in the regional context of India. The shares of FPI in Kerala and textiles in other states display the local resources base and its linkage with the industrial structure.

6.4 Basic Chemical and Chemical Products

One expects larger share of basic chemical and chemical products in industrilised states. However, a mixed picture has emerged in this case also. As will be seen in the case of rubber, plastic and petroleum products, Bengal and Bihar showed a similar decline in the share of fixed capital in this industry. For instance, the share of fixed capital declined from 21.86 in 1980-81 to 5.87 in 1997-98 in West Bengal. Such a decline was observed in Bihar as well. However, a simultaneous decline in employment and value added was not seen in Bengal but it was so in Bihar. The vibrancy of manufacturing sector in Gujarat was mainly due to the increase in the share of fixed capital and value added. It reached almost 50 percent in Gujarat in 1997-98. Though Kerala was not an industrialised state, a quarter of fixed capital and about 17percent of value added was emanated from this sector. In spite of this, Kerala was far too low in the level of industrilisation as the state could not escape itself from the influence of the food processing industry. Meanwhile Gujarat could move from a 'textile industrial economy' to a 'chemical based industrial economy' Theoretically, this transition is very important to reach high level of industrilisation This sector was also important in Maharashtra. Fixed capital seems to have better relation with value added than employment. The results are reported in the following table.

Table – 6.4 : Relative share of Basic Chemicals and Chemical Products Industry in Selected States for Selected Years (in %)

Fixed Capital

	1965	1980-81	1991-92	1997-98
Bihar	8.26	10.30	5.15	2.17
Gujarat	2.2	30.41	41.81	49.89
Kerala	27.94	29.45	32.41	25.65
Maharashtra	20.49	11.84	30.49	23.35
Tamil Nadu	6.44	16.25	19	18.76
West Bengal	5.12	21.86	7.97	5.87

No of Employees

Bihar	5.23	6.03	6.56	4.62
Gujarat	5.36	10.18	15.18	23.20
Kerala	4.99	6.59	7.67	7.98
Maharashtra	7.71	10.33	11.10	11.63
Tamil Nadu	5.66	10.46	12.38	11.74
West Bengal	3.48	0.89	5.06	8.02

Value Added

Bihar	15.94	2.10	9.25	3.82
Gujarat	17.66	25	37.52	54.22
Kerala	11.08	23.71	17.81	18.20
Maharashtra	18.20	24.09	20.01	28.74
Tamil Nadu	6.14	13	11.86	9.77
West Bengal	6.35	6.84	10.54	9.06

6.5 Rubber, Plastic, Petroleum, Coal Products and Processing of Nuclear Fuels

This industry was very prominent in Kerala at the four time points (table – 6.5). It was next in order to food processing industry (FPI). The increase in the share of fixed capital explicitly reflected in value addition and not in employment. This argument was generally true for other states as well. The share of this industry had been on the rise and on theoretical ground this could be considered as a sign of structural improvement. One important aspect may be noted here. Though rubber and petroleum industry was prominent in Kerala, the state could not lessen the influence of FPI. As a result, Kerala still continued at the lower end of the industrial ladder. Meanwhile, Gujarat could reduce the share of textile industry and that of chemical industry was increased. This shows the presence of misplaced practices in the industrial strategy of Kerala.

Table - 6.5 : Relative Share of Rubber, Plastic, Petroleum and Coal Products, and Processing of Nuclear Fuels Industry in Selected States for Selected Years (in %)

Fixed Capital

	1965	1980-81	1991-92	1997-98
Bihar	0.005	2.17	4.11	2.89
Gujarat	0.22	5.32	10.79	5.21
Kerala	5.89	10.08	20.96	23.61
Maharashtra	1.72	2.47	8.29	9.99
Tamil Nadu	3.35	3.93	11.34	7.91
West Bengal	2.10	6.79	4.66	6.91

No of Employees

	1965	1980-81	1991-92	1997-98
Bihar	0.02	7.26	7.36	8.31
Gujarat	0.32	1.73	3.50	3.84
Kerala	1.62	3.27	4.48	6.75
Maharashtra	1.31	3.39	4.31	5.00
Tamil Nadu	1.01	2.51	2.62	2.60
West Bengal	2.91	3.01	2.74	6.51

Value Added

	1965	1980-81	1991-92	1993-94
Bihar	0.01	10.70	10.24	4.96
Gujarat	0.22	7.45	3.68	2.10
Kerala	5.54	20.26	21.57	17.03
Maharashtra	2.17	4.26	8.89	9.51
Tamil Nadu	2.96	3.96	7.97	5.90
West Bengal	4.83	7.72	5.30	7.94

6.6 Non- Metallic Mineral Products (NMMP)

This industry did not have a significant share in any state in 1965 except in Maharashtra. This trend changed later in the catching up states of Gujarat and TN, and in Kerala too. Bihar was able to accommodate more than 10 percent of manufacturing labour force during the last two decades (table – 6.6).

Table – 6.6 : Relative Share of Non- Metallic Mineral Products Industry in Selected States for Selected years

	1965	1980-81	1991-92	1997-98
Fixed Capital				
Bihar	4.24	1.38	2.46	4.33
Gujarat		1.97	8.92	6.75
Kerala		3.02	4.71	7.40
Maharashtra	6.88	1.03	3.02	3.04
Tamil Nadu	0.24	6.37	5.96	3.01
West Bengal	3.07	1.80	0.81	1.04
No. of Employees				
Bihar	1.83	11.89	16.07	14.26
Gujarat		6.86	8.35	7.67
Kerala		5.59	7.16	6.13
Maharashtra	0.31	2.99	3.46	2.63
Tamil Nadu	0.47	3.51	3.84	2.66
West Bengal	0.30	2.36	3.01	4.06

VALUE ADDED

Bihar	0.005	5.49	5.68	0.50
Gujarat		3.60	6.20	8.10
Kerala		4.32	4.62	3.12
Maharashtra	2.38	2.09	3.80	1.08
Tamil Nadu	0.39	3.65	5.87	5.44
West Bengal	0.98	2.24	2.34	2.02

6.7 Basic Metal and Alloys Industries

This industry has been progressively becoming prominent in Bihar. 78.30 and 62.42 per cents of fixed capital and value added respectively belonged to Basic Metal Industry in (1997-98) in Bihar. More than one third of the employment in manufacturing was also in this sector of the state in the same year. West Bengal also showed more or less the same features, though at a less magnitude. The shares of fixed capital and employment increased from 1.40 and 2.57 per cent to 51.93 and 26.34 per cents in 1965 and 1997-98 respectively. However, it was not reflected in value addition. This can be accounted as a weakness of the manufacturing base in West Bengal. Other states have a share less than 10 percent on average in terms of FC, NOE and VA. However, Tamil Nadu showed more stability in its share (table – 6.7).

Table – 6.7 : Relative share of Basic Metal and Alloys Industries in Selected States for Selected Years

Fixed Capital

	1965	1980-81	1991-92	1997-98
Bihar	6.62	63.85	74.57	78.30
Gujarat	7.79	2.08	7.42	15.40
Kerala	4 .62	2.70	4.12	7.40
Maharashtra	1.80	3.95	11.55	11.31
Tamil Nadu	7.33	8.91	5.99	7.02
West Bengal	1.40	28.14	57.95	51.93

No. of Employees

Bihar	15.02	31.22	33.19	36.03
Gujarat	7.08	3.61	5.51	5.23
Kerala	7.51	1.45	1.95	1.83
Maharashtra	3.37	5.71	5.41	5.03
Tamil Nadu	3.87	4.40	3.31	3.32
West Bengal	2.57	13.40	15.68	26.34

Value Added

	1965	1980-81	1991-92	1997-98
Bihar	0.57	40.37	49.17	62.42
Gujarat	5.64	3.40	6.99	5.31
Kerala	5.39	3.30	4.15	2.81
Maharashtra	2.24	7.30	1.14	5.98
Tamil Nadu	5.20	4.43	4.15	4.87
West Bengal	1.70	16.38	19.34	10.4

6.8 Metal Products (MP)

This industry was prominent in Bihar in terms of the three variables in 1965 but later lost it. MP industry accounted for a quarter of employment and shared a sizeable amount (40%) of value added in the manufacturing of Bihar in 1965. It was also important in West Bengal, even though it was relatively capital intensive. It did not get reflected in value added. Probably this was a major failure of manufacturing in Bengal. The share of capital fell down in the subsequent decades. It was the direct impact of slow growth of capital as noted in the chapters 3 and 4. Its significance declined in Tamil Nadu also, but it was not so prominent as in Bihar and Bengal in the first decade of analysis. A low share of the metal product industry seems to be not very favourable to modern industrilisation (table – 6.8).

Table – 6.8 : Relative share of Metal Products industry in Selected States for Selected Years(%)

Fixed Capital

	1965	1980-81	1991-92	1997-98
Bihar	48.64	0.06	0.30	0.18
Gujarat	2.87	0.84	1.62	1.12
Kerala	2.90	2.23	1.41	90.97
Maharashtra	5.09	1.73	2.84	4.14
Tamil Nadu	10.84	1.39	1.20	1.54
West Bengal	39.38	1.80	1.36	0.96

No. of Employees

Bihar	25.50	0.78	1.29	1.12
Gujarat	2.05	2.29	4.14	3.47
Kerala	0.63	1.33	1.66	1.34
Maharashtra	4.43	4.47	3.97	5.39
Tamil Nadu	4.52	2.56	2.11	2.05
West Bengal	12.56	3.10	2.97	5.59

Value Added

	1965	1980-81	1991-92	1997-98
Bihar	40.90	0.31	0.44	0.36
Gujarat	2.33	2.01	4.56	1.32
Kerala	2.17	1.09	1.58	1.07
Maharashtra	4.16	5.2	3.17	4.19
Tamil Nadu	4.40	2.61	1.84	2.15
West Bengal	5.16	2.89	3.21	2.75

6.9 Machinery and Equipment

The share of this industry has not changed appreciably in different states Marginal changes took place in Bihar and Bengal. Like Metal Products Industry, the share of fixed capital of Machinery and Equipment industry also came down in 1997-98 as compared to 1965 in Bihar and Bengal. The low share of capital in the latter decades seemed to show changes in the size of operations especially in the case of slow growth of capital (chapters 3 and 4). It also showed a geographical proximity of Bengal and Bihar. Meanwhile, Kerala's share of fixed capital in this Industry improved during the same period.

Table – 6.9: Relative share of Machinery and Equipment industry in Selected States for Selected Years(%)

Fixed Capital

	1965	1980-81	1991-92	1997-98
Bihar	9.88	1.48	3.05	2.41
Gujarat	5.82	0.97	7.13	4.74
Kerala	2.25	8.50	8.64	7.69
Maharashtra	12.53	42.46	10.68	11.09
Tamil Nadu	7.14	12.36	10.30	9.68
West Bengal	9.00	9.88	6.64	4.60

No. of Employees

Bihar	5.75	4.34	6.49	5.52
Gujarat	6.80	9.62	11.36	10.83
Kerala	2.21	4.60	6.37	4.95
Maharashtra	13.63	12.63	14.53	14.61
Tamil Nadu	8.43	10.37	10.69	10.15
West Bengal	9.98	10.08	10.75	13.10

Value Added

	1965	1980-81	1991-92	1997-98
Bihar	3.26	5.47	2.79	6.80
Gujarat	6.68	2.87	12.32	10.49
Kerala	2.28	10.31	9.03	9.01
Maharashtra	12.49	18.39	20.55	17.32
Tamil Nadu	10.06	15.54	15.25	14.20
West Bengal	12.80	14.07	17.09	14.98

The argument of Das Gupta (1998), and, Raychaudhari and Chatterji (1998) was that Bengal experienced capital flight in the 80s. Metal Products and Machinery and Equipment Industries might have contributed to this phenomenon. This argument seemed to be valid for Bihar as well. Though the share of capital had a diverging trend the share of employment and value added progressed in general. This industry accounted for more than 10 per cent of employment and value added of manufacturing in the four industrilised states. In this sense, this industry is a major determinant of industrilisation in a region. It was not the case with metal industry.

6.10 Transport Equipment and Parts

This is not a major industry in Gujarat .Bengal again felt capital flight in this sector. However, the share of employment and value added improved. This sub-sector became more labour intensive in relative terms (table 6.10). Though Kerala had a better share of this industry in terms of capital and value added in 1965 it declined later. In spite of a better share of capital (19%) in 1980-81, it did not reflect either in value added or employment in Kerala. Bihar showed steady rise in employment in this sector, but the improvement in the share of employment and value added declined after 1980-81. It can be seen that value added was more responsive to capital in Bihar as far as this industry was concerned. Maharashtra and Tamil Nadu had steady progress in the share of this industry. But we are not in a position to conclude that this is a major determinant of industrialisation, because, the share of Transport Equipment industry is negligible in Gujarat. Meanwhile the importance of this industry improved in Bengal in terms of employment and value added when its position in the national map of industrilisation declined further.

Table – 6.10: Relative Share of Transport Equipment and Parts industry in Selected States for Selected Years (in %)

Fixed Capital

States	1965	1980-81	1991-92	1997-98
Bihar	2.64	19.10	7.24	6.18
Gujarat	1.41	0.52	0.57	0.71
Kerala	6.33	19.22	4.55	1.95
Maharashtra	5.68	4.97	8.82	9.46
Tamilnadu	3.90	10.86	8.40	6.66
West Bengal	3.91	7.28	2.70	2.26

Number of Employees

States	1965	1980-81	1991-92	1997-98
Bihar	2.38	10.05	12.45	12.31
Gujarat	0.98	1.94	1.92	2.7
Kerala	1.14	1.98	1.75	1
Maharashtra	4.39	8.13	7.64	7.27
Tamilnadu	3.22	9.46	8.80	7 17
West Bengal	3.95	12.07	11.35	18.28

Value Added

States	1965	1980-81	1991-92	1997-98
Bihar	2.89	21.90	12.15	11.61
Gujarat	1.26	1.29	1.28	1.64
Kerala	6.79	3.29	1.83	2.48
Maharashtra	5.72	9.42	11.41	9.63
Tamilnadu	4.14	11.70	8.71	9.17
West Bengal	6.40	11.87	10.70	9.16

It was prominent in 1965, especially in three industrilised states, MH, TN and WB. But it came down in all states later.

This reflects the composition and structure of the manufacturing. Industrial structure is generally determined by either value added or quantity of one of its inputs, especially labour.The relative importance of the secondary sector increases continuously in terms of value added and employment (Kuznets, 1966; Chenery and Syrquin, 1975). As industrialization progresses Chenery and Syrquin argued that food, drink and textiles were relatively less important in advanced compared to backward economies, while metals, metal products and chemicals were relatively more important. One of the recent studies also points to similar structural change in the East Asian countries. The importance of food and textiles sub sectors is declining while the shares of capital goods are rising (Timmer and Szirma, 1997).Such major sectors are machinery, transport and equipment and electrical machinery. Timmer and Szirmai call this a process of convergence in the structure of the manufacturing sectors.

6.11 General Remarks

The industrial structure in the states doesn't show any specific pattern so as to distinguish between industrialized and less industrialized states. Resources based industries flourished in both types of states. FPI in Kerala and textiles in Tamilnadu justified the above argument. The geographical contiguity caused the emergence of metal based industry in Bihar and West Bengal. It can be noted that TN and WB are relatively industrialized states. Convergence occurred in certain respects. FPI was not a major sector in any state except in Kerala. Convergence mainly took place between Maharashtra and Gujarat in terms of high share of chemical, petroleum and machinery and equipment industries TN and WB were closer to those states in the case of petroleum and machinery industries. One major peculiarity of Maharashtra is the diversification in its industrial structure. This state has no overwhelming influence of any particular sub-sector as FPI in kerala, chemical based industry in Gujarat, and basic metals and alloys industry in Bihar, fall in the share of textiles and FPI indicates modernization, but the low profile of metal products and transport equipment industries is not a progressive sign, it seems that the pride position of west Bengal has lost due to capital flight especially in the chemical based industry. Thus the convergence in the structure of manufacturing in India got struck at half way to the matured level of industrialization.

The process of convergence in the structure of manufacturing sub-sectors can be computed by using similarity indices in the line suggested by Timmer and Szirmai (1997). The indices represent a share vector for each state in a two-way comparison. Each vector constitutes the share of all sub-sectors of manufacturing in terms of value added. The angle between the two vectors measures the similarity or dissimilarity between the vectors. The similarity index is defined as the cosine of this angle and its value varies between 0and 1. A higher value shows greater similarity and a lower value points to dissimilarity. It is expressed as:

$$Sxy = \frac{\sum_{j=1}^{m} S_j^u \; S_j^x}{\sqrt{\sum_{j=1}^{m} (S_j^x)^2 \; \sum_{j=1}^{m} (S_j^y)^2}}$$

where Sxy is the similarity index between states x and y. Sx and Sy are the sub-sector shares in value added of state x and y respectively. Indices are computed for the four time points under consideration. The results are reported in the table 6-11.

Table 6.11: Similarity Index between states

States	1965	1980-81	1991-92	1997-98
Bihar vs Maharastra	0.40958	0.440193	0.314596	0.321301
Bihar vs Gujarat	0.205716	0.219957	0.368122	0.180252
Bihar vs WB	0.451243	0.724824	0.728306	0.475017
Bihar vs TN	0.432394	0413556	0.371869	0.315433
Bihar vs Kerala	0.349173	0340474	0.38816	0.215249
Gujarat vs MH	0.369372	0521582	0.39089	0.363633
Gujarat vs WB	0.843213	0.413599	0.600531	0.464749
Gujarat vs TN	0.840691	O.868674	0.715151	0.533869
Gujarat vs Kerala	0.611119	0.754789	0.7183	0.656697
Kerala vs WB	0.657862	0.497899	0.578945	0.607562
Kerala vs TN	0.726415	0.689521	0.784381	0.782439
Kerala vs MH	0.686758	0.792622	0791934	0792848
MH vs TN	0.89874	0.843644	0.900021	0.741728
MH vs WB	0.92883	0.609961	0.718662	0.698201
TN vs WB	0.96405	0.554805	0684794	0.70167

Let us take Maharastra as a reference point as this state is relatively matured in industrialisation. As expected, the similarity between Maharastra and West Bengal declined over time. It was already noted that certain sub-sectors like chemical industry declined in West Bengal. Tamil Nadu and Kerala had better convergence to Maharastra than with Gujarat. Further Gujarat had divergence with other two industrialized states (West Bengal and Tamil Nadu) over time. Though Kerala belonged to the low level of industrialization, its structure was rather converged to that of industrialized states. Such a trend could not be found in the case of Bihar. That is, convergence in the structure alone did not guarantee higher level of industrialization in the regional context of India. Meanwhile we found that high productivity of both labour and capital gave a better picture about the level of industrialization (chapter 4). This required the consideration of the employment and capital elasticities of output.

6.12 Employment and Capital Elasticities of Value Added

In the discussion made above, it was seen that value added in certain sectors responded better to capital than to employment. FPI, chemical and, plastic and petroleum products industries responded more to capital. But, value added did not change, as expected, in the case of metal products and transport equipment in WB and Bihar. In order to verify this finding, the share of value added is regressed on employment and FC for the four time points under consideration. This underlies our earlier conclusion (chapter 4) that capital productivity was a major determinant of regional industrialization in India. The results are presented in table 6.12.

Table 6.12 Linear regression results -VA=f(Emp, FC)

1965

States	B	Emp(B_1)	FC (B_2)	R^2	Sig
Bihar	0.125	0.354	0.666	0.858	1%
Gujarat	0.708	0.489	0.641	0.99	1%
Kerala	1.58	0.418	0.296	0.930	1%
Maharastra	0.717	0.418	0.698	0.981	1%
Tamil Nadu	0.393	0.562	0.373	0.975	1%
West Bengal	1.429	0.686	-9.32	0.902	1%

1980-81

States	B	Emp(B_1)	FC (B_2)	R^2	Sig
Bihar	1.199	0.273	0.507	0.906	1%
Gujarat	1.927	0.531	0.448	0.979	1%
Kerala	1.470	0.169	0.581	0.605	1%
Maharastra	0.827	0.673	0.186	0.537	1%
Tamil Nadu	-.111	0.532	0.496	0.929	1%
West Bengal	0.428	0.650	0.283	0.908	1%

1991-92

States	B	Emp(B_1)	FC (B_2)	R^2	Sig
Bihar	0.424	0.467	0.453	0.969	1%
Gujarat	-.137	0.284	0.765	0.969	1%
Kerala	0.657	0.282	0.610	0.870	1%
Maharastra	-.495	0.658	0.431	0.776	1%
Tamil Nadu	0.421	0.446	0.462	0.905	1%
West Bengal	1.067	0.631	0.166	0.797	1%

1997-98

States	B	Emp(B_1)	FC (B_2)	R^2	Sig
Bihar	0.670	0.145	0.725	0.9872	1%
Gujarat	-1.352	0.396	0.864	0.943	1%
Kerala	-1.36	0.436	0.574	0.955	1%
Maharastra	-1.361	0.243	1.015	0.888	1%
Tamil Nadu	1.153	0.625	0.171	0.847	1%
West Bengal	2.040	0.560	4.040	0.550	1%

Value added mainly responded to capital in Bihar, Gujarat and MH in 1965. It was expected in TN and WB. As seen in chapter 3, the size of working capital was closer to FC in Tamil Nadu. This seemed to operate for a better relation between value added and employment in that state. The negative relation between value added and FC reminded us of the argument made in chapter 4 that the germ of industrial decline was already present in WB.

The three states (Kerala, TN and WB) that had better responsiveness between employment and value added in 1965 improved their position in terms of capital and value added in 1980-81. However, employment elasticity of output continued to be higher in TN and WB. Meanwhile, the other three states had a lower responsiveness between FC and VA in that year. It implied a reversing of the relationship and the shifting of emphasis from one factor to another between 1965 and 1980-81(sometimes industrial policy might have guided the system in this direction).

No particular pattern was found in 1991-92.However, a definite direction was discernible in 1997-98. Capital elasticity of value added became greater than that of employment in five states except in TN in 1997-98.This could be interpreted as the influence of new economic policy which promoted capital deepening technology. One can make general conclusions from the above regression results: 1) capital elasticity of value added was more for the two top industrialized states(MH and Gujarat)in the 1990s; 2)Though TN was closer to MH and Gujarat in the level of industrialization its employment elasticity of value added was more than that of capital. As argued earlier, the influence of working capital was more in TN; 3) the capital elasticity of value added was highly volatile in WB. This volatility could be taken as an explanation for the relatively poor performance of WB in the last two decades. This was particularly applicable for sub-sectors like metal products and transport equipment; and 4) both the elasticities of value added were inconsistent in Bihar and Kerala. In short, the hypothesis of higher capital elasticity of value added was better seen in the 1990s.

6.13 Summary

The industrial structure in the states did not have a specific pattern as to distinguish between industrialized and less industrialized states. Resource based industries flourished in both types of states. The industrial structure of Maharastra is noted for its diversification. Flight of capital could be traced as a major reason for declined level of industrial activity in West Bengal, especially in the chemical based industry The regional convergence in the structure of manufacturing in India showed only half way to the matured stage of ndustrialization. The convergence was measured with the help of the so called similarity index. The measurement showed that the convergence between Maharastra and West Bengal declined over time. The low industrialized Kerala and the catching up Tamil Nadu converged to Maharastra. That is, convergence in the structure of manufacturing alone did not guarantee high level of industrialization in the regional context of India.

It was hypothesized from the share analysis of different sub-sectors of manufacturing that the responsiveness of value added to capital was more than to employment. The hypothesis was found true for the two top industrialized states (Maharashtra and Gujarat) in the 1990s. The hypothesis lacked consistency in other states. Generally, the capital elasticity of value added was seen better in the 1990s pointing to the direction of the new economic policy

Appendix- 6.1

NIC 1970

Code Name of the Industry

20. Food manufacturing industries, except beverage industries.
21. Beverage industries.
22. Tobacco manufacturers.
23. Manufacture of textiles.
24. Manufacture of footwear, other wear apparel and made up textile goods.
25. Manufacture of wood and cork, except manufacture of furniture.
26. Manufacture of furniture and fixtures.
27. Manufacture of paper and Paper products.
28. Printing, publishing and allied industries.
29. Manufacture of leather and fur products, except footwear and other wearing apparel.
30. Manufacture of rubber products.
31. Manufacture of chemicals and chemical products.
32. Manufacture of products of petroleum and coal.
33. Manufacture of non- metallic mineral products, except products of petroleum and coal.
34. Basic metal industries.
35. Manufacture of metal products, except machinery and transport equipment.
36. Manufacture of machinery, except electrical machinery.
37. Manufacture of electrical apparatus, appliances and suppliers.
38. Manufacture of transport equipment.
39. Miscellaneous manufacturing industries.

NIC 1987- 88

Code Name of the Industry

20-21. Manufacture of food products

22. Manufacture of beverages, tobacco and related products.

23. Manufacture of cotton textiles.

24. Manufacture of wool, silk and man- made fibre textiles.

25. Manufacture of jute and other vegetables

26. Manufacture of textiles products (including wearing apparels).

27. Manufacture of wood products, Furniture and Fixtures.

28. Manufacture of paper and paper products and printing, publishing and allied industries.

29. Leather and leather products, Fur etc.

30. Basic chemicals and chemical products.

31. Rubber, plastic, petroleum and coal products, processing of nuclear fuels.

32. Non-Metallic mineral products.

33. Basic metal and alloys industries.

34. Metal products.

35-36. Machinery and equipment.

37. Manufacture of transport equipment and parts.

38. Others.

39. Repair of capital goods.

42. Water works.

43. Non- conventional energy.

74. Storage and warehousing services.

97.Repair services

CHAPTER – 7

CONCLUSION

The present study entitled 'Inter-State Variations in Manufacturing Productivity and Technological Changes in India' covers a period of 38 years from 1960 to1998-99. The study is mainly based on ASI data. The study starts with a discussion of the major facilitating factors of industrialization, namely, historical forces, public policy and infrastructure facilities. These are discussed in greater details in the context of our discussion on Perrox's (1998) 'growth pole' and 'development pole', Hirschman's (1958) 'industrial centers' and Myrdal's 'spread effect'

Most of the existing literature more or less agrees that the process of industrialization has not been uniform in all Indian states. There has been a decline in inter-state industrial disparities over time. This aspect is dealt at some length in the third chapter.

An important element that deserves detailed attention is the intra-regional differences in industrialisation. Regional industrialisation implies the emergence of a few focal points and industrial regions. Calcutta, Bombay and Madras were the initial focal points. Later other centers like Bangalore, Amritsar, Ahemedabad etc. emerged as nodal points in other states. All major states account for focal points. The analysis made in the third chapter shows that industrial activities generally converge to one or two focal points and industrial regions have emerged out of the focal points in almost all states. One of the general features of these complexes and regions is that they approximately accommodate 50 to 75 percent of the total industrial units and workers in the state. Such convergence is seen hands in glow with urbanization. It was further seen that intra-regional industrial disparity comes down in industrial states like Maharashtra, Gujarat and Uttar Pradesh.

Intra-regional differences is analysed on the basis of the spatial (geographical) location of specific industries. For the purpose of our analysis, industries may be grouped into two: metal based and non-metal based. Within in the metal based industry, the high location industry is the metal products which is found both in industrialized and less industrialized states in India. In the non-metal group, chemical products and pharmaceuticals dominate. More industrial conglomerations are found in top ranking industrial states. Non-metal based industries have more intra-regional dispersal than metal based industries. It implies that intra-regional growth is uniform in India. In other words, there exists both converging and diverging forces in the intra-regional industrialization process.

After considering intra-regional difference in industrialisation, we take up the issue of regional industrialisation. Five variables are considered here as indicators of industrialisation. They are value of output (VO), value added (VA), number of persons employed (NOE), productive capital (PC) and number of registered factories (NOF). Maharashtra ranked top in almost all variables among the fourteen major states during the whole period. West Bengal slipped from second position in the first decade to the fifth in the 1990's. The position of West Bengal was relegated initially in terms of capital and number of factories in the 1970's. Tamil Nadu, Gujarat and Uttar Pradesh occupied next three positions at varying degrees for the five variables under consideration. Tamil Nadu and Gujarat became the catching up states to rally behind Maharashtra. These states got better ranking in terms of capital in the recent decades. Kerala, Rajastan and Orissa came in the lowest positions. Kerala had been gradually slipping to the bottom level. Haryana improved its position in the 1990's by attracting more foreign capital. No proper ordering is found in the case of middle ranked states.

Level of industrialization shows a general interchangeability of ranks in terms of all variables. Hence an attempt is made to understand whether there exists any similarity in ranking of states in terms of these variables. Two variables are taken for one time comparison and they are plotted on graphs for visual comparison. If a particular state has the same ranking for two variables the plotted points are located on the 45^0 line. This we call synchronization rule. The nature of this rule is examined in the cases of VO, NE, NOE, NOF, PC with VA. Generally top and bottom ranked states satisfy the synchronization rule in the cases of VO, NE and NOF with VA. Middle ranking states do not show any particular pattern. The above facts can have the following implications:

a) There is no concurrence between the ranking in terms of VA and input use among the middle ranking states.

b) Employment in states are more than the value added in terms of ranking; and

c) The value addition relatively increases irrespective of the number of factories.

In addition, the middle ranking states are almost equally spread on the two sides of the 45^0 line in the case of GVA and VA. No coincidence is found between VA and productive capital except in Maharashtra. There is consistency between number of workers (NW) and number of employees (NE), while it is absent in the case of fixed capital and working capital. In short, ranking in terms of VA has no direct relation with the ranking of capital.

After considering the level of industrialisation and synchronization rule, we examine the dual characteristics of productivity and cost. Simple ratios were used initially for the major 14 states. Six cost ratios are considered between Fixed Cost (FC), working capital (WC) and productive capital (PC) to gross value of output (VO), FC, WC and PC to value added (VA). Another ratio is related to inputs (TI) and VO. Another two ratios stand for number of factories per employee (NF/NE) and average fixed cost per employee (FC/NE) or capital intensity. As year to year variations are marginal most often, graphical analysis is made for easy and better understanding. This is made for the 1970s and the 1980s. The reverse of these ratios are used to understand the general trend in productivity.

Cost ratios have the usual theoretical shapes. FC ratio considerably increased in the mid-1980s. Factories per employee showed a stagnant nature. Regarding the productivity ratios , they did not show any particular trend so as to distinguish between industrialized and less industrialized states. As compared to the values initially calculated on current prices, better conclusions were inferred from values at constant prices.

Based on the degree of industrialisation, six states are selected for detailed study. They are Kerala, Bihar, Gujarat, Maharashtra, Tamil Nadu and West Bengal. They account for about 60 percent of the value added in manufacturing in India. As the main objective of this study is to understand the regional variation in manufacturing productivity, growth in gross value added (GVA) and total factor productivity (TFP) have been estimated Average productivity of labour (APL) and average productivity of capital (APK) are also computed to gauge the contribution of primary factors to value added. Whether growth in average productivity took place along with growth in primary factors (Labour and Capital) or not is also examined. Capital intensity (K/L) is used to know the bias in the technique of production. Input intensity (IN/GVA) is calculated as an indirect indicator to efficiency in manufacturing. Deflationary effects on manufacturing growth are also examined.

One of the hypotheses of the study is that there has not been uniformity in the growth of GVA and productivity in regional (state) manufacturing in India. This issue is addressed in Chapter 4. The growth of GVA and TFP was not uniform in the whole period (1960-1998-99). This lack of uniformity persisted decade after decade. Generally speaking, there has not been any consonance between growth rate and the level of industrialisation. Maharashtra registered slow growth with top level of industrialisation, while Kerala experienced the paradox of high growth with low level of industrialisation especially during 1960-1979-80. Bengal also had similar experience of low level of industrialisation and relatively better growth of GVA and TFP in the 1990's. Gujarat and Tamil Nadu had higher growth in GVA and TFP so that they became the 'catching up' states in India. While Gujarat and Tamil Nadu stepped into the shoes of West Bengal, the latter slipped from the second position in 1960's to the seventh in the 1990's in value added. This was very much reflected in the negative growth or near stagnation of GVA and TFP in the manufacturing of West Bengal in the 1960's or 1980's. The decline of West Bengal in the level of industrialisation as noted above, was evident in the slow growth of GVA or negative growth of TFP in the 1960's itself. It later reflected in the slow growth of number of factories and capital in that state. The ranking in terms of growth in GVA did not strictly apply to the ranking in terms of TFP

However, the growth rates of GVA and TFP was also moving in the direction of ranking of states in the early 1990's. Gujarat had an 'accelerated growth' (Ahluwalia 2000) at that time. Maharashtra also did well. On account of the poor performance of the state economy, Bihar registered negative growth in GVA and TFP in the early 1990's.

The growth of manufacturing (both GVA and TFP) slightly declined in the leading states (Maharashtra, Gujarat and Tamil Nadu) in the late 1990's. Meanwhile, the scenario improved in the other three states. Thus, the leading states reaped the benefits of liberalization in the first phase. These gains later became less pronounced with the slackening of the Indian Economy.

7.1 Average productivity

Rather than in GVA and TFP, average productivity is more realistic to reflect the level of industrialization. Though labour productivity (APL) is generally used for international comparison, it is not frequently seen to be applied in the regional context of India. Labour productivity was higher in Bihar than in Gujarat and Tamil Nadu during the whole period. The two top industrialized states Maharashtra and Bengal were at the top in capital productivity during the first two decades (1960-80). A middle ranking state Bihar accounted for a low APK. Bengal lost its top position in capital productivity with decline in its level of industrialization. Capital productivity in Gujarat and Tamil Nadu improved with their ranking in industrialization. Such a trend was seen in the growth rates of GVA and TFP in these two states. This enabled Gujarat and Tamil Nadu to maintain the pace of catching up. It can be noted that Maharashtra was always at the top in APL and APK. APL and APK were always at the lower end in Kerala, a bottom ranking state. The spurt in average productivity seen in the early 1990's marginally declined in the leading industrial states (Maharashtra, Gujarat and Tamil Nadu) in the late 1990's due to fall in the growth of GVA.

7.2 Capital intensity (K/L)

Capital intensity is considered to know the bias in the technique of production. A clear pattern has evolved as far as K/L ratio is concerned. Capital intensity had three phases during the last four decades. Capital intensity was inversely related to the level of industrialization during the first phase (1960's). High ranking states had low capital intensity while bottom ranking states showed the opposite trend. It implies that employment increased faster than the increase in investment. The second phase (1980-85) was characterized by convergence in among states in K/L ratio. That is, the ratio increased and decreased in the high rank and low rank states respectively. In the third phase, (1985 onwards) capital intensity increased in all states a case noted earlier. The experience of industrialized and catching up status did not satisfy the theoretical argument that capital intensity increased the industrial growth. Catching up states had always a medium level of capital intensity.

7.3 Growth of Employment, Capital and Input

As a part of 'catching up' process, Gujarat and Tamil Nadu registered the highest growth rates in employment during 1960-1998-99. Tamil Nadu even surpassed Maharashtra in absolute employment of workers by 1998-99. Decade wise analysis also showed better growth of employment in the 'catching up' states. APL and GVA also improved in these states along with increase in employment. Meanwhile, Bengal displayed continuous decline in employment with fall in the growth of GVA and TFP and APL decade after decade. Bihar also became the ill-fated state in TFP and GVA in the last two decades. The moderate growth of Maharashtra was justifiable considering its top level of absolute employment and APL.

Liberalization appears to have had two kinds of impacts on employment in the states. The employment growth became negative except in Tamil Nadu in the 1980's when the first dose of liberalization occurred. However, employment improved in the early 1990's along with growth in manufacturing except in Bihar. There was 'spectacular growth' in employment in Gujarat in the late 1990's. The growth of the same declined in Kerala, Bihar and Tamil Nadu at the same period. Further employment has not grown evenly in all regions as a result of liberalization. Growths in GVA and employment were not in the order of ranking of all states in the 1990's. Apart from this, growth in employment contributed positively to the growth of GVA.

Though employment growth did not represent the level of industrialization, growth in capital reflected the same during 1960-1998-99. Maharashtra, Gujarat and Tamil Nadu occupied the first three positions in terms of growth of capital along with high level of capital productivity, especially in the last two decades. While Tamil Nadu excelled in the growth of employment, Gujarat improved its position in the growth of capital decade after decade and reached the top rank in the level of fixed capital in the 1990's. Thus, growth in employment and capital helped the 'catching up' process in Gujarat and Tamil Nadu respectively. There had been consistent growth of capital since 1980 to the 1990's. As noted in the discussion of the level of industrialization and the growths of GVA, TFP and employment, Bengal showed a dismal picture in the growth of capital in the 1970's and 1980's. This acted as one of the factors in Bengal for its deceleration in the level of industrialization. Maharashtra kept its top order in industrialization through higher growth in capital. Bihar and Kerala continued their lower ranking mainly due to the slow growth in capital. Growth of capital had a set back in the late 1990's mainly due to the slackened growth of the economy. Both capital and employment grew at an increasing rate (except in Bihar) in the early 1990's compared to the negative growth of employment (except in Tamil Nadu) in the 1980's.

The 'catching up' states Gujarat and Tamil Nadu once again came to the forefront in the case of input growth during the whole period. They had better rating in the growths of capital and employment. Maharashtra had only better rating in the growth of capital while Bengal, as a laggard state, was generally at low level in the growth of L, K and In. Thus 'catching up' process required growth in both primary factors and inputs. A reverse trend was seen in lagging states like Bengal and Bihar. The general trend has been experiencing fall in input growth since the second decade. The trend changed in the late 1990's.

7.4 Convergence and Divergence of Regional manufacturing

Another major objective of this study is to know the process of convergence divergence in regional manufacturing in India. It was argued above that intra-regional divergence (focal points and industrial complexes) is a basic feature of regional industrialization in India. In fact, there are two lines of argument relating to the regional convergence-divergence phenomenon in Indian Industry. According to one group, inter-state disparity in industry had been declining overtime. The disparity, as argued by the other group, came down among states belonging to a particular group, i.e., either industrialized or less industrialized states. Meanwhile, regional variation increased between the two groups. As a normal dictum, labour productivity, is taken for regional comparison. Labour productivity of six states is plotted against time.

We can group the six states into three groups. Tamil Nadu and Kerala happened to be at the middle level and the rest at a higher level except Bengal, which initially converged with Kerala and became isolated at lower level after the early 1980's. Maharashtra and Gujarat except Bihar ranked top in terms of the level of industrialization. The high growth in employment was a reason for lower labour productivity in Tamil Nadu than in Maharashtra and Gujarat. One can observe an odd case in this convergence process. Bihar, a low rank state, converged with Maharashtra and Gujarat, while a catching up state, Tamil Nadu, converged with Kerala. In order to understand this odd behavior, we plotted capital productivity against time. It is found that Bihar remained at the lower level if industrialization due to low capital productivity. Lagging Bengal also converged with Kerala and Bihar at the lower level.

Conditional convergence occurred from the 1970's onwards in terms of labour productivity. Though Bihar was closer to Maharashtra, it was Gujarat and Tamil Nadu that moved simultaneously to catch-up with Maharashtra which reflected in capital productivity also. Considering the sagging nature of Bengal and Bihar in the level of industrialization, it can be argued that low capital productivity had a depressive effect on industrialization. The same factor continued to keep Kerala at the lower edge of industrialization.

The case of Bengal shows that an industrialized region can slip in the level of industrialization and converge with a bottom ranking region like Kerala. Once, Bengal shared more than 20 percent of value added in manufacturing in India. This share dipped to 5 percent by the end of the 1990's. Though similar discussions took place in Belgium and England (4.4.1), the theory of unconditional or conditional convergence mainly considers the growth of the economies. In this sense, it is a missing point in the theoretical discussion of convergence hypothesis. This also points a paradoxical situation that convergence could also take place in the downward direction.

7.5 Growth and Deflationary Effects

The present study also aims at issues relating to deflationary methods and its implication on manufacturing growth. Certain important points need to be noted here.

Generally GVA and TFPG at DD were higher than them at SD for all states during 1960-1998-99. Decade wise analysis ratified the argument of B.P (1994) and Rao (1996) that TFP in India was lower in the 1980's than in the 1970's. However, this was not seen uniformly in all the states in all decades. There was not much difference between the growth rates of GVA and TFP at SD and DD in all states in the 1960's. It was the result of the same trend in the prices of output and input (BP-1994). However, it is a confusing fact that the divergence in growth at SD and DD narrowed in the 1980's even if the difference between the prices of output and input continued in the 1980's.

Two important arguments of Rao (1996) and Ahluwalia (1991) are not found valid in all states. It is argued by Rao that double deflation has a tendency to inflate the computed value during the period when the base period is selected. 1970-71 is taken as the base period. The bias of deflation is seen in the 1970's as the growth of GVADD was more than GVASD in all states except in Bihar. However, the expected lower growth of GVA and TFP at DD as argued by Rao, was not found for distant period from base period. This is evident from the higher value at DD for all states except in Bihar in the 1990's. Meanwhile, Ahluwalia tried to show by using single deflation that Indian manufacturing had a phase out from stagnation to growth in the 1980's. Lower growth of GVA and TFP in the 1980's was found in Gujarat compared to their growth in the previous decade even if single deflation was followed. Bihar and Bengal had such an experience in the growth of GVA. This finding is contrary to the hotly debated argument of Ahluwalia (1991) about 'turn around' of Indian manufacturing in the 1980's.

Change in the deflationary methods reflected in average productivity also. While comparing the TFP_{DD} index series of B-P (1994) and average productivity (APL and APK) in the late 1970s, one can conclude that the higher growth in TFP_{DD} in the 1970's than the same in the 1980's was mainly attributed to the achievement in the late 1970's. Increase in the input prices reflected in average productivity in the 1970's. For instance, APL_{DD} overtook APL_{SD} mainly after 1973. Further, APL became greater than APK_{SD} by the end of the 1970's. It was mainly due to the fall in the growth of employment.

7.6 Determinants of TFP in the regional context of India

It is argued in chapter 4 that TFP, as a residual factor can catch not only pure technical progress but also other factors like managerial capabilities and organizational competence, R and D, intersector transfer of resources, increasing returns to scale, embodied technical progress, diffusion of technology etc. The new growth theory highlights the importance of technology, capital intensity and human capital. It is also pointed out in chapter 5 that fuel intensity (fuel/number of employees) has an indirect impact in technology and thereby on the magnitude of TFP Though there are many influencing factors on TFP, capital intensity (K/L), skilled labour to number of employees (SK/L) and fuel intensity (FU/L) are taken as the determinants of TFP, considering the nature of ASI data.

Fuel intensity was the only variable which had a significant relationship with TFP under single and double deflation during 1960-1998-99 It is noted in chapter 4 that average productivity at DD became more than the same at SD after 1973, when the 'oil shock' was experienced. Further, fuel is a major component of inputs, whose prices are important to determine average productivity at DD. The catching up states Tamil Nadu and Gujarat showed significant relationship between TFP at SD and K/L, SK/L and FU/L during the same period. Tamil Nadu had a uniquely significant relationship between the three explanatory variables and TFP at SD and DD. The most striking case was that the relationship between capital intensity and TFP which was negative and was against the well established theoretical postulations. It is shown in chapter 4 that employment increased with growth in capital. This seemed to have contributed to the negative relationship between TFP and capital intensity. Though significant relation between skilled labour per employee and TFP was found in a few cases, it was not helpful to arrive at any meaningful conclusion. Non availability of more disaggregated data on the composition of employees seems to be the reason for this.

A look at the three sub periods (1960-79, 1980-1993-1994 and the 1990s) did not help us to draw any better conclusion. The logic of this break up was to examine the impact of liberalization. In short capital intensity, skilled labour per employee and fuel intensity were not sufficient to explain the nature of technical progress at the regional level in Indian manufacturing. The third sub-period registered certain symptoms of modern industrial growth. TFP positively responded to capital intensity in Gujarat. Maharashtra and Tamil Nadu experienced positive relation between fuel intensity and TFP

7.7 Regional Industrial Structure in India

As noted above, TFP was mainly influenced by energy consumption and other factors did not show any significant impact on TFPG. In order to get more details, we examined the dynamics of regional industrial structure. The focus is mainly on the sub-sectors of manufacturing in which a substantial share of value addition takes place.

The industrial structure in the states does not show any specific pattern so as to distinguish between industrialized and less industrialized states. Resource based industries flourished in both types of states. Food processing Industry in Kerala and textiles in Tamil Nadu justified the above argument. The geographical contiguity caused the emergence of Metal Based Industry in Bihar and West Bengal. It can be noted that Tamil Nadu and Wet Bengal are relatively industrialized states. The geographical proximity of Bengal and Bihar also reflected in the low share of capital in both Metal Products Industry and Machinery and Equipment Industry. It is noted above that low average productivity of capital depressed the level of industrialization in Bengal and Bihar.

While discussing average productivity of capital, it is shown that Gujarat, as a catching up state, converged with Maharashtra during the recent decades. The industrial structure shows that convergence mainly took place between Maharashtra and Gujarat in terms of high shares of chemical, petroleum and machinery and equipment industries. Tamil Nadu and West Bengal were closer to those states in the case of petroleum and machinery industries. Convergence occurred in another sense also. That is, FPI was not a major sector in any state except in Kerala. One major peculiarity of Maharashtra is the diversification in its industrial structure. This state has no overwhelming influence of any particular sub-sector as FPI in Kerala, chemical based industry in Gujarat, and basic metals and alloys industry in Bihar. Fall in the share of textiles and FPI indicates modernization, but the low profile of metal products and transport equipment industries is not a progress sign. It seems that the pride of position of West Bengal has been lost due to capital flight especially in the chemical based industry. Along with the flight of capital, capital productivity also fell in West Bengal (4.7). In fact, the convergence in the structure of manufacturing in India got stuck at half way to the matured level of industrialisation.

The process of convergence in the structure of the manufacturing sub-sectors is computed by using similarity indices in terms of value added. Maharashtra is taken as the reference point as this state is relatively matured in industrialization. As expected, the similarity between Maharashtra and West Bengal declined overtime. It is just noted above that certain sub-sectors like chemical industry declined in West Bengal. Tamil Nadu and Kerala had better convergence to Maharashtra than with Gujarat. Further, Gujarat had divergence with other two industrialized states (West Bengal and Tamil Nadu) over time. Though Kerala belonged to low level of industrialization, its structure was rather converged to that of industrialized states. Such a trend could not be found in the case of Bihar. This underscores the earlier argument that the productivity ratios at current prices and share composition of sub-sectors of manufacturing do not help us to draw a specific pattern for industrialized and less industrialized states. In other words, convergence in the structure alone did not guarantee higher level of industrialization in the regional context of India. At the same time the degree of industrialization corroborated with the growth of TFP, only when there was higher growth in GVA in the 1990's. Meanwhile we found that high productivity (at constant prices) of both labour and capital gave always a better picture about the level of industrialization. This required the consideration of the employment and capital elasticities of output.

It was seen, in the share analysis of sub-sector of manufacturing that value added in certain sectors responded better to capital than to employment. FPI, chemical and plastic and petroleum products industries responded more to capital. But value added did not change, as expected, in the case of metal products and transport equipment in West Bengal and Bihar. In order to verify this finding, the share of value added has been regressed on employment and FC for four time points (1965, 1980-81, 1991-92 and 1997-98). The hypothesis was found true for the two top industrialized states (Maharashtra and Gujarat) in the 1990's. The hypothesis lacked consistency in other states. Generally, the capital elasticity of value added was seen well in the 1990's pointing to the direction of the new economic policy.

Employment elasticity of output was more in Tamil Nadu and West Bengal. It was expected earlier as working capital was closer to FC in these two states. Tamil Nadu was high ranking in number of workers in 1998-99 and it was the only state, which registered positive growth in employment in the 1980's. The negative relation between value added and FC reminded us of the argument made earlier that the germ of industrial decline was already present in West Bengal. The capital elasticity of value added was highly volatile in West Bengal. This might have further caused the poor performance of manufacturing in that state, especially in metal products and transport equipment industries. The two elastic ties were inconsistent in the relatively less industrialized states, Bihar and Kerala.

7.8 Highlights of the conclusion

1. Intra-regional concentration of industries play a major role in the inter-regional variations in the level of industrialization in India. Intra-regional centers emerged out of focal points (growth poles) and industrial centers. Hence perrox's concept is valid in India.
2. The number of focal points and industrial centers are more in top industrialized states like Maharashtra, Gujarat, Tamil Nadu, Uttar Pradesh etc. This is true in the cases of both metal based and non-metal based industries.
3. Resource based industries are found dominating both in industrialized and less industrialized states.
4. The variables like value added, number of employees, fixed capital, number of factories etc. that determine the level of industrialization are most often at the top and bottom in absolute terms for the top (Maharashtra) and bottom (Orissa) rank states respectively (synchronization principle). Middle rank states do not keep a strict order in that case over time.
5. Level of investment (FC) is the major determinant of the level of industrialization. West Bengal sagged to the seventh position from second in industrial growth mainly due to the capital flight to other states. Meanwhile, Gujarat surged to the second position through large volume of investment in modern sectors like petroleum industry. If Gujarat

continues the present trend in the growth of capital, this state may reach at the top of industrialization in India within a couple of decades.

6. Tamil Nadu had a significant growth in employment as well as capital. It helped Tamil Nadu in the catching up process.

7 Like the growth of capital, high capital productivity co-existed with top level of industrialization. For instance, Maharashtra and West Bengal was top in capital productivity in the first two decades of analysis, when these two states ranked at the top. Later capital productivity of the two catching up states (Tamil Nadu and Gujarat) increased and that of West Bengal declined.

8. Regional industrial structure analysis revealed that value added was more responded to capital than to employment in the modern sectors of the top industrialized states (Maharashtra and Gujarat).

9. Curves based on cost ratios showed theoretical shapes, i.e. U shape for working capital and somewhat straight line trend for fixed capital.

10. Cost ratios, productivity ratios and structural shares at current prices do not show specific difference between industrialized and less industrialized states.

11. Growth rates in gross value added and total factor productivity did not corroborate with the degree of industrialization except in the 1990's. While Kerala had higher growth in the first two decades (1960's and 1970's), it was one of the lowest rank states in industrialization. On other hand, Maharashtra registered lower growth with top position in industrialization at the same time. West Bengal even registered negative growth and stagnation in the 1960's and 1980's respectively. This paradox reversed in the previous decade.

12. Capital intensity was lower for high rank states showing simultaneous growth of capital and employment.

13. Capital intensity started to rise in the mid-1980's when the first dose of liberalization started in India. This continued in the 1990's also.

14. In general, TFP had positive relation with fuel intensity, while TFP had negative relation with capital intensity and skilled labour to number of employees. However, ASI is insufficient to capture the determinants of TFP in the regional context. Gujarat registered positive relation between capital intensity and TFP in the 1990s.

15. Convergence in terms of labour productivity did not show the degree of industrialization. Gujarat and Tamil Nadu displayed the catching up process while both the states converged with Maharashtra in terms of capital productivity. West Bengal initially converged with Kerala at a low level and further went down as an odd state in terms of capital productivity.

16. The regional convergence in the structure of manufacturing in India showed only halfway to the matured stage of industrialization. That is, the convergence between Maharashtra and West Bengal declined over time. At the same time, low industrialized Kerala and the catching up Tamil Nadu and Gujarat converged to Maharashtra.

17 Industrial structure of Maharashtra is noted for its diversification.

18. Input intensity declined over time except in the late 1990's.

19 Though TFPDD in India was lower in the 1980s than the 1970s, it was not seen uniformly in all the states in all decades. Different methods of deflation need not change the broad conclusion while a region experiences either very low growth or very high growth

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