

**AGRICULTURE : NON-AGRICULTURE  
LINKAGE IN INDIAN ECONOMY—A  
Test of The Resilience Hypothesis.**

Dissertation submitted to Jawaharlal Nehru University  
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**MASTER OF PHILOSOPHY**

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DECLARATION

This is to certify that the dissertation entitled  
"Agriculture : Non-agriculture Linkage in Indian Economy - A  
Test of the Resilience Hypothesis" submitted by DILLIP KUMAR RAY  
in partial fulfilment of the requirements for the award of the  
Degree of MASTER OF PHILOSOPHY (M.Phil) of this University is  
a bonafide work of his own to the best of our knowledge and has  
not been previously submitted for the award of any degree of  
this or any other University.

We, therefore recommend that this dissertation may be placed  
before the examiners for evaluation.

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CHAPTER - 1

INTRODUCTION

#### 1.1 THE ROLE OF AGRICULTURE IN ECONOMIC DEVELOPMENT:

As economic development goes apace, the share of agriculture in national income goes down. In an absolute sense, agriculture continues to be of extreme importance for a fairly long period during the process of economic development. "The rapidly growing literature on the history, theory, and policy of economic development has perforce recognised the dominant place of agriculture in the under-developed countries."<sup>1</sup> It is true that the contribution of agriculture both to the income and employment of developed countries is very low. But it is well-known that during the initial phase of their development, agriculture contributed a lot. "The role of agriculture in economic development depends heavily upon the stage of economic history in which a particular nation finds itself and, especially at the time that economic progress first becomes a major social aspiration, upon the ratio of agricultural land to population."<sup>2</sup> That is why we find a good number of developing economies striving to modernise their agriculture over the past many years.

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1. William H. Nicholls, "The Place of Agriculture in Economic Development", in Carl Eicher & Lawrence Witt (ed.), "Agriculture in Economic Development", Vora & Co., Bombay, 1970, p.11.

2. Ibid.

In a closed economy, development/the agricultural sector/of is a very important prerequisite for industrial expansion. In this connection, Johnston and Mellor have the following to say,

Agriculture's contribution to requirements for development capital is especially significant in the earlier stages of the process of growth; it will not be so crucial in countries which have the possibility of securing a sizable fraction of their capital requirements by export of mineral products or in the form of foreign loans or grants.

The importance of agricultural development as an engine of growth can not be minimised even in an open economy. In such an economy even if it is advantageous on the part of the country to go in for food imports, "Agriculture contributes to development by saving scarce foreign exchange needed for financing of industrial capital and integrating dualistic agricultural economy. It can help the Balance of Payment position by contributing to exports also".<sup>4</sup> Enumerating the diverse ways in which agriculture contributes to the development of the national economy, Johnston and Mellor say

The most important ways in which increased agricultural output and productivity contribute to over-all economic growth can be summarised in five propositions: (i) Economic development is characterised by a substantial increase in

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3. Bruce F. Johnston and John W. Mellor, "The Role of Agriculture in Economic Development", American Economic Review, Sept. 1961, p.590.

4. William H. Nicholls, 1970, Op.Cit. pp.12-13.

the demand for agricultural products, and failure to expand food supplies in pace with the growth of demand can seriously impede economic growth, (ii) Expansion of exports of agricultural products may be one of the most promising means of increasing income and foreign exchange earnings, particularly at the earlier stages of development, (iii) The labour force ~~for~~ manufacturing and other expanding sectors of the economy must be drawn mainly from agriculture, (iv) Agriculture, as the dominant sector of the under-developed economy, can and should make a net contribution to the capital required for overhead investment and expansion of secondary industry. (v) Rising net cash incomes of the farm population may be important as a stimulus to industrial expansion.<sup>5</sup>

Kuznets summarises the contribution of agriculture in the process of economic development as, (a) product contribution, (b) market contribution (c) factor contribution. He enumerates how agricultural development is key to three linked aspects of (i) aggregative (increase in total and per capita real output), (ii) structural (in terms of shifts in relative importance of various sectors) and (iii) inter-relations of a nation's growth with that of others through international trade. Following Kuznets we list below the various contributions that agriculture can make towards economic development, which will be discussed in some detail.

- (1) Product contribution - (a) supply of food
- (b) Raw material for agro-based and other industries

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5. Bruce F. Johnston and John W. Mellor, 1961, Op.Cit., pp.571-72.

- (2) Factor contribution - (a) Transfer of labour
  - (b) Capital transfer for non-agricultural sector.
- (3) Market Contribution - (a) Market for producers' goods industry.
  - (b) Market for consumer goods industry.
- (4) Foreign exchange contribution.

Product contribution: Agriculture has a responsibility to provide foodgrains to the workforce engaged in non-agricultural activity and people living in urban areas. So, agricultural sector should have some marketable surplus over and above its own requirement. If it fails to provide the same, it can hamper both the development of agriculture and industry. The annual rate of increase in demand for food can be neatly computed from the following well-known equation.

$$D = p + ng \text{ where,}$$

p = rate of growth of population

g = rate of growth of real per capita income

n = income elasticity of demand for agricultural products.

Among the developing countries, death rate has started declining perceptibly due to improved health measures, but child is still considered to be an asset. Again, the cost of raising a child is not very high; so birth rate and rate of growth of population are high. Moreover, the income elasticity of demand for agricultural products is very high too in these

countries, for they are obliged to spend very high proportion of their income on foodgrains. Naturally, given the low level of per capita income, the demand for food will be very high in the developing countries. According to Johnston and Mellox, "With current rates of population growth and a modest rise in per capita incomes, the annual rate of increase of demand for food in a developing economy can easily exceed 3 percent, a formidable challenge for the agriculture of an under-developed country".<sup>6</sup> Keeping in mind the low price elasticity of food items, if supply of foodgrains can not keep pace with demand for food, it is natural that prices of agricultural commodities will rise, particularly in the urban areas, where a fairly vulnerable section of population lives. This will lead to reduction in the real wage of workers engaged in industrial and tertiary sectors. So, agriculture's growth is essential for that of other sectors. Agriculture's growth can contribute to the growth of other sectors also by providing raw materials to agro-based industries. Again, agriculture contributes to the national growth in a simple way as, "An increase in the net output of agriculture represents a rise in the product of the country, since the latter is the sum of the increases in the net products of several sectors".<sup>7</sup>

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6. Ibid, p.573.

7. Simon Kuznets, Economic Growth and Structure, Selected Essays OUP & IBH, New Delhi, 1969, p.239.

Factor contribution : If some resources, ie. labour, capital etc. are transferred from agriculture to other sectors we say agriculture is making a factor contribution. Lewis's two-sector model deals with transfer of labour from agriculture to other sectors. In his model, agriculture is considered to be a labour-surplus sector where the marginal productivity of labour is either zero or even negative. The labour force in this sector is maintained at the subsistence level. It is also often argued that the rate of growth of population living on agriculture is more than that in other sectors, for birth rate in the former is more and death-rate not being much different. For sustaining the process of development, the non-agricultural activities need working hands which the agriculture can provide without hampering its own production, till the marginal productivity of the labourers engaged in agriculture becomes positive. Of course, this will be valid in the absence of large-scale international migration. But even in that case, perhaps agriculture of one country can contribute to non-agricultural expansion of another.

Agriculture can be and in most cases happens to be the most important source of capital formation. In the volatile international relations that exist today, agriculture is the potential source of tapping resources for development of other sectors. The transfer of capital from agriculture to non-

agriculture can take place by voluntary saving, lending or by taxation, deliberate tilting of terms of trade against agriculture.

Market Contribution: In a big country such as ours, the non-agricultural sector cannot sustain itself if it is completely insulated from agriculture. There must be someone to buy the products of non-agricultural sector. Kuznets defined market contribution as, "A given sector makes a contribution to an economy when it provides opportunities for other sectors to emerge, or for the economy as a whole to participate in international economic flows. We designate this contribution the market type because the given sector provides such opportunities by offering parts of its product on domestic or foreign markets in exchange for goods produced by other sectors".<sup>8</sup>

The agricultural sector provides a market by using industrial products such as tractor, harvester, fertilizer, pesticide etc. Apart from these, people dependent on agriculture also buy consumer goods such as sugar, textile products, bicycles etc. produced by the non-agricultural sector. The process of development will not be self-sustaining unless there is enough demand for industrial products. Market is as important as capital. It also facilitates international flow and provides market for non-agricultural sector abroad. With increasing 'mechanisation' of agriculture, its contribution of market to manufacturing sector becomes more important. Another important sector which

8. Simon Kuznets, 1969, Op.Cit., p.244.



is benefited by the market contribution of agriculture is transport.

Foreign Exchange Contribution: Foreign exchange has a special role to play in the development of an economy. The country must import capital equipment and other goods to modernize its industry and agriculture. In the absence of a developed industrial sector, agriculture is the only way out either for export promotion or import substitution. In the early phase of economic development, it is natural that primary (agricultural) products will constitute a major chunk of the export basket. Today, when the technologies are fast becoming outdated and developed countries are more and more protecting their boundaries, agriculture has a greater role to play in maintaining foreign exchange reserves and modernising the industrial sector of the third world. Since the Balance of Payment is generally the binding constraint to further growth, the rate of growth of agriculture as a provider of foreign exchange through import-substitution is a crucial one. Profitable export crops should be added to the existing cropping pattern. We must however, hasten to add that dependence on agriculture as a foreign exchange earner or dependence on a few crops for export earnings may be vulnerable, especially because of excessively uncertain price regime for such exports which have, in any case, a low income elasticity. So, as a long term strategy of development especially for a big country, there should be greater flexibility ✓

and diversification in the export basket.

Many countries grasped well the crucial importance of agriculture in their strategy of development and accordingly gave due prominence to agriculture at the outset. This is strikingly true for industrially developed countries like USA, Canada and those of Western Europe, socialist countries, under-populated land-abundant new countries like Argentina, Australia and over-populated Asian countries. The contributions from agriculture has been absorbed on voluntary basis (U.K.) and also forced basis (USSR, Japan). There has been greater inter-action between agriculture and other sectors with the advent of Industrial Revolution. In our own five-year plans we have been cautious of the crucial role that agriculture would have to play in the course of development. Perhaps, the present level of development of Indian agriculture owes itself to a whole host of government policies, including infrastructural development, institutional support and agrarian changes. The hallmark of success on agricultural front is the claim, widely accepted by people both inside and outside, that India is now nearly self-sufficient in food.

History of economic thought is full of wide-ranging literature on which sector is/ought to be the leading sector of the economy. It has become increasingly evident in the last few years that the conception of both economists and policy-makers regarding the role of agriculture in economic

development has undergone important evolution. "Whereas in the past, agriculture was often viewed as the passive partner in development process, it is now typically regarded as an active and co-equal partner with industrial sector".<sup>9</sup>

The above said evolution starts with earmarking of a bulk of investment in the more productive, modern sector, i.e industry and industrial infrastructure in tune with one-sector models of Harod-Domar type. Gradually, economists recognized the role of agriculture as a potential source of 'unlimited labour' and agricultural surplus for the rest of the economy in their two-sector models. Even if it is granted that industry is the leading sector, importance of agriculture remains fairly high in as much as, inter-alia, this sector continues to provide food-stuffs and raw materials to industrial sector. In his 'Principles of Political Economy and Taxation', Ricardo viewed the problem of diminishing returns in agriculture as crucial. He believed that a limitation on the growth of agricultural output set the upper limit to the growth of the non-agricultural sector and to capital formation for economic expansion<sup>10</sup> Kuznets<sup>11</sup> enumerated (i) a minimum level of efficiency in some major sectors of the economy, other than industry; (ii) a supply of labour and capital suitable for modern industry, (iii) adequate

9. Erick Thorbecke (ed.): The Role of Agriculture in Economic Development, National Bureau of Economic Research, New York, p.3.

10. G.M.Meir (Ed.): Leading Issues in Economic Development, Oxford Univ. Press, New York, 1984, p.427

11. Simon Kuznets Op. cit 1969, p.197.

demand for the products of industry, (iv) a supply of entrepreneurial talent capable of decisions on labour and capital; as the economic requirements of industrialization. Policy prescriptions like deliberately turning terms of trade in favour of industry were given to attract resources away from agriculture. Then this simplistic two-sector model became more sophisticated and just release and absorption of resources by agriculture and industry respectively was not considered a sufficient condition for general economic development. Rather, it was felt that growth could result only if these conditions occurred simultaneously and that this release - cum- absorption of labour and capital resources was in fact, key to development. Recognition of this active inter-dependence was a large step forward from the native industrialisation - first prescription, because the above conceptual framework no longer identified either sector as leading or lagging".<sup>12</sup> Johnston & Mellor go a step forward and say, "The nature of agriculture's role is of course, highly relevant to determining the appropriate 'balance' between agriculture and other sections with respect to (i) direct government investment or aids to investment, (ii) budget allocations for publicly supported research and education-extension programmes (iii) the burden of taxation levied on different sectors".<sup>13</sup>

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12. Erick Thorbecke (ed), Op.Cit., p.4.

13. Bruce F. Johnston and John W. Mellor, Op.Cit., 1961, p.566.

Considering the overwhelming importance of one sector in the development of the other, 'the problem of establishing priorities to any sector is very difficult', Nevertheless, considering the extremely limited resource base of the developing economies, one cannot plead for a balanced distribution of resources among the sectors, for it will be much below that critical minimum, below which it will be difficult to raise the productivity and income in any sector if indeed the resources are thinly spread. So, in the short run at least, there should be some leading sector. In this controversy economists are clearly divided. One school of thought represented by Kahn, Viner, Coale and Hoover gives prominence to agriculture. According to them, increase in food supply is an extremely important development pre-requisite. There is a great need for additional food supply because of high demand and naturally, highest marginal productivity of capital lies in agriculture. Again, a sector's contribution to overall growth depends not only on its growth rate but also on its relative size. Even a fast growing sector may not contribute much to overall growth if it is much too small in an absolute sense, while even a slow growing sector may make a bigger contribution if it is large in terms of its share income, and so on. Though another group represented by Hirschman, Leibenstein and Higgins gives prominence to industry and plead for a 'big push' to the industrialisation effort, Nicholls terms their position as vulnerable. He opines,

By seriously understanding the time, effort and resources required to bring about drastic structural change in under-developed countries, they overlook the short-run potentialities of raising agricultural output with given supplies of land and labour and existing small-scale farming units. By doing so, their conclusions almost amount to saying that the way for an under-developed country to become developed is to become developed.<sup>14</sup>

The above discussion leads us to believe that agriculture versus industry has been a hot point of debate. In essence, however, the question is not whether agriculture or industry should be given prominence. Agriculture has its own role in earlier stages of development and it must continue to play its role well. The dependence on agriculture must, however, decline beyond a point and industry must become the engine of growth as the process of development gains momentum. What is more important is the need for the inter-relationship between agriculture and other sectors to change as economic development takes place. In other words, beyond a certain stage of economic development, the changing fortunes of agriculture should no more remain the sole cause for total economic fluctuations; agricultural ups and downs should play a steadily declining role in the growth profile of other sectors. An analysis to look into the relationship between agriculture and non-agricultural activities is conducted in this study.

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14. William H. Nicholls, Op.Cit., 1970, p.16.

1.2 ECONOMIC GROWTH AND STRUCTURAL CHANGE :

With economic development, fundamental changes take place in the structure of the economy. According to Chenry, "Relatively stable relations in economic and social system are commonly described as its structure. Without a formal model of underlying relations, any observed change in composition of demand or other economic aggregate can be defined as structural change".<sup>15</sup> Broadly speaking an economy can be divided into three sectors - primary comprising agriculture, animal husbandry, forestry, fishery etc.; secondary consisting of manufacturing industries both small and large, construction activities and electricity generation etc.; and tertiary having transport, communications, banking and finance and other services in its fold. Economic growth not only helps making sectoral shifts in both income and occupational structures, but individual sectors undergo change with it. With economic growth we find a shift away from agriculture to non-agricultural sectors, and from industry to tertiary. Economic growth not only transforms income and occupational structure but improve the scale of total production also. Referring to structural transformation, Kuznets writes, "The distinctive feature of modern economic growth is not the shifts in the long-term proportions of industries in product and resources - proportions

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15. Hollis Chenry, Structural and development policy , OUP, N.Y., 1979, p.109.

referred to as industrial structure - but rather the rapidity of these shifts and their striking magnitude when cumulated over the decades".<sup>16</sup>

The study of structural transformation started with Lewis's concept of development as a transition from traditional to modern forms of production and economic behaviour. Over the period of transition, the supply of unskilled labour is elastic; profits, savings and investment are rising; industry grows more rapidly than agriculture; and the pattern of international trade is gradually transformed as the comparative advantage of a country changes.<sup>17</sup> Kuznets advanced the work of Lewis by measuring the transition by accumulation of structure of demand, production, trade, and employment as the level of income rises. Kuznets studied these phenomena in historical experience of the advanced countries in time-series and cross-country analysis. He took 13 developed countries (of the Western world and Japan) and studied the pattern of change in sectoral incomes over a fairly long period of time.<sup>18</sup> Associated with tremendous and consistent rise in percapita income and total product, growth of productivity, following structural changes were observed in these economies.

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16. Simon Kuznets, Modern Economic Growth , Oxford & IBH, New Delhi, 1972, p.96.

17. Hollis Chenry, Op.Cit., p.5.

18. Simon Kuznets, Economic Growth of Nations : Total output and production structure Harvard University Press, Massachusetts 1971, pp.303-14.



1. A marked decline in the share of primary sector, from over 40 percent in initial decades to less than 10 percent in recent years was observed. The share of agricultural sector in total product declined in twelve of the thirteen countries studied. The share declined at least by about 20 percentage points, often over 30. The only significant and interesting exception is Australia; the share practically remained constant for some eight decades. Apparently, the highly developed, capital-intensive agriculture of Australia was able to maintain its share because of the network of close relations with more industrialised mother countries.<sup>19</sup>

2. In twelve countries the share of the secondary sector in countrywide product rose. In the early phases of development, this share ranged from 20 to 30 percent of the total national product. A marked rise in this share was observed from 22 and 25 percent in initial decades to 40 and 50 percent in recent years. Australia again is an exception.

3. The movement in the share of services sector is neither marked nor consistent among countries or along the time period. In Sweden and Australia the share fell, in Canada and Japan it rose. Then, in most countries, the rise was too small to be significant. It was consistent neither. However, more

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19. Simon Kuznets, 'Modern Economic Growth', Op.Cit, p.96.

recently, in the developed economies a shift away from secondary towards service sector, which was not observable at the time of Kuznet's study, is observed.

4. Another important point to note is that the share of secondary sector is largely contributed by manufacturing. Of the other subdivisions it is the share of transportation and public utilities that rose most rapidly. Among the service sector subdivisions, government services tended to rise in most countries. Long term changes in the shares of the other subdivisions of the service sector were minor and showed much diversity among countries.

5. The share of the primary sector declined even when per capita product did not rise (and, indeed such cases can be found among the less developed countries also); some institutional and technological factors moved the time-trend downward over time for the share of the primary sector and upward over the same time period for the share of (secondary + service) sector.<sup>20</sup>

6. The share of the labour force employed in primary sector declined sharply in the course of growth of developed countries, from initial levels ranging between 50 and 60 percent to levels as low as 10 to 20 percent in the early 1960s. Johnston and Mellor observed in this context,

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20. Simon Kuznets, Economic Growth of Nation, Op.Cit., p.310.

Reduction of the farm labour force is a necessary condition for establishing factor proportions that yield returns to labour in agriculture that are more or less in accord with returns to labour in other sectors. More concretely, insignificant movement out of agriculture will perpetuate, or lead to, excessively small farms and serious underemployment of labour as the proximate causes of substandard farm incomes.<sup>21</sup>

Kuznets observed that the share of the secondary sector rose from initial levels that ranged between 20 and 40 percent to levels that were well above 40 in most countries - but unlike the changes in the shares in product, the rise of the secondary sector share <sup>in employment</sup> was not dominant relative to the decline in the share of the primary sector. The rise in the share of the secondary sector in the labour force was either smaller or about the same as that of service sector. While the product was 'industrialised', the labour force was partly 'industrialised' and partly 'servicised'.<sup>22</sup>

Despite the diversities among the nations, rural welfare as well as overall economic growth demand a transformation of a country's economic structure, involving relative decline of agricultural sector and a net flow of capital and other resources from agriculture to industrial sector of the economy.<sup>23</sup> However, the nature of this flow may not be the same in the

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21. Bruce F. Johnston & John W. Mellor, Op.Cit., p.590.

22. Simon Kuznets Economic Growth of Nations, Op.Cit., p.311.

23. Bruce F. Johnston & John F. Mellor, Op.Cit., p.590.

case of developing countries as that of developed ones. For the developing countries of today, historical experience, social objectives, choice of policies, natural resource endowments, country size, disparity in access to external capital etc. vary sharply. The divergence from the structural transformation pattern of the developed countries can be observed from the fact that, though the share of agriculture in the total product has declined, there has not been a perceptible decline in the percentage of labour force engaged in agriculture. Secondly, in recent years, the manufacturing sector's share is found to follow a declining trend in the developing countries and such a decline is accompanied by the rising share of service sector.<sup>24</sup> The large services sector is also wide-spread in developing countries. The rapid rate of growth of the tertiary sector in the developed world may be considered to be natural, because of the reason that after a certain level of secondary sector's growth, the demand for a diverse variety of services grows faster and that, in fact reduces the share of manufacturing sector, but in case of developing countries the dominance of tertiary sector by-passing secondary one should be studied more minutely. According to Panchmukhi, et.al.,<sup>25</sup> the structure of developing countries differ from developed ones in

(i) increasing role of the government in implementing the objectives

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24. V.K.R.V. Rao's inaugural address to the VIIIth world congress of IEA, New Delhi.

25. V.R. Panchmukhi, Nambiar, Mehta "Structural change and Economic Growth in developing countries", VIIIth World Congress of IEA, Theme - 4.

of the growth, employment generation, poverty alleviation etc., (ii) historical role of urban middle-class in the wholesale trade and distribution, (iii) operation of demonstration effect, (iv) comparative advantage in tourism, (v) urbanisation intensifying the need for various services. So it is natural that in developing countries shifts away from agriculture go towards tertiary sector not fully via secondary sector.

The foregoing discussion gives a picture of the structural transformation in the process of growth. While considering the sectoral change of an economy the following things must be kept in mind.

1. There may be monetary growth of sectoral income but not in the real income. This difference between in the nominal and real incomes may be due to high rate of inflation.
2. Fluctuation in the sectoral incomes may be due to a number of forces, operating independently or inter-connectedly. Examples are, erratic rainfall and the consequent response of an underdeveloped agriculture to it, built-in factor of Dearness Allowance in employee compensation and its impact in services sector, increasing role of deficit financing in planned economic development in general and industrial development in particular.
3. We should bear in mind the comparative growth rates of the sectors. "The difference in sectoral growth rates is a normal picture of economic development".<sup>26</sup>

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26. V.K.R.V. Rao, Growth and structural change in Indian Economy in V.R. Panchamukhi & P.R. Brahmananda (ed) 'Development Process in India', Himalayan, Bombay, 1987.

4. As we all know, demographic changes can be a function of economic growth. At certain stage of economic development, population explosion can take place and at some other point a modest growth, which can influence the supply of workforce to different sectors. We should also note this constraint while analysing the occupational change.

### 1.3 INTER-SECTORAL LINKAGES:

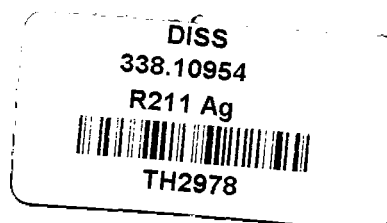


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In the first section of this chapter we discussed the contribution of agriculture to economic development of a country. However, the process of development is not that simple. As Kuznets opines, "We must first recognize an element of ambiguity. Since any sector is part of an inter-dependent system represented by the country's economy, what a sector does is not fully attributable or credited to it but is contingent upon what happens in other sectors (and perhaps also outside the country)".<sup>27</sup> The inter-relationship between growth in manufacturing and that in other sectors of the economy is critical for industrialisation as well as for overall development. Sometimes agricultural economists assume absence of foreign trade and final demand linkages and input-output relations ensure perfect complementarity in production between agriculture and industry. International trade theorists, on the other hand caution that when trade

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27. Simon Kuznets, Economic growth and structure, Op.Cit., p.239.



intervences, demand interrelationships need not imply supply complementarities.<sup>28</sup> Throughout the process of development, certain important changes affecting the sectors' relative importance and interdependence take place. But they explain two extremes of very large and very small economies.

Inter-sectoral articulation, especially that between agriculture and industry has become a popular subject of public debate in recent years. Strong agriculture - industry linkages are known to have played a prominent role in the development of many present day economies like USSR, Japan, UK and Italy which transferred labour and capital from agriculture to industry with a fair degree of success.<sup>29</sup> So, we must see to the complicated process through which development of one sector gets transmitted to other sectors. Sometimes this very linkage between sectors stands as a hinderance for the growth of a sector. Again the degree and extent of linkages among various sectors vary from sector to sector. Industry produces both for home and foreign market, services sector in most of the countries produces more substantially for home market. It may be roughly derived from this that the relationship of the services sector with agriculture would be more than <sup>that of agriculture</sup> with the industrial sector.

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28. Edmar L. Bacha, "Industrialisation & Agricultural development" in G.M. Meir (ed) Leading Issues in Economic Development, Op.Cit., p.406.

29. G.S. Monga & L. Singh: "India and global trends: /Tarlok Sectoral articulation", VIIIth World Congress of IEA, Theme-18

Another point we have to bear in mind while looking at the inter-sectoral linkages is that it would not be sufficient to study the market mechanism either for ingredients of inputs or outputs. Government intervention plays a dominant role in many countries especially those of the third world, where market behaviour is <sup>not</sup> the true reflection of supply and demand forces. The third point is the natural environment of the country. If natural behaviour (like rainfall) becomes unpredictable and erratic, then that will go much beyond affecting agricultural sector also; it will influence the inter-sectoral relationships.

Before going to specific channels through which agriculture influences other sectors or gets influenced by them let us have an idea about the major ways in which sectors are naturally related. Thorbecke<sup>30</sup> enumerated them as, (a) Technically or technologically, (b) by income and (c) by price. Bacha<sup>31</sup> termed them as by, (i) labour market (ii) product market and (iii) marketed surplus. The relationship is not one-way. The technical relations determine the sectoral production functions through input-output framework. A pre-requisite as well as consequence of economic development is a change in technical (input-output) coefficients. It is also true of inputs from industry to agriculture. The slow growth of income in any sector

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30. Erick Thorbecke, Op.Cit., pp.171-72.

31. Edmar L. Bacha, Op.Cit., p.407.



constraints the growth of other. Again, by changing external and internal terms of trade, the growth of sectoral inputs can be influenced. By moving the terms of trade in favour of agriculture, the adoption of new inputs such as fertilizer, pesticide etc can be encouraged. After agricultural output and productivity have risen, terms of trade can be tilted in favour of industry to siphon off capital and labour resources to it. Discussing the agriculture-industry in terms of political economy, Krishna Bharadwaj<sup>32</sup> said, "Agrarian conditions were important as they affected supply (the availability as well as the terms on which supplied) of one of the main constituents of 'wage goods'. That apart, they also influenced the supply of 'wage labour' to industry and were important in the formation of home market, wherein agriculture was related symbiotically with industry". The existence of backward linkage between agriculture and industry via the home market in the transitional economies (where material production is still dominated by agriculture but there is already substantial manufacturing sector and the relative weight is steadily moving towards the latter) has been generally recognized ever since it was originally pointed out by Adam Smith towards the end of eighteenth century, while the modern industrial system was still just emerging in Western Europe.<sup>33</sup>

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32. Krishna Bhardwaj, "Analytics of Agriculture-Industry Relation" EPW, Annual No. 1987, p. AN. 19.

33. Sudipto Mundle, "The Agrarian Barrier to Industrial Growth" in Aswini Seith (ed), The Agrarian Question in Socialist Transition, Frank Cass, London, 1985, p.49.

Now let us come to more concrete framework of inter-sectoral linkages. While the analysis of the linkages between agriculture and the rest of the economy can be dated back to Quesnay in 18th century France, the effort to specify them empirically and quantitatively is much more recent. Hirschman<sup>34</sup> defined two types of linkages in the context of industrialisation. These are (i) the input-provision, derived demand, or backward linkage effects, (ii) the output-utilisation are forward linkage effects. Using these Harriss<sup>35</sup> referred to growth linkages as "downstream effects" and disaggregated these into three types:

1. Backward linkages or resultants of demand from the agricultural sector for inter-mediate or capital goods. If we add the amount of inputs used to produce one unit of output in the given sector, which are given in the column of the input-output matrix, we get the backward linkage.

2. Forward linkages, or resultants of supply of agricultural products to agroprocessing industries. The outputs of a given sector to others are given in the rows, the addition of which will give the forward linkage.

3. Consumption linkages, emanating from expenditure of income from marketed surplus provide a market. The people engaged in agriculture<sup>provide a market</sup> for the non-agriculture, by consuming the non-agricultural consumer goods. The consumption linkages are also called expenditure linkages. An important aspect of growth

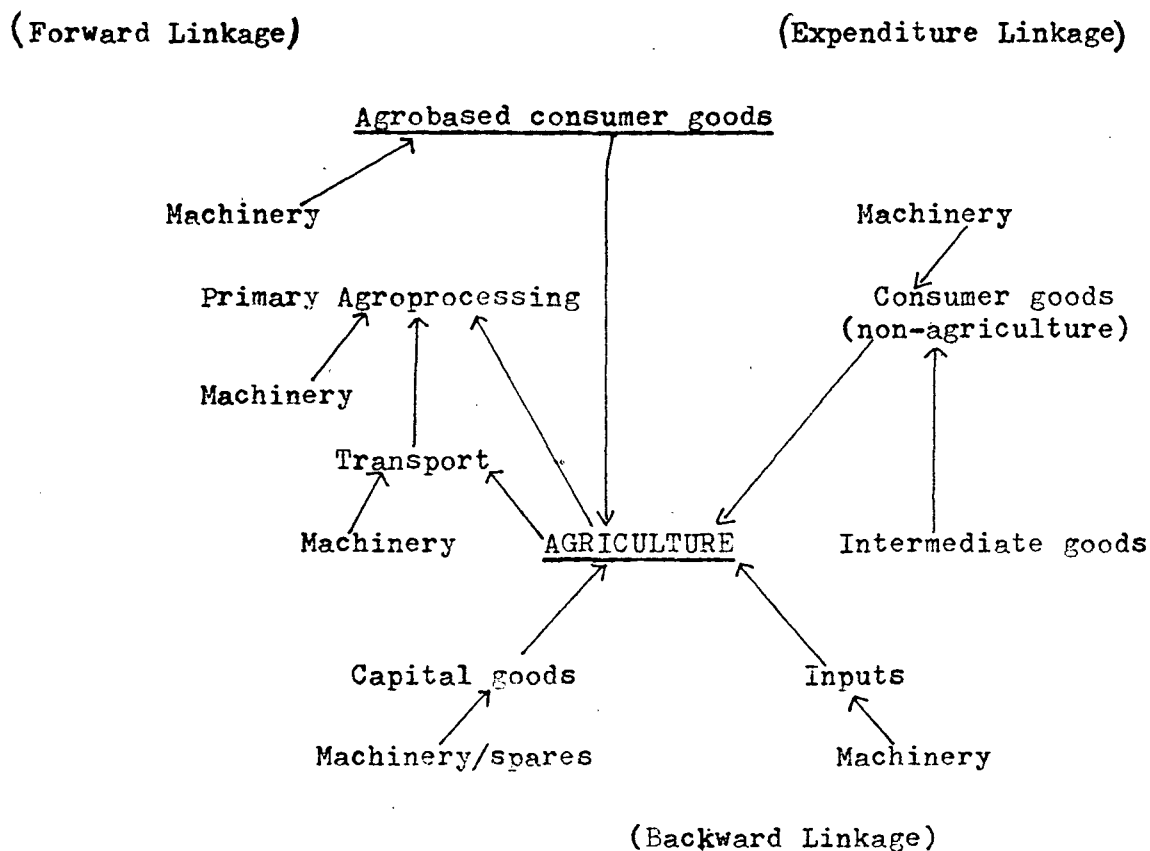
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34. Albert O. Hirschman, 'The Strategy of Economic Development' in G.M. Mair (ed), Op.Cit., p.308.

35. Barbara Harriss, 'Regional Growth Linkages from Agriculture' The journal of Development Studies, Jan. '87, pp.275-94.

linkages to the non-farm economy is that they are pre-dominantly due to increase in the household consumption expenditures.<sup>36</sup>

Hariss<sup>37</sup> tried to show different linkages between agriculture and industries by the following diagram :



36. Peter B.R. Hazell and Alsa Roell, Rural growth linkages, Household expenditure patterns in Malaysia & Nigeria IFPRI, Sept. 1983, p.12.

37. Barbara Hariss, "Regional Growth Linkages from Agriculture and Resource Flows in Non-Farm Economy," EPW, Jan.3-10, 1987, p.33.

Sudipto Mandle<sup>38</sup> sees the influence of surplus on the rest of the economy through (a) trade surplus (difference between agricultural material goods delivered to industrial sector and industrial goods flowing in the opposite direction) (b) saving surplus (flow of funds out of agriculture in the form of private savings transfer (net) or the excess of government revenues collected from agriculture over and above public expenditure made for the sector) (c) terms of trade movements. Sundaram<sup>39</sup> traces the influence of agriculture on the rest of the economy through monetary and financial management. On the ground of fiscal discipline and curbing inflation, the instability in the agricultural sector gets transmitted to the rest of the economy through public investment. If there is a deceleration in the agricultural production and public spending is maintained as before there will be an inflation in the foodgrains market. The real income of the fixed income group will fall. No doubt it will

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38. Sudipto Mandle : "Agrarian barrier to Industrial Growth", Journal of Development studies, Oct '85, p.49.

39. R.M. Sundaram : Growth and Income distribution in India, New Delhi, 1987.

have a bad repercussion on the demand of the industrial consumption goods. But our point of reference is public investment. Government can not afford to ignore the inflation and volatile salaried class. So, consequently it will cut-back its public spending and industry will suffer. Ahluwalia suggests that the principal linkages between agriculture and industry can be traced through the rate at which agriculture acts as (i) a supplier of wage goods (food) to industrial sector, (ii) a provider of raw materials for the agro-based industries, (iii) generator of agricultural incomes which in turn creates final demand for outputs of industrial sector. The first two constitute supply side linkages, while the third one is the demand side linkage between agriculture and industry.<sup>40</sup> Scarcity of wage goods can exercise upward pressure on wage rate relative to price of the manufactured product and this squeezes the profitability of industrial sector and retards the overall growth. Ahluwalia describes operation of wage goods constraints as follows: let  $w, P_w, P_q$  refer to nominal wage rate, price of wage goods, price of industrial products respectively. Then we have,

$$\frac{W}{P_q} = \frac{W}{P_w} \cdot \frac{P_w}{P_q}$$

The wage good constraint on industrial production would hold if

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<sup>40</sup> I.J. Ahluwalia, Growth in India: Industrial stagnation since mid-sixties, OUP, Delhi, 1987, p.33.

$\frac{W}{Pq}$ , ie. the product wage, rises.  $\frac{W}{Pw}$  being constant,

product wage would rise if relative prices ( $\frac{Pw}{Pq}$ ) rises.

Rangarajan<sup>41</sup> sees the channels through which agricultural sector influences the industrial sector are

1. Industrial inputs to agriculture. As the technology of agricultural production changes link becomes stronger.
2. Supplies of input to agrd-based industries,
3. Influence of agriculture on output of industrial consumption goods like clothing, footwear, sugar, edible oil, furnitures, services etc. But here one should be cautious of pointing out the categories of consumers. With terms of trade tilting in favour of agriculture, the food items will be dearer, and considering urban poor's consumption basket largely containing food items, it is normal that cross elasticity will be more negative and the demand for industrial goods consequently go down. The rural poor will also behave that way. However the rural rich will be benefited and the influence of terms of trade in favour of agriculture will have positive effect on industrial consumption goods. So, we must distinguish the negative cross elasticity and positive income effect of a certain rise in the price of food items as,

$E_{if} + \alpha n_i$ , where

$E_{if}$  = Cross elasticity of demand for non-food items

$\alpha$  = % increase in the total expenditure due to rise in food prices.

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41. C. Rangarajan: Agricultural Growth and Industrial Performance in India - A Survey of interdependence, IFPRI Research Report 1982.

and

$\eta_i$  = expenditure elasticity for non-food items of that group.

4. Through government spending and public investment, a rise in agricultural production can result in increased government savings, so public investment may be on basic and capital goods industries.
5. Fluctuations in agriculture may affect private corporate investment decisions through the impact of terms of trade on profitability.

Apart from industry, there exists a strong linkage between agriculture and transport. The growth of transport depends upon growth in other 'behind' or 'upstream' sectors by way of backward linkages.<sup>42</sup> It has forward linkage with other sectors also. In both ways, development of transport sector is affected and affects that of agriculture. It stimulates the demand for agriculture products.<sup>43</sup> It is really the secondary effect of transport sector's backward links upon production costs in other basic industrial sectors that stimulates growth.

From the foregoing discussion it is evident that inter sectoral

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42. F. Moavenzadeh and D. Geltner: Transportation, energy and Economic Development, Elsevier, 1984, p.138.

43. Ibid., p.140.

linkages have diverse ramifications. In particular, these linkages not only grow apace as an economy moves on higher on the development path but their nature also depends on the level of development, especially in the non-agricultural sectors, already achieved by an economy. In Indian context this becomes more important. With the expansion of the non-agricultural sectors, and sectoral shifts, the inter-sectoral linkages have become more and more complicated. On the one hand with declining share of agro-based industries, production linkage has declined, on the other hand with growing mechanization of agriculture it is rising. The agricultural production has not been immune to fluctuations, so, there is scope of discovering consumption linkage through income and terms of trade, Government, Corporate and Household savings, so investment are still sensitive to agriculture. So, we have to look into the problem of inter-sectoral linkage in greater detail, which we will do in the forthcoming chapter.

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CHAPTER - II

REVIEW OF LITERATURE AND METHODOLOGY

## 2.1 REVIEW OF LITERATURE:

In the preceding chapter we discussed the nature of inter-sectoral linkages, especially that between agriculture and other sectors. This linkage arises mainly for supply of wage-good, raw material, market and of course contribution towards saving and investment. By now, a number of studies on the subject of inter-sectoral linkages or dependencies have accumulated in literature. The agriculture versus the rest of the economy has been widely discussed in connection with sectoral transformation, deceleration in the industrial performance after the mid-sixties, terms of trade, the problem of instability and in some cases efforts have been made to quantify this inter-dependence.

The sectoral changes based on growth rates of various sectors have been quite interesting to study after independence. In some respects, the results have been in tune with global trends and in some other aspects, some peculiar results have been observed. As in most other developing countries, Indian economy also started with a huge agricultural sector both in terms of its contribution to national income and employment. Over time, while its share in national income declined markedly the share in employment did not witness more than a marginal decline. Analysing the growth process of the Indian economy from 1950-51 to 1983-84, Rao<sup>1</sup> found that primary sector grew at a compound annual rate of 2.4 percent,

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1. V.K.R.V. Rao, "Growth and Structural Change in Indian Economy" in P.R. Brahmananda and V.R. Panchmukhi (ed), The Development Process of Indian Economy, pp.1-41.

secondary at 4.7 percent and tertiary sector at 5.2 percent. According to him this sectoral growth pattern is fairly in line with historical trends observed in the early years of development of other countries, except that growth rates of the primary and tertiary sectors are little higher and that of the secondary sector significantly lower in our case. The other striking feature, which has been well recognised, is about the failure of the secondary sector to absorb more labour force. He gave some policy prescriptions like decentralisation and dispersal of economic activity in rural areas, labour-intensive technology, limits on urban expansion etc. to bring a sectoral balance. Another aspect he observed was that the organised sector grew almost one and half as fast as the unorganised sector. And within the industrial sector, registered enterprises grew at a faster rate and claimed a larger share of its output than unregistered enterprises. He also observed a wide-spread disparity among the states in this respect.

The services sector has been relatively small to begin with however, as Sundaram<sup>2</sup> observes, its contribution to overall growth rate has been higher than agriculture sector during the period 1950-51 to 80-81, especially from 66-67 onwards. On the other hand, the industrial sector has the highest growth rate among the three major sectors, but its small share in GDP, kept its contribution to overall growth at a very modest level

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2. R.M. Sundaram, Growth and Income Distribution in India, 1987.

and deceleration of the industrial sector further reduced its contribution.

Sen and Ghosh<sup>3</sup> discuss structural transformation from the angle of growing sectoral imbalance and lop-sidedness. They say,

In the beginning of the planning process of development India exhibited a situation of low level underemployment equilibrium co-existing with low output and lower volume of investment and employment but at the same time, the intra-sectoral imbalances were less prominent though there was overall lopsidedness. But now after three and half decades of planning, we find that lop-sidedness of both inter-sectoral and intra-sectoral growth is becoming more distinct in agricultural and industrial sectors.

The sectoral transformation has a special bearing on the inter-sectoral linkages with the changing importance of the various sectors, their bearing on the national income of an economy and their relationships with one another. Let us take the example of agriculture. It has been depending on the vagaries of the monsoon and has demonstrated a high degree of instability. As the share of agriculture was very high in the national income, it is natural that agricultural instability would be stoutly reflected in the national income. Gupta<sup>4</sup>, analysing the sector-wise

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3. Raj Kumar Sen and Alak Ghosh, "Inter-sectoral imbalance in relation to intra-sectoral lopsidedness in agriculture and industrial growth in India in recent times", VIIIth World Congress of IEA, New Delhi 1986, Theme-4, pp.101-27.
  4. Anupam Gupta, "Overall Rate of Growth and Sectoral rates of growth: A study of instability in economic development", VIIIth World Congress of IEA, 1986, New Delhi, Theme-18, pp.85-102.

contribution to Net Domestic Product from 1961-62 to 1981-82 observed that,

1. Instability has increased over time. The coefficients of growth variation estimated for the rates of growth in Net Domestic Product increased from 1.0787 in the period 1960-61 to 1970-71 to 1.4259 in the period 1970-71 to 1981-82. This is not of cyclical nature of Harod-Domar type.

2. Ascribing this instability totally to agriculture will not explain the whole economic reality. The coefficient of variation of the non-agricultural sector, both in private and public enterprises was high enough to prove the validity of the above statement.<sup>5</sup>

While the analysis of the linkages between agriculture and the rest of the economy can be dated back to Quesnay in 18th century France, the efforts to specify them empirically and quantitatively is a much more recent phenomenon. Many research scholars have found it easy to quantify inter-sectoral linkages from the input-output matrices. The addition of the columns gives the backward linkages while that of rows gives the forward linkages. Though according to Monga and Panigrahi<sup>6</sup> it is difficult

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5. However, coefficient of variation, which gives the fluctuation around the mean is not a good measure of instability in this case. Fluctuation around the trend will give a much better result, which will later be taken as a measure of instability in our study.

6. G.S.Monga and Madhu S. Panigrahi, "Disproportionality crisis and ride of Indian agriculture", The Indian Economic Association, Sixty-Eighth Annual Conference 1985, pp.28-39.

to discover any fundamental relation between agriculture and industry in the Indian economy typically characterised by Zigzag rise and fall in both the sectors over the past three decades, many scholars have tried to capture the production linkages between agriculture and industry using input-output tables. For example, Venkatramaiah<sup>7</sup> analysed the changing structure of the Indian economy for the period 1950-51 to 1973-74 and concluded,

1. The backward linkages of agriculture with industry and vice-versa are found to be stronger compared with forward linkages. While the direct industrial inputs necessary to produce a rupee worth of agricultural output is growing at compound rate of 4.4 percent, the agricultural input per rupee worth of industrial output shows a decline of 2.8 percent per annum. In production relations while industry's dependence on agriculture is greater than agriculture's dependence on industry, the analysis of linkages over the time period shows that industry's dependence on agriculture is declining while agriculture's dependence on industry is on the increase.

2. The forward linkages of agriculture in the economy as a whole somewhat deteriorated over-time. The proportion of intermediate use of agricultural output in the economy which was of the order of 40 percent in 1950-51 declined to 30% by the seventies. The decline in the forward linkages of agriculture is due to decline

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7. P. Venkatramaiah, Technological Linkages between Agriculture and Industry in Indian Economy, VIIIth World Congress of IEA, 1986, New Delhi, Theme-6.

in agricultural input in the production of agricultural output.

The mid-sixties as a historical divide is important not only from the point of view of Indian economy in general, but also for the debate on inter-sectoral linkages. The importance is to be understood on two accounts - the advent of Green Revolution and secondly, the acceleration in the industrial production. The introduction of HYV seeds necessitated the use of many industrial inputs like chemical fertilisers, pesticides, insecticides etc. Again, multiple cropping called for farm mechanisation and use of tractors, harvesters etc. considering this situation, Monga and Singh<sup>8</sup> make a generalised statement, "In developing countries like India, the inter-dependence between agriculture and industry has increased after the advent of Green Revolution in 1965". Another major act of linkage is labour contribution. Mitra<sup>9</sup> feels this has not happened in India, which shows a lack of dynamic linkage between agriculture and industry. This has happened because Green Revolution was not labour-productivity augmenting, rather land-productivity augmenting .

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9. Priyatosh Mitra, "Technological change and question of linkage between Agriculture and Industry - a case study of India and Japan", VIII th World Congress of IEA, 1986, New Delhi, Theme-6, p.87.
  8. G.S. Monga and Tarlok Singh, "Sectoral Articulation: Indian and Global Trends", VIIIth World Congress of IEA, 1986, New Delhi, Theme-18, p.119.

In a recent study Singh<sup>10</sup> tries to analyse the two way process of interrelationships between agriculture and industry from 1951-52 to 1984-85. Dividing the total period into two parts, taking 1964-65<sup>11</sup> as the cut-off year, and regressing agricultural production on industrial production and vice-versa, using OLS and 2 SIS method, he finds,

1. Agricultural production significantly affects industrial production both in periods I and II. This is true both when agricultural production is considered with as well as without a time lag.
2. He also notices that in all the periods, the effect of lagged agricultural production on the industrial production is stronger than that of current agricultural production.
3. The relationship got strengthened in the second period compared to the first one.

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10. Tarlok Singh, "Inter-sectoral Relations and Growth - Indian and Global perspective", The Indian Journal of Economics, Vol. LXIX. No.272, July 1988.

11. He gives no reason for selecting this as the cut-off year. Even if we assume that he takes it as per the advent of introduction of new technology in Indian agriculture, it would be a  $\Delta$  analysis. Firstly, in 1964-65, a  $\Delta$  faulty negligible part of Indian agriculture was mechanised, so, it would be wrong to take it for whole India. Secondly, even before 1964-65, the inter-sectoral linkage was quite high, though it was of a different kind. He does not try to distinguish between the two kinds of linkages and analyse them accordingly.



4. This relationship is not one-way. Industry also affects the agricultural production, though to a lesser extent. Agriculture's dependence on industry has increased in the second period.

He explains these as the result of development and emergence of more agro-based industries (this is a very faulty explanation, as the position of agro-based industries deteriorated in the seventies and the early eighties), the quest for market by capital goods industries for their products like tractors, threshers, combines, seed drills etc. Industries producing agricultural inputs like fertilizer, pesticides also depend upon agriculture for the market of their own products.

Another important work in this field is by Thamarajakshi<sup>12</sup>. Her period of analysis is from 1950-51 to 1983-84. Dividing this period into three sub-periods, ie. 50-51 to 60-61, 60-61 to 73-74, 73-74 to 83-84, she found industrial production is well correlated with agricultural production. Both sales and purchases of agriculture vis-a-vis non-agriculture have grown faster during 1960-78 compared to the earlier period 1951-60. However, while the rate of growth of sales was faster than that of purchases in the earlier period, the position was reversed in the latter period

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12. R. Thamarajakshi, 'Inter-relation Agriculture and Industry in India' keynote paper for 68th Conference of Indian Economic Association, 1985.

with purchases growing faster than the sales. At current and constant prices agriculture was a net importer in 1978-79. Between the deteriorating and improving phases in the terms of trade, the deterioration in the terms of trade since 1973-74 is a reflection of an accelerated demand for modern inputs by agriculture rather than of plentiful agricultural supplies. Agriculture received a good share of public investment. This study shows a strong linkage between agriculture and industry still prevails.

Deceleration of industrial growth rate in India after the mid-sixties has been a popular subject of debate in recent years. There is no dispute about the fact that industrial production entered into a clear-cut sluggish phase starting in the mid-sixties. While the over-all industrial growth rate was 7.1 percent in the decade preceeding 1965, in the post-1965 decade, it sharply fell to 3.9 percent. But the divergence of opinion arises while explaining this deceleration. Some analysis describe it to the sluggish agricultural performance setting in a big demand constraint on industry. Some say it is due to adverse terms of trade of agriculture vis-a-vis industry; so less income at the hands of rural population and hence less demand for industrial good. Still some others explanation is based on the overall income inequality. And for some others it was due to a decline in public investment. Again some economists explained this by exhaustion of easy avenues of import substitution. In any case, none of the explanations

gives a complete story. Some detailed studies have placed serious doubts over these simplistic explanations.

Considering the changes in the period 1959-60 to 1979-80, Ahluwalia<sup>13</sup> tries to show whether the industrial recession starting from mid-sixties was due to an agricultural drag. Though some economists like Nayar<sup>14</sup> ascribe slackening agricultural growth for the industrial deceleration after mid-sixties; giving various causes like rise in food-grain production, per capita food availability, marketable surplus in the agricultural sector after the mid-sixties, Ahluwalia concludes, "on the strength of this evidence it can be safely asserted that wage-goods constraint cannot be held responsible either for the slow-down in the growth of heavy industries after the mid-sixties or for the slow growth of light industries throughout".<sup>15</sup>

To further substantiate her argument that industrial deceleration has taken <sup>place</sup> not due to agriculture-industry linkage, she revealed that slow down is confined to capital-intensive industries. Again she found no proof of the raw-material constraint to the Industrial growth. Of course, there was a slow-down in the agricultural income, but even with that level of income, faster

13. I.J. Ahluwalia, Industrial Growth in India: Stagnation since mid-sixties, OUP, Delhi, 1985, pp.33-52.

14. Deepak Nayar, "Industrial Development in India", EPW, August 1978, p.1269.

15. I.J. Ahluwalia, 1985, Op.Cit., p.48.

industrial growth could have been achieved.

Another important study in this area is that of Rangarajan.<sup>16</sup> Analysing phase by phase the industrial performance of India from 1951 to 1976, he found that while the decline in industrial output during 1966-70 was primarily due to a setback in capital goods industries, during 1970-75, it was due to the decline in the consumer goods industries. Another feature of industrial growth has been unevenness, except for the period 1960-65. Coming to agricultural performance he found no significant decline in the rate of growth of agricultural output in recent years. A decline if at all, is perceptible only in relation to non-foodgrains. But in their case there has been a severe year-to-year fluctuation in the growth rates.<sup>17</sup> He found the influence of agricultural production on industry in the drought as well as bumper crop years. But he concluded, "One should not even in theory expect industrial production to be a simple reflection of agricultural performance. Industrial growth is fuelled by a variety of factors which are not directly influenced by agriculture. On the other hand, raw data may hide some of the influences of agriculture on industrial performance because of lags involved".<sup>18</sup>

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16. C. Rangarajan, Agricultural Growth and Industrial Performance in India, IFPRI Research Report, October 1982.

17. Ibid., p.9.

18. Ibid., p.11.

Constructing a macro-economic model for the period 1962-72, having total agricultural output, non-foodgrains outputs, capital inflows, import of foodgrains and raw materials as exogeneous variable; terms of trade and its components, index of industrial consumption goods, gross capital formation of various sectors, index of basic and capital goods, industrial production and national income as endogeneous, Rangarajan concludes,

Agriculture exercises a reasonably strong independent influence on the growth of industry. From the various simulations, it was found that a one percent growth rate in agriculture can by itself generate a rate of growth one percent in industry. The impact of agricultural performance is felt both on the output of consumption goods industries and on the output of basic and capital good industries. In the first case, the impact is direct (production-linkage), in the second, the impact is through savings and investment. The overall impact on capital and basic goods industries emerged to be as strong as its impact on the output of consumption goods industries.<sup>19</sup>

However, quoting second Asian Agricultural Survey and RBI, Bulletins, he says that not only in India, but also in other Asian countries, the production linkage is very low. Agriculture and allied activities used only 6.4 percent of the output of industrial and service sectors in 1968-69. The corresponding figure for non-agricultural sector is only 13 percent of agricultural and allied output. These data show that the dependence of agriculture on industry (which depends on the level of technology in agriculture) is less than the dependence of industry on agriculture (which

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19. Ibid., p.42

depends upon the development of agro-based industries, general level of income etc.).

In this model he tries to show the impact of agriculture on industry separately through output effects and terms of trade effects, though it is very difficult to do so. He tries to capture the impact of foodgrains terms of trade through changes in the import of foodgrains which is an exogeneous variable. An increase in imports causes the foodgrain terms of trade to fall and imports of foodgrains do not affect the rest of the system directly in the model. Taking the overall effect (positive on Household savings in current year and negative on the Government and corporate savings in the subsequent years) he concludes, there is no ground to believe that an improvement in the foodgrain terms of trade will produce any positive effect on national income.

Another important contribution to this debate of agriculture: nonagriculture linkage is made by Bhattacharya and Rao.<sup>20</sup> They agree with Ahluwalia in pointing out that it is not slackening of agricultural growth, which has caused industrial deacceleration. Rather some other reasons like deacceleration in public investment have done this. Analysing agricultural and non-agricultural

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20. B.B. Bhattacharya and C.H. Hanumantha Rao, "Agriculture-Industry inter-relationship: Issues of Relative Prices and Growth in the context of Public Investment": VIIIth World Congress of IEA, New Delhi, 1986, Theme-18.

growth rates ranging from 1951-52 to 1983-84 and further dividing then into three sub periods, Bhattacharya and Rao find the proof of weakening linkage between agriculture and non-agriculture. They ascribed this weakening of linkage partly to the reduction in the relative share of agro-based industries' output and also to relatively slower growth of employment and real wage rate reducing the demand for and other agro-based products.

A study by Nachane et.al.<sup>21</sup> does agree with Bhattacharya and Rao in seeing a role of public investment in industrial deceleration. However, studying the most recent phase of Indian economy, ie. 1971-72 to 83-84 they find that performance of agriculture does also play a crucial role in the overall growth of our national economy. Both wage-good constraint and demand constraint were responsible to a certain extent in slowing down the growth of industrial sector, at least partially. Secondly, the policy of providing an increasing support of administered prices to foodgrain crops on the one hand has reduced the degree of sensitivity of foodgrain prices to supplies of them and adversely affected the prospects of expansion in demand for consumer durables both in the short and the long run, on the other.

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21. Mrs. D.M. Nachane, S.D. Sawant, C.V. Achutham, "Inter-dependence between Industry and agriculture in India", VIIIth World Congress of IEA, New Delhi, 1986, Theme-4.

Almost all the above studies analyse the problem at national level. Venkatramaih et.al.<sup>22</sup> have done a state level analysis of the linkage problem. Using the input-output table prepared by the Gokhale Institute of Politics and Economics for the year 1965, they conclude that inter-industry consumption (aggregate linkage) is higher in more developed states, as they use more indirect input for a given quantum of direct output.

The above survey gives us a diverse and sometimes contradictory picture of the problem of agriculture-nonagriculture linkage in Indian economy. Considering the varying scope and different period of analysis, it is not surprising that the results will be so. Still some questions remain unanswered, which will be attempted in our study.

## 2.2. SCOPE OF THE STUDY

The discussion in the previous section poses a problem before us rather than solve it. We do not find a clear picture, whether the inter-sectoral linkages have become stronger over time, whether other sectors of the Indian economy owe their ups and down on the corresponding ups and downs of agriculture, and so on. As we have seen, different studies portray different results depending upon their

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22. P. Venkatramaih, A.R. Kulkarni & Smt. L. Argade, "An Analysis of Industrial linkages in states of Indian Union" in Regional Structure of Development and Growth in India, Vol.I, Ed, G.P. Mishra, Ashis Publishing House, New Delhi, 1985, pp.253-313.



scope and period of study. The picture is, by no means, clear. It may, therefore, be in order to mount another study both to gain some fresh insights as also to pose some of the problems in a slightly different way and seek empirical answers for them.

Secondly, a number of the studies take mid-sixties as the cut-off year and compare the two periods, one before and the other after it. However, the two decades following 65-66 is not a homogenous period. We agree that two important changes took place - namely, the introduction of a new technology in agriculture and setting in of industrial deceleration. But these did not take place all of a sudden and then stopped. The intensity of farm mechanisation and application of bio-chemical technology continued to change for a number of years since mid-sixties. Most importantly, the new technology was spreading itself to newer and newer areas, though not in a big way as in the states of Punjab, Haryana and (western) Uttar Pradesh to begin with. Similarly the pace of deceleration in industrial output has also undergone a change. Again, the government has been headed intermittently by people having different political outlook towards agriculture and industry during last twenty years. As we all know political decision making can very well contribute to structural change especially in the field of remunerative prices to agricultural products and administrative prices of the industrial products. So, there is a scope to look afresh into the changing inter-sectoral relationships during last two decades.

Thirdly, though the share of agriculture in the national income of the country is declining over the years it still constitutes about 35 percent of the value added in the economy and employs more than 65.0 percent of the labour force, it is important enough to influence the demand for industrial goods. Again, there are certain consumer goods such as clothing, footwear, sugar, edible oils for which the total rural consumption is nearly three times the urban consumption. So, there is every scope of enquiring into inter-sectoral linkages.

Incidentally government of India claims, "The growing resilience of the non-agricultural sector to drought and supply-shocks in agriculture is shown by recent trends in industrial production".<sup>23</sup> The government claim is that, in spite of unprecedented drought in 1987, and sharp fall in agricultural production, industrial production could still grow at a reasonably high rate. So, industrial sector has become resilient from agriculture. But one should not accept this claim at its face value. Now a natural question arises whether this resilience process started during the last few years only or has been firmly established by now? To get concrete answers to these questions, we must have a look at the problem of linkage. Again, the impact of one sector on another is not necessarily an instant one, perhaps it works better with a lag. As a matter of fact, if the theoretical arguments for agricultural

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23. Government of India, Economic Survey, 1987-88, p.2.

sector gradually loosening its grip over other sectors of the economy are correct, the lagged response of non-agricultural income to changing levels of agricultural incomes should become more sure beyond some historical time-divide. So, an attempt has been made in this study to look whether other sectors are still largely dependent on agriculture or they have started growing on their own. We do not deny that agriculture is also influenced by other sectors. We will throw some light on this aspect also. But the primary concern of this study will be the former. Though there are many attempts to study this aspect at the national level, not many indepth studies deal with the regional picture. Our study will try to fill this gap. In other words, an attempt will be made to see whether the national picture is uniformly reflected in all states. If not, what is the nature of regional variations. We have selected seventeen states - Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Kerala, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Punjab, Rajasthan, U.P., West Bengal and Tamil Nadu. These main states providewide range of variety for our analysis. We have a nice mixture of agriculturally developed states, relatively ~~developed~~ industrialised states, poor under-developed ones and of course, states with fairly large tertiary sectors. The period of analysis is 1960-61 to 1985-86.

It is in the fitness of things that the limitations of the study are mentioned at the very outset. The sectoral linkages are a very complicated process. Several links between agriculture and industry could be visualized. It is quite possible that not all

influences are in the same direction. There might be differing impact on the demand for industrial consumption goods of agricultural output and terms of trade for different classes of the people. In some situations, government policy might off-set some of the effects. A sharp rise in agricultural prices resulting from a decline in agricultural output may be off-set by imports. Capturing all such finer components of the linkages is outside the scope of this study.

Another problem arises while we are analysing data at the state level. In the national sphere, one can visualize one single market within the national boundary. But in case of individual states, there is no boundary for markets. The industry of a particular state might be using the agricultural products of another state. Andhra Pradesh produces raw tobacco but does not have industries to use it. The textile mills of Maharashtra and Gujarat do not use cotton of these states only. Punjab's cotton goes out in a large measure while a big proportion of inputs used in its farm sector come from outside. We are conscious of these difficulties. Nevertheless, we tend to believe as a broad approximation that industries of a particular state do have considerable backing of agriculture of that state. Our study tries to capture that overall picture.

We must mention here that our study is not going to challenge or endorse the government position. Ours is an explanatory exercise. Again we are not ambitious enough to study every aspect of inter-

sectoral linkages. Our main object is production linkage which will explain a lot about the problem.

### 2.3 OBJECTIVES OF THE STUDY

The main objectives of the present study are as follows:

1. Unless we know the structure of the economy and the changes that have taken place in the economy over a period of time, we cannot study inter-sectoral relationships. So the first purpose of this study is to see the percentage share of different sectors of the economy, whether the percentage share of different sectors have changed over time or not.

2. The second aspect is to estimate the year-to-year growth rates of different sectors. Our purpose is to see what are the years, when there has been high growth/fall in a particular sector and whether that is associated with similar growth/fall in other sectors. In particular, our objective in this exercise is to see whether high growth/fall in agriculture in a particular year is reflected in other sectors or not.

3. The third objective of the study is to see the trend or growth rate over the entire period of time for different sectors. We also intend to divide the total time period into two periods (the criterion of the division will be discussed later) and see the trend over each subperiod.

4. Fourthly, we want to enquire about the problem of instability for which the percentage fluctuations around the trend of different sectors will be analysed. Our objective in this

regard is to see whether fluctuations in the agricultural sector get transmitted to other sectors or not. Here also, we intend to divide the time period into two sub-periods and compare the fluctuations of one with these of the other.

5. The main objective of this study is to see whether agriculture has all along continued to influence other sectors or not. In other words, we would like to see if the dependence of other sectors on agriculture has weakened over period of time.

6. We also intend to look into the dependence of agriculture on secondary and tertiary sectors and whether this dependence is stronger/weaker than dependence of later on the former. Here also, we intend to see whether this dependence has strengthened/weakened over time.

7. The above exercise will be extended to the states. It will be seen whether the national picture is uniformly reflected in the states for most of the aspects enumerated above. Our hunch is that there are significant inter-state variations emerging out of their respective development experiences.

#### 2.4 HYPOTHESES

In light of the above objectives and conceptual framework of the study analysed earlier, the following tentative hypotheses can be framed:

1. Over the period of time, the share of agriculture in the national income goes down. This fall in agriculture's share is compensated by a rise in the shares of manufacturing and services

sectors. The rise in the share of tertiary sector is more than that of secondary sector.

2. There exists a high degree of income instability in the agricultural sector whereas other sectors are comparatively more stable and this stability has increased over the period.

3. Agriculture still influences other non-agricultural sectors. But agriculture's influence on other sectors has tended to weaken over time.

4. Secondary and tertiary sectors also explain the variation in agricultural sector. But the influence of the former is more than that of the latter. The influence of industry on agriculture has increased over time.

5. In the case of the states where industries are largely agro-based like Maharashtra, Gujarat and U.P. the agriculture manufacturing (registered) linkage would be high. Due to declining share of agro-based industries, these linkages have weakened over time.

6. The states where there are more small-scale industries like Punjab, Haryana, U.P., the agriculture manufacturing (un-registered) linkage would be high.

7. In the case of relatively more industrialised states like Maharashtra, Tamil Nadu, West Bengal the agriculture-industry linkage will be comparatively low.

## 2.5 SELECTION OF VARIABLES

As we are going to study the inter-sectoral linkages, more pointedly production linkages, between agriculture and other sectors it is natural that our variables will be contributions of different sectors to Net Domestic Product of the states and the country as a whole. Our job has been simplified by the classification of the Net Domestic Product into incomes originating in different industries by Central Statistical Organisation. These classifications are,

- (i) Agriculture
- (ii) Forestry and logging
- (iii) Fishing
- (iv) Mining and quarrying
- (v) Manufacturing
  - V.1 Registered
  - V.2 Unregistered
- (vi) Construction
- (vii) Electricity, gas and water supply
- (viii) Transport, storage and communication
  - 1. Railways
  - 2. Transport by other means and storage
  - 3. Communication
- (ix) Trade, Hotels and Restaurants
- (x) Banking and Insurance
- (xi) Real Estate, ownership of dwelling and business services
- (xii) Public Administration and Defence
- (xiii) Other Services.



Out of these, the first four constitute the primary sectors: Fifth, Sixth and Seventh make secondary and the rest is the tertiary sector.

As the main thrust of our analysis is dependence of the rest of the economy or parts thereof on agriculture, we take contribution of agriculture to the Net Domestic Product at factor cost as one format of the main independent variable. We also take the income originating in the primary sector as a whole as another format of the independent variable. Of course, these become dependent when we study the dependence of these on other sectors. We leave out other components of primary sector as they are not that important.

For dependent variables we have taken manufacturing (Registered), Manufacturing (Unregistered), Construction, Secondary, Tertiary-1 (which constitutes transport, storage and communication, trades, hotels and restaurants). Tertiary-2 (consisting of banking, insurance and real estate etc.) and total tertiary sectoral incomes. Other sub-sectors such as public administration are left out because they are known to have very weak relationship with agriculture. Another important dependent variable in this exercise is non-agricultural income, which is obtained by deducting agricultural income from the net domestic product. While finding the dependence of

agriculture on other sectors, secondary and tertiary sectoral incomes are taken as independent variable.

To capture the change in inter-relationships over the period of time, a dummy variable D is introduced. The value of D is zero for pre-cut-off years and one for post-out-off years. The procedure of selecting the cut-of years for different states is elaborated later.

So, we can enumerate our variables as,

Y<sub>a</sub> = Income originating in Agricultural Sector.

Y<sub>p</sub> = Income originating in Primary Sector.

Y<sub>mr</sub> = Income originating in manufacturing (registered) sector.

Y<sub>mu</sub> = Income originating in manufacturing (unregistered) sector.

Y<sub>c</sub> = Income originating in Construction.

Y<sub>s</sub> = Income originating in secondary sector.

Y<sub>t1</sub> = Income originating in Tertiary-1 sector.

Y<sub>t2</sub> = Income originating in Teritiary-2 Sector.

Y<sub>tt</sub> = Income originating in Tertiary (total) sector.

Y<sub>na</sub> = Income originating in all the non-agricultural sectors.

D = Dummy variable

All these incomes are estimated at constant (1970-71) prices for India as well as for individual states.

2.6 Data base:

Our study is based on the secondary data published by Government of India. The following are the publications from which we collected our data:

1. National Accounts Statistics, Central Statistical Organization, 1975, 1978, 1981, 1984 and 1987.
2. Estimates of State Domestic Product, Central Statistical Organization, 1985, 1987.

Only for four states, i.e. Uttar Pradesh, Andhra Pradesh, Madhya Pradesh and Orissa, full series from 1960-61 to 1985-86 at 1970-71 prices were available. But for other states and India as a whole, we had to convert the 1960-70 series, which was available at 1960-61 prices to figures at 1970-71 prices. We could have taken figures for at least one <sup>more</sup> year, but those were based on a totally new base (1980-81) and what is more important, the classification by industry of origin changed totally. As mentioned in these new publications, the new series are not comparable with the old series. So, we restricted ourselves to 1984-85 for India and 1985-86 for States. Apart from that, for some states like Punjab, Haryana, Himachal Pradesh and Assam the full series was not available, as these states were reorganized much after 1960-61. The series for these states start from 1965-66, ~~1965-66~~, 1967-68, 1968-69 respectively.

Apart from these, we have used data from Statistical Abstract (India), 1985 published by C.S.O. and Fertilizer Statistics, 1985-86, published by Fertilizer Association of India.

### 2.7. Methodology:

On the basis of the objectives mentioned earlier we use the following statistical techniques and methods to facilitate our study.

To capture structural changes in the Indian economy, we work out sectoral shares of income at the national and state levels for each year and for each selected sector. Also, we compute year-to-year simple growth rate for each sector as to gain further insights into the working of the economy on a continuous basis. For assessing the changes on a long-term basis, we estimate compound growth rates for specified periods, for specified sector. Since Time-series data are available, we regressed a particular variable (sectoral income) over time to find the growth rate,

$$Y = ab^t, \text{ where } b \text{ is the growth rate and}$$
$$t \text{ is the time period considered}$$

The second objective of our study is to measure the instability or fluctuation. Coefficient of variation could

have been used as a measure of instability, but that would give the fluctuations around the mean value. So, a better measure of instability would be measuring fluctuation around an estimated trend. That can be done by regressing the variable on time. The estimated equation would be,

$$\hat{Y}_i = \alpha + \hat{\beta}t_i + e_i \quad \text{and}$$

the measure of instability would be,

$$\frac{\sum \frac{|e_i|}{\hat{Y}_i} \%}{n} \quad \text{where}$$

$|e_i|$  = Absolute value of the estimated error term.

$\hat{Y}_i$  = Estimated value of the variable (sectoral income concerned)

n = Sample size

The third problem is that of quantifying the inter-sectoral linkages. The production linkages can be measured from input-output matrix, which gives the inflow and outflow to/from different sectors. In a matrix of input-output coefficients, the addition of the columns or the amount of inputs was to produce one unit of output in the given sector gives the backward linkage. Similarly addition of rows or outputs from the given sector to others gives the forward linkage. But a problem in this regard is that the input-output tables

are available only at national and for a handful of States only. Again, even at the national level, it is available only at three points of time, 1964-65, 1968-69 and 1973-74, out of which only the last two are compiled by CSO, the first one was compiled by Indian Statistical Institute on a request of the Planning Commission. So, we are severely handicapped in this regard.

The second option is that of finding whether there exists a cause and effect relationship between agricultural income and income generated by other sectors and vice-versa; if so, whether that relationship has remained uniform over the period of analysis or undergone any change. So here comes the problem of selecting a particular time period which will enable us to compare the change in the sectoral inter-relationships. Honestly speaking, in this regard, one cannot use any objective method to find out that cut-off year. Again, it will vary from state to state. Here we have to apply our judgement and we have two options before us to do so.

First, we tried to find the cut-off year by finding the ratio of agricultural income to other sectoral incomes. Here we tried with lagged non-agricultural incomes. So, the ratios we found were,

$$\frac{Y_a(t)}{Y_{na}(t)}, \frac{Y_a(t)}{Y_{na}(t+1)}, \frac{Y_a(t)}{Y_s(t)}, \frac{Y_a(t)}{Y_s(t+1)}, \frac{Y_a(t)}{Y_{tt}(t)}, \frac{Y_a(t)}{Y_{tt}(t+1)}$$

The purpose of finding these ratios is to see whether a clear-cut divergence takes place from a particular ratio after a certain time. If there exists a relation between agriculture and other sectors, then we would hope to get a particular value or around that. If at all this relationship strengthens/weakens itself, there will be divergence from that value. A second thing we did to find the required cut-off year was to plot the graph of agricultural, secondary, tertiary and total income against time and see if there exists any divergence or change in the pattern of the sectoral relationships. (see Appendix, ch. II). From the above two exercises we found different cut-off years for different states as,

Andhra Pradesh	-	1973-74
Assam	-	1979-80
Bihar	-	1973-74
Gujarat	-	1975-76
Haryana	-	1975-76
Himachal Pradesh	-	1976-77
Jammu and Kashmir	-	1976-77
Karnataka	-	1974-75
Kerala	-	1970-71
Madhya Pradesh	-	1976-77
Maharashtra	-	1972-73
Orissa	-	1975-76
Punjab	-	1974-75
Rajasthan	-	1974-75
Tamil Nadu	-	1976-77

U.P.	-	1976-77
West Bengal	-	1972-73
India	-	1974-75

After finding the cut-off years our next task is to run regressions taking agricultural income, primary income separately as independent variables and other variables as dependent and using dummy variable D:

$$Y_t^i = \alpha + \beta X_t^j + \gamma (DX_t^j) \text{ and, } \text{----- (i)}$$

$$Y_t^i = \alpha_1 + \beta_1 X_{t-1}^j + \gamma_1 (DX_{t-1}^j) \text{ ----- (ii)}$$

where,

$$Y^i = Y_{na}, Y_{mr}, Y_{mu}, Y_c, Y_s, Y_{t_1}, Y_{t_2}, Y_{tt}$$

$$X^j = Y_a, Y_p$$

$$D = 1 \text{ for Post-cut off years.}$$

$$D = 0 \text{ for Pre-cut off years.}$$

We also intend to take agricultural income as a dependent variable and regress it upon secondary and tertiary sector incomes to find

$$X_t^j = \alpha + \beta Y_t^i + \gamma (DY_t^i) \text{ and, } \text{----- (iii)}$$

$$X_t^j = \alpha_1 + \beta_1 Y_{t-1}^i + \gamma_1 (DY_{t-1}^i) \text{ ----- (iv)}$$

$$\text{there, } X^j = Y_a$$

$$\text{and } Y^i = Y_s \text{ and } Y_{tt}$$



In the equations (ii) and (iv) we have introduced lagged variables to see the effect of the sectoral income of the previous year on the income of another sector in the present year. Here in these above equations,

$\alpha$  = intercept or the value of the dependent variable before the independent variable starts influencing it.

$\beta$  = Slope or the change in the dependent variable for a unit change in the independent variable in the pre-cut off year.

$\gamma$  = difference between the slope of pre and post cut-off years

$\beta_1$  = slope for the lagged independent variable in the pre-cut off year

$\gamma_1$  = difference between the slope of pre and post cut-off year for the lagged variable.

But here, we have introduced dummy and lagged variables, which transform the regression process into a multiple ~~one~~ (having more than one independent variable). So, we have to use stepwise regression to avoid multicollinearity. Secondly, as we are fitting the regression equation on a time-series data, it may show autocorrelations. To detect autocorrelation, we go in for Durbin-Watson test:

$$d = \frac{\sum_{t=2}^n (e_t - e_{t-1})^2}{\sum_{t=1}^n e_t^2}$$

where  $e$  is the residual.

If  $d = 0$ , we conclude high autocorrelation and so solve the problem by Cochrane-Orcutt iterative process, for first order autocorrelation.

In our regression exercises, all standard measures such as  $t$  and  $F$  tests are used for conducting the necessary tests of significance.

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APPENDIX (CHAPTER - II)

GRAPHICAL REPRESENTATION OF THE SECTORAL INCOMES OVER TIME

( 1960 - 61 to 1985 - 86 )

NDP = Net Domestic Product

NSDP = Net State Domestic Product

AGRI = Income Generating in Agriculture

SECN = Income generating in Secondary Sector

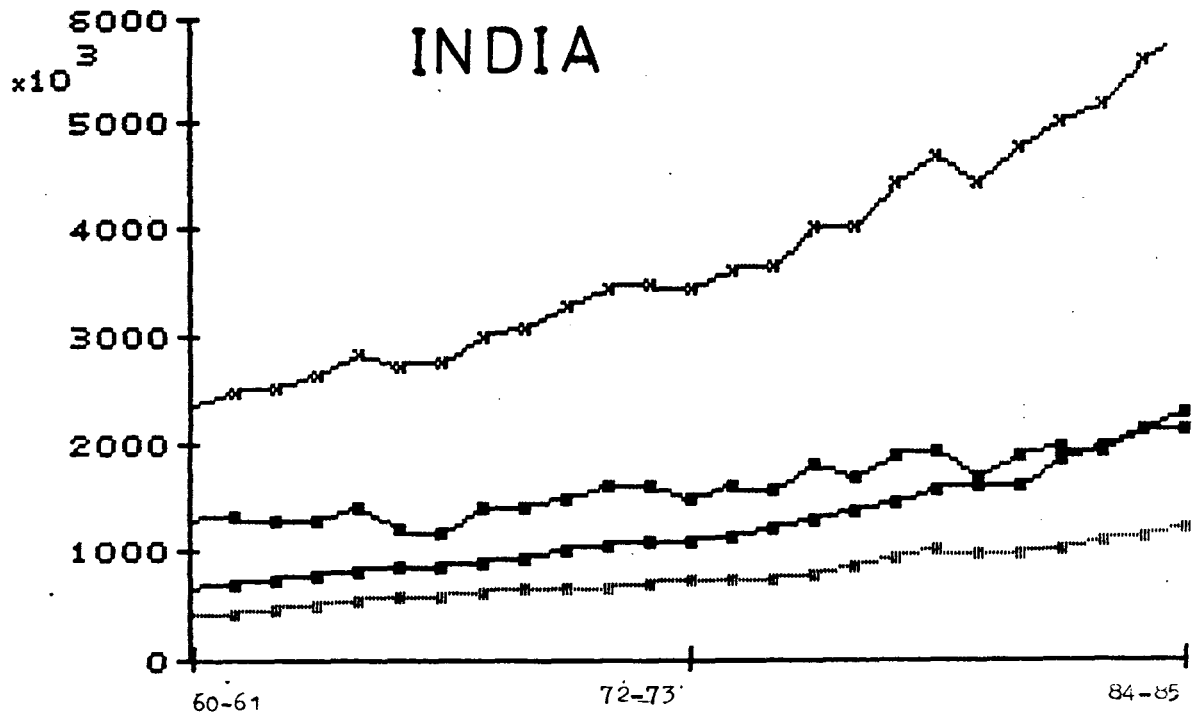
TERT = Income Generating in Tertiary Sector

N.B: All these incomes are calculated at factor cost in terms of  
rs. at constant (1970-71) prices.

Source: (i) National Accounts Statistics, Various Issues  
(Original Data)

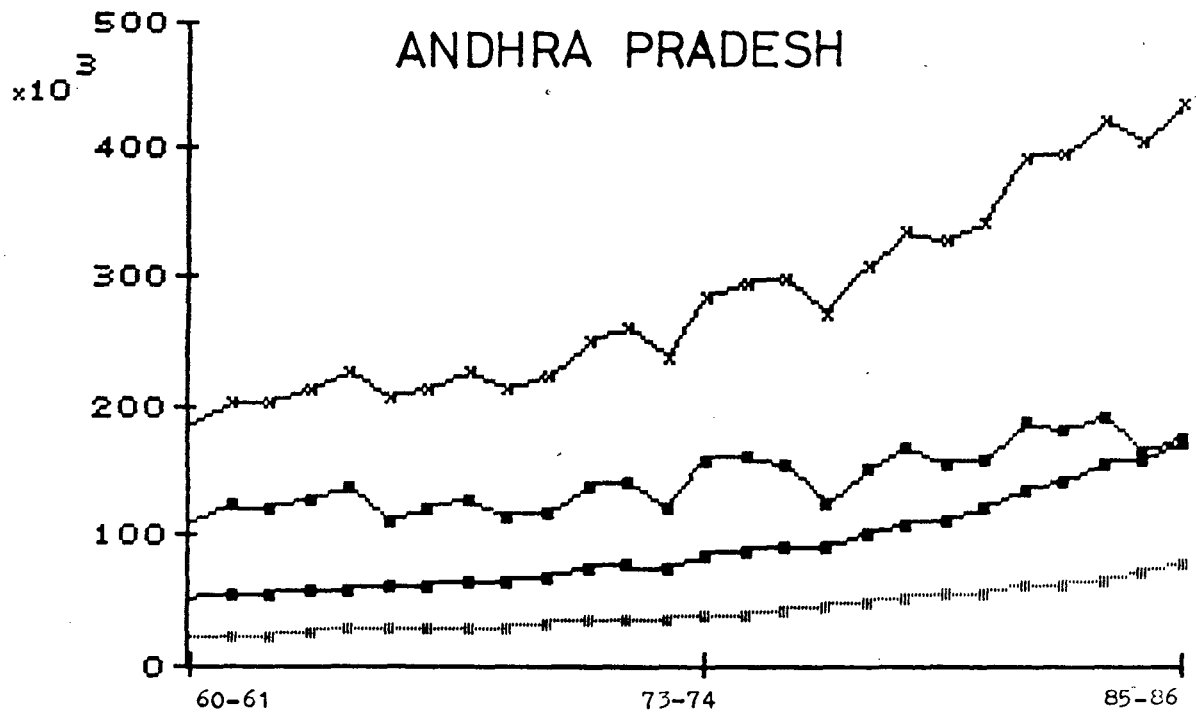
(ii) Estimates of State Domestic Product, 1985, 1987

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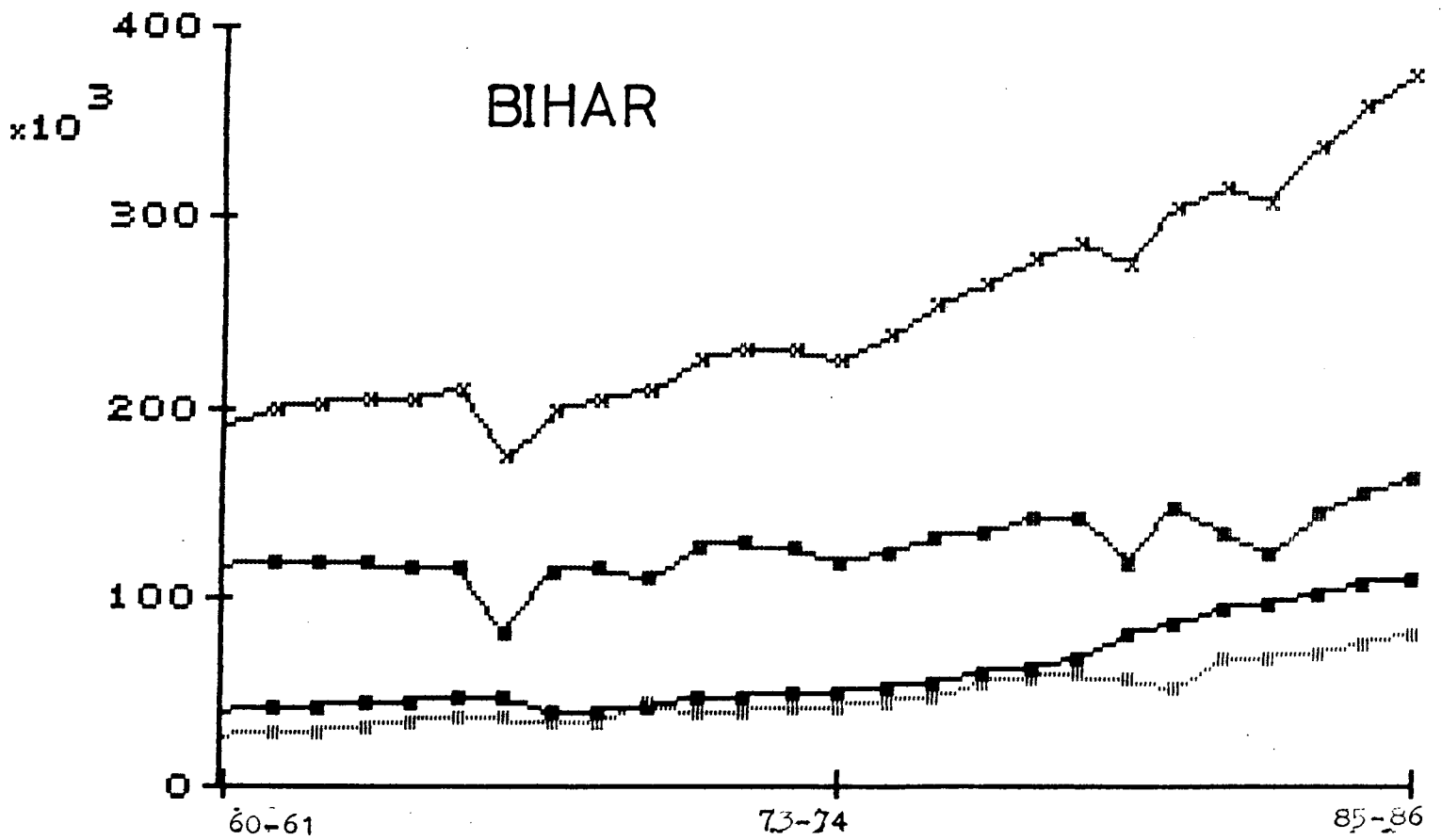
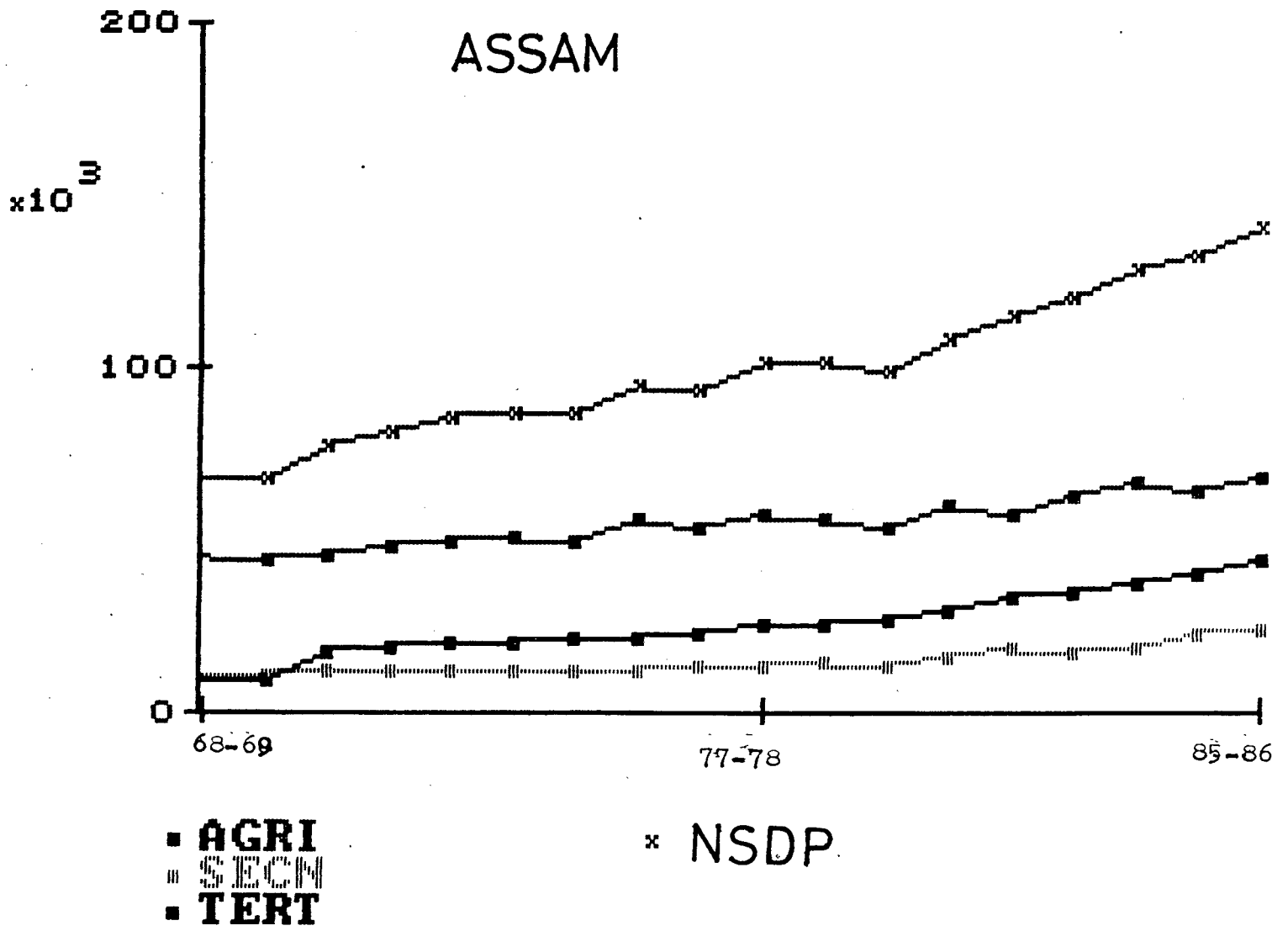
■ AGRI  
■ SECN  
■ TERT

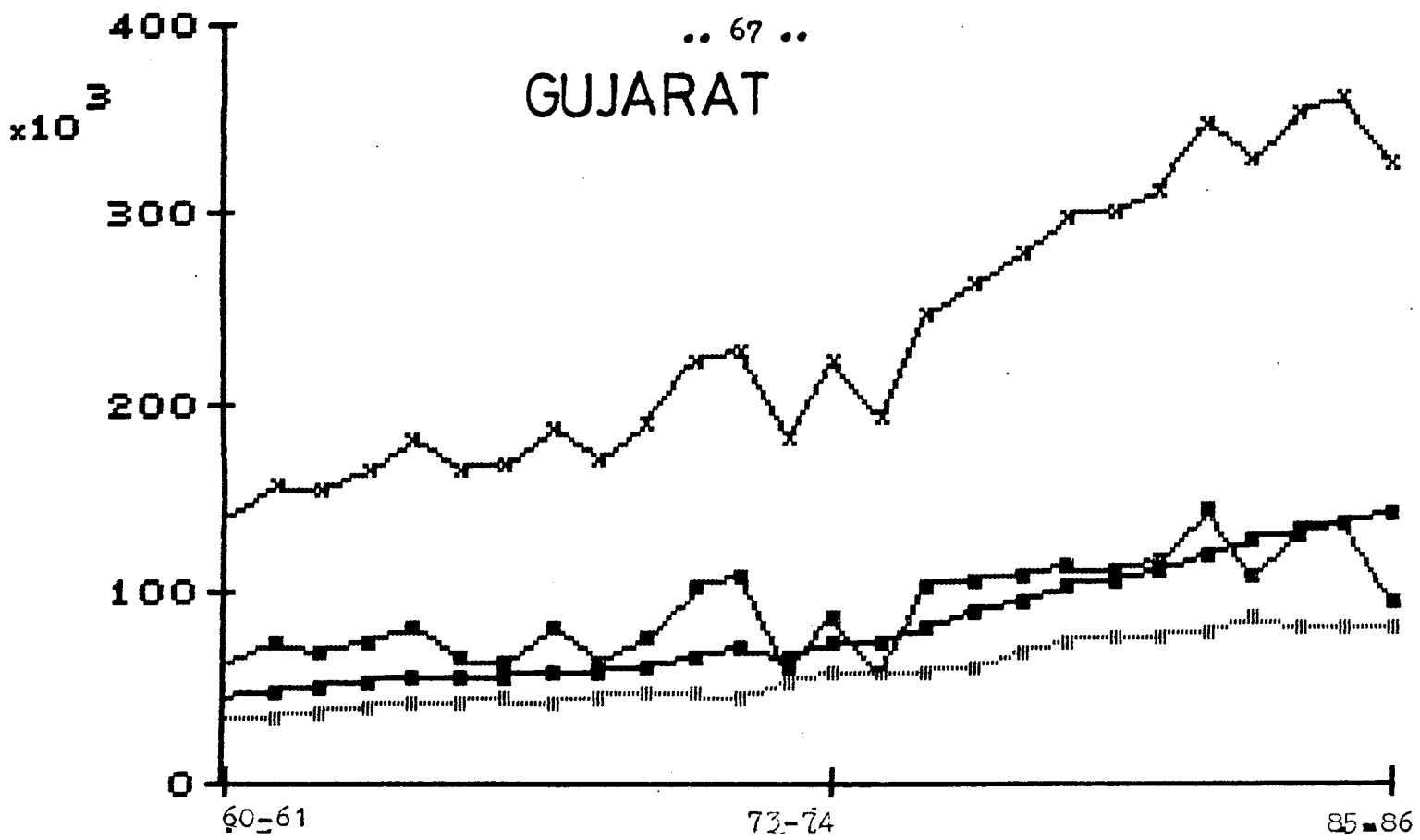
x NDP



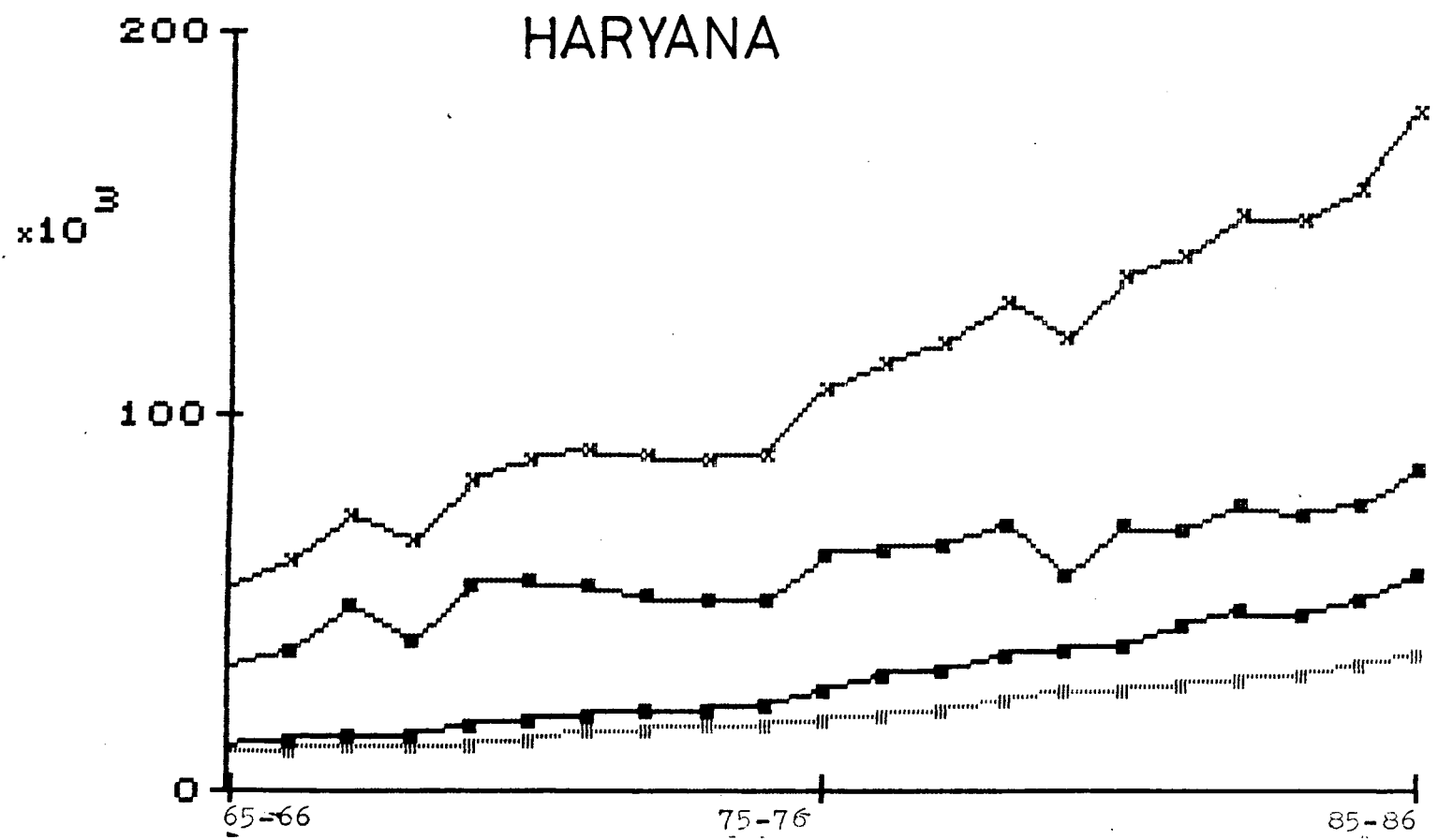
■ AGRI  
■ SECN  
■ TERT

x NSDP

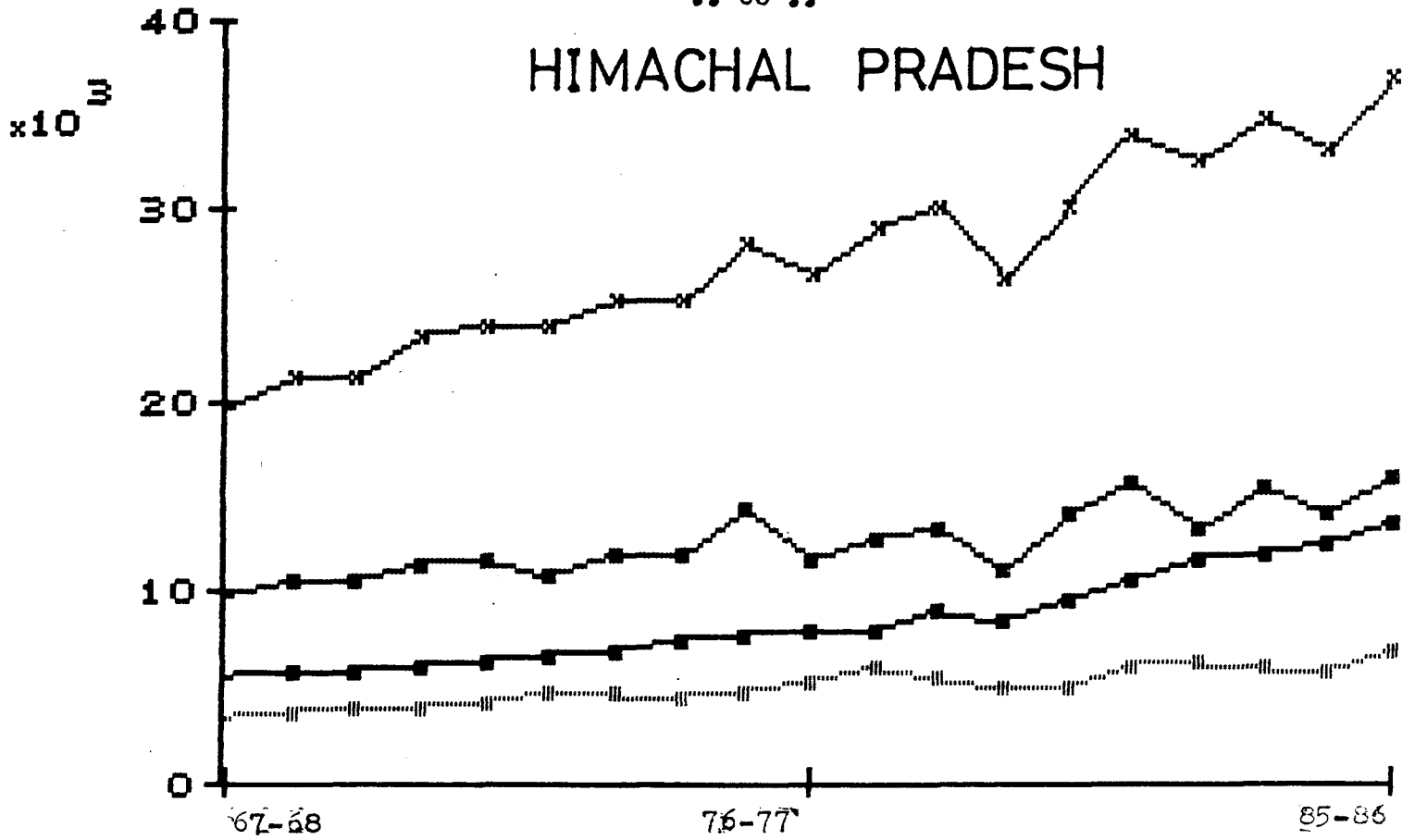




■ AGRI                      \* NSDP  
 ● SECN  
 ■ TERT

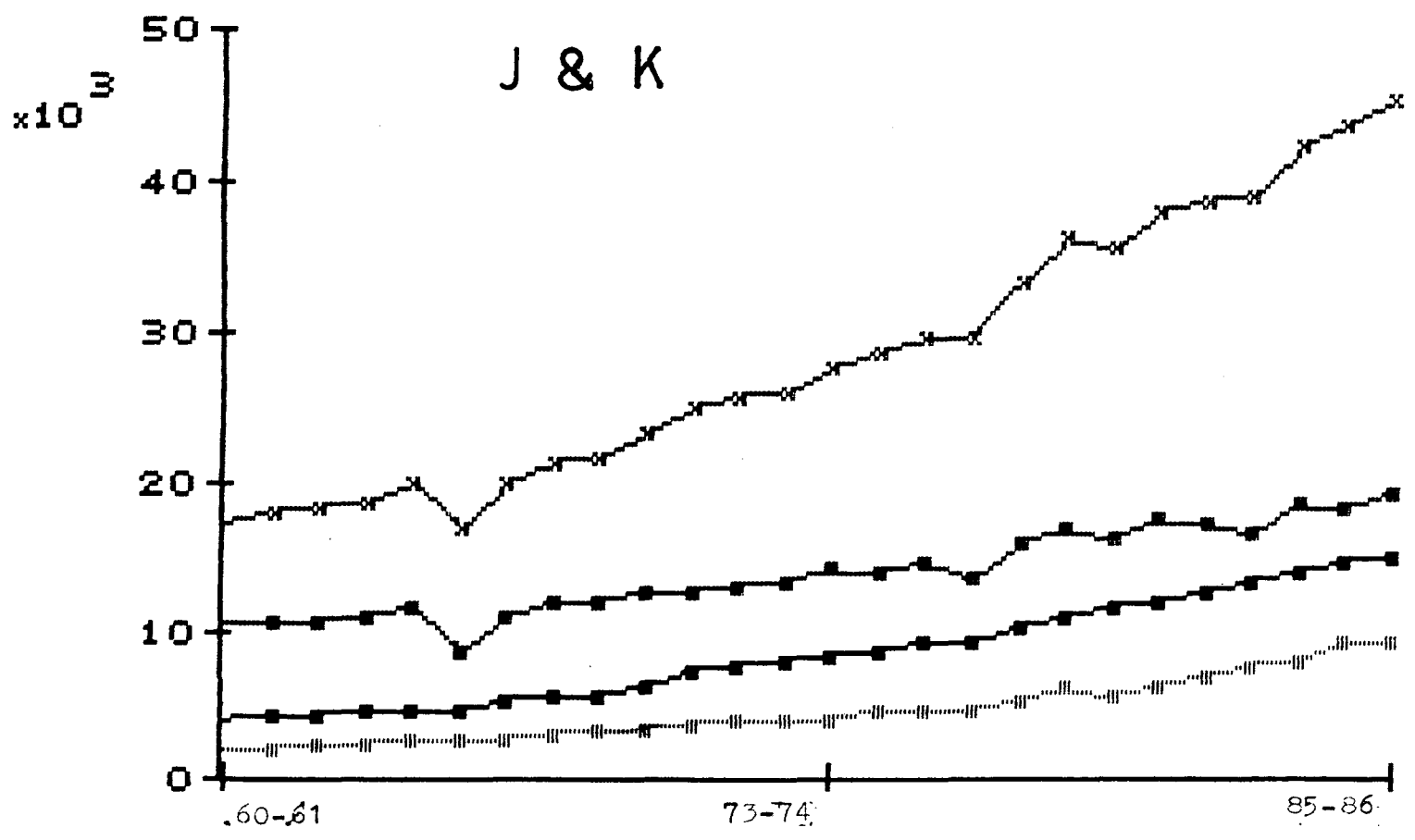


# HIMACHAL PRADESH

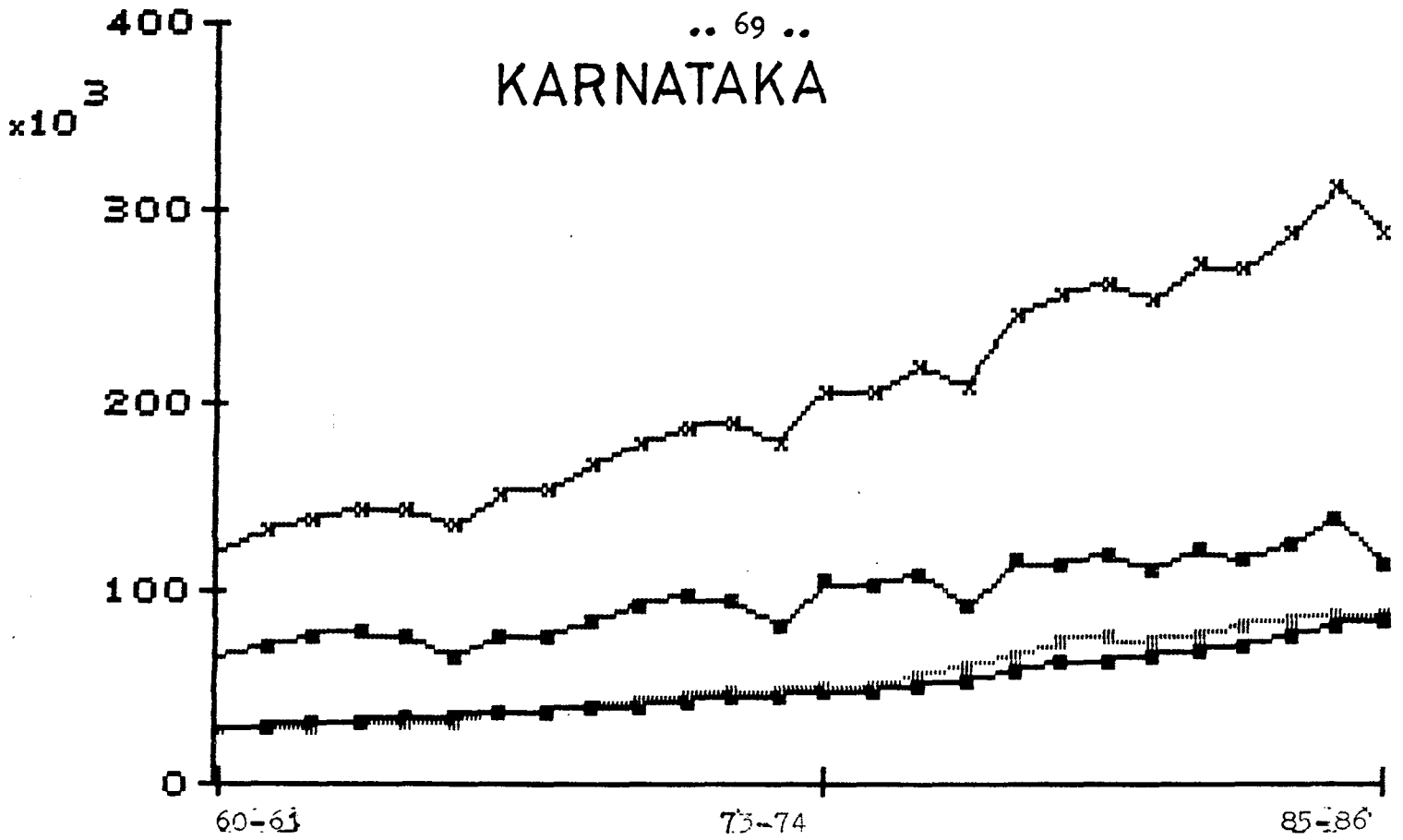


■ AGRI  
● SECN  
▲ TERT  
\* NSDP

# J & K



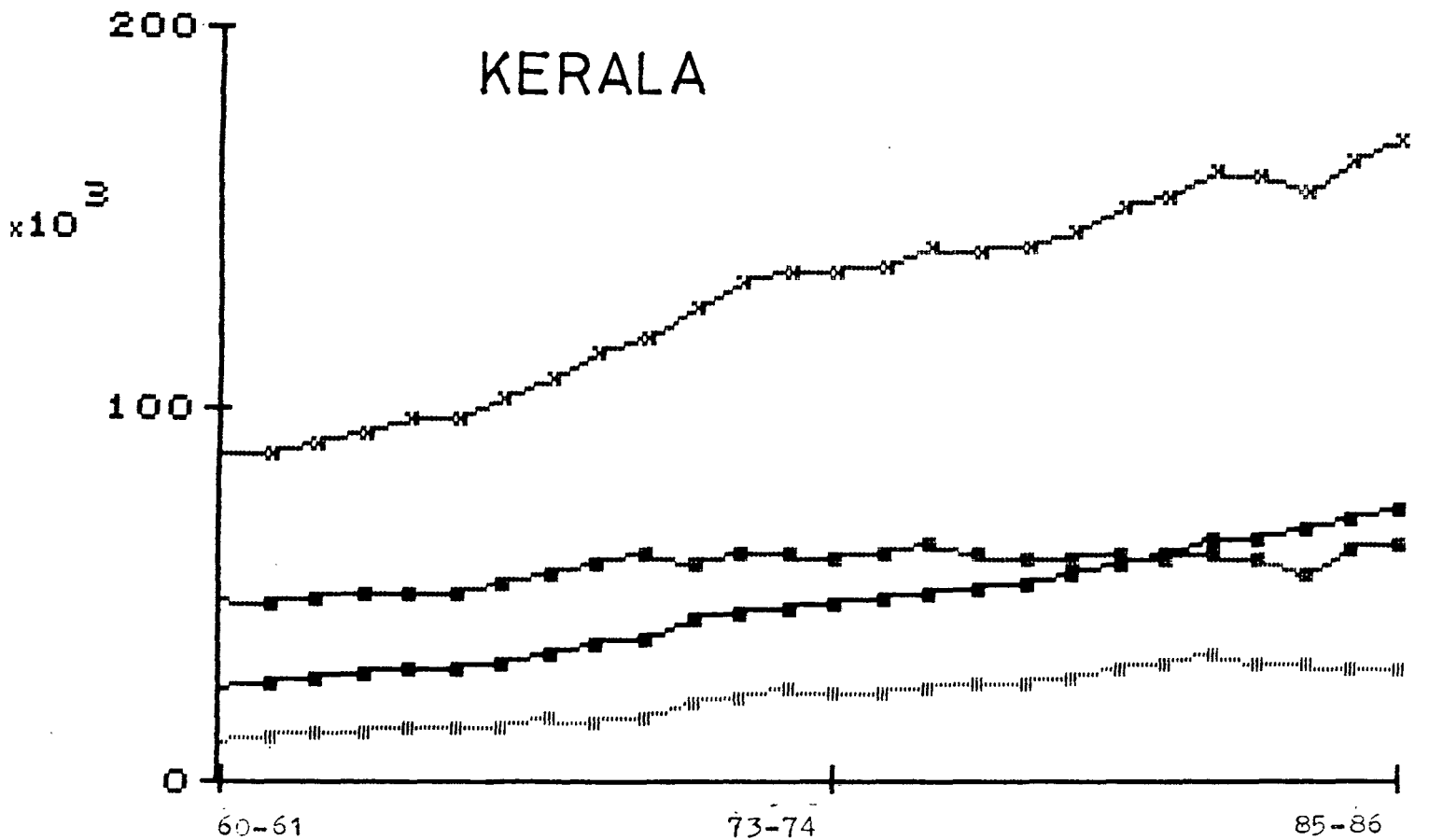
# KARNATAKA



■ AGRI  
■ SEC  
■ TERT

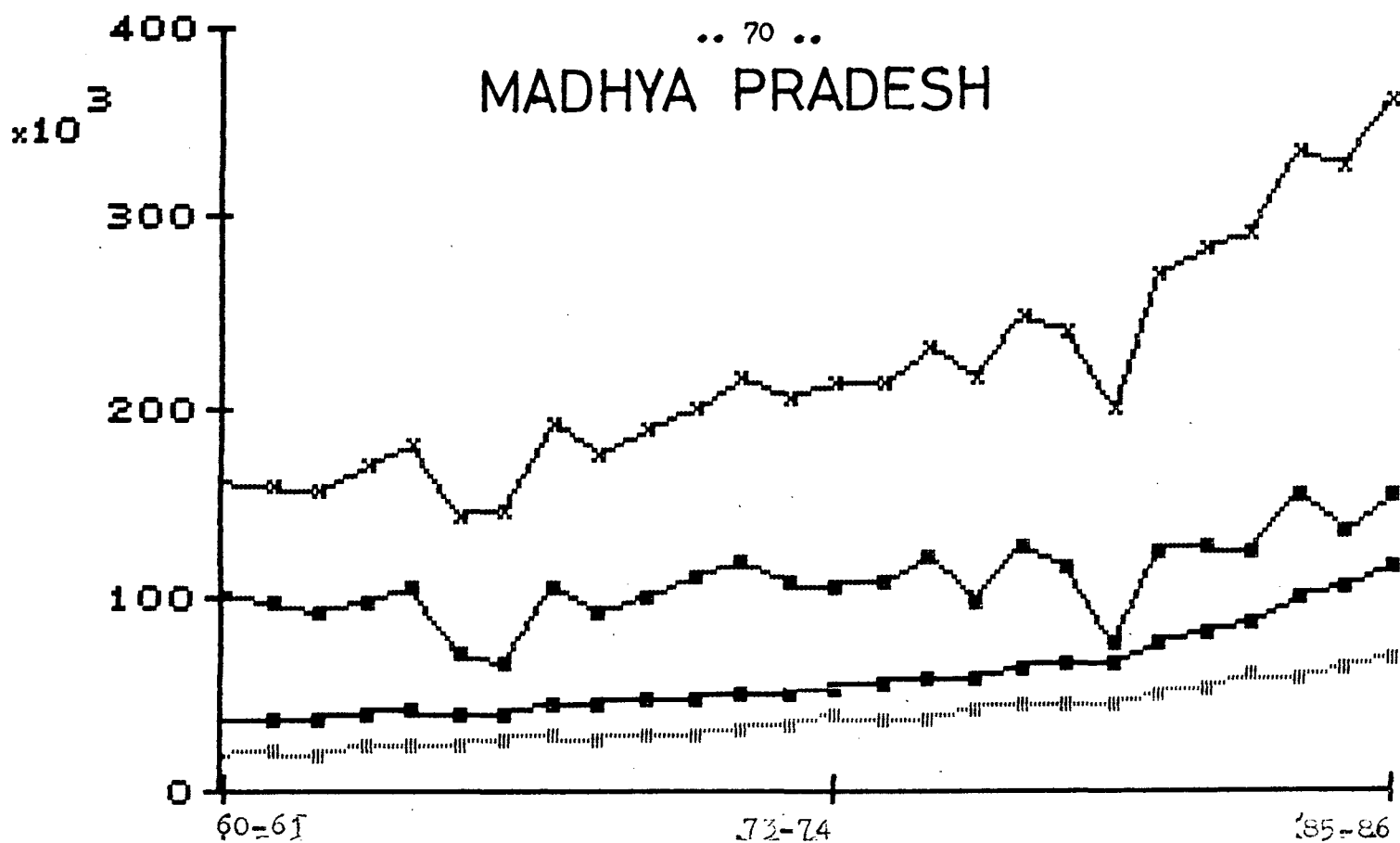
× NSDP

# KERALA





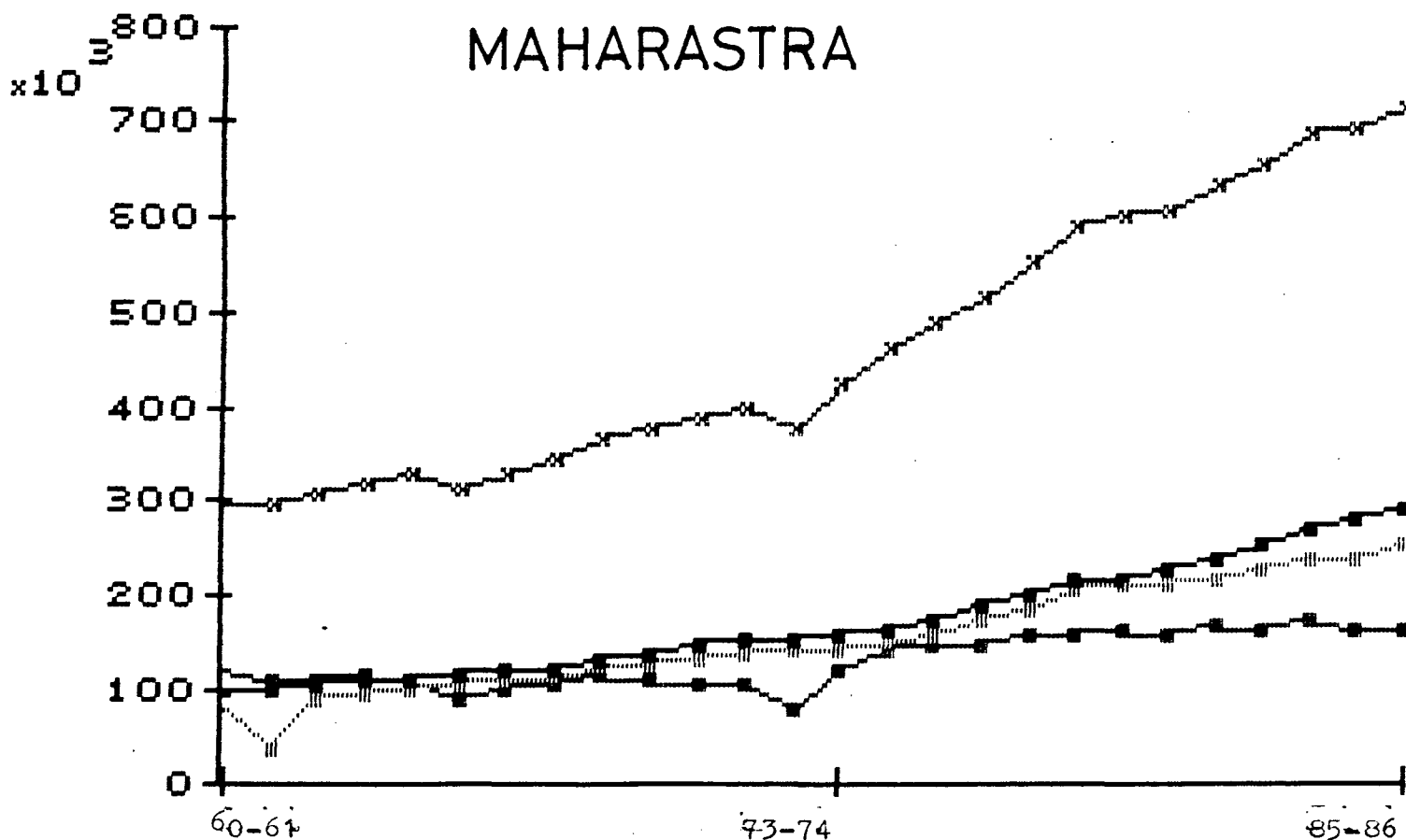
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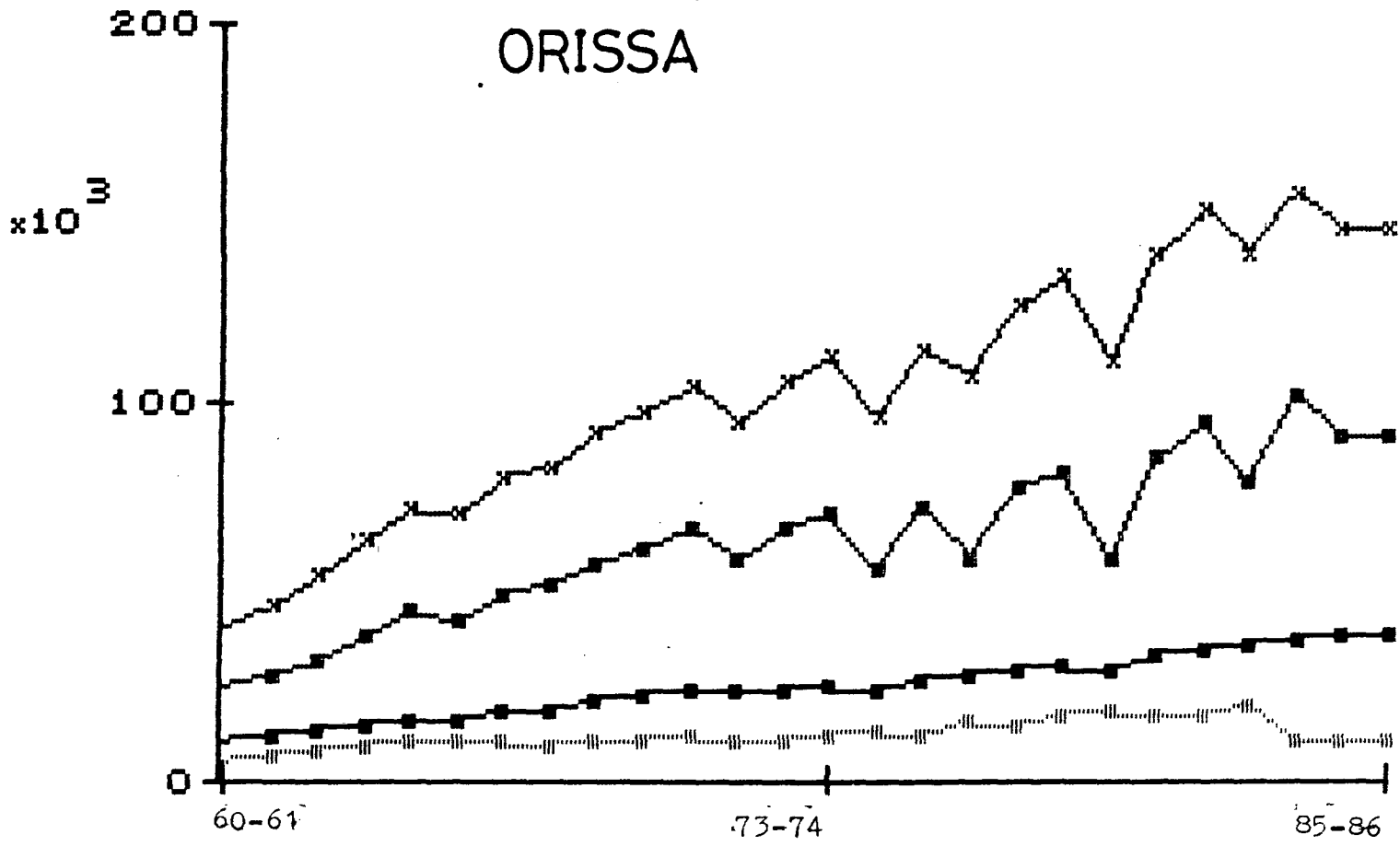
■ AGRI  
 ▨ SECN  
 ▩ TERT

x NSDP

# MAHARASTRA

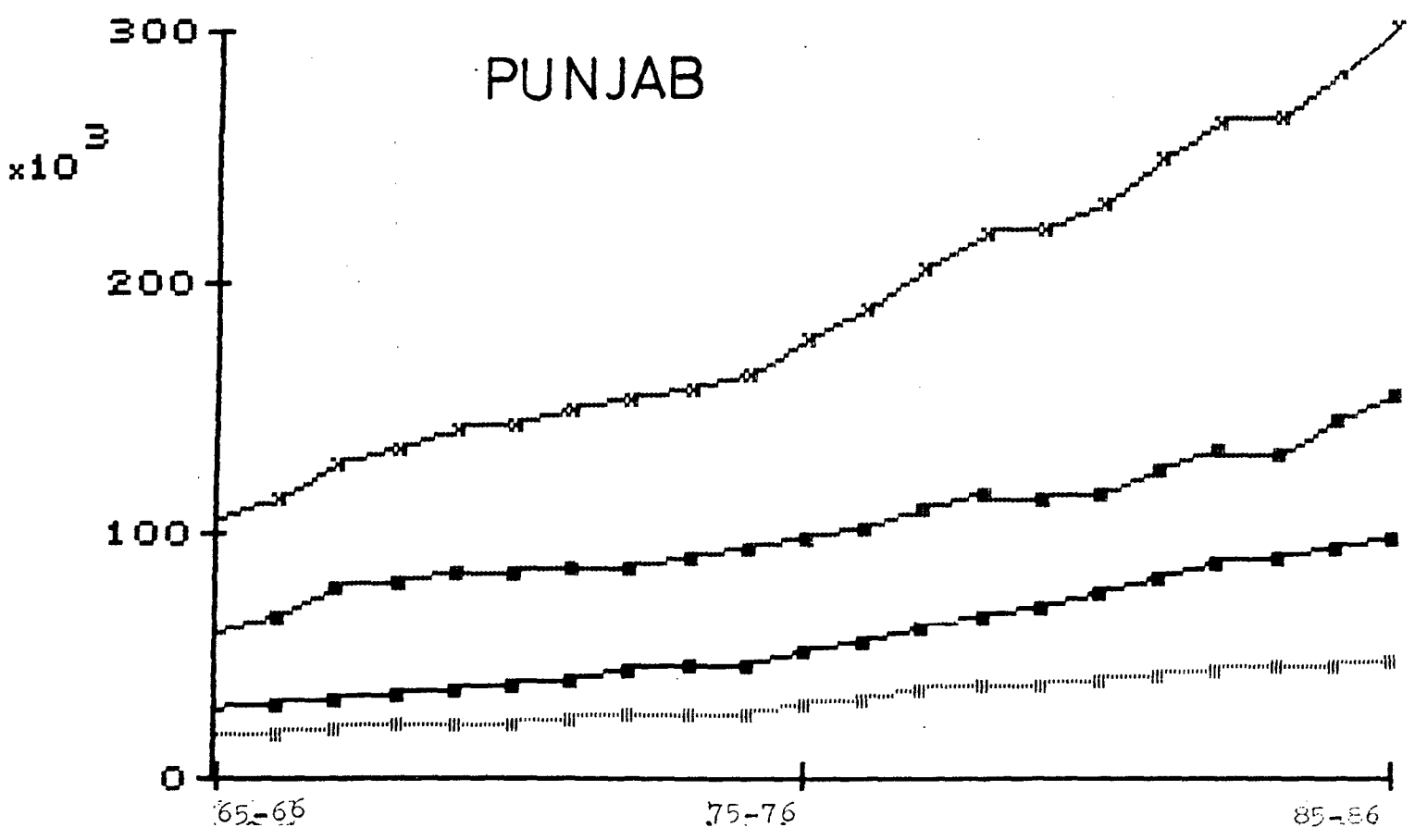


# ORISSA

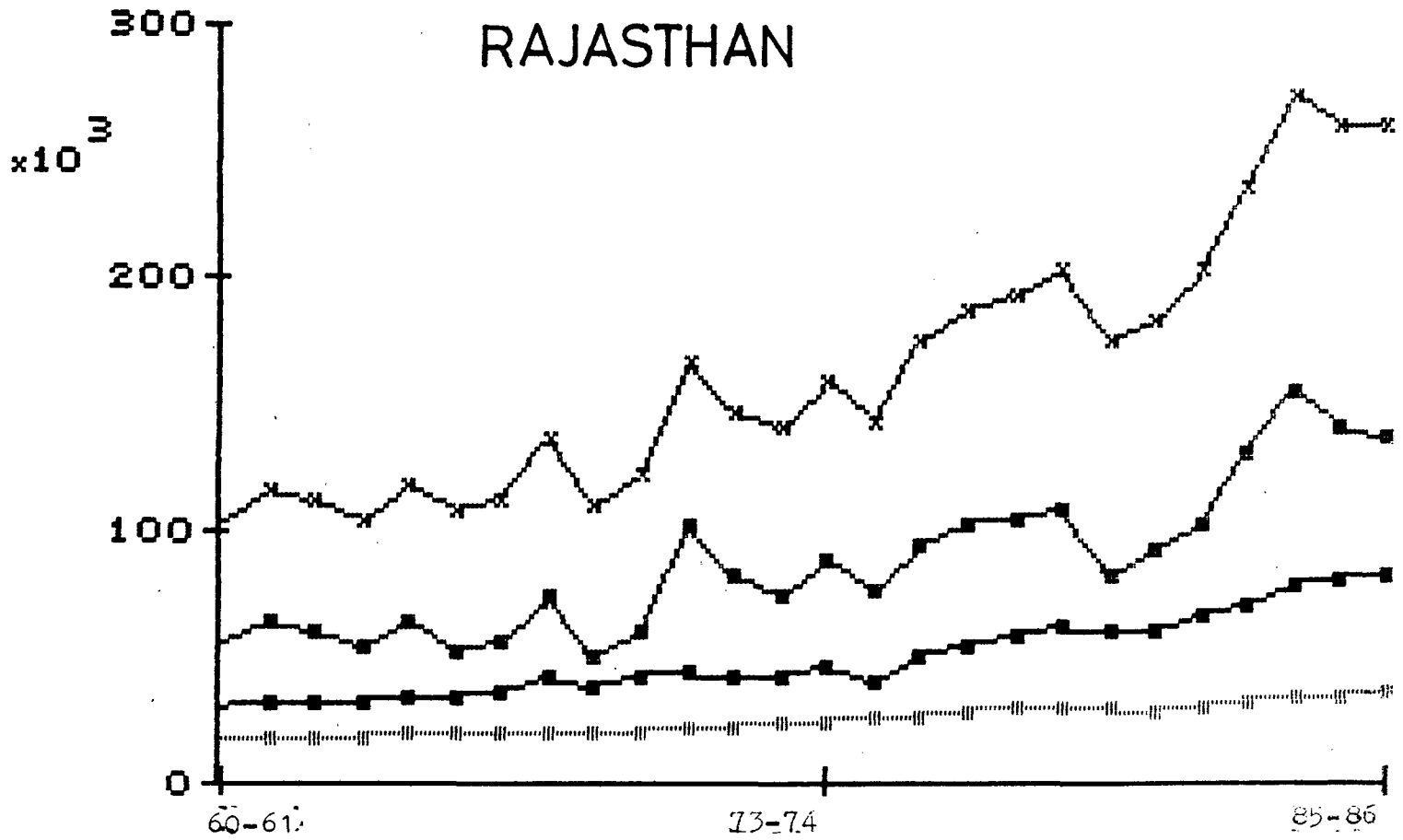


■ AGRI  
● SECN  
▲ TERT  
× NSDP

# PUNJAB



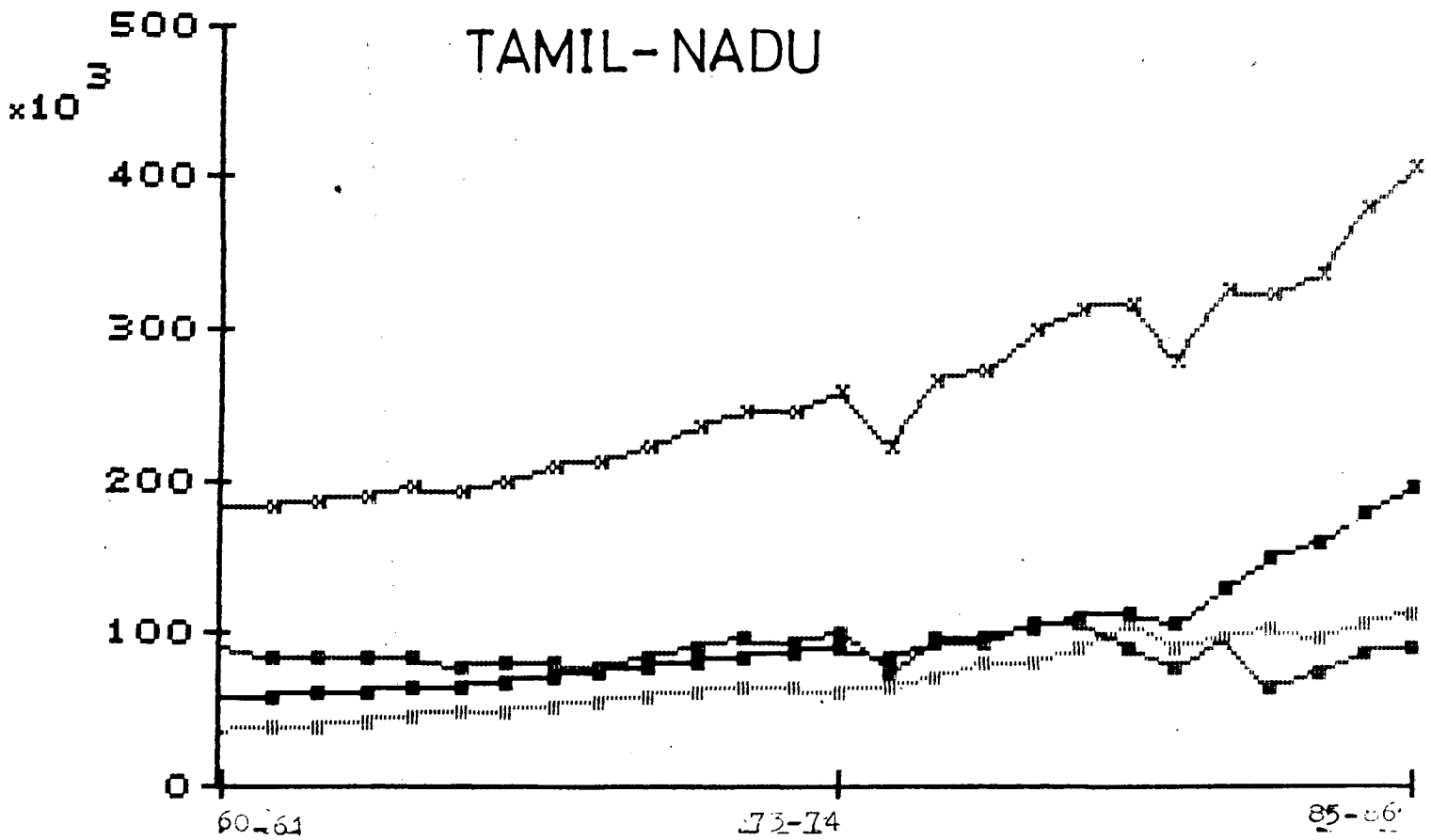
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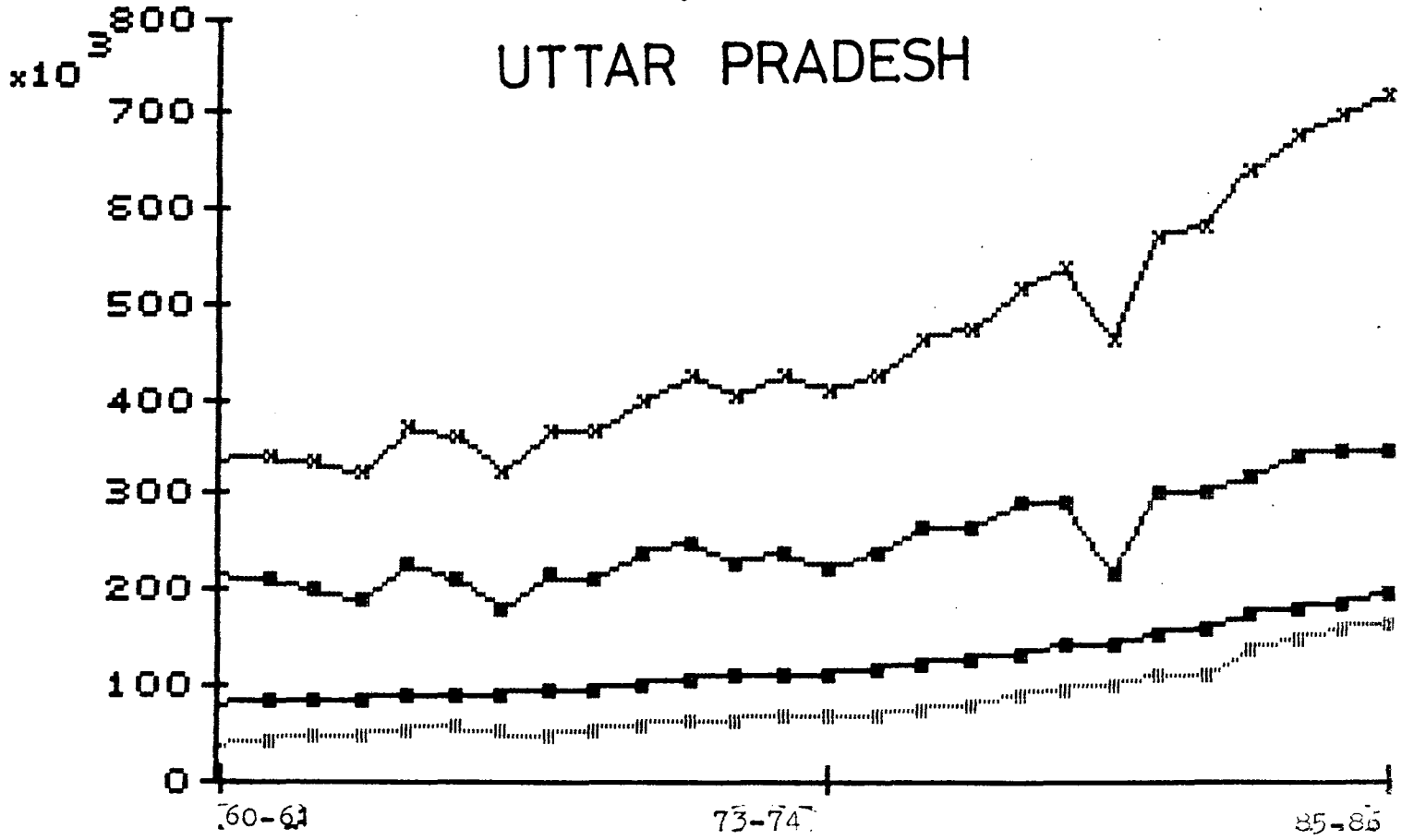
■ AGRI  
● SECN  
▲ TERT

× NSDP

# TAMIL-NADU



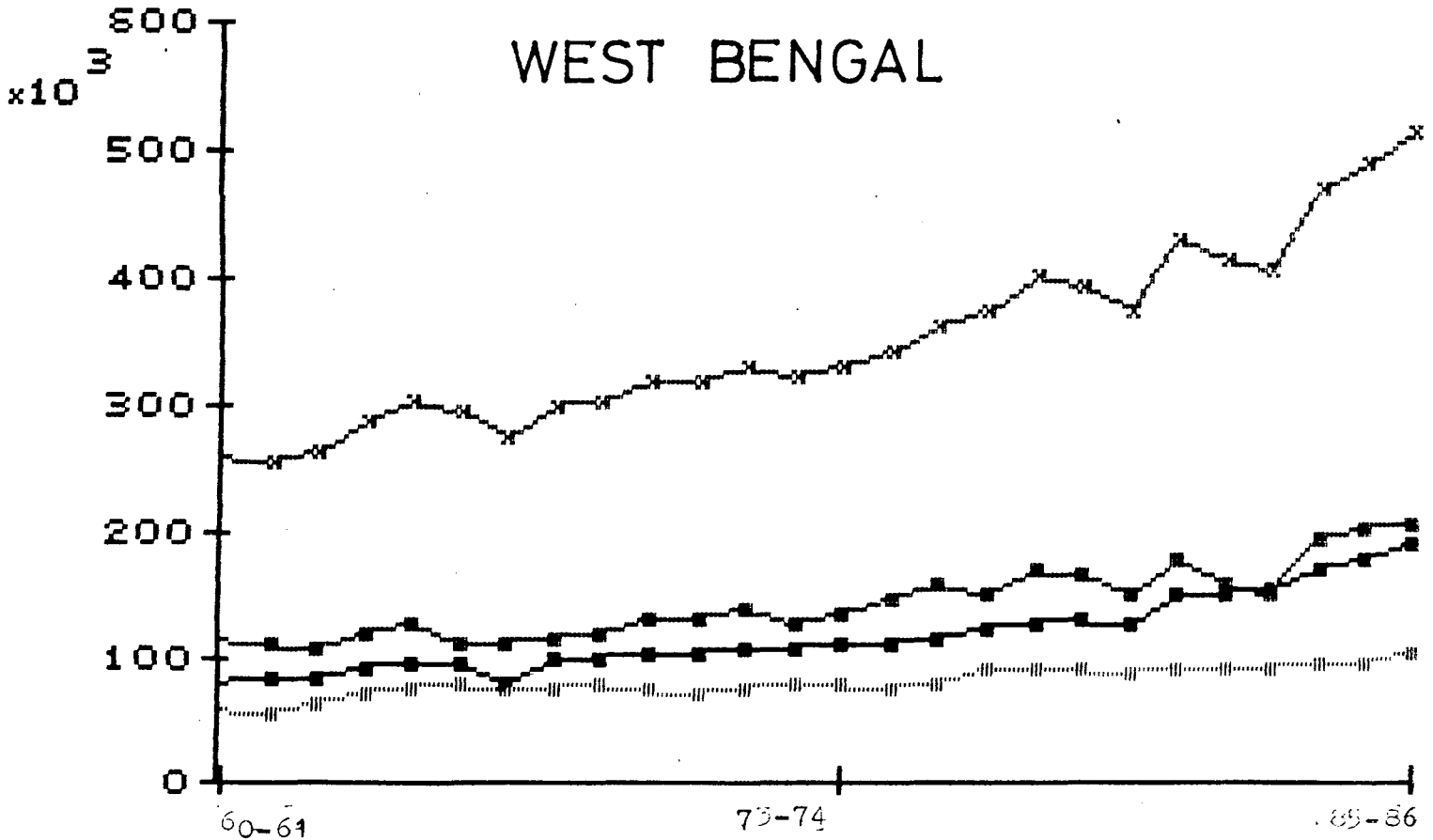
# UTTAR PRADESH



■ AGRI  
▲ SECN  
● TERT

x NSDP

# WEST BENGAL



60-61

73-74

85-86

CHAPTER - III

AGRICULTURE: NON-AGRICULTURE LINKAGE

IN INDIAN ECONOMY

SOME EMPIRICAL FINDINGS

### 3.1 STRUCTURAL TRANSFORMATION OF INDIAN ECONOMY

The inter-relationship between agriculture and non-agriculture cannot be studied isolated from structural changes which have been taking place in the Indian economy during the last three decades or so. Indeed, it is both worthwhile and essential to study the relative position of different sectors in the national economy, which has a definite bearing on the inter-sectoral linkages.

There is no ambiguity in the fact that the relative importance of agriculture has been declining in the national income. The contribution of agriculture to the national income has declined by nearly 18.0 percent points from 54.74 percent in 1960-61 to 36.80 percent in 1984-85 (see table-3.1). The decline has not been uniform throughout the period. For example, during the first five years (ie. from 1960-61 to 1965-66) the share of agriculture in national income declined sharply by 10.0 percent points from 54.74 percent to 44.77 percent. On the contrary, during this very period, the secondary sector grew the most (by 4 percent points), which was contributed mostly by the registered manufacturing industries. So, this sharp decline in agriculture's share during the five years 1960-65 might have happened due to increasing importance given to heavy industries earlier in the second five year plan and its starting giving results during the early sixties. Then, during the next decade (ie. from 1965-66 to 75-76), the share of agriculture remained nearly stationery at 45 percent. This happened

TABLE - 3.1

Percentage share of different sectors in the National Income (India)

	<u>Agriculture</u>	<u>Primary</u>	<u>Manufacturing</u> (Reg.)	<u>Manufacturing</u> (Unregd.)	<u>Construction</u>	<u>Secondary</u>	<u>Tert-1</u>	<u>Tert-2</u>	<u>Tert.T</u>	<u>Non-agr</u>
1960-61	54.74	57.23	6.99	4.97	4.53	16.99	14.20	5.04	26.94	45.26
1965-66	44.77	47.95	9.05	5.39	5.49	20.74	16.42	5.33	30.94	55.23
1970-71	47.38	50.14	8.33	5.06	5.37	19.67	15.80	4.88	30.19	52.62
1975-76	44.99	47.80	8.46	5.38	4.79	19.75	17.18	5.04	32.45	55.01
1980-81	40.30	42.65	9.13	5.50	4.89	20.89	18.48	5.89	34.34	59.70
1984-85	36.80	39.12	9.90	5.14	4.38	20.97	19.20	6.44	39.91	63.20

Source: Derived from various issues of National Accounts Statistics.

possibly due to the success of Green Revolution during the late sixties and the early seventies. After that, there has been a steady decline in the share of agriculture. The picture of primary sector is, mutatis mutandis almost same as that of agriculture, which occupies a dominant part of it.

Coming to the secondary sector, as pointed out earlier there was a big spurt in its activity during the first half of the sixties, after which there has been a clear stagnancy. As a matter of fact, we witnessed a fall in the share of the secondary sector during the late sixties and the early seventies, after which a slight revival has been observed. This trend could also be observed in the three constituents of the secondary sector. But the one clear-cut picture emerges out of this is that only registered manufacturing industries made some headway as far as their contribution to national income is concerned. Their share increased from 6.99 percent in 1960-61 to 9.90 in 1984-85. But the share of unregistered manufacturing industries and construction activities did not change significantly. The former's share increased only by 0.17 percent points during the twenty-five years since 1960-61, whereas that of the latter, it decreased by 0.15 percent points. However, after the mid-sixties the decelerating tendency is true of all the three components.

There has been a rapid increase in the share of tertiary sector in the national economy. Its share has been increasing regularly except during the second half of the sixties. Its share



increased by staggering 13 percent points during last twenty-five years compared to a nominal 4 percent point rise in the share of the secondary sector, proving the theory of growing 'tertiarisation' of the Indian economy by-passing the status of the secondary sector. This process got accelerated in the eighties. The share of tertiary sector has increased from 34.34 percent in 1980-81 to 39.91 percent in 1984-85, - a rise of five and half percent points just in four years. Out of the three major constituents of the tertiary sector, transport, railways and communication rose by 5 percent points while banking, insurance and real estates by a meagre 1.40 percent points; defence and personnel activities rose rather rapidly. During the later half of the sixties, there was a slight fall in every type of tertiary activities, perhaps due to the rapid rise in the agricultural activities during this period.

We can thus conclude that agriculture's contribution to national income has declined considerably. The decline in agriculture's share has been shared by the increase in the secondary as well as the tertiary sector. It is however, of significance to note that the services sector chipped off a much larger share compared with the secondary sector. To fix our idea more clearly about the changing importance of the major sectors, we may better look at the sectoral growth rates, for specified periods. We deal with sectoral growth performance of the Indian economy in the next section.

### 3.2 THE SECTORAL GROWTH-RATES

If we look at the year-to-year growth rate of different sectors of the Indian economy (table-3.2), we fail to discover a uniform pattern of growth both across the years and sectors. Let alone sectoral growth rates, even the time profile of the Net Domestic Product is punctuated by high degree of fluctuations. There are years showing growth rates as high as 9.64 percent and others showing as low as - 5.36 percent. There are three years having negative growth rate. The agricultural sector is more prone to this fluctuation than other sectors. Out of the twenty-five years under study, on ten occasions, agriculture shows negative trend. The range of fluctuation varies from 17.52 percent to -14.89 percent. The negative growth in agriculture was observed mostly in the drought years, showing how Indian agriculture is still sensitive to monsoons. The growth rate of the primary sector almost completely reflects the picture of the agricultural situation.

However, on the other hand, secondary and tertiary sectors show comparatively lesser degree of fluctuation. Though there are years having high and low growth rates, only once in the last twenty-five years they experienced actual fall in their production. Of course, there are phases such as from 1961-62 to 64-65 and from 1976-77 to 78-79 for the secondary sector and from 1961-62 to 64-65, 1975-76 to 78-79, and from 1981-82 to 84-85 for the tertiary sector which were marked by high growth rates. Again, out of the

Table - 3.2

Sectoral Growth rates (India)

	<u>Agriculture</u>	<u>Primary</u>	<u>Mfg.</u> (Reg.)	<u>Mfg.</u> (Unregd.)	<u>Construction</u>	<u>Secondary</u>	<u>Tert-1</u>	<u>Tert-2</u>	<u>Tert.T</u>	<u>Non-agr.</u>	<u>NDP</u>
1961-62	0.70	0.96	9.98	7.30	3.23	7.67	6.90	5.79	5.97	7.27	3.67
63	-2.72	-2.32	9.61	4.85	3.57	6.78	5.83	3.91	6.30	7.38	2.01
64	2.56	2.80	10.11	6.64	12.60	10.00	7.38	4.52	6.82	8.57	5.52
65	9.27	8.79	8.73	5.53	7.59	7.56	6.27	2.81	6.12	6.18	7.70
66	-14.89	-13.22	2.52	-2.19	6.91	2.49	2.28	2.17	2.77	4.98	-4.95
67	-2.07	-1.51	1.01	1.76	8.53	3.26	2.49	1.03	3.19	3.75	1.15
68	17.52	16.19	0.52	5.53	7.49	3.96	4.15	1.02	1.41	2.55	9.04
69	1.11	1.09	8.07	3.54	2.28	5.40	5.17	4.70	7.20	5.22	3.30
70	6.39	6.10	6.84	3.35	4.24	5.26	5.25	3.53	5.32	5.03	5.65
71	7.83	7.49	-1.03	2.95	-0.75	0.47	2.75	4.34	4.19	2.22	4.80
72	-1.46	-0.99	4.84	5.62	3.02	4.49	3.56	3.98	5.09	4.97	1.93
73	-6.19	-5.88	1.19	3.36	-0.31	1.65	0.92	6.06	1.90	1.66	-1.94
74	7.81	7.37	7.48	3.67	-8.25	2.08	3.49	1.99	3.25	2.69	4.93
75	-2.23	-1.84	3.39	5.32	-3.72	2.43	7.00	-1.80	4.87	3.94	1.16

(Contd. p. 80.)

	<u>Agriculture</u>	<u>Primary</u>	<u>Mfg.</u> (Reg.)	<u>Mfg.</u> (Unregd.)	<u>Construction</u>	<u>Secondary</u>	<u>Tert-1</u>	<u>Tert-2</u>	<u>Tert.T</u>	<u>Non-agr.</u>	<u>NDP</u>
76	13.38	12.93	0.24	3.89	14.46	5.16	9.28	8.93	7.82	6.76	9.64
77	-6.96	-6.62	12.04	3.42	11.33	9.71	4.74	10.37	5.38	6.60	0.50
78	12.90	11.87	6.02	7.07	11.25	7.44	7.24	7.16	6.42	6.32	9.06
79	3.12	3.16	10.91	9.53	-2.27	7.34	7.59	12.07	8.62	7.94	5.86
80	-13.71	-13.07	-1.81	-1.60	-5.28	-2.37	-0.38	1.01	2.80	0.68	-5.36
81	12.94	12.25	-1.68	0.97	4.99	0.94	5.31	2.84	-0.39	3.85	7.33
82	4.24	4.43	7.46	3.19	1.77	5.03	6.45	5.63	13.65	6.37	5.51
83	-3.35	-3.15	9.48	2.49	0.38	5.43	6.81	9.75	8.19	6.92	2.83
84	11.69	11.30	5.79	3.63	3.42	4.79	5.68	6.56	7.00	6.18	8.24
85	-1.13	-0.76	6.23	3.82	3.23	5.40	5.32	7.78	7.60	6.79	3.73
1960-61 to 1973-74	1.94	2.06	4.70	3.62	4.73	4.56	4.22	3.26	4.50	4.68	3.33
1974-75 to 1984-85	2.38	2.35	5.18	3.45	3.01	4.38	5.47	6.71	6.40	5.52	4.23
1960-61 to 1984-85	2.25	2.28	4.65	3.82	3.29	4.26	4.80	4.57	5.08	4.75	3.62

Source: Derived from various issues of National Accounts Statistics.

Note: NDP: Net Domestic Product

three major constituents of the secondary sector, construction activities showed greater degree of variation in their growth rates than the other two sectors. Out of the three constituents of the secondary sector, registered manufacturing industries has generally been contributing the most to its growth. On fourteen occasions, it showed a very high growth performance. Only thrice did its production fall and that too quite negligibly. The growth of unregistered manufacturing industries and construction has been rather modest. During the three years from 1975-76 to 77-78, construction activities showed unprecedented growth, perhaps due to the prevailing political situation at that time. Both transport, railways, communication (tertiary-1) and banking, insurance, real estates showed modest and stable growth throughout, eighties being the phase of very high growth. In sum, non-agriculture as a whole showed a fairly stable growth, not even a single year showing a fall.

Coming to the comparative picture of the growth of different sectors for the total period, whereas agriculture grew at a rate of 2.25 percent exponentially, the rate of growth of non-agriculture was more than double, ie 4.75 percent. The rate of growth of the tertiary sector was the highest, ie. 5.08 percent compared to 4.26 percent in the secondary sector. The registered manufacturing grew at a higher rate than the unregistered manufacturing and construction throughout the period of study. Transport, communication, banking, insurance and real estate also grew at a

fairly high rate of more than four and half percent. But when we divide the entire period into two parts and study, the growth performance, the picture undergoes a noticeable change. During the first fourteen years from 1960-61 to 1973-74, the secondary sector grew at a rate higher than that of the tertiary sector. So, the tertiarisation phenomenon had really set in well in the early seventies. During the first phase, whereas agriculture grew at a low rate of 1.94 percent, the growth rate of non-agriculture was as high as 4.68 percent. If we compare the growth rate of the two periods we find that the growth rate during the second period was higher than that of the first one, in almost all the sectors except unregistered manufacturing, construction and the secondary sector as a whole. During the second period, the tertiary sector grew at a very high rate of 6.40 percent thanks to the spurt in banking, transport and other services. Between the two periods, whereas the increase in the exponential growth rate of agriculture was 0.44 percent points that of tertiary sector was 1.90 percent points. On the other extreme, in the case of the secondary sector, it fell by 0.18 percent points. The real beneficiary was finance and real estate activities. In the second period its growth was higher by 3.45 percent points compared to the first one. The Net Domestic Product also grew at a higher rate in the second period. Another important aspect that we observed by studying the year to year growth rates was that in those years in which the agricultural growth was slow, the Net Domestic Product also grew slowly showing predominance of agriculture in it (which can

be seen from the graph in the Appendix<sup>Ch</sup>-II). But it is not true of other non-agricultural sectors. The years of high agricultural growth are not necessarily the years of high non-agricultural growth. This is perhaps due to the fact that, though agriculture has not been able to influence some individual sectors ( a rise in the agricultural growth rate is associated with a fall in growth rate of some sectors during second period), the cumulative influence of the agriculture is felt on the non-agricultural sectors (when they are taken as a whole), so one-to-one correspondence between growth rate of agriculture and Net Domestic Product. However, this issue of interdependence will be dealt with more vividly later.

### 3.3 THE PROBLEM OF INSTABILITY

How stable or unstable are the different sectors of our economy can be judged from the average percentage fluctuation around the trend when we see the growth of different sectors over time (Table- 3.3). Over the entire period under study, if we compare the fluctuations in different sectors, we find that the tertiary sector is the most unstable. The secondary sector has shown relatively small fluctuations. As expected agriculture too has shown high degree of instability. If we compare the fluctuation between the two periods, we find that after 1974-75, Indian agriculture has become relatively more stable. This has been partly due to a steady increase in irrigation facilities, since the 1960s and partly

TABLE - 3.3

Average Percentage Fluctuation around the trend

Period	Sectors-->										
	Agriculture	Primary	Manufg. (Reg.)	Manuf. (Unregd.)	Construction	Secondary	Tert-1	Tert-2	Tert.T	Non-Agr.	Total % NDP
1960-61 to 1973-74	4.82	4.39	2.97	1.81	5.11	2.18	1.34	1.81	0.98	1.60	2.17
1974-75 to 1984-85	4.38	4.21	2.94	1.71	4.40	2.43	1.54	1.87	2.75	1.73	2.58
1960-61 to 1984-85	5.13	4.73	5.85	3.80	5.73	3.59	6.98	10.21	9.06	5.93	4.56

Note: NDP = Net Domestic Product

Source: Derived from various issues of National Accounts Statistics.



because monsoons have not been able to exert their excessively damaging impact as they did during the pre-1974 period. In the case of other non-agricultural sectors, either the fluctuation around the trend has remained the same or increased slightly. The economy as a whole, as reflected in the Net Domestic product, has become relatively more unstable in the second period. Though agriculture seems to have become less unstable, the non-agriculture does not seem to have tided over the problem of fluctuating growth around the trend. Nevertheless, the moot question is, whether the fluctuations in the agriculture have ceased to be transmitted to other sectors is still to be answered by us. The next section attends to this crucial aspect at the national level.

#### 3.4 SECTORAL INTER-DEPENDENCE

In the previous section, we saw that most of the sectors showed high degree of instability. The purpose of this section is to see whether the fluctuation in the agricultural sector has anything to contribute towards the observed instability in the non-agricultural sectors. The agriculture, non-agriculture linkages could have been explained in a better way if we had got the actual input-output transactions between agricultural and non-agricultural sectors. But we could get only two tables (1968-69 and 1973-74), published by the Central Statistical Organisation and another for 1964-65, prepared by the Indian Statistical Institute for Planning Commission. Though they are not strictly comparable, we made some

TABLE - 3.4

Technological Coefficient Matrices of Agriculture and non-agriculture  
(India)

		Agr.	Non Agr.
<u>1964-65</u>			
Agr.	[	.127	.166
Non-agr.	]	.0403	.46
		Agr.	Non Agr.
<u>1968-69</u>			
Agr.	[	.187	.069
Non-agr.	]	.06	.371
		Agr.	Non Agr.
<u>1973-74</u>			
Agr.	[	.172	.102
Non-agr.	]	.065	.358

Source: National Accounts Statistics.

rearrangements and found the technical coefficients between agricultural and non-agricultural sectors.<sup>1</sup> (see table 34).

It is very interesting to see that the technological coefficient between non-agriculture and agriculture has declined substantially from 0.166 in 1964-65, 0.069 in 1968-69, but it increased to 0.102 in 1973-74. On the other hand, the coefficient between agriculture and non-agriculture has increased substantially from 0.04 to 0.07 between 1964-65 and 1973-74. The severe limitations of interpretation imposed by figures in Table 34 notwithstanding, it seems clear enough that for nearly a decade since 1964-65, for every unit of production in agriculture an increasingly larger dependence on non-agricultural sectors was emerging. On the contrary the non-agricultural activities were showing shrinking dependence on agriculture till 1968-69, which increased after that. Unluckily, the picture beyond 1973-74 cannot be portrayed in terms of input-output coefficients, since comparable information could not be obtained. There are, however, no strong reasons to believe that the pattern deserved during 1964-65 to 1973-74, or atleast after 1968-69 at all got reversed; on the contrary, perhaps it got further strengthened.<sup>2</sup>

- 
1. We have clubbed, foodcrops, cashcrops, plantation crops, other crops and animal husbandry as agricultural sector and rest as non-agriculture.
  2. Thamarajakshi (1985) has proved this point by showing that between 1960-61 and 1978-79, the purchases by agriculture from non-agriculture has increased by 214 percent in case of intermediate use and by 107 percent in case of final use. Similarly, sales by agriculture to non-agriculture has increased by 40 and 73 percent respectively during this time period.

Table-3.5(i)

Non-agriculture-Agricultural/Primary Inter-relationships:Some Regression Results

Eq.No.			DW
-----			--
1.	$Y_{na}(t) = -1017593 + 1.829 Y_a(t) + 0.1950 DY_a(t)$	$\bar{R}^2 = 0.8944$	1.29 <sup>a</sup>
	$\begin{matrix} @ & * & @ \\ (-2.0591) & (5.2542) & (1.8971) \end{matrix}$	[102.5949]	
2.	$Y_{na}(t) = -756941.5 + 1.6959 Y_a(t-1) + 0.2517 DY_a(t-1)$	$\bar{R}^2 = 0.8952$	1.22 <sup>a</sup>
	$\begin{matrix} * & @ \\ (-1.5197) & (2.5084) \end{matrix}$	[ 99.1914]	
3.	$Y_{na}(t) = -1130964 + 1.8008 Y_p(t) + 0.1629 DY_p(t)$	$\bar{R}^2 = 0.9044$	1.34
	$\begin{matrix} @ & * & @ \\ (-2.3941) & (5.7380) & (1.7575) \end{matrix}$	[114.5611]	
4.	$Y_{na}(t) = -872121.4 + 1.6764 Y_p(t-1) + 0.2174 DY_p(t-1)$	$\bar{R}^2 = 0.9042$	1.26 <sup>a</sup>
	$\begin{matrix} @ & * & @ \\ (-1.8196) & (5.2674) & (2.3889) \end{matrix}$	[109.5411]	

Notes:

- ( i)  $Y_{na}$  = Income originating in non-agricultural sectors.  
 $Y_a$  = Income originating in agricultural sector.  
 $Y_p$  = Income originating in primary sector.

D (Dummy variable) = 0 for pre-1974/75 years and  
 1 for post-1974/75 years.

(t) = Current year

(t-1) = Previous year

a = The presence of autocorrelation has been dealt with by  
 Cochrane-Orcutt's iterative process for first order  
 auto-regressive models.

DW = Durbin-Watson Statistic(d)

( ii) Figures in the parantheses denote t-values and in the square  
 bracket denote F-values. t- and F values should be read same  
 way in the subsequent tables of this chapter.

(iii) \* = Significant at 1% level

@ = Significant at 5% level

Source: Derived from various issues of National Accounts Statistics.

To see the changing nature of association between agriculture/primary sector and non-agriculture, we have attempted a number of regressions between non-agricultural income (as a whole and income originating in various constituents of the non-agricultural sector) and agricultural/primary sector income separately. We have divided our time period as pre and post- 1974/75, the criteria of which are discussed in chapter II. It was noticed from the regression results that agriculture exercises a strong influence on the non-agricultural sector. Agricultural income significantly affects the non-agricultural income explaining 89 percent variation in the latter (Table-3.5 (i), eq.1). Not only the current, but lagged agricultural income has also considerable influence on the non-agricultural income. It explains almost equal percentage of variation as the current one. (Table-3.5(i), eq.2). There exists a positive and significant relationship between non-agricultural and agricultural income, which has further strengthened after the mid-seventies. The probable explanations will be discussed while analysing the inter-sectoral linkages between agriculture and various individual constituents of the non-agricultural sectors. The primary sector also has a considerable influence on the non-agricultural sector. It explains 90 percent variation in the latter (Table 3.5(i) eq.3&4). The interrelationship is almost similar as in the case of agriculture and non-agriculture.

Now let us consider the relationship between secondary sector and agriculture. The regression results showed a strong association between secondary and agriculture sectors. The agricultural income

explains 90 percent variation in the income originating in the secondary sector (see Table-3.5(ii), eq-1), The secondary sector has a strong association not only with current agricultural performance, but with that of previous year also. The lagged agricultural income explains slightly more (91 percent) variation in the secondary sector's income (Table 3.5 (ii),eq-2). The inter-relationship between these two sectors was <sup>positive and</sup> significant during the pre-1974-75 period, which has become even stronger during the later period. Positive and significant intercept dummy in both the models, ie. current and lagged (table-3.5(ii), eq-1,2) bear testimony to the above observation. The inter-relationship between secondary and primary sectors is almost similar to that between the former and agriculture, except that income originating in primary sector explains a slightly higher percentage of variation in the secondary sector income (table-3.5(ii), eq-3,4). Though this shows that secondary agriculture relationship gets almost reflected on the secondary-primary relationship due to high contribution of agriculture to primary sector's income, we can safely conclude that other allied activities like forestry, logging, fishing, mining and quarrying do influence the performance of the secondary sector.

The economic explanation of the above result can be given in various ways. After sixties there has been a sea-change in Indian economy. There has been huge investment, both private and public in canal and lift irrigation, power availability for agricultural purposes, provision of marketing support and so on. In many parts of India, the farmer today thinks of a tube-well or a pumpset

Table-3.5(ii)

Secondary-Agriculture/Primary Sector inter-relationships:Some Regression Results

Eq.No.			$\bar{R}^2$	DW
1.	$Y_S(t) = -233445.1 + 0.5833Y_a^*(t) + 0.0631DY_a^e(t)$	$(-1.5289) \quad (5.4229) \quad (1.9878)$	$\bar{R}^2 = 0.9009$ [110.1342]	1.37
2.	$Y_S(t) = -133140.6 + 0.5301Y_a^*(t-1) + 0.0828DY_a^*(t-1)$	$(- .8975) \quad (5.0761) \quad (2.7687)$	$\bar{R}^2 = 0.9069$ [113.0480]	1.35
3.	$Y_S(t) = -272566.1 + 0.5763Y_p^*(t) + 0.0523DY_p^e(t)$	$(-1.8830) \quad (5.9921) \quad (1.8416)$	$\bar{R}^2 = 0.9118$ [125.1212]	1.45
4.	$Y_S(t) = -173970.6 + 0.5273Y_p^*(t-1) + 0.0710DY_a^*(t-1)$	$(-1.2357) \quad (5.6406) \quad (2.6559)$	$\bar{R}^2 = 0.9173$ [128.5139]	1.44
5.	$Y_{mr}(t) = -142442.2 + 0.2791Y_a^*(t) + 0.0317DY_a^e(t)$	$(-1.7944) \quad (4.9915) \quad (1.9172)$	$\bar{R}^2 = 0.8874$ [ 95.6098]	1.44
6.	$Y_{mr}(t) = 987967.8 + 0.0623Y_a^*(t-1) - 0.0029DY_a^*(t-1)$	$( 0.7038) \quad (2.5548) \quad (-0.2997)$	$\bar{R}^2 = 0.9794$ [350.4592]	1.45 <sup>a</sup>
7.	$Y_{mr}(t) = -160344.8 + 0.2752Y_p^*(t) + 0.0265DY_p^e(t)$	$(-2.1066) \quad (5.4424) \quad (1.7775)$	$\bar{R}^2 = 0.8975$ [106.1196]	1.49
8.	$Y_{mr}(t) = -143670.3 + 0.2723Y_p^*(t-1) + 0.0303DY_p^*(t-1)$	$(-2.0429) \quad (5.8303) \quad (2.2667)$	$\bar{R}^2 = 0.9138$ [122.9732]	1.34
9.	$Y_{mu}(t) = -17480 + 0.1238Y_a^*(t) + 0.0203DY_a^e(t)$	$(-0.5605) \quad (5.6372) \quad (3.1219)$	$\bar{R}^2 = 0.9266$ [152.5027]	1.39
10.	$Y_{mu}(t) = -7490.4 + 0.1213Y_a^*(t-1) + 0.0217DY_a^*(t-1)$	$(-0.2291) \quad (5.2707) \quad (3.2863)$	$\bar{R}^2 = 0.9205$ [134.1875]	1.66
11.	$Y_{mu}(t) = -25160.7 + 0.1219Y_p^*(t) + 0.0177DY_p^*(t)$	$(-0.8497) \quad (6.1987) \quad (3.0414)$	$\bar{R}^2 = 0.9345$ [172.2152]	1.45
12.	$Y_{mu}(t) = -16147.2 + 0.1202Y_p^*(t-1) + 0.0189DY_p^*(t-1)$	$(-0.5196) \quad (5.8263) \quad (3.2066)$	$\bar{R}^2 = 0.9292$ [151.8463]	1.77

(Contd... p-92)

Secondary-Agriculture/Primary Sector inter-relationships:Some Regression Results

Eq.				DW
13.	$Y_C(t)$	$= 216287.5 + 0.03 Y_a^e(t) - 0.0034 DY_a(t)$	$\bar{R}^2 = 0.9445$	1.28 <sup>a</sup>
		$(2.5941) \quad (1.8826) \quad (-0.5491)$	[131.4242]	
14.	$Y_C(t)$	$= -264193.8 - 0.0156 Y_a^{(t-1)} + 0.0126 DY_a^{(t-1)}$	$\bar{R}^2 = 0.9374$	1.35
		$(4.0017) \quad (-0.9602) \quad (2.0516)$	[110.8779]	
15.	$Y_C(t)$	$= 210810.8 + 0.0304 Y_p^e(t) - 0.0034 DY_p(t)$	$\bar{R}^2 = 0.9448$	1.29 <sup>a</sup>
		$(2.5292) \quad (1.9084) \quad (-0.5831)$	[132.1215]	
16.	$Y_C(t)$	$= 264262.3 - 0.0149 Y_p^{(t-1)} + 0.012 DY_p^{(t-1)}$	$\bar{R}^2 = 0.9374$	1.35
		$(3.9397) \quad (-0.9176) \quad (2.0659)$	[110.8983]	

Notes:

- ( i)  $Y_S$  = Income originating in secondary sector.
- $Y_a$  = Income originating in agricultural sector.
- $Y_p$  = Income originating in primary sector.
- $Y_{mr}$  = Income originating in manufacturing (Registered) sector
- $Y_{mu}$  = Income originating in manufacturing (Unregd.) sector
- $Y_C$  = Income originating in construction.

$D, (t), (t-1), a, DW, * @$  denote same as table 3.5(i)



instead of waiting for the rain-god. There has been a steady expansion in the use of chemical fertilisers, pesticides, insecticides etc. All India consumption of plant nutrient per unit of Gross cropped area (consumption of Nitrogen, Phosphorous, and Pottash per hectre) has increased almost 25 times between 1960-61 and 1984-85 and by more than thrice after 1974-75. Similarly, there has been a continuous rise in the area cultivated under HYV seeds. This has increased 29 times between 1966-67 and 1984-85 (see Table-3.6). Naturally, the changing composition of input use in Indian agriculture made agriculture: non-agriculture relationship to undergo substantial changes. This process got further strengthened after mid-seventies due to a still higher degree of modernisation of agriculture, particularly because of a decisively higher degree of farm mechanisation on the one hand, and the spread of the new HYV-technology in new areas, generally with active support from the government. As a matter of fact, the period since mid-seventies has witnessed a steep rise in the use of industrial inputs like tractor, harvester, diesel/electricity-pump sets etc. Between 1972 and 1977 the use of oil engine pumps rose from 1546 thousand to 2,359 thousand, that of electricity pumps rose from 1618 thousands to 2,438 thousands and four-wheeled tractors from 1482 hundred to 2759 hundred.<sup>3</sup>

Again, as pointed out above, since mid-seventies, agriculture growth got extended to newer areas, inter alia, because of increasing

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3. Statistical Abstract, India, 1985.

**TABLE 3.6**  
**USE OF INDUSTRIAL INPUTS IN INDIAN AGRICULTURE**

YEARS	CONSUMPTION OF FERTILIZER (NPK)	CULTIVATED AREA UNDER HYV.	USE OF OIL ENGINE PUMPS	USE OF ELECTRICITY PUMPS	USE OF TRACTORS
	KG. PER HECTRE	'000 HECTRES	'000	'000	'00
1960-61	1.93	NA	230	160	310
62	2.17	NA	NA	NA	NA
63	2.88	NA	NA	NA	NA
64	3.46	NA	NA	NA	NA
65	4.86	NA	NA	NA	NA
66	5.05	NA	471	415	540
67	7.00	1,886	NA	NA	NA
68	9.40	6,036	NA	NA	NA
69	11.05	9,297	NA	NA	NA
70	12.21	11,413	NA	NA	NA
71	13.61	15,383	NA	NA	NA
72	16.14	18,173	1,546	1,618	1,482
73	17.06	22,321	NA	NA	NA
74	16.71	26,038	NA	NA	NA
75	15.67	27,337	NA	NA	NA
76	16.93	31,888	NA	NA	NA
77	20.39	33,560	2,359	2,438	2,759
78	24.83	38,930	NA	NA	NA
79	29.28	40,134	NA	NA	NA
80	30.97	38,383	NA	NA	NA
81	31.82	43,079	NA	NA	NA
82	34.27	46,491	NA	NA	NA
83	37.08	47,485	NA	NA	NA
84	44.70	53,739	NA	NA	NA
85	46.60	55,418	NA	NA	NA

Note: NA = Not Available

SOURCE: (i) Fertilizer Statistics, 1985-86  
(ii) Statistical Abstract, 1985

use of modern inputs. As for example the per hectre fertiliser use even in a backward state such as Bihar which was 9.79 Kg in 1971-72 increased to 40 Kg in 1984-85.<sup>4</sup> Again, in the same state, between 1966 and 1977 the number of tractors increased from 2100 to 10500, oil/electricity pumpsets from 11 thousand to 225 thousand.<sup>5</sup> Apart from these development in the production side, the neo-rich peasants and rural middle-class have become a potential market for industrial consumer goods especially during late seventies and early eighties. So the increase in inter-dependence between secondary and agricultural sectors is a reflection of rising modernization of Indian agriculture which is now encompassing larger geographical areas and increasing number of industrial products and infra-structural services.<sup>6</sup>

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4. Fertilizer statistics, FAI, 1985-86.

5. Statistical Abstracts, India, 1970 & 1985.

6. Though some economists like Bhattacharya and Rao (1986) have argued that interdependence between agriculture and industry has decreased after mid-sixties, inter alia due to falling share of agro-based industries, this argument does not take us very far. Firstly, though the share of agro-based industries has fallen, its size is quite big to demand large quantities of raw materials from agriculture. Secondly, after mid-sixties there has been large-scale mechanisation of Indian agriculture. The capital goods industry itself looks, at least partially, towards agriculture for a market. Again, there is ample literature to show that the demand for non-agricultural products by agriculture has risen at a faster rate than the demand for agricultural products by non-agriculture (Thamarajakshi, 1985). People have gone so far as to argue that the industrial deceleration after mid-sixties is due to unsatisfactory growth of agricultural sector. (Raj, 1976).

The secondary sector is not a homogeneous entity. There are some constituents of it which would be more responsive towards agriculture than other. We have looked into the linkages of three of them - Registered manufacturing, Unregistered manufacturing and constructions with agricultural and primary sector activities of current and lagged (by one year) period (see table-5(ii), eq-5+16). In all the cases the association is very strong. Agricultural/primary income explains very high percentage of variation in the income originating in various constituents of secondary sector.

There are a few observations to be made from these regression results. The lagged agricultural income explains more variation in the income of the registered manufacturing sector than that is done by current one (see Table 3.5(ii), eq-6). But in the case of unregistered manufacturing the level of explanations by current as well as lagged agricultural/primary income are about the same. It is perhaps due to the fact that organised industrial sector takes some time to mobilise the household savings during a good agricultural season, so lagged agricultural income has greater influence on registered manufacturing than the current one. On the other hand, the responsiveness of the industrial activities in the unorganised sector to that of lagged agricultural performance is not higher than that to current one. Because in most cases, in the case of a bumper crop/crop failure, particularly the latter, people would look instandly towards unorganised industrial sector. Secondly, there exists a positive and significant relationship between various constituents of the secondary sector and

agricultural/primary sector income, during the pre-1974 period except for that between construction and lagged income of agriculture/primary sector (table-3.5(ii), eq-14&16). In most of the cases this interrelationship has got further strengthened during the post-1974 period. Only in a few cases like that of registered manufacturing with lagged agricultural performance (eq-6) and construction with current agricultural/primary performance (eq-13&15), the relationship has not changed significantly.

Not only the secondary sector, but the tertiary sector also gets influenced by the performance of the agricultural sector. Over the period of time there has been a rapid growth of tertiary sector, especially after the mid-seventies. High degree of fluctuations was also observed in this sector. Possibly some of these are contributed by agriculture. The regression results show a strong association between tertiary sector and agriculture/primary both in terms of the current and the lagged models. Agricultural/primary income explains almost 89 percent variation in the income originating in the tertiary sector (see Table-5(iii) eq-9to12). In all the four cases we find a significantly positive inter-relationship between the tertiary and agriculture/primary in the pre-1974 period. This relationship has become stronger after mid-seventies, except in the case of that between tertiary and current primary income.

TABLE 3.5(iii)

Tertiary-agriculture/Primary Sector Interrelationship: Some regression results

Eq.No.				$\bar{R}^2$	DW	
1.	$Y_t^1(t) =$	$\begin{matrix} @ \\ -292406.1 \\ (-2.0954) \end{matrix}$	$\begin{matrix} * \\ + 0.5398 Y_a(t-1) \\ (5.4914) \end{matrix}$	$\begin{matrix} * \\ + 0.0724 DY_a(t) \\ (2.4932) \end{matrix}$	$\begin{matrix} 0.9132 \\ [127.2236] \end{matrix}$	1.26 <sup>a</sup>
2.	$Y_t^1(t) =$	$\begin{matrix} @ \\ -196983.6 \\ (-1.3265) \end{matrix}$	$\begin{matrix} * \\ + 0.4877 Y_a(t-1) \\ (4.6645) \end{matrix}$	$\begin{matrix} * \\ + 0.0928 DY_a(t-1) \\ (3.1010) \end{matrix}$	$\begin{matrix} 0.9049 \\ [110.40] \end{matrix}$	1.31
3.	$Y_t^1(t) =$	$\begin{matrix} @ \\ 322327.8 \\ (-2.4090) \end{matrix}$	$\begin{matrix} * \\ + 0.529 Y_p(t) \\ (5.9521) \end{matrix}$	$\begin{matrix} @ \\ + 0.0626 DY_p(t) \\ (2.3861) \end{matrix}$	$\begin{matrix} 0.9210 \\ [140.849] \end{matrix}$	1.28 <sup>a</sup>
4.	$Y_t^1(t) =$	$\begin{matrix} @ \\ -229397.1 \\ (-1.598) \end{matrix}$	$\begin{matrix} * \\ + 0.482 Y_p(t-1) \\ (5.052) \end{matrix}$	$\begin{matrix} * \\ + 0.082 DY_p(t-1) \\ (3.004) \end{matrix}$	$\begin{matrix} 0.9123 \\ [120.6077] \end{matrix}$	1.34
5.	$Y_t^2(t) =$	$\begin{matrix} @ \\ -99364.3 \\ (-1.802) \end{matrix}$	$\begin{matrix} * \\ + 0.177 Y_a(t) \\ (4.566) \end{matrix}$	$\begin{matrix} @ \\ + 0.021 DY_a(t) \\ (1.837) \end{matrix}$	$\begin{matrix} 0.871 \\ [82.057] \end{matrix}$	1.15 <sup>a</sup>
6.	$Y_t^2(t) =$	$\begin{matrix} @ \\ -74945.4 \\ (-1.457) \end{matrix}$	$\begin{matrix} * \\ + 0.164 Y_a(t-1) \\ (4.517) \end{matrix}$	$\begin{matrix} * \\ + 0.029 DY_a(t-1) \\ (2.783) \end{matrix}$	$\begin{matrix} 0.894 \\ [97.66] \end{matrix}$	1.07 <sup>a</sup>
7.	$Y_t^2(t) =$	$\begin{matrix} @ \\ -106938.4 \\ (-1.9737) \end{matrix}$	$\begin{matrix} * \\ + 0.172 Y_p(t) \\ (4.787) \end{matrix}$	$\begin{matrix} @ \\ + 0.018 DY_p(t) \\ (1.732) \end{matrix}$	$\begin{matrix} 0.8767 \\ [86.321] \end{matrix}$	1.12 <sup>a</sup>
8.	$Y_t^2(t) =$	$\begin{matrix} @ \\ -82376.6 \\ (-1.624) \end{matrix}$	$\begin{matrix} * \\ + 0.159 Y_p(t-1) \\ (4.726) \end{matrix}$	$\begin{matrix} * \\ + 0.026 DY_p(t-1) \\ (2.684) \end{matrix}$	$\begin{matrix} 0.898 \\ [102.148] \end{matrix}$	1.03 <sup>a</sup>

(cont. . . . .)

9.	$Y_{tt}(t)$	$=$	$\begin{matrix} @ \\ -787395.5 \\ (-2.3525) \end{matrix}$	$+$	$\begin{matrix} * \\ 1.188 Y_a(t) \\ (5.042) \end{matrix}$	$+$	$\begin{matrix} @ \\ 0.124 DY_a(t) \\ (1.788) \end{matrix}$	$0.8853$	$[93.64]$	$1.29^a$
10.	$Y_{tt}(t)$	$=$	$\begin{matrix} @ \\ -691450.9 \\ (-2.096) \end{matrix}$	$+$	$\begin{matrix} * \\ 1.15 Y_a(t-1) \\ (4.953) \end{matrix}$	$+$	$\begin{matrix} @ \\ 0.153 DY_a(t-1) \\ (2.307) \end{matrix}$	$0.8932$	$[97.158]$	$1.06^a$
11.	$Y_{tt}(t)$	$=$	$\begin{matrix} * \\ -850580.9 \\ (-2.628) \end{matrix}$	$+$	$\begin{matrix} * \\ 1.163 Y_p(t) \\ (5.409) \end{matrix}$	$+$	$\begin{matrix} * \\ 0.106 DW_p(t) \\ (1.663) \end{matrix}$	$0.894$	$[101.988]$	$1.30^a$
12.	$Y_{tt}(t)$	$=$	$\begin{matrix} @ \\ -754418.8 \\ (-2.352) \end{matrix}$	$+$	$\begin{matrix} * \\ 1.127 Y_p(t-1) \\ (5.2915) \end{matrix}$	$+$	$\begin{matrix} @ \\ 0.1335 DW_p(t-1) \\ (2.1929) \end{matrix}$	$0.9003$	$[104.90]$	$1.06^a$

NOTES:  $Y_t^1$  = Income Originating in transport, communication, trade etc.

$Y_t^2$  = Income Originating in banking, insurance etc.

$Y_{tt}$  = Income Originating in Tertiary sector.

D, (t), (t-1), a, DW, \*, @ denote same as in Table 3.5(i).

We have also tried to show the inter-dependence of two out of three constituents of the tertiary sector with agriculture/primary, they being transport, communication, trade and railways; and banking, insurance, real estate etc. The third constituent, public administration, defence and other services naturally will have a very weak relationship with agriculture/primary sector. We have denoted the first constituent as Tertiary 1 and second as Tertiary 2. In both the cases there exists a very strong association with agriculture/primary sector. But the regression result shows two interesting features: (table-3.5(iii)eq-1to8).

(i) Agricultural/primary sector's performance explains a slightly more percentage of variation in Tertiary 1 than Tertiary 2. It is perhaps due to the fact that whereas in case of the former there exists a direct inter-relationship, agriculture/primary sectors influence the banking, insurance activities in an indirect way.

(ii) While in the case of Tertiary 1 sector, the lagged agricultural/primary income explains slightly less variation than the current one, the reverse is true in the case of Tertiary 2 sector. Generally, as soon as crops are harvested, they go to the market giving a spurt to transport and trade. Whereas, usually it takes some time for banking, insurance activities to respond to a good/bad agricultural performance.



TABLE 3.5(iv)

**Agriculture/ -Secondary/ Tertiary Sector Interrelationship: Some regression results**

Eq.No.				$\bar{R}^2$	DW
1.	$Y_a(t)$	$= 804782.2 + 1.03 Y_s(t) + 0.064 DY_s(t)$	$(6.5731) \quad (5.04) \quad (0.684)$	0.886 [93.87]	2.00
2.	$Y_a(t)$	$= 972966 + 0.499 Y_{tt}(t) + 0.037 DY_{tt}(t)$	$(8.7356) \quad (4.042) \quad (0.5674)$	0.87 [81.695]	1.89
3.	$Y_a(t)$	$= 857723.7 + 0.98 Y_s(t-1) + 0.114 DY_s(t-1)$	$(6.0977) \quad (4.175) \quad (1.097)$	0.859 [71.4564]	1.89
4.	$Y_a(t)$	$= 985877.3 + 0.508 Y_{tt}(t-1) + 0.509 DY_{tt}(t-1)$	$(7.6865) \quad (3.584) \quad (0.818)$	0.851 [66.8332]	1.84
5.	$Y_p(t)$	$= 830107 + 1.13 Y_s(t) + 0.053 DY_s(t)$	$(6.8261) \quad (5.577) \quad (0.573)$	0.899 [108.699]	2.00
6.	$Y_p(t)$	$= 1016262 + 0.55 Y_{tt}(t) + 0.032 DY_{tt}(t)$	$(8.9941) \quad (4.3641) \quad (0.4792)$	0.882 [90.418]	1.81
7.	$Y_p(t)$	$= 886222.9 + 1.08 Y_s(t-1) + 0.103 DY_s(t-1)$	$(6.2467) \quad (4.5695) \quad (0.9842)$	0.8724 [79.6035]	1.88
8.	$Y_p(t)$	$= 1027644 + 0.56 Y_{tt}(t-1) + 0.052 DY_{tt}(t-1)$	$(7.8694) \quad (3.885) \quad (0.706)$	0.862 [72.93]	1.80

NOTES:  $Y_a$  = Income Originating in agriculture.

$Y_s$  = Income Originating in Secondary sector.

$Y_{tt}$  = Income Originating in Tertiary sector.

D, (t), (t-1), a, DW, \*, @ denote same as in Table 3.5(i).

$Y_p$  = Income Originating in Primary Sector

In all the cases a positive and significant relationship was observed in the pre-1974 period which got strengthened in the later period. During the last few years there has been a spurt in the banking and insurance activities in the rural areas. Direct and indirect finance to agriculture by public sector banks has increased by 48 times between 1969 and 1985.<sup>7</sup> Another important service activity which has expanded in the rural areas is marketing. Vegetable and grain markets have come up in the rural and semi-urban areas of Punjab, Haryana, U.P. and other north Indian states in a big way. These factors might have contributed to higher dependence of tertiary sector on agriculture/primary after mid-seventies. Again, in the agriculturally developed states which are not equally developed industrially, agriculture might have inter-acted more with the tertiary sector. This theory should await more authentic verification till we explore such relationships separately for each state in the next chapter. Lastly, with the rise in agricultural production, government's procurement of agricultural products especially foodgrains is rising giving momentum to the tertiary sector activities of diverse type.

Though our primary objective was to investigate the degree of dependence of non-agriculture on agriculture, we tried to show the reverse also separately. The strong and significant association between agriculture and secondary and tertiary sectors (see table-5(iv)) reinforces the results obtained previously.

7. Economic Survey, 1988-89, Table-S-54.

### 3.5 CONCLUSION

From the foregoing discussion we conclude that during the last twenty-five years, the structure of Indian economy has changed a lot. The share of agriculture and primary sector has declined quite steadily; the share of secondary sector has increased but rather slowly. The Indian economy is becoming more and more 'tertiarised.'

Secondly, we find high degree of fluctuation in the growth of each and every sector of the economy. Compared to agriculture, secondary sector shows less and tertiary sector more instability around the trend.

Thirdly, there exists a highly significant inter-dependence between non-agriculture and agriculture, which has become even stronger after the mid-seventies. This is equally true of each of the major constituents of the non-agricultural sectors. The high and increasing dependence of secondary sector on agriculture is due to increasing use of industrial inputs in the agriculture. This also makes the reverse true.

CHAPTER - IV

STATE WISE ANALYSIS OF AGRICULTURE,

NON-AGRICULTURE LINKAGE

#### 4.1 STRUCTURAL TRANSFORMATION OF THE ECONOMIES OF VARIOUS INDIAN STATES

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In the previous chapter, we saw how Indian economy has got transformed during the last twenty-five years. But, as we know national picture for a big country such as India, cannot just be the reflection of that of individual states. Regional diversity is discernible in every aspect of the economy. In the present chapter, a state-level analysis is attempted to see the nature of inter-sectoral relationships since 1960-61. To begin with, we look into the changes in the share of sectoral incomes over last twenty-five years for each of the states included in the study. A well recognised empirical reality is that as the process of development sets in, the share of agriculture in the total income goes down. This was confirmed earlier in the case of Indian economy as a whole. In case of states, we find, barring a few exceptions, the share of agriculture has witnessed a fall. Of course, the degree of this fall varies from state to state (see Table-4.1). As could be seen from the table, there was a clear fall in agriculture's share in every state except Orissa, Rajasthan and West Bengal between 1960-61 and 85-86. In the case of Orissa there is a marginal rise in the share of the agriculture. It is interesting to note that, in the case of the four industrially important states, Maharashtra, Gujarat, Tamil Nadu and West Bengal, the share of agriculture was comparatively low to begin with in 1960-61. In the first three states, it fell further and reached a

TABLE - 4.1

Percentage share of different sectors to State Domestic Product

State\Years	Agriculture				Secondary				Tertiary			
	60-61	70-71	80-81	85-86	60-61	70-71	80-81	85-86	60-61	70-71	80-81	85-86
1. Punjab	NA	58.09	49.56	51.82	NA	15.31	17.20	15.46	NA	26.32	32.94	32.40
2. Haryana	NA	64.43	51.69	47.82	NA	15.22	19.61	20.02	NA	20.01	28.08	31.69
3. Andhra Pradesh	59.63	54.90	46.17	40.06	10.65	13.43	16.23	18.27	27.56	29.40	35.56	39.75
4. Maharashtra	40.36	26.99	26.35	22.55	26.64	34.19	35.12	35.67	31.24	37.19	37.20	40.47
5. Gujarat	44.23	47.20	37.90	29.08	23.21	20.83	24.98	25.49	31.44	30.26	35.74	43.37
6. Tamil Nadu	49.12	38.15	27.61	22.50	19.18	26.12	32.70	27.87	30.76	34.02	38.38	48.69
7. West Bengal	43.78	41.46	41.38	39.92	21.91	22.66	20.59	20.22	30.60	32.22	34.96	36.75
8. Bihar	60.40	56.34	48.81	43.77	13.88	16.83	17.11	21.44	20.64	20.41	28.30	29.46
9. Orissa	59.95	63.24	61.16	62.48	11.66	10.37	12.17	6.77	23.76	22.34	23.22	26.28
10. M.P.	62.54	55.85	45.94	42.73	10.94	14.73	18.61	19.00	21.72	23.11	28.60	32.16
11. H.P.	NA	49.23	46.64	43.49	NA	16.88	16.33	18.71	NA	25.95	31.61	36.30
12. J & K	60.44	50.75	46.54	42.09	9.84	14.67	16.64	20.20	21.95	29.00	31.70	33.08
13. Assam	NA	57.57	55.05	48.04	NA	14.08	14.57	16.60	NA	22.12	26.18	30.66
14. Rajasthan	53.62	60.70	49.99	52.22	15.81	12.86	15.19	13.86	28.93	25.53	32.74	31.69
15. Karnataka	54.13	52.19	43.37	39.49	20.11	23.16	29.55	30.15	22.63	22.17	25.57	29.35
16. Kerala	56.33	46.44	38.45	37.27	12.01	16.32	19.98	17.92	28.62	34.24	39.38	43.08
17. U.P.	64.38	58.40	53.33	48.16	10.59	14.93	18.95	22.83	23.71	24.81	26.36	27.54

Source: Derived from Estimates of State Domestic Product, 1985, 1987.

very low level of 23 percent, but in the case of West Bengal, industrialisation stagnated and the share of agriculture fell only by 4 percent<sup>points</sup> during last twenty-five years. Another point to note is that in Maharashtra, during the sixties, there has been a massive fall of more than 13 percent points in the share of agriculture, after which there has not been any perceptible sectoral shift in its economy. Similarly, coming to the eighties, we find a clear stagnation in the case of Kerala and Punjab. Whereas in case of the former it might be due to negative effect of lack of industrialisation, in the latter's case, profitability of highly commercialised agriculture might have hindered the process of shift away from agriculture. Again, mountainous states like Assam, Himachal, where there is little scope of development of either agriculture or industry, the process of shift away from agriculture has also been very slow. One state, where the economy is fast transforming itself is Haryana, thanks to its highly expanding secondary and tertiary sectors. We find many industrial townships coming up in Haryana. Its closeness to the capital might have helped in the process of industrialisation as well as expansion of service sector like transport, communication, insurance, finance etc.

Coming to the secondary sector we find definite stagnation in the case of Punjab, Gujarat, Himachal Pradesh and Assam. Most interesting is the fact that the share of the secondary sector in the State Domestic Product has fallen in the case of Orissa, Rajasthan and West Bengal. Lack of investment might have been the

cause in the case of the former two, large-scale closures and lock-outs might have hampered industrialisation in the third. Between 1960-61 and 85-86, the growth of the share of secondary sector has been fairly high in the case of U.P., Karnataka, Jammu and Kashmir, and Maharashtra. If we compare the percentage share of the secondary sector to State Domestic Product of different states in 1985-86, we find, only in 9 states considered out of 17 states, secondary sector contributed 20 percent or more to the State Domestic Product which is clear from the following :

<u>Percentage share of secondary sector</u>	<u>States</u>
30 percent or more	Maharashtra, Karnataka
25 percent or more	Tamil Nadu, Gujarat
20 percent or more	U.P., Bihar, J&K, Haryana, West Bengal.

During the sixties shares of the secondary sectors in Maharashtra, Tamil Nadu, Karnataka and Jammu & Kashmir has grown rapidly, whereas during the seventies this growth was noticed in Tamil Nadu, U.P, Karnataka and M.P. During the first five years of the eighties, only in case of U.P., Bihar, and J&K, perceptible rise in the share of the secondary sector was observed. There are many states e.g. Punjab, Tamil Nadu, West Bengal, Orissa, Rajasthan and Kerala where the share of secondary sector fell during the first half of the eighties.



The growth of the share of tertiary sector has been more rapid compared to that of the secondary sector, during the two and half decades since 1960-61 in most of the states. Only in three states, Maharashtra, Karnataka and U.P. the rise in the share of the tertiary sector has been lower than that in secondary sector during the last twenty-five years. We can get a picture of the process of tertiarisation, if we have a look on the share of this sector in 1985-86 for different states.

<u>Percentage share of Tertiary sector</u>	<u>States</u>
More than 40 percent	Tamil Nadu, Gujarat, Kerala, Maharashtra
More than 35 percent but less than 40 percent	Andhra Pradesh, West Bengal, Himachal Pradesh
More than 30 percent but less than 35 percent	Punjab, Haryana, M.P., J&K, Assam, Rajasthan
More than 25 percent but less than 30 percent	U.P., Karnataka, Orissa, Bihar

It is understandable that tertiary sector will be high in the case of states like Kerala and Himachal but tertiarisation of industrialised states like Gujarat, Maharashtra and Tamil Nadu might be due to some structural snag in the development process of these states, the tertiarisation process has been very rapid in Maharashtra, J&K and Kerala during the sixties.

From the foregoing discussion, we conclude that,  
(i) baring two states (Orissa and Rajasthan), in every state, the percentage share of agriculture in the State Domestic Product has fallen over time;

- (ii) in the most of the states, this fall has been accompanied by a noticeable rise in the share of the tertiary sector;
- (iii) Karnataka is the only state, where tertiarisation has not bypassed the industrialisation process.

We will try to capture the actual growth of different sectors in the next section.

#### 4.2 SECTORAL GROWTH RATES

In the previous section we saw how percentage share of different sectors grew or fell over the period of time. But that did not give us the picture of the rates of growth of different sectors, which will now be attempted in this section. The exponential growth rates of different sectors and state Domestic Product of different states could be seen from Table - 4.2.

It is noticed that the Net State Domestic Product grew more rapidly in agriculturally developed states like Punjab and Haryana. The industrially important states, Maharashtra, Gujarat and Karnataka also grew at a reasonably high rate. But other two relatively industrialised states, Tamil Nadu and West Bengal grew at a slower rate than the national one (3.62 percent) during 1960-61 and 1985-86. Other states, where growth rate of net state domestic product was more than the national one are Orissa, Rajasthan, Jammu and Kashmir and Assam.

TABLE - 4.2State-wise Growth Rates of Sectoral Incomes (1960-61 to 85-86)

States	Agriculture	Primary	Secondary	Tertiary	Non-Agri- culture	NSDP
1. Punjab	4.15	4.17	5.60	6.76	6.35	5.15
2. Haryana	3.72	3.76	6.63	8.34	7.64	5.43
3. Andhra Pradesh	1.88	1.90	5.24	4.88	4.87	3.31
4. Maharashtra	2.37	2.37	5.53	4.68	4.69	3.98
5. Karnataka	2.64	2.51	5.40	4.55	4.76	3.73
6. Gujarat	2.77	2.85	4.09	4.81	4.53	3.83
7. Tamil Nadu	0.07	0.13	4.71	4.60	4.60	3.04
8. West Bengal	2.46	2.40	1.88	3.27	2.65	2.57
9. Bihar	1.30	1.43	4.33	4.39	4.15	2.68
10. Orissa	4.62	4.59	3.26	5.12	4.54	4.60
11. M.P.	1.77	1.93	5.25	4.55	4.62	3.15
12. Rajasthan	3.93	3.96	3.18	4.08	3.83	3.88
13. U.P.	2.22	2.22	5.75	3.70	4.41	3.19
14. H.P.	2.20	1.56	3.36	5.13	4.02	3.17
15. J&K	2.72	2.70	6.65	5.95	5.74	4.19
16. Kerala	0.97	0.99	4.79	4.47	4.44	2.84
17. Assam	2.45	2.41	4.68	8.09	6.02	4.00

Note: (i) The period of analysis is from 1965-66 to 1985-86 for the Punjab & Haryana.  
from 1968-69 to 1985-86 for Assam &  
from 1967-68 to 1985-86 for Himachal Pradesh

(ii) NSDP = Net State Domestic Product.

Source: Derived from Estimates of State Domestic Product, 1985, 1987.

Coming to sectoral growth rates we find that incomes originating in agriculture grew very rapidly in Punjab, Haryana, Orissa, Rajasthan during the entire period of our study. Agriculture in the industrialised states grew steadily, more than that of the national rate, except in the case of Tamil Nadu, where the rate of growth of agriculture was the lowest. Another state where it was less than 1 percent is Kerala. Agricultural growth of Bihar and M.P. was also very slow. In the rest of the states it was more than 2 percent. Another important aspect to note is that barring two states (Orissa and Rajasthan), every other state showed a higher non-agricultural growth than that of agriculture. The picture about the growth of the primary sector is almost similar to that of agriculture, it being the dominant contributor to the primary sector.

Coming to the secondary sector, we find that only three states, Orissa, Rajasthan and West Bengal show a lower growth rate than that of agriculture. In the case of the first two states, it might be due to industrial underdevelopment, whereas, in case of West Bengal industrial deceleration might have caused the slower growth of secondary sector. The following table will give a picture of the states where secondary sector growth rate has been very high.

Growth rate of the  
Secondary Sector

States

6 percent or higher	Haryana, J &K
Between 5.5 percent and 6.0 percent	Punjab, Maharashtra, U.P.
Between 5 percent and 5.5. percent	Andhra Pradesh, Karnataka, M.P.

Out of the 17 states included in our study, 9 states, Punjab, Haryana, Gujarat, West Bengal, Bihar, Orissa, Rajasthan, Himachal Pradesh and Assam showed higher growth in tertiary sector than in secondary one. Out of these Punjab, Haryana and Assam showed very high growth in the tertiary sector. Compared to other states, tertiary sector has grown at a slower rate in West Bengal and U.P.

We have divided the total period into two subperiods<sup>1</sup> and tried to show a comparative picture of the growths between them (see Table-4.3). It can be noticed that the state Domestic Product grew at a higher rate during the later period than the former in most of the states baring Punjab, Haryana, Karnataka, Orissa, Himachal Pradesh and Kerala. Again, baring these states and Tamil Nadu, every other state showed a rise in the agricultural growth during the second period. Punjab's agricultural growth remained equally high in both the periods, but in Haryana, it was considerably lower in the second period than in the first one. In states like Andhra Pradesh, Gujarat, Tamil Nadu and Bihar agricultural growth was very low, that of Maharashtra was negative in the first

1. The point of division varies from state to state. Various years of division and its criterion is given in the chapter-II.

TABLE - 4.3

State-wise Growth Rates of Sectoral Incomes in two different periods

States\Sectors	Agriculture		Primary		Secondary		Tertiary		Non-Agri-culture		NSDP	
	P-I	P-II	P-I	P-II	P-I	P-II	P-I	P-II	P-I	P-II	P-I	P-II
1. Punjab	4.57	4.44	4.57	4.46	5.15	5.33	6.17	7.07	5.78	6.49	5.09	3.39
2. Haryana	4.35	2.81	4.39	2.81	6.52	6.66	8.01	7.44	7.37	7.09	5.55	4.83
3. Andhra Pradesh	0.67	1.65	0.75	1.65	4.84	6.03	3.39	6.51	3.75	6.17	2.00	3.98
4. Maharashtra	NEGTV	3.64	NEG.	3.56	7.93	4.92	4.31	5.23	4.56	5.04	2.84	4.64
5. Karnataka	2.86	1.93	2.84	1.70	5.40	4.99	3.90	5.41	4.52	4.89	3.65	3.53
6. Gujarat	0.68	1.21	0.96	1.34	3.69	3.54	3.57	5.44	3.75	4.66	2.58	3.41
7. Tamil Nadu	0.55	NEGATIVE	0.68	NEG.	4.53	3.30	3.48	8.14	3.93	5.99	2.52	3.52

Contd P. 114.

8. West Bengal	1.76	3.02	1.79	2.89	2.54	2.12	2.61	4.55	2.55	3.47	2.22	3.29
9. Bihar	0.59	1.68	0.80	1.67	3.66	5.24	0.95	7.71	2.24	6.01	1.29	3.93
10. Orissa	7.02	3.84	6.92	3.82	5.16	NEG.	6.87	4.06	6.19	2.27	6.70	3.21
11. M.P.	1.62	4.69	1.91	4.66	5.05	5.78	3.20	8.13	4.01	6.90	2.65	5.86
12. Rajasthan	3.24	4.96	3.15	4.98	2.71	2.91	3.15	5.85	2.89	4.89	3.11	4.93
13. U.P.	1.41	3.35	1.46	3.42	4.09	8.85	2.86	5.16	3.29	6.67	2.16	4.91
14. H.P.	3.43	2.91	2.53	1.46	4.01	2.31	4.35	6.57	4.61	3.51	4.04	3.25
15. J&K	2.47	2.79	2.27	2.41	6.79	7.68	6.30	5.26	5.63	5.44	3.90	4.24
16. Kerala	2.48	0.07	2.55	NEG.	5.25	2.84	4.66	3.60	4.79	3.12	3.55	1.85
17. Assam	2.78	3.42	2.82	3.49	2.79	9.04	10.03	8.42	6.23	8.18	4.13	5.71

Note: (i) The two periods are not uniform among the states. (Refer Chapter -II)

(ii) NSDP = Net State Domestic Product.

Source: Derived from Estimates of State Domestic Product, 1985, 1987.

period, but they revived during the second period. Only Tamil Nadu showed a negative trend. The secondary sectors of Punjab, Haryana, M.P., and Jammu and Kashmir showed consistently high rates of growth in both the periods. But the two states which have made a real jump between two periods are Assam and U.P.. Andhra Pradesh and Bihar also showed impressive rise in the growth rates of their secondary sectors during the second period. As regards the growth of relatively industrialised states such as Maharashtra, Gujarat and Karnataka it seems to have ~~dece~~elerated, the ~~dece~~eleration process being very high in the case of Maharashtra. The service sector has grown at equally high rate in agriculturally developed states of Punjab and Haryana. It has grown at a higher rate during the second period in the rest of the states except Jammu and Kashmir, Kerala and Assam. The tertiary sector has grown very rapidly in the second period compared to the first one in M.P., Andhra Pradesh, Tamil Nadu and Bihar.

So, we can conclude from the proceeding discussion that,

- (i) Non-agriculture has grown at a more rapid rate than agriculture in almost all states during 1960-61 to 85-86;
- (ii) The agriculturally developed states like Punjab and Haryana showed high growth rate in all the sectors;
- (iii) the industrialised states showed higher growth rates in non-agricultural sectors, baring West Bengal, where we find a clear industrial ~~dece~~eleration;
- (iv) the picture of other states is highly heterogeneous and diverse;



(v) the tertiary sector has grown consistently at a higher rate in almost all the states;

(vi) the comparative picture for the two periods show that non-agricultural sectors showed less differences in the growth rates than the agricultural sector,

#### 4.3 FLUCTUATIONS AROUND THE TREND

It could be seen from the graphs (see the Appendix<sup>E</sup>) that most of the states show high degree of instability. We have tried to capture the fluctuations in various sectoral incomes around the trend numerically. The following major trends were noticed. (See Table 4.4).

(i) Agriculturally developed states such as Punjab and Haryana show lower degree of fluctuation in Net Domestic Product as also in agricultural and non-agricultural incomes. The agriculture of Punjab is one of the stablest in the country, thanks to a high level of its technology based on an extremely high and stable irrigation base. Not only that, the fluctuations around the trend were found to be comparatively low in Primary, Unregistered manufacturing industries, construction, secondary and tertiary sectors in this states.

Table - 4.4

Average percentage fluctuations around the trend

State\Sectors	Agriculture	Primary	Manufacturing (Regd.)	Manufacturing (Unregd.)	Construction	Secondary	Tertiary-1	Tertiary-2	Tertiary Total	Non-Agriculture	NSDP
1. Punjab	4.30	4.32	11.37	6.18	3.93	5.03	6.05	18.49	8.02	6.58	4.67
2. Haryana	7.79	7.76	9.02	6.96	7.53	6.95	15.80	17.97	10.37	8.31	5.08
3. Andhra Pradesh	7.25	6.93	12.77	7.99	9.21	9.40	4.34	26.46	11.91	10.48	6.95
4. Maharashtra	10.31	9.82	8.49	5.36	2.54	7.63	7.67	12.51	6.85	6.07	6.72
5. Karnataka	6.23	5.95	15.45	8.83	2.74	6.82	5.05	11.57	7.25	5.99	4.69
6. Gujarat	13.17	12.52	7.27	4.53	5.46	6.31	11.25	7.97	9.48	7.37	7.63
7. Tamil Nadu	9.08	8.77	NA	NA	5.04	5.07	11.52	19.79	12.69	8.26	5.12
8. West Bengal	7.04	6.43	7.06	2.02	6.93	5.15	4.42	10.33	7.27	4.49	4.78
9. Bihar	6.64	6.05	15.81	31.27	10.46	9.08	28.85	18.66	18.26	11.46	7.09
10. Orissa	9.75	9.24	32.08	6.01	14.40	15.44	9.15	8.39	3.29	4.86	7.00
11. M.P.	10.49	9.10	18.51	10.51	4.32	8.47	6.22	12.44	13.29	9.56	8.70
12. Rajasthan	13.81	13.61	8.21	4.58	7.10	4.50	8.42	18.81	8.26	6.92	10.10
13. U.P.	7.07	6.84	21.27	25.18	10.37	18.79	9.03	12.79	7.16	10.70	7.70
14. H.P.	5.36	4.85	19.50	4.86	5.53	5.04	13.96	14.11	6.33	3.06	3.29
15. J&K	4.92	5.50	146.01	4.59	17.43	12.62	11.74	20.06	8.00	9.03	6.40
16. Kerala	4.17	4.69	7.12	13.59	12.00	5.22	4.41	7.95	3.37	3.42	2.61
17. Assam	2.82	2.70	3.79	13.11	19.53	9.88	16.15	6.83	8.87	6.05	3.30

Note: NSDP - Net State Domestic Product

Source: Derived from Estimates of State Domestic Product, 1985, 1987.

- (ii) Another set of three states, where most of the sectoral incomes were found to be stable are Assam, Kerala and Himachal Pradesh. The agriculture of these three States is very different from those of others. It is plantation crops (like tea and rubber) which contribute mostly to agriculture in the first two states, Himachal's agricultural performance is typical of the progress made by its fruit orchards. Naturally, these types of agriculture will not be very highly influenced by erratic rainfall.
- (iii) Another striking result we got is that the agricultural performance of the states of Rajasthan, Madhya Pradesh, Gujarat and Maharashtra show high degree of fluctuation, which gets reflected more prominently in the first two states' domestic product than those of the later two. The highly unstable agriculture of these three states might be due to environmental causes, they being the most drought-prone states. The comparative importance of agriculture in the state domestic product being less in the case of Gujarat and Maharashtra, the simultaneous fluctuation is less in these two states.
- (iv) The secondary sector of the industrialised states is more stable than the others the cause of which is obvious. These states are Maharashtra, Karnataka, Gujarat, Tamil Nadu and West Bengal. Perhaps, the unstable agricultural sector has not been able to influence the secondary

sector of these industrialised states inter alia, due to the fact that industrial expansions in some of these states are not so much rooted in agriculture, on the supply side (a la agro-industrialisation model) if not so much on the demand side. In any case, this hypothesis will be tested in the next section. Apart from these states, the secondary sectors of the states with extremely small industrial base like Himachal Pradesh, Kerala and Rajasthan are more stable than those of the industrially emerging states like U.P and Bihar. Again, if we look at the average percentage fluctuations around the trend of various constituents of the secondary sector, we find that the manufacturing sectors of industrialised states such as Maharashtra, Gujarat and West Bengal show more stability than those in other states. In the case of most of the states, the construction activities are less stable than manufacturing activities.

(v) Lastly, in most of the cases, tertiary sector is more unstable than even agriculture, but no clear-cut picture emerged vis-a-vis the secondary sector. The tertiary sectors of Kerala, Assam and Gujarat are relatively more stable than in other states. Here, another point need to be mentioned. It is that, the transport and communications sector shows lower degree of fluctuation than the finance and real estate sector in most of the states. Only in the case of mountainous states such as Assam, Himachal Pradesh the reverse is true.

#### 4.4 INTER-SECTORAL DEPENDENCIES:

From the previous section we get a varying picture of sectoral instabilities among the states. Some showed stabler agriculture, whereas others showed stabler non-agriculture. But the moot question we wish to answer now is whether one sector causes instability in the other? More precisely, whether fluctuations in the agricultural income get transmitted to other sectors? While discussing the objectives of the study earlier in chapter - II, we had outlined its limitations. Here we must mention that there is a possibility of agriculture of one state influencing non-agricultural sectors of another, through diverse types of inter-regional linkages. In as much as free factor and product markets operate at the national level, in the case of a large number of products (agricultural and non-agricultural), the extra-state effects of sectoral changes cannot be wished away. As already mentioned in chapter-II, we are not in a position to capture such effects in a neat fashion, since movements of goods and services, to and fro, among individual states, especially in terms of their compartmentalised sectoral setting, cannot be ascertained reliably. We would, therefore, confine our analysis to intra-state inter-sectoral dependencies/relationships.

Before going to analyse the above phenomenon in a greater detail, let us have a look at the broad picture that emerges out of various regression results (see Table-4.5). Most of the states showed a significantly positive relationship between non-agricultural income (taken as a whole) and agricultural one during the first period of

TABLE - 4.5Inter-Sectoral Dependencies in different States

Between Sectoral Incomes	Number of States					
	In Period - I			In Period - II		
	+ve signi- ficant	-ve signi- ficant	Insigni- ficant	Increa- sed signi- ficantly	Fell signi- ficantly	Remains Same
i) Non-agriculture(t) and agriculture(t)	11	1	5	8	0	9
ii) Non-agriculture(t) and agriculture(t-1)	9	1	7	10	0	7
iii) Secondary (t) and agriculture(t)	7	1	9	7	0	10
iv) Secondary (t) and agriculture(t-1)	8	0	9	6	0	11
v) Regd. Mnfg.(t) and agriculture(t)	5	1	10	6	1	9
vi) Regd. Mnfg.(t) and agriculture(t-1)	7	0	9	6	0	10
vii) Unregd. Mnfg.(t) and agriculture(t)	6	0	10	3	0	13
viii) Unregd. Mnfg.(t) and agriculture(t-1)	5	0	11	7	0	9
ix) Construction(t) and agriculture(t)	7	1	9	5	1	11
x) Construction(t) and agriculture(t-1)	5	1	11	5	0	12

(Contd... p.121)



Between Sectoral Incomes	Number of States					
	In Period - I			In Period - II		
	+ve significant	-ve significant	Insignificant	Increased significantly	Fell significantly	Remains Same
xi) Tertiary(t) and agriculture(t)	13	1	3	5	0	12
xii) Tertiary(t) and agriculture(t-1)	8	2	7	7	2 (-ve to+ve)	8
xiii) Tertiary 1(t) & agriculture(t)	13	0	4	6	0	11
xiv) Tertiary 1(t) and agriculture(t-1)	8	0	9	10	0	7
xv) Tertiary 2 (t) & agriculture(t)	8	1	8	5	2	10
xvi) Tertiary 2 (t) & agriculture(t-1)	7	0	10	5	0	12
xvii) Secondary (t) & Primary (t)	4	2	11	6	0	11
xviii) Tertiary(t) and Primary (t)	12	1	4	5	0	12
xix) Agriculture (t) & Secondary(t)	11	1	5	3	0	14
xx) Agriculture (t) & Tertiary (t)	13	0	4	1	2	14

NOTES: (i) (t) = Current year.  
(t-1) = Previous year.

(ii) The two periods are not uniform among the states (Ref. Chapter-II).

(iii) Significant at 5% level.

Sources: Regression results computed from data from Estimates of State Domestic Product, 1985, 1987.

our analysis. This trend was observed in the case of inter-relationship between tertiary and agricultural/primary income also. But majority of the states showed insignificant relationship between secondary and agricultural/primary sectors. We found only stray cases of negative inter-relationship. The above trend was also observed in the case of various non-agricultural sub-sectors (manufacturing, construction, transport etc.). The regression results of the lagged models reinforced <sup>was</sup> trend. In the second period, this dependence has remained same in majority of the states - this is true of secondary, tertiary and their constituents. But the non-agricultural income taken as a whole show increasing dependence on agriculture in almost half of the states. In table 4.6 we have enumerated the different sectors which show significant inter-dependencies for different states. It is clear from the table that some states such as Maharashtra, Kerala, Gujarat, Tamil Nadu, Bihar and Andhra Pradesh show insignificant inter-sectoral dependencies in most of the sectors in the first period. In the second period most of the states except Andhra Pradesh, Maharashtra, Tamil Nadu and Bihar show a significant increase in the inter-sectoral dependencies - taking a holistic look.

Now let us be more specific and look at the individual non-agricultural sectors' dependence on agriculture and bring out some regional picture, if any. Coming to dependence of non-agriculture as a whole on agriculture, it was noticed that current agricultural performance explains a very high degree of variation in the non-



TABLE - 4.6

INTERSECTORAL DEPENDENCIES IN DIFFERENT STATES

INTERDEPENDENT SECTORS

States	PERIOD - I		PERIOD - II	
	+ve Significant (1)	-ve Signi- ficant (2)	Increased signifi- cantly (3)	Decreased signifi- cantly (4)
Punjab	<u>Ymr, Yc, Ytt, Yt<sup>2</sup></u> , on Ya(t)  <u>Yna, Ys, Ymr, Yc, Ytt, Yt<sup>1</sup>, Yt<sup>2</sup></u> on Ya (t-1)  <u>Ytt</u> , on Yp(t)  Ya on Ys(t)&Ytt(t)		<u>Yna, Ys, Ymr, Ymu, Yc, Yt<sup>1</sup></u> on Ya(t-1)	<u>Yt<sup>2</sup></u> on Ya (t)
Harya- na	<u>Yna, Ys, Ymr, Yc, Yt<sup>1</sup>, Yt<sup>2</sup></u> on Ya(t)  <u>Yna, Ys, Yc, Ytt</u> , on Ya(t-1)  <u>Ya</u> , on Ys(t) & Ytt(t)		<u>Yna, Ys, Ymr, Yc, Yt<sup>1</sup></u> on Ya (t)  <u>Yna, Ys, Yc, Ytt</u> , on Ya(t-1)	
A. P.	<u>Yna, Ytt, Yt<sup>1</sup></u> on Ya(t)  <u>Ytt</u> on Yp(t)		<u>Yt<sup>1</sup></u> , on Ya(t-1)  <u>Ya</u> on Ys(t) & Ytt(t)	
Mahara- shtra	<u>Ymr</u> , on Ya (t-1)  <u>Ya</u> on Ys(t) & Ytt(t)			<u>Yc</u> on Ya(t)
H.P.	<u>Yna, Ys, Ymu, Yc, Ytt</u> on Ya(t)  <u>Yna, Ys, Yc, Ytt, Yt<sup>1</sup></u> on Ya(t-1)  <u>Ys</u> on Yp(t)  <u>Ya</u> , on Ys(t) & Ytt(t)		<u>Yna, Ys, Ymr, Yc, Ytt</u> , on Ya(t)  <u>Yna, Ys, Ymr, Yc, Ytt</u> on Ya(t-1)  <u>Ys</u> on Yp(t)	

(Contd... p.125...)

	PERIOD - I		PERIOD - II	
	(1)	(2)	(3)	(4)
J & K	$\frac{Y_{na}, Y_s, Y_c, Y_{tt}, Y_t^1, Y_t^2}{Y_a(t)} \text{ on}$ $\frac{Y_{na}, Y_s, Y_{mr}, Y_c, Y_{tt}, Y_t^1, Y_t^2}{\text{on } Y_a(t-1)}$ $Y_{tt} \text{ on } Y_p(t)$ $Y_a, \text{ on } Y_s(t) \text{ \& } Y_{tt}(t)$		$\frac{Y_{na}, Y_{mr}, Y_t^1, Y_t^2}{Y_a(t)} \text{ on}$ $\frac{Y_{na}, Y_{mr}, Y_{tt}, Y_t^1, Y_t^2}{\text{on } Y_a(t-1)}$	
Kerala	$Y_t^1, \text{ on } Y_a(t)$ $Y_{mu}, \text{ on } Y_a(t-1)$	$Y_c \text{ on } Y_a(t)$	$\frac{Y_{na}, Y_s, Y_{mu}, Y_{tt}, Y_t^1}{\text{on } Y_a(t)}$ $Y_{mr}, Y_{mu}, Y_c, \text{ on } Y_a(t-1)$ $Y_s, Y_{tt} \text{ on } Y_p(t)$	$Y_{mr} \text{ on } Y_a(t)$
Assam	$\frac{Y_{na}, Y_s, Y_{mr}, Y_{mu}, Y_{tt}, Y_t^1, Y_t^2}{\text{on } Y_a(t)}$ $\frac{Y_{na}, Y_{mr}, Y_{mu}, Y_{tt}, Y_t^1, Y_t^2}{\text{on } Y_a(t-1)}$ $Y_s, Y_{tt} \text{ on } Y_p(t)$ $Y_a \text{ on } Y_s(t) \text{ \& } Y_{tt}(t)$		$\frac{Y_{na}, Y_s, Y_{mu}, Y_{tt}}{\text{on } Y_a(t)}$ $\frac{Y_{na}, Y_s, Y_{mr}, Y_c, Y_{tt}, Y_t^1}{\text{on } Y_a(t-1)}$ $Y_s, Y_{tt} \text{ on } Y_p(t)$	
Orissa	$\frac{Y_{na}, Y_{mu}, Y_{tt}, Y_t^1, Y_t^2}{\text{on } Y_a(t)}$ $\frac{Y_{na}, Y_{mu}, Y_{tt}, Y_t^1, Y_t^2}{\text{on } Y_a(t-1)}$ $Y_{tt} \text{ on } Y_p(t)$ $Y_a \text{ on } Y_{tt}(t)$	$Y_s \text{ on } Y_p(t)$ $Y_a \text{ on } Y_s(t)$	$\frac{Y_{na}, Y_c, Y_{tt}, Y_t^2}{\text{on } Y_a(t)}$ $\frac{Y_{na}, Y_{mu}, Y_{tt}, Y_t^2}{\text{on } Y_a(t-1)}$	$Y_a \text{ on } Y_{tt}(t)$
M.P.	$\frac{Y_{na}, Y_c, Y_{tt}, Y_t^1}{\text{on } Y_a(t)}$ $Y_t^2, \text{ on } Y_a(t-1)$ $Y_{tt} \text{ on } Y_p(t)$ $Y_a \text{ on } Y_s(t) \text{ \& } Y_{tt}(t)$	$Y_c \text{ on } Y_a(t-1)$	$\frac{Y_s, Y_{mu}, Y_c, Y_t^2}{\text{on } Y_a(t)}$ $\frac{Y_{mu}, Y_t^1, Y_t^2}{\text{on } Y_a(t-1)}$ $Y_s, Y_{tt} \text{ on } Y_p(t)$	$Y_a \text{ on } Y_{tt}(t)$

	(1) <u>PERIOD - I</u>	(2)	(3) <u>PERIOD - II</u>	(4)
Rajas- than	$\frac{Yna, Ys, Yc, Ytt, Yt^1, Yt^2}{\text{on } Ya(t)}$		$\frac{Yt^1, Yt^2}{\text{on } Ya(t)}$	
		$\frac{Ytt \text{ on } Ya(t-1)}{Ytt \text{ on } Yp(t)}$	$\frac{Yna, Ytt, Yt^1}{\text{on } Ya(t-1)}$	
		$Ya \text{ on } Ys(t) \text{ \& } Ytt(t)$		
U.P.	$\frac{Yna, Ys, Ymr, Ymu, Ytt, Yt^1, Yt^2}{\text{on } Ya(t)}$		$\frac{Yna, Ys, Ytt, Yt^1, Yt^2}{\text{on } Ya(t)}$	
	$\frac{Yna, Ys, Ymr, Ymu, Ytt, Yt^1, Yt^2}{\text{on } Ya(t-1)}$		$\frac{Yna, Ys, Ymu, Ytt, Yt^1, Yt^2}{\text{on } Ya(t-1)}$	
	$Ya \text{ on } Yp(t)$		$Ys \text{ on } Yp(t)$	
	$Ya \text{ on } Ys(t) \text{ \& } Ytt(t)$			
Karna- taka	$\frac{Yna, Ys, Ymr, Ymu, Ytt, Yt^1}{\text{on } Ya(t)}$		$\frac{Yna, Ys, Ymr}{\text{on } Ya(t)}$	
	$\frac{Yna, Ys, Ymr, Ymu, Ytt, Yt^1}{\text{on } Ya(t-1)}$		$\frac{Yna, Ys, Ymr, Ymu, Ytt, Yt^1}{\text{on } Ya(t-1)}$	
	$Ys, Ytt \text{ on } Yp(t)$		$Ys \text{ on } Yp(t)$	
	$Ya \text{ on } Ys(t) \text{ \& } Ytt(t)$			
Guja- rat	$\frac{Ytt, Yt^1}{\text{on } Ya(t)}$		$\frac{Ymr, Ys}{\text{on } Ya(t)}$	
		$\frac{Yna, Ytt}{\text{on } Ya(t-1)}$	$\frac{Yna, Ymr, Ytt, Yt^1, Yt^2}{\text{on } Ya(t-1)}$	
	$Ytt \text{ on } Yp(t)$	$Ys \text{ on } Yp(t)$	$Ya \text{ on } Ys(t)$	
Tamil Nadu	$\frac{Ytt, Yt^1}{\text{on } Ya(t)}$			$\frac{Yt^2}{\text{on } Ya(t)}$
	$Ytt \text{ on } Yp(t)$			
West Bengal	$\frac{Yna, Ymu, Yc, Ytt, Yt^1, Yt^2}{\text{on } Ya(t)}$		$\frac{Ymr, Yc, Yt^1}{\text{on } Ya(t)}$	
	$\frac{Ys, Yc, Yt^1}{\text{on } Ya(t-1)}$		$Yt^1 \text{ on } Ya(t-1)$	
	$Ytt \text{ on } Yp(t)$		$Ya \text{ on } Ys(t)$	
	$Ya \text{ on } Ys(t) \text{ \& } Ytt(t)$			

	PERIOD-I		PERIOD - II	
	(1)	(2)	(3)	(4)
Bihar	$\frac{Y_{na}, Y_s, Y_{mr}, Y_t^2}{\text{on } Y_a(t-1)}$	$\frac{Y_{na}, Y_{tt}, Y_t^2}{\text{on } Y_a(t)}$ $\underline{Y_{tt}}$ on $Y_p(t)$	$Y_{mr}$ , on $Y_a(t)$	

Notes:

- $Y_a$  = Income generated in the agricultural sector
- $Y_p$  = Income generated in the primary sector
- $Y_{na}$  = Income generated in Non-agricultural sector
- $Y_s$  = Income generated in the Secondary sector
- $Y_{mr}$  = Income generated in the Manufacturing (registered) sector
- $Y_{mu}$  = Income generated in the Manufacturing (unregistered) sector
- $Y_c$  = Income generated in the construction sector
- $Y_{tt}$  = Income generated in the tertiary sector
- $Y_t^1$  = Income generated in the Transport, communications & Railways sector
- $Y_t^2$  = Income generated in the Banking, insurance and real real estate
- (t) = Income of the current year.
- (t-1) = Income of the previous year.

Source : As in Table 4.5.

agricultural sector in all the states (see Appendix Table-4.1). The extent of explanation varies from 89 percent to 99 percent. High value of F-statistic shows that the association is strong in every state. Generally, the under-developed states showed a positive and significant inter-relationship between non-agriculture and agriculture. Of course, few exceptions are there. The non-agriculture of these states is not at all dominant in terms of its contribution to the State Domestic Product. The infant non-agriculture will naturally grow on the shoulder of agriculture during the initial stage of their development. In the few developed states like Haryana, where both agriculture and non-agriculture were developed, nature of agricultural development was such that non-agricultural sector would be bound to depend on the growth of agriculture. During the later period agriculture of these states was becoming more and more mechanised and commercialised strengthening the non-agriculture - agriculture linkage. On the other hand, the non-agriculture of the underdeveloped states was growing too slowly to stand on its own. So, we find increasing inter-sectoral dependence in the second period in these states. The above trend is almost corroborated by the lagged models (Appendix Table-4.2). The agricultural performance of the previous year was influencing the current non-agricultural performance through 'capital generation'. This process was happening in the under-developed states and those of the developed states, where agriculture is more developed. On the other hand, for those states, which are developed due to development of non-agriculture rather than agriculture, (like

Maharashtra and Gujarat), non-agriculture could manage its capital from within, and show a weaker relationship with agriculture in the second period.

We now turn to see the dependence of various individual sectors on agriculture. Let us first examine the dependence of the secondary sector. As in the previous case, current agricultural performance explains a high degree of variation in the secondary sector's income, which is reinforced by same type of explanation by the lagged agricultural income (Appendix Tables - 4.3 & 4.4) : Of course there is regional variation. The degree of explanation is comparatively low in states like Orissa, which is underdeveloped - both agriculturally and industrially. During the first period of our analysis we find some distinct regional pattern. Both relatively industrialised (ie. Maharashtra, Tamil Nadu, Kerala, West Bengal) and industrially backward<sup>1</sup> (like Orissa, Madhya Pradesh, Rajasthan, Andhra Pradesh)<sup>states</sup> show an insignificant inter-relationship between secondary and agricultural sector. Only in the case of first group of states, we can say that the secondary sector had become resilient from agriculture even in the sixties and mid-seventies. But a-ny such conclusion for the second group of states would be deceptive, considering the nascent stage of development of the secondary sector

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1. For exact ranking of the states on the basis of six industrial indicators, see Hemlata Rao, "Inter-State Disparities in Development of India", in G.P. Mishra (ed): Regional Structure of Development and Growth in India, Vol.I, Ashis Publishing House, New Delhi, 1985, pp.77-78.

in these states. The secondary sector of the relatively industrialised states might have become insulated from agriculture due to higher industrial base (so, higher capacity to generate its own resource from within), rise of the non-agro-based industries etc. On the other hand secondary sector of the backward states is too small- so it would be wrong to conclude resilience on the basis of insignificant relationship between secondary and agriculture sectors. The middle ranking industrial states show a positive and significant relationship during the first period, which has increased in the second period. Most of these states like Karnataka, Haryana, Punjab, Bihar, U.P., etc. have been expanding their industrial base in a rapid rate, so depending more and more on agriculture. Rest of the states show no change in the inter-sectoral relationship between secondary and agricultural sector in the second period, except Kerala, where there has been a significant decline.

A better and perhaps a more surer picture will emerge if we analyse the dependence of the constituents of the secondary sector on agriculture. For this purpose, we have divided the secondary sector into three constituents - registered manufacturing, un-registered manufacturing and construction, and regressed them upon agricultural income of both current and previous year. (Appendix Tables 4.5 to 4.10). The regression results give us some distinct features. For most of the states percentage variation explained by the agricultural income in the manufacturing sector is higher <sup>than</sup> that in the construction. However, no such clear picture emerges when

we compare the percentage variation explained in the two manufacturing sectors. Agriculture explains more variation in the unregistered manufacturing sectors of Punjab, Karnataka, Gujarat, West Bengal, Orissa, U.P., Himachal, Jammu and Kashmir, and Kerala. Most of these states have a larger small-scale industrial base.<sup>2</sup> In the rest of the states agriculture explains less or as much variation in the registered as in the unregistered manufacturing sector.

Now let us come to the inter-state analysis of the dependence of the various constituents of the secondary sector. Taking the registered manufacturing first we find that association between this sector and agriculture is strong and significant in most of the states except few like Orissa, Himachal Pradesh, Jammu and Kashmir and West Bengal. While the registered manufacturing sector contributes negligible share to the respective State Domestic Product of the first three states,<sup>3</sup> there is almost stagnancy in the growth of this sector in West Bengal (the compound growth rate being only 0.58 percent over the twenty-five years). Probably for these reasons agriculture explains a lesser percentage variation in the registered manufacturing sector of these sectors. In general, we

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2. Ibid., pp. 77, 78.

3. The percentage share of the registered manufacturing sector to the state domestic product are

	1960-61	1985-86	
Orissa	1.98	1.68	Source: Derived from Estimates of State Domestic Product, 1987.
J & K	0.87	3.91	
Himachal Pr.	1.43	2.63	



find an insignificant inter-relationship between the registered manufacturing and agriculture. However, the states where agriculture is dominant and developed like Punjab, Haryana and U.P. we found a positive and significant inter-relationship during the first period. These are the states where Green Revolution was successful in the late sixties and early seventies. Higher dependence of the registered manufacturing on agriculture in these states is found probably due to higher use of industrial inputs in the agricultural activities of these states.<sup>4</sup> Another group of states Karnataka, Maharashtra and Assam show a significant and positive dependence between these two sectors, probably due to agriculture's supply of inputs to agro-based industries in these states. In most of the states this dependence has increased after mid-seventies, when Green Revolution was extended to newer areas.

Coming to unregistered manufacturing industries, we find that most of the states show an insignificant dependence on agriculture in both the periods. The states like U.P., Orissa, Himachal Pradesh and Assam which are industrially backward show a positive and significant dependence. In the absence of large-scale industries, it is natural that a good agricultural performance will give a boost to unorganised, petty, small-scale industrial activities. Apart from these states Madhya Pradesh and Kerala show increased

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4. Fertiliser use per hectre was 52.69 Kg in Punjab against All-India average of 16.03 Kg way back in 1971-72, Source: Fertiliser statistics.

inter-relationship between unregistered manufacturing and agriculture.

There is no doubt that a good/bad agricultural performance will affect the housing and other construction activities. However, in case the states like Orissa and Assam, the agriculture explains a very low variation in the construction sector. The agriculture of these states is at subsistence level and even a good performance cannot supply the requisite surplus for the construction activities. The agriculturally developed states of Punjab and Haryana show a positive and significant inter-relationship between construction and agricultural activities, which has become even stronger over the period of time. Other states which follow this type of trend are Madhya Pradesh, West Bengal, Rajasthan and Himachal Pradesh. The construction sector of relatively industrialised states like Maharashtra, Gujarat, Tamil Nadu and Karnataka is totally resilient from the ups and downs of agriculture.

The association between tertiary and agriculture sector is strong and significant in almost all the states. Agriculture explains more than 90 percent variation in the tertiary sector of sixteen out of seventeen states considered for our study (Appendix Table-4.11), which is reinforced by the regression results of the lagged model (Appendix Table-4.12). During the first period, the dependence was found to be positive and significant in most of the states except Haryana, Maharashtra and Kerala. The weak link between tertiary and agriculture sectors is found in these states perhaps due to

growing urbanisation and industry-linked service activities. Though during the first period of analysis the tertiary sector of most of the states show positive and significant dependence on agriculture, during the second period, there has been a significant rise in this dependence only in few states, most of which belong to relatively backward in industrialisation and urbanisation like, Orissa, Assam, Himachal Pradesh, U.P., Rajasthan, Jammu and Kashmir.

Transport, Communication, railways, trade & commerce are a major constituent of the tertiary sector. We have denoted it as tertiary 1. As expected, agriculture explains a high degree of variation in this sector in all the states (Appendix Table 4.13). Though the lagged agricultural performance explains slightly low percentage of variation (see Appendix Table 4.14), (as bulk of the trade and transport will take place soon after the harvest), the broad trend observed in the current model is corroborated by the lagged one. Not only that, we find a positive and significant dependence of this sector on agriculture in most of the states in the first period of our analysis. Only exceptions being Maharashtra and Bihar, where bulk of the transport and commercial activities are confined to non-agricultural sectors like manufacturing, mining etc. we make this judgement basing upon the regression results of both current and lagged models. This dependence has become even stronger in the second period in most of the states bearing relatively industrialised ones like Maharashtra, Tamil Nadu, and agriculturally backward states like Bihar, Orissa and Himachal, where agriculture has not been commercialised.

The second constituent of the tertiary sector - banking, insurance, real estate etc. (we denote it tertiary 2) is also equally influenced by the performance of the agriculture, both of current and previous year (Appendix Tables - 4.15 & 4.16). Except Bihar and Assam, every other state's agriculture explains a high percentage of variation in tertiary 2 ranging between 85 to 98 percent. Probably, the rural agricultural sector of these two states depends more on unorganised, indigeneous monetary sector, rather than organised one. During first period of our analysis we find a positive and significant inter-relationship between tertiary 2 and agriculture<sup>in</sup> relatively non-industrialised (both agriculturally developed and under-developed) states, whereas the banking, insurance sector of the industrialised states like Maharashtra, Gujarat, Tamil Nadu and Karnataka show a clear-cut resilience from the agriculture. During the second period, very few states (mostly both agriculturally and industrially under-developed states) show increasing dependence of tertiary2 on agriculture. Most of the states show no significant increase. There are few case of significant decline like that of Punjab and Tamil Nadu.

Earlier in this section we looked into the dependence of secondary and tertiary sectors on agriculture. Now let us have a look on their dependence on the income generated in primary sector (Appendix Tables 4.17, 4.18). Both the types of relationship are almost similar, agriculture being the dominant contributor to the primary sector's income. Here again, the secondary sector of the

relatively industrialised and industrially backward states are insulated from the primary sector. Industrially emerging <sup>states</sup> like Karnataka show positive and significant inter-relationship, which has got strengthened over the period of time. One state, Haryana, which showed significant inter-dependence between secondary and agriculture, does not do so when primary sector comes in. But here the presence of high autocorrelation even after taking corrective measure (Cochrane-Orcutt's iterative method), prevents us from making any judgement. The inter-relationship between tertiary and primary sector adds nothing more over that between tertiary and agricultural sectors.

Though our main purpose was to look into the dependence of non-agricultural sectors on agriculture, we had a separate, but casual look on the reverse phenomenon also. We attempted to see whether agriculture also depends upon secondary/tertiary sectors in different states in the same way as latter depends upon the former (Appendix Tables 4.19 & 4.20). It could be seen that the percentage of variation in agriculture explained by the secondary sector is comparatively lower than in the opposite case. Though industrial inputs used in agriculture has increased after the Green Revolution, as yet, at the national level, farm mechanisation has not taken place on a big scale, except for the limited areas of the Green Revolution. In particular, in states such as Orissa, Assam, Kerala, Bihar, Madhya Pradesh etc. farm mechanisation is

still in infancy.<sup>5</sup> In the first period of our analysis we find a positive and significant dependence of agriculture on secondary sector, but there has been a significant rise in this dependence, only in few states like Andhra Pradesh, Gujarat and West Bengal.<sup>6</sup> Coming to dependence of agriculture on tertiary sector, it is noticed that latter does not explain a very high degree of variation in the former. It is very low in case of Bihar, Gujarat, Madhya Pradesh and Himachal Pradesh. Only striking thing we observe that, though agriculture's dependence on tertiary sector is positive and significant in the first period of our analysis, there has been perceptible rise in this only in one state - Andhra Pradesh in the second period. Rather it has fallen significantly in Orissa and Madhya Pradesh. Over the period banking, insurance etc. has not made any impact on the agriculture of the most of the states.

From the foregoing discussion we conclude that,

5. Even in as late as 1984-85, the per hectre fertiliser use in Assam, Madhya Pradesh, Orissa, Rajasthan was 4, 17, 14, 12 Kgs respectively compared to that 151 Kg in Punjab and 48 Kg at the national level. (Source: fertiliser, statistics, 1985-86). Similarly, in 1977 the other mechanical impliments used were,

	<u>Oil engine Pumps ('000)</u>	<u>Electric Pumps ('000)</u>	<u>four wheeled tractors ('00)</u>
Assam	1	N.A	7
Orissa	3	1	14
Punjab	323	129	667

(Source: Statistical Abstract, India, 1985).

6. There has been a phenomenal rise in the use of mechanical implements in the agriculture of these states between the two periods of our analysis.

	<u>Oil Engine Pumps ('000)</u>		<u>Electric Engine Pumps ('000)</u>		<u>Four wheeled tractors ('00)</u>	
	<u>1966</u>	<u>1977</u>	<u>1966</u>	<u>1977</u>	<u>1966</u>	<u>1977</u>
Andhra Pradesh	47	199	57	234	29	111
Gujarat	112	414	15	79	32	112

(i) The dependence of non-agriculture on agriculture is almost total in most of the states. This dependence has increased over the period of time in a few of the states. Our empirical analysis shows that there is no sign of weakening of this dependence, in most of the states, since the onset of the seventies.

(ii) Almost all the constituents of the non-agricultural sector of the relatively industrialised states are insulated from the ups and downs of the agricultural performance.

(iii) States like Karnataka, Haryana, U.P., which are industrialising their economy at a faster rate show strong dependence of almost all non-agricultural sectors on agriculture, which significantly strengthened itself over the time.

(iv) Punjab's non-agriculture shows a strong dependence on agricultural performance of the previous year than of the current one. There is thus a lag of one year between the up and down-swings in agriculture and their impact being felt by the non-agricultural sectors. Thanks to the nature of the industrial sector, very largely of the agro-processing type, and related tertiary sector, the Punjab's economy seems to have developed a degree of "maturity" so that the shocks of agricultural changes do not get instantly transmitted to other sectors. Some intervening time is available for soothing out the transferred effects. The effects are otherwise clear and unmistakable.

(v) The secondary sector of some backward states like Orissa, Madhya Pradesh and Rajasthan show insignificant dependence on agriculture, but their industrial activities are still at infant level to show any linkage, so we can-not conclude that they have become resilient from agriculture.

APPENDIX (CHAPTER - IV)  
INTER- SECTORAL DEPENDENCIES -  
SOME REGRESSION RESULTS



APPENDIX TABLE-4.1

REGRESSION RESULTS

Income from Non-agriculture = f(Current agricultural income)

$$Y_{na}(t) = \alpha + \beta Y_a(t) + \gamma DY_a(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\frac{2}{R}$	DW
1. Punjab	280850.9 (1.0017)	0.1923 (1.2115)	-0.0368 (-1.0706)	0.9914* [734.1104]	0.87a
2. Haryana	-12729.6 (-1.0297)	0.9029* (3.4771)	0.2510@ (2.5389)	0.8805* [74.696]	1.28
3. Andhra Pradesh	663970.5 (0.6389)	0.1603@ (1.7172)	-0.0163 (-0.349)	0.9894* [652.4722]	0.28a
4. Maharashtra	1244210 (1.3651)	0.0176 (0.1123)	-0.111 (-0.9634)	0.9921* [1010.0]	1.00a
5. Karnataka	-11718.8 (-0.5702)	1.0813* (4.3175)	0.2485* (2.8609)	0.8843* [96.5279]	1.34
6. Gujarat	496098.1 (1.0765)	0.0265 (0.4199)	-0.0275 (-0.4699)	0.9881* [666.9999]	1.33
7. Tamil Nadu	733196.9 (0.4397)	0.1694 (0.9003)	0.0511 (0.4290)	0.9626* [206.6521]	1.90
8. West Bengal	413098.4 (0.5760)	0.2481@ (1.8364)	0.0428 (0.6033)	0.9520* [159.5374]	1.97
9. Bihar	551345.4 (0.6536)	-0.1582@ (-1.7279)	-0.0297 (-0.5704)	0.9762* [328.5561]	1.52
10. Orissa	11525.9* (3.1668)	0.4004* (5.5884)	0.0963* (2.666)	0.8815* [93.946]	2.32
11. M.P.	453983.0 (0.5379)	0.1387* (2.6248)	0.0576 (1.2968)	0.9836* [479.391]	0.87a
12. Rajasthan	231825.5 (0.5448)	0.1699* (3.7727)	-0.0255 (-0.6259)	0.9757* [322.2083]	1.81
13. U.P.	-42287.1 (-0.9202)	0.9048* (4.3431)	0.1802* (2.6454)	0.8852* [97.4173]	1.43
14. H.P.	2271.4 (0.9934)	0.8565* (4.2779)	0.2594* (5.0736)	0.8969* [79.2895]	1.53
15. J & K	-8992.3* (-4.016)	1.6211* (8.6738)	0.1491@ (2.2865)	0.9534* [256.9148]	1.68
16. Kerala	166854.9@ (1.9408)	0.0408 (0.2338)	0.1144* (3.5142)	0.993* [1131.4]	1.70
17. Assam	-35571.2* (-3.064)	1.4232* (6.1312)	0.1197@ (2.1879)	0.9117* [88.731]	1.94

contd..

NOTE:

- i) The figures in the parantheses are t-values and in the square bracket are F-values. t & F values should be read in the same fashion in the subsequent tables.
- ii)  $Y_{na}$  = Income generated in Non-agricultural sector
- $Y_a$  = Agricultural Income
- D. = Dummy Variable, D = 0, for pre-cut-off years  
D = 1, for post-cut-off years
- (t) = current year
- (t-1) = Previous year
- DW = Durbin-Watson statistic(d)
- \* = Significant at 1 per cent level
- ⊙ = Significant at 5 per cent level

The above notations should be read as such in the subsequent tables.

Source: The regression results are computed from data from Estimates of State Domestic Product, 1985, 1987.

APPENDIX TABLE-4.2

REGRESSION RESULTS

Income from Non-agriculture = f(agricultural income of the previous year)

$$Y_{na}(t) = \alpha + \beta Y_a(t-1) + \gamma DY_a(t-1)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	205648@ (-2.2190)	1.0257* (8.6468)	0.1440* (3.1291)	0.9739 [355.5164]	1.29
2. Haryana	-8274.9 (-0.5931)	0.8594* (2.9406)	0.2877* (2.7393)	0.8647 [61.6941]	1.36
3. Andhra Pradesh	674825.2 (0.7203)	-0.0914 (-0.8927)	0.0171 (0.3329)	0.9853 [513.1889]	0.65a
4. Maharashtra	1124720 (1.2439)	0.2469 (1.5899)	-0.0207 (-0.1816)	0.9921 [968.2916]	1.14a
5. Karnataka	-2373.2 (-0.1352)	1.0066* (4.7071)	0.2711* (3.6212)	0.9126 [126.3185]	1.58
6. Gujarat	430623.1 (1.2575)	-0.1035@ (-1.8805)	0.1539* (3.0014)	0.9910 [848.4186]	1.42
7. Tamil Nadu	723319.5 (0.4197)	0.1752 (0.9304)	0.0996 (0.8350)	0.9616 [193.1289]	1.96
8. West Bengal	518789.4 (0.6305)	0.0812 (0.5406)	-0.0400 (-0.5119)	0.9378 [116.5937]	2.01
9. Bihar	415445.0 (0.5450)	0.2484* (3.0879)	0.0463 (1.0133)	0.9814 [405.4393]	1.52
10. Orissa	15497.5* (4.5017)	0.3547* (5.2357)	0.1098* (3.2076)	0.8816 [90.3572]	1.82
11. M.P.	562746.4 (0.5521)	-0.0924 (-1.4749)	-0.0182 (-0.3478)	0.9764 [318.3750]	0.87a
12. Rajasthan	199452.2 (0.5375)	-0.0534 (-1.1899)	0.1651* (4.0697)	0.9762 [315.6352]	2.05
13. U.P.	-15916.3 (0.3268)	0.8123* (3.6805)	0.2282* (3.2561)	0.8766 [86.2142]	1.73
14. H.P.	3430.0 (1.2087)	0.8065* (3.2505)	0.2646* (4.4645)	0.8481 [48.4439]	1.95
15. J & K	-8241.7* (-3.3917)	1.6044* (7.9235)	0.1762* (2.5410)	0.9460 [211.2180]	1.67
16. Kerala	157267.3 (1.6115)	0.2532 (1.1869)	0.0378 (0.9503)	0.9889 [682.1369]	1.88
17. Assam	-24814.2@ (-2.3507)	1.2475* (5.9130)	0.1795* (3.7676)	0.9263 [101.5071]	1.73

Note: @ - at 5% level of significance  
\* - at 1% level of significance

APPENDIX TABLE-4.3

REGRESSION RESULTS

Income of Secondary Sector = f(Current agricultural income)

$$Y_s(t) = \alpha + \beta Y_s(t) + \gamma DY_s(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	78837.5 (1.0235)	0.0538 (0.7967)	-0.0171 (-1.1583)	0.9833 [373.6472]	1.34
2. Haryana	-2181.5 (-0.4439)	0.3243* (3.1417)	0.0872@ (2.2192)	0.8537 [59.3339]	1.26a
3. Andhra Pradesh	429756.4 (0.0793)	0.0157 (0.6319)	-0.0099 (-0.72)	0.9852 [383.3907]	1.84
4. Maharashtra	399328.7 (0.678)	0.1476 (0.6017)	-0.0502 (-0.28)	0.9246 [99.0596]	2.34
5. Karnataka	-10459.4 (-0.9351)	0.5749* (4.218)	0.1464* (3.0976)	0.888 [100.1246]	1.54
6. Gujarat	139660.2 (1.5234)	-0.0642@ (-1.8234)	-0.00646 (-0.1974)	0.9713 [271.8354]	1.54
7. Tamil Nadu	157730.9 (0.9170)	-0.0140 (-0.1387)	0.0624 (0.9791)	0.9304 [107.9772]	2.69
8. West Bengal	101419.5* (2.9495)	-0.0161 (-0.2484)	0.0222 (0.6564)	0.8475 [45.4563]	1.64
9. Bihar	186265.7 (0.4650)	-0.1010 (-1.4625)	-0.0066 (-0.1674)	0.9053 [77.4796]	2.42
10. Orissa	20727.1* (4.4661)	-0.0826 (-1.69)	-0.0160 (-0.4939)	0.7291 [22.5263]	1.73
11. M.P.	133002.4 (0.4893)	-0.0008 (-0.0298)	0.0454@ (2.0173)	0.9671 [236.0394]	2.15
12. Rajasthan	59050.8 (0.6916)	0.0164 (1.2178)	0.0042 (0.3425)	0.9664 [231.018]	2.13
13. U.P.	-43378.1@ (-1.7576)	0.4413* (3.9439)	0.0940* (2.5680)	0.8698 [84.5032]	1.34
14. H.P.	1555.0@ (1.8073)	0.2260* (2.9995)	0.0779* (4.0474)	0.8306 [45.1134]	1.47
15. J & K	-4023.9* (-3.6607)	0.5939* (6.4729)	0.0463 (1.4465)	0.9145 [134.6565]	1.31
16. Kerala	39308.4* (2.6899)	-0.0745 (-0.6561)	0.0467@ (2.2102)	0.9731 [290.1122]	1.93
17. Assam	-4414.5 (-0.979)	0.3178* (3.5243)	0.0501@ (2.3559)	0.8331 [43.4414]	1.38

Y = Income from secondary sector.

s

Note: @ - at 5% level of significance  
\* - at 1% level of significance

APPENDIX TABLE-4.4

REGRESSION RESULTS

Income from Secondary Sector = f(agricultural income of previous year)

$$Y_s(t) = \alpha + \beta Y_a(t-1) + \gamma DY_a(t-1)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	1355.8 (0.511)	0.2624* (7.7255)	0.0655* (4.9672)	0.9773 [409.3720]	1.53
2. Haryana	-1654.0 (-0.3172)	0.3311* (3.0312)	0.0938@ (2.3893)	0.8533 [56.2384]	1.28
3. Andhra Pradesh	203688.3 (0.6049)	-0.0199 (-0.5244)	0.0034 (0.1772)	0.9783 [346.6512]	0.76a
4. Maharashtra	310172.6@ (2.4361)	0.0277 (0.1598)	-0.0518 (-0.4169)	0.9579 [175.2241]	1.19a
5. Karnataka	-3924.0 (-0.4119)	0.5171* (4.4549)	0.1639* (4.0336)	0.9155 [131.0829]	1.50
6. Gujarat	99847.7@ (1.7676)	-0.0198 (-0.4985)	0.0610 (1.6498)	0.9640 [206.4472]	2.04
7. Tamil Nadu	151711.2 (0.8207)	0.1544 (1.6010)	0.0395 (0.6453)	0.9332 [108.0456]	2.82
8. West Bengal	57928.3* (6.6822)	0.1491* (2.2675)	0.0412 (1.6566)	0.8389 [40.9239]	1.82
9. Bihar	75977.9 (0.5437)	0.1883* (3.1627)	0.0292 (0.8645)	0.9286 [100.6515]	2.65
10. Orissa	8103.0@ (2.3871)	0.0367 (0.6982)	0.0373 (1.1739)	0.6843 [17.6169]	1.69
11. M.P.	173346.2 (0.4934)	-0.0183 (-0.6218)	-0.0132 (-0.5311)	0.9590 [180.3025]	1.88
12. Rajasthan	53947.6 (0.6771)	0.0052 (0.3888)	0.0204 (1.6412)	0.9660 [218.9776]	2.26
13. U.P.	-30812.9 (-1.2422)	0.3968* (3.5308)	0.1192* (3.3396)	0.8744 [84.5556]	1.74
14. H.P.	1830.5@ (1.7312)	0.2201@ (2.3811)	0.0731* (3.3078)	0.7489 [26.3488]	1.84
15. J & K	14041.6 (0.3892)	0.1473@ (2.1011)	0.0414 (1.4928)	0.9697 [246.7084]	2.48
16. Kerala	22683.1 (1.6991)	0.1732 (1.4327)	0.0315 (1.4019)	0.9675 [229.5401]	1.91
17. Assam	31341.3 (0.1262)	0.1012 (0.9847)	0.0530@ (2.2236)	0.9058 [49.0675]	1.41

Note: @ - at 5% level of significance  
\* - at 1% level of significance

## APPENDIX TABLE-4.5

## REGRESSION RESULTS

Income from Registered Manufacturing Sector = f(current agricultural income)

$$Y_{mr}(t) = \alpha + \beta Y_a(t) + \gamma DY_a(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	-5457.6* (-2.6035)	0.1389* (5.5517)	0.0089 (0.9416)	0.9577 [144.4169]	1.73
2. Haryana	-3942.5 (-1.3394)	0.2042* (3.3028)	0.0464@ (1.9715)	0.8498 [57.5578]	1.41
3. Andhra Pradesh	68871.7 (0.4593)	0.008 (0.3825)	-0.0045 (-0.4248)	0.9567 [177.5956]	1.66
4. Maharashtra	393000.6 (1.0709)	-0.0249 (-0.3350)	-0.0328 (-0.5995)	0.9854 [541.4867]	1.22a
5. Karnataka	-9953.8 (-1.6251)	0.2614* (3.5020)	0.7691* (3.0542)	0.8638 [80.3086]	1.48
6. Gujarat	76134.4 (1.5847)	-0.0533@ (-1.8458)	-0.0097 (-0.3612)	0.9461 [141.4524]	1.71
7. Tamil Nadu	NA	NA	NA	NA	NA
8. West Bengal	49179.8* (7.4389)	-0.0161 (-0.3566)	0.0086* (0.4159)	0.5116 [9.3787]	1.42
9. Bihar	-3816.0 (-0.4147)	0.1269 (1.5980)	0.0769** (4.0328)	0.7003 [30.2087]	1.43
10. Orissa	10360.2* (2.8277)	-0.0521 (-1.077)	-0.0152 (-0.4779)	0.5553 [10.9892]	1.88
11. M.P.	49795.3 (0.5276)	-0.159 (-0.7480)	0.0148 (0.8204)	0.9221 [95.6372]	1.98
12. Rajasthan	24273.8 (0.69)	0.0025 (0.6068)	0.0011 (0.2877)	0.9794 [381.4280]	1.79
13. U.P.	-18447.2@ (-2.1309)	0.1505* (3.8337)	0.0189 (1.4738)	0.8167 [56.7096]	1.48
14. H.P.	110.8876 (0.3307)	0.0318 (1.0828)	0.0148@ (1.9701)	0.4564 [8.5549]	1.46
15. J & K	-555.4325 (-0.9367)	0.0720 (1.5423)	0.0285@ (1.7282)	0.7465 [24.5623]	2.09
16. Kerala	10563.1 (1.3688)	0.0896 (1.4327)	-0.0214@ (-1.8387)	0.9412 [129.0910]	2.077
17. Assam	-1634.2 (-1.4176)	0.1274* (5.5280)	0.0039 (0.7111)	0.8569 [51.9142]	2.22

**Imr = Income generated in registered Manufacturing sector.**

Note: @ - at 5% level of significance

\* - at 1% level of significance

NA - Not Available

APPENDIX TABLE-4.6

REGRESSION RESULTS

Income from Registered Manufacturing Sector= f(agricultural income of the Previous year)

$$y_{mr}(t) = \alpha + \beta y_a(t-1) + \gamma dy_a(t-1)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	5025.1* (-2.6975)	0.1361* (6.0821)	0.0172@ (2.2485)	0.9752 [237.1825]	1.63
2. Haryana	49016.9 (0.7039)	0.0136 (0.5935)	0.0007 (0.0652)	0.9831 [350.7075]	0.84a
3. Andhra Pradesh	67171.8 (0.4261)	-0.0137 (-0.6396)	0.0096 (0.8977)	0.9546 [162.2393]	1.69
4. Maharashtra	342643.2 (0.9635)	0.1397@ (1.9660)	-0.0226 (-0.4359)	0.9865 [560.9569]	1.29
5. Karnataka	-7486.0 (-1.6727)	0.24* (4.4011)	0.0887* (4.6468)	0.9250 [148.9091]	1.37
6. Gujarat	41765.7* (3.5383)	-0.0104 (-0.3190)	0.0612@ (2.0310)	0.9357 [112.5135]	2.20
7. Tamil Nadu	NA	NA	NA	NA	
8. West Bengal	47869.8* (8.6416)	0.00132 (0.0317)	-0.0013 (-0.0751)	0.4409 [7.0455]	1.11a
9. Bihar	-1579.9 (-0.2046)	0.1492* (2.9190)	0.0427 (1.6401)	0.8451 [42.8182]	2.18
10. Orissa	2132.4 (0.6643)	0.0359 (0.7070)	0.0189 (0.6318)	0.5049 [8.8195]	1.80
11. M.P.	54631.7 (0.4748)	0.0119 (0.5374)	-0.007 (-0.3734)	0.9140 [82.4460]	2.05
12. Rajasthan	22164.1 (0.6439)	0.0042 (1.0131)	0.0040 (1.0657)	0.9798 [371.9393]	1.94
13. U.P.	-19790.4@ (-2.32)	0.1604* (4.1509)	0.01970 (1.6029)	0.8314 [60.1733]	2.06
14. H.P.	246.6239 (0.7199)	0.0225 (0.7504)	0.0166@ (2.3162)	0.4510 [7.9817]	1.35
15. J & K	-1183.6@ (-2.2775)	0.1227* (3.1636)	0.0245@ (1.7555)	0.8401 [41.2664]	1.94
16. Kerala	7827.8 (1.4280)	0.0418 (0.6356)	0.0278@ (2.3013)	0.9315 [105.3155]	2.09
17. Assam	-1802.5@ (-1.9946)	0.1341* (7.4261)	0.0044 (1.0873)	0.9118 [83.6824]	1.37

Note: @ - at 5% level of significance  
\* - at 1% level of significance

NA - Not Available

APPENDIX TABLE-4.7

REGRESSION RESULTS

Income from Unregistered Manufacturing Sector= f(current agricultural income)

$$Y_{\mu}(t) = \alpha + \beta Y_a(t) + \gamma DY_a(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	16371.0 (1.33)	0.0199 (0.8424)	-0.00045 (-0.0853)	0.9808 [324.2065]	1.37
2. Haryana	15858.4 (0.4483)	0.0066 (0.7318)	0.0016 (0.3603)	0.9701 [206.3914]	1.40
3. Andhra Pradesh	51413.4 (0.4484)	0.0064 (0.4518)	0.0003 (0.0409)	0.9535 [165.1855]	1.38
4. Maharashtra	77067.8 (0.9002)	-0.0089 (-0.5130)	-0.0054 (-0.4296)	0.9732 [291.7109]	1.81
5. Karnataka	31343.3 (0.7388)	0.0405@ (2.0673)	0.0011 (0.1074)	0.9550 [170.7333]	1.70
6. Gujarat	22789.7 (1.3559)	-0.0045 (-1.2484)	0.0002 (0.0498)	0.9816 [428.1573]	1.61
7. Tamil Nadu	NA	NA	NA	NA	NA
8. West Bengal	16 217.1* (4.5936)	0.0172@ (2.288)	0.003 (0.7589)	0.9704 [263.3918]	1.30
9. Bihar	20861.4@ (2.2345)	-0.0745 (-0.9403)	-0.0084 (-0.338)	0.1697 [2.6353]	2.07
10. Orissa	1895.8* (7.2956)	0.0151* (2.9477)	0.0036 (1.3882)	0.6661 [25.9324]	1.76
11. M.P.	11809.1 (1.5193)	0.0023 (0.1592)	0.0255* (2.1758)	0.8423 [43.7206]	2.18
12. Rajasthan	7994.6* (13.3673)	-0.0022 (-0.2721)	0.0041 (0.9126)	0.1655 [2.5860]	1.77
13. U.P.	144851.0 (0.2918)	0.0389@ (1.9584)	0.0002 (0.0202)	0.9615 [200.9435]	1.53
14. H.P.	451.6446* (4.0844)	0.0307* (3.1745)	0.00114 (0.4598)	0.5720 [13.0299]	1.47
15. J & K	2386.8 (0.7586)	0.0012373 (0.1362)	0.00115 (0.3196)	0.9290 [105.6577]	1.96
16. Kerala	10399.6* (3.2512)	-0.0764 (-1.6431)	0.0665* (7.6447)	0.9690 [251.0436]	1.99
17. Assam	-2863.5 (-1.2582)	0.1230* (2.7020)	0.0202@ (1.8820)	0.7491 [26.3779]	1.81

Y<sub>mu</sub> = Income from Unregistered Manufacturing sector.  
 Note: @ - at 5% level of significance  
 \* - at 1% level of significance  
 NA - Not Available



**APPENDIX TABLE-4.8**

**REGRESSION RESULTS**

Income from Unregistered Manufacturing Sector= f(agricultural income of the previous year)

$$Y_{mu}(t) = \alpha + \beta Y_a(t-1) + \gamma DY_a(t-1)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	22329.2@ (1.9252)	-0.0210 (-0.9088)	0.0091@ (1.8329)	0.9821 [330.9717]	1.74
2. Haryana	16345.9 (0.5123)	0.0007 (0.2564)	0.0023 (0.3464)	0.9341 [201.5234]	1.38
3. Andhra Pradesh	53745.3 (0.4000)	0.0101 (0.6991)	-0.002 (-0.2744)	0.9499 [146.3795]	1.32
4. Maharashtra	71831.8 (0.9375)	0.0049 (0.2803)	-0.0088 (-0.6753)	0.9713 [260.5724]	1.92
5. Karnataka	6625.1@ (2.2594)	0.0857@ (2.3995)	0.0537* (4.2951)	0.8710 [81.9995]	1.63
6. Gujarat	21664.3 (1.1576)	0.0004 (0.1041)	0.0013 (0.3542)	0.9784 [347.9879]	1.74
7. Tamil Nadu	NA	NA	NA	NA	NA
8. West Bengal	25167.3* (2.6811)	-0.0062 (-0.7270)	-0.0013 (-0.2797)	0.9570 [171.8104]	1.64
9. Bihar	21574.3@ (2.0620)	-0.0835 (-0.9259)	-0.0082 (-0.4057)	0.0437 [1.5484]	1.36
10. Orissa	2137.0* (8.5193)	0.0113@ (2.2879)	0.0052@ (2.1025)	0.6599 [24.2823]	1.62
11. M.P.	3482.9 (1.4098)	0.0419 (1.6982)	0.0378* (4.5618)	0.6818 [26.7070]	1.38
12. Rajasthan	7336.6* (12.0308)	0.0062 (0.7966)	0.0029 (0.6491)	0.2239 [3.2124]	1.79
13. U.P.	-8862.6 (-0.8512)	0.1231* (2.6092)	0.0508* (3.3913)	0.8412 [64.5785]	1.35
14. H.P.	616.0921* (4.0887)	0.0174 (1.3238)	0.0030 (0.9628)	0.2770 [4.2559]	2.17
15. J & K	2327.4 (0.7157)	0.0019 (0.2018)	0.0018 (0.5031)	0.9227 [92.4813]	1.96
16. Kerala	-4263.8 (-1.3445)	0.1743* (2.8704)	0.0617* (6.1977)	0.9020 [111.4314]	2.02
17. Assam	-2335.4 (-1.0206)	0.1150@ (2.5152)	0.0263@ (2.5432)	0.7684 [27.5463]	1.83

Note: \* - at 1% level of significance  
@ - at 5% level of significance

NA - Not Available

APPENDIX TABLE-4.9

REGRESSION RESULTS

Income from Construction sector = f(Current agricultural income)

$$Y_c(t) = \alpha + \beta Y_a(t) + \gamma DY_a(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\frac{R^2}{R}$	DW
1. Punjab	5148.7* (3.1111)	0.0494* (2.5877)	0.0020 (0.2932)	0.8574 [39.0727]	1.70
2. Haryana	1930.7@ (2.0634)	0.036@ (1.8326)	0.0134@ (1.7844)	0.7219 [26.9598]	1.34
3. Andhra Pradesh	36072.5 (0.5048)	-0.0059 (-0.3072)	-0.0068 (-0.7001)	0.8761 [57.5762]	2.29
4. Maharashtra	34930.8* (17.2777)	-0.0003 (-0.1548)	-0.0027@ (-1.7804)	0.9986 [5652.6]	1.00a
5. Karnataka	29920.6* (3.9219)	-0.0011 (-0.2528)	-0.0002 (-0.0757)	0.9951 [1631.0]	0.96a
6. Gujarat	15002.7* (3.3896)	-0.0063 (-0.6573)	0.0039 (0.4373)	0.9260 [101.0698]	1.89
7. Tamil Nadu	15695.7* (2.8567)	0.0124 (0.8567)	0.0114 (1.2334)	0.8960 [69.9131]	1.68
8. West Bengal	-2945.5 (-0.7869)	0.1119* (3.5022)	0.0221@ (1.9822)	0.8245 [59.7358]	1.6496
9. Bihar	52653.1 (0.3847)	-0.0094 (-0.2996)	0.0061 (0.3407)	0.8528 [47.3344]	2.31
10. Orissa	2761.2* (5.7435)	-0.0029 (-0.3034)	0.0112@ (2.3386)	0.3094 [6.6005]	1.43
11. M.P.	9696.8* (5.7360)	0.0134@ (1.7462)	0.0119@ (1.7826)	0.8688 [53.9534]	1.92
12. Rajasthan	7940.0* (2.6860)	0.0165@ (1.9269)	-0.0002 (-0.0198)	0.8864 [63.4422]	2.52
13. U.P.	30747.6@ (1.9446)	0.0255 (1.3658)	0.0062 (0.6481)	0.9209 [94.1555]	1.65
14. H.P.	1456.5* (2.7955)	0.1163@ (2.5495)	0.0464* (3.9831)	0.8083 [38.9453]	1.52
15. J & K	-3498.2* (-5.6478)	0.4189* (8.1029)	0.0120 (0.6666)	0.9305 [168.3523]	1.83
16. Kerala	11394.0* (3.2851)	-0.1264@ (-2.3304)	0.0136 (1.3374)	0.7147 [21.0403]	2.56
17. Assam	1817.6 (0.8262)	0.0284 (0.6463)	0.0171 (1.6523)	0.4035 [6.7498]	1.49

Note:  $Y_c$  = Income from Construction Sector.  
 \* - at 1% level of significance  
 @ - at 5% level of significance

APPENDIX TABLE-4.10

REGRESSION RESULTS

Income from Construction sector = f(Agricultural income of the previous year)

$$Y_c(t) = \alpha + \beta Y_a(t-1) + \gamma DY_a(t-1)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	6598.7* (7.0944)	0.0295@ (2.4769)	0.0142* (3.0707)	0.8902 [78.0577]	1.56
2. Haryana	1483.7 (1.6709)	0.0471@ (2.5343)	0.0117@ (1.7555)	0.7830 [35.2710]	1.59
3. Andhra Pradesh	36669.8 (0.5153)	-0.0179 (-0.9135)	-0.0025 (-0.2547)	0.8717 [53.1085]	2.12
4. Maharashtra	33937.0* (17.4265)	0.0007 (0.3523)	-0.0021 (-1.3775)	0.9983 [4622.8]	0.99a
5. Karnataka	28748.8* (4.3070)	-0.0016 (-0.3342)	-0.0001 (-0.0657)	0.9950 [1538.4]	1.07a
6. Gujarat	16307.5* (3.2078)	-0.0135 (-1.4100)	0.0045 (0.5094)	0.9236 [93.7303]	1.68
7. Tamil Nadu	17402.6@ (2.2999)	0.0038 (0.2440)	0.0046 (0.4540)	0.8652 [50.1920]	1.65
8. West Bengal	-6716.0@ (-1.9371)	0.1496* (5.0687)	0.0126 (1.3034)	0.8670 [79.1990]	1.50
9. Bihar	37605.9 (0.5011)	0.0284 (0.8991)	0.0062 (0.3458)	0.8521 [45.1612]	2.48
10. Orissa	2605.3* (3.6958)	0.0013 (0.1023)	0.0101 (1.5411)	0.4578 [7.4734]	1.70
11. M.P.	31809.9 (0.5963)	-0.0255* (-4.4797)	-0.0027 (-0.5661)	0.9117 [80.1830]	1.66
12. Rajasthan	14006.1 (1.4309)	-0.0124 (-1.3775)	0.0013 (0.1540)	0.8662 [50.6522]	2.62
13. U.P.	38933.3 (1.5551)	0.0084 (0.4213)	0.0076 (0.7353)	0.9053 [74.2585]	1.84
14. H.P.	1424.5@ (2.0357)	0.1309@ (2.1399)	0.0379@ (2.5922)	0.6689 [18.1735]	1.79
15. J & K	-3064.7* (-4.4835)	0.3937* (6.9037)	0.0250 (1.2806)	0.9155 [131.0582]	1.75
16. Kerala	1126.2 (0.3778)	0.0421 (0.7601)	0.0173@ (1.8754)	0.6382 [14.5255]	2.16
17. Assam	3276.4@ (1.7373)	-0.0022 (-0.0590)	0.0293* (3.4442)	0.6203 [14.0681]	1.35

Note: \* - at 1% level of significance  
@ - at 5% level of significance

APPENDIX TABLE-4.11

REGRESSION RESULTS

Income from Tertiary Sector = f(Current Agricultural income)

$$Y_{tt}(t) = \alpha + \beta Y_{at}(t) + \gamma DY_{at}(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	-24666.20 (-2.5395)	0.7680* (6.8420)	0.0361 (0.8761)	0.9738 [236.6659]	1.64
2. Haryana	133789.5 (0.4924)	0.0833 (1.0988)	0.0325 (0.8681)	0.9789 [294.1176]	1.48
3. Andhra Pradesh	637454.2 (0.0564)	0.1303* (4.3881)	0.0089 (0.5339)	0.9949 [1126.1]	2.62
4. Maharashtra	1324187.0 (0.1859)	.0087 (.1641)	-0.0759 (-1.5658)	0.9954 [1249.2]	2.28
5. Karnataka	187799.4 (0.7866)	0.0889* (2.8527)	-0.0037 (-0.2299)	0.9899 [782.9250]	0.55a
6. Gujarat	332813.4 (0.7964)	0.0908@ (2.3004)	-0.0211 (-0.5775)	0.9880 [659.4336]	1.16a
7. Tamil Nadu	756355.8 (.0801)	0.1615@ (1.9922)	-0.0177 (-0.2934)	0.9670 [169.2351]	1.95
8. West Bengal	268566.5 (0.3794)	0.2629* (2.8293)	0.0159 (0.3250)	0.9562 [175.7215]	2.30
9. Bihar	415623.1 (0.1294)	-0.0978* (-2.7364)	-0.0271 (-1.1806)	0.9807 [292.9815]	2.03
10. Orissa	3249.20 (1.8790)	0.3055* (8.9758)	0.0538* (3.1345)	0.9421 [204.3825]	2.67
11. M.P.	266121.5 (0.4402)	0.1372* (4.4704)	0.0148 (0.5751)	0.9827 [455.7631]	0.36a
12. Rajasthan	150126.6 (0.4795)	0.1610* (4.4865)	-0.0416 (-1.2844)	0.9684 [246.3855]	1.93
13. U.P.	885.8251 (0.0431)	0.4342* (4.6650)	0.0881* (2.8935)	0.9003 [113.9257]	1.51
14. H.P.	-1528.7 (-0.7142)	0.6879* (3.6702)	0.1706* (3.5635)	0.8375 [47.3896]	1.36
15. J & K	-6032.0* (-4.4835)	1.0114* (9.0059)	0.0668 (1.7054)	0.9556 [247.2801]	1.79
16. Kerala	303942.8 (0.2747)	0.0564 (0.5878)	0.0628* (3.467)	0.9945 [1048.4]	1.97
17. Assam	-31176.9* (-3.9253)	1.0002* (6.2981)	0.0764* (2.0405)	0.9124 [89.4938]	1.89

Note:  $Y_{tt}$  = Income from Tertiary Sector.  
 \* - at 1% level of significance  
 @ - at 5% level of significance

## APPENDIX TABLE-4.12

## REGRESSION RESULTS

Income from Tertiary Sector = f(Agricultural Income of the Previous year)

$$Y_{tt}(t) = \alpha + \beta Y_a(t-1) + \gamma DY_a(t-1)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	-26212.5* (-2.8804)	0.8043* (7.2763)	0.0643 (1.6359)	0.9740 [225.4120]	1.92
2. Haryana	-6681.3 (-0.7553)	0.5239* (2.8270)	0.1880* (2.8230)	0.8634 [61.0411]	1.37
3. Andhra Pradesh	455233.5 (0.6503)	-0.0709 (-0.9314)	0.0107 (0.2802)	0.9823 [427.0280]	0.90a
4. Maharashtra	604085.5 (1.1744)	0.0810 (1.0159)	0.0204 (0.3486)	0.9924 [995.8495]	0.92a
5. Karnataka	-2434.0 (-0.2748)	0.4862* (4.5050)	0.1142* (3.0236)	0.8951 [103.3896]	1.47
6. Gujarat	310759.1 (0.8003)	-0.0883@ (-2.1636)	0.0965* (2.5419)	0.9874 [601.4108]	1.51
7. Tamil Nadu	-1171660 (-0.0774)	0.0264 (0.2131)	0.0551 (0.7052)	0.9579 [175.5513]	1.12
8. West Bengal	410752.1 (0.4185)	-0.0042 (0.4185)	-0.0335 (-0.5661)	0.9340 [109.4614]	2.28
9. Bihar	253262.2 (0.4399)	0.0730 (1.2542)	0.0068 (0.2067)	0.9710 [257.5266]	1.08a
10. Orissa	6409.4@ (2.6878)	0.2653* (5.6538)	0.0646* (2.7248)	0.8807 [89.6053]	2.89
11. M.P.	322302.1 (0.3785)	-0.0515 (-1.1549)	0.007279 (0.1957)	0.9638 [205.0318]	1.09 <sup>a</sup>
12. Rajasthan	131551.4 (0.4251)	-0.0671@ (-1.7244)	0.1388* (3.9797)	0.9639 [205.9916]	2.10
13. U.P.	13433.6 (0.5718)	0.3911* (3.6740)	0.1089* (3.2212)	0.8752 [85.1896]	1.67
14. H.P.	-478.9878 (-0.1934)	0.6206* (2.8664)	0.1953* (3.7754)	0.8040 [35.8637]	1.29
15. J & K	-5453.8* (-3.5925)	0.9923* (7.8337)	0.0850@ (1.9622)	0.9392 [186.3058]	1.84
16. Kerala	137913.1 (1.3925)	0.0633 (0.4833)	0.0036 (0.1495)	0.9905 [804.3367]	1.59
17. Assam	-23228.5* (-2.9810)	0.8733* (5.6079)	0.1109* (3.1539)	0.9116 [83.4690]	1.87

Note: \* - at 1% level of significance  
@ - at 5% level of significance

## APPENDIX TABLE-4.13

## REGRESSION RESULTS

Income from Tertiary 1 = f(current agricultural income)

$$Y_{t1}(t) = \alpha + \beta Y_a(t) + \gamma DY_a(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	105575.2 (1.2920)	0.0721 (1.2095)	-0.0100 (-0.7690)	0.9932 [923.3050]	0.63a
2. Haryana	-9167.2@ (-1.9617)	0.3767* (3.8880)	0.1141* (3.0520)	0.9065 [97.9051]	1.39
3. Andhra Pradesh	73981.2 (0.9288)	0.1498* (3.9501)	-0.0002 (-0.0136)	0.9720 [278.6384]	2.82
4. Maharashtra	327034.1 (1.0262)	0.0857 (1.6674)	-0.0274 (-0.7232)	0.9891 [725.3316]	1.09a
5. Karnataka	54527.2 (0.8294)	0.0887* (6.0076)	0.0034 (0.4409)	0.9878 [650.7256]	1.38
6. Gujarat	165186.7 (0.7933)	0.0944* (3.4806)	-0.0126 (-0.5002)	0.9853 [537.9035]	1.50
7. Tamil Nadu	253724.8 (0.3367)	0.1353@ (1.7996)	-0.0290 (-0.6102)	0.9434 [134.2951]	1.42
8. West Bengal	18629.6* (3.0513)	0.2796* (5.3670)	0.0320@ (1.7620)	0.8900 [102.1463]	2.02
9. Bihar	243837.9 (0.3298)	-0.0557 (-0.7587)	-0.0378 (-0.9105)	0.9298 [106.9230]	2.09
10. Orissa	39.0199 (0.0483)	0.1721* (10.8210)	0.0063 (0.7913)	0.9402 [197.4462]	1.82
11. M.P.	61135.2 (0.7216)	0.0967* (12.3544)	-0.00009 (0.0138)	0.9874 [628.8155]	1.82
12. Rajasthan	7602.0* (3.5230)	0.2009* (6.1704)	0.0367@ (2.2172)	0.9166 [138.2977]	1.36
13. U.P.	-9797.4 (-1.0021)	0.2693* (6.0748)	0.0435* (2.9999)	0.9291 [164.8750]	1.63
14. H.P.	14694.5 (0.3836)	0.0351 (0.9957)	0.0064 (0.3416)	0.9662 [163.0724]	0.75a
15. J & K	-3298.6* (-5.3221)	0.5000* (9.6919)	0.0381@ (2.1170)	0.9598 [299.5736]	1.90
16. Kerala	33694.9 (1.4384)	0.1570@ (2.4153)	0.0415* (3.4208)	0.9887 [701.3192]	1.80
17. Assam	-21546.2* (-3.4191)	0.6339* (5.0308)	0.0308 (1.0368)	0.8476 [48.2673]	1.55

$Y_{t1}$  = Income from Transport, Communication, Railways, Trade and Commerce.

Note: \* - at 1% level of significance  
@ - at 5% level of significance

APPENDIX TABLE-4.14

REGRESSION RESULTS

Income from Tertiary 1 = f(agriculture income of the previous year)

$$Y_{t1}(t) = \alpha + \beta Y_{a(t-1)} + \gamma DY_{a(t-1)}$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	-8475.0@ (-2.1604)	0.4043* (8.0515)	0.0740* (3.7997)	0.9747 [358.3994]	1.36
2. Haryana	83269.5 (0.4756)	-0.0249 (-0.3358)	0.0415 (1.1656)	0.9571 [134.7148]	1.67
3. Andhra Pradesh	22055.7 (1.5747)	0.1270 (1.1292)	0.1178* (3.6510)	0.8000 [48.9914]	1.40
4. Maharashtra	324397.3 (0.8765)	0.0408 (0.7502)	0.0204 (0.5104)	0.9876 [613.2408]	1.25a
5. Karnataka	4418.3 (1.1527)	0.1867* (3.9965)	0.0578* (3.5376)	0.8950 [103.2728]	1.84
6. Gujarat	26816.7* (3.2972)	0.0973 (0.9072)	0.2565* (5.5052)	0.8686 [80.3170]	1.34
7. Tamil Nadu	236888.4 (0.2973)	-0.0113 (-0.1403)	0.0535 (1.0522)	0.9349 [111.1570]	1.64
8. West Bengal	26734.8* (3.1695)	0.2203* (3.068)	0.0525@ (2.2325)	0.8142 [53.5824]	2.05
9. Bihar	197519.2 (0.2887)	0.00069 (0.0089)	0.00172 (0.039)	0.9214 [90.8379]	2.28
10. Orissa	2356.6 (1.6729)	0.1387* (5.0045)	0.0137 (0.9810)	0.7944 [47.3681]	2.39
11. M.P.	18013.4* (4.1603)	0.0675 (1.5606)	0.0838* (5.7776)	0.7536 [37.7076]	1.44
12. Rajasthan	16487.7* (6.0722)	0.0683 (1.6698)	0.1034* (5.0484)	0.8691 [80.6532]	1.55
13. U.P.	2619.7 (0.1906)	0.2203* (3.5367)	0.0619* (3.1301)	0.8676 [79.6363]	1.91
14. H.P.	15574.2 (0.4187)	0.0114@ (0.2921)	-0.0023 (-0.1155)	0.9616 [134.7063]	0.74a
15. J & K	-2942.3* (-3.9825)	0.4846* (7.8619)	0.0501@ (2.3749)	0.9438 [0.9438]	2.06
16. Kerala	43504.3 (1.6052)	0.0596 (0.6807)	0.005 (0.3079)	0.9782 [344.6054]	1.97
17. Assam	-11579.8@ (-1.8677)	0.4546* (3.6688)	0.0699@ (2.4996)	0.8338 [41.1409]	1.63

Note: \* - at 1% level of significance  
@ - at 5% level of significance

APPENDIX TABLE-4.15

REGRESSION RESULTS

Income from Tertiary 2 = f(Current agricultural income)

$$Y_{t2}(t) = \alpha + \beta Y_{t1}(t) + \gamma DY_{t1}(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	-9502.0* (-9.2264)	0.1681* (13.3106)	-0.0141* (-2.7516)	0.9791 [211.6532]	2.04
2. Haryana	34085.3 (0.0796)	0.0169* (2.8298)	-0.0021 (-0.6074)	0.9889 [400.5060]	2.65
3. Andhra Pradesh	7637.8* (2.5278)	-0.0029 (-0.2041)	-0.00003 (-0.0044)	0.9834 [474.3602]	1.66
4. Maharashtra	314731.3 (0.1462)	-0.0242 (-0.6539)	-0.0174 (-0.5560)	0.9699 [186.1661]	2.07
5. Karnataka	44623.0 (0.6902)	-0.0018 (-0.2278)	-0.0037 (-0.8863)	0.9844 [505.5727]	0.66a
6. Gujarat	111751.5 (0.1668)	0.0031 (0.4257)	-0.0005 (-0.0701)	0.9825 [323.9980]	2.02
7. Tamil Nadu	130665.9 (0.0843)	-0.0017 (-0.1198)	-0.0250@ (-2.2617)	0.9724 [203.3380]	1.78
8. West Bengal	-8696.0 (-1.7102)	0.2095* (4.8278)	0.0256 (1.6936)	0.8709 [85.3339]	1.36
9. Bihar	15597.0* (4.0563)	-0.0452@ (-2.2515)	0.0090 (0.8254)	0.5979 [12.8936]	1.39
10. Orissa	354.3456 (0.7446)	0.0454* (4.8436)	0.0170* (3.5971)	0.8850 [97.2183]	1.61
11. M.P.	38224.5 (0.5547)	0.0036 (0.8242)	0.0066@ (1.8220)	0.9847 [515.8365]	0.97a
12. Rajasthan	865.2078 (1.0147)	0.0399* (3.0989)	0.0270* (4.1325)	0.8893 [101.3894]	1.96
13. U.P.	462.1808 (0.0803)	0.0728* (2.7895)	0.0295* (3.4612)	0.8598 [77.6875]	1.39
14. H.P.	6671.6 (0.4296)	0.0041 (0.3014)	0.0014 (0.1989)	0.9716 [194.8174]	1.09a
15. J & K	-1085.1* (-4.9745)	0.1428* (7.8408)	0.0117@ (1.8431)	0.9412 [201.1077]	1.48
16. Kerala	31995.1 (0.2420)	0.0031 (0.1601)	-0.0037 (-0.9546)	0.9837 [348.3036]	1.93
17. Assam	-1799.2@ (-2.2494)	0.0742* (4.6382)	-0.0001 (-0.0388)	0.7703 [29.4991]	1.51

Note: Y' 2 = Income from banking, insurance and real estate.  
 \* - at 1% level of significance  
 @ - at 5% level of significance



APPENDIX TABLE-4.16REGRESSION RESULTS

Income from Tertiary 2 sector = f(agricultural income of the previous year)

$$Y_t^{2(t)} = \alpha + \beta Y_a(t+1) + DY_a(t-1)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	-7941.6* (-4.12)	0.1494* (6.8187)	-0.0007 (-0.0896)	0.9655 [168.7512]	2.18
2. Haryana	25517.7 (0.6081)	-0.0126 (-1.0749)	0.0032 (0.562)	0.9787 [276.3414]	0.63a
3. Andhra Pradesh	7419.5@ (2.3198)	-0.0024 (-0.1693)	-0.0036 (-0.4901)	0.9833 [453.5403]	1.60
4. Maharashtra	175876.2 (0.4394)	0.0267 (0.6521)	-0.0114 (-0.3777)	0.9664 [221.4857]	1.34
5. Karnataka	37829.8 (0.5844)	0.0059 (0.6730)	0.0052 (1.25)	0.9846 [489.7571]	0.76a
6. Gujarat	54762.3 (0.7002)	-0.0068 (-0.8266)	0.0187@ (2.4276)	0.9847 [495.5586]	1.22a
7. Tamil Nadu	8409.1* (2.6392)	0.00609 (0.3170)	0.0089 (0.7368)	0.9752 [302.5785]	1.67
8. West Bengal	102393.3 (0.6805)	0.0196 (1.3068)	-0.00865 (-1.097)	0.9851 [507.7413]	0.77
9. Bihar	2529.1 (0.8758)	0.0524* (2.5397)	0.0043 (0.4322)	0.6403 [14.65]	1.57
10. Orissa	698.6360 (1.3571)	0.0420* (4.1486)	0.0183* (3.5739)	0.8607 [75.1578]	2.30
11. M.P.	1751.0 (1.1508)	0.0494* (3.2271)	0.0415* (7.4322)	0.8347 [64.1130]	1.49
12. Rajasthan	26930.1 (0.4667)	0.0044 (0.9034)	0.0074 (1.6958)	0.9818 [413.7088]	1.32
13. U.P.	-92.0080 (-0.0184)	0.0778* (3.4379)	0.0315* (4.3790)	0.9005 [109.5713]	1.56
14. H.P.	6630.9 (0.4387)	0.0123 (0.8794)	-0.00085 (-0.1169)	0.9720 [186.0579]	0.92a
15. J & K	-944.2744* (-3.8356)	0.1346* (6.5525)	0.0167@ (2.3819)	0.9270 [153.4667]	1.31
16. Kerala	20843.6 (0.8873)	-0.0236 (-1.0805)	0.006 (1.4623)	0.9838 [466.1510]	1.02a
17. Assam	-2733.8* (-4.4614)	0.0955* (7.8014)	-0.0048 (-1.7501)	0.8651 [52.3102]	2.01

Note: \* - at 1% level of significance

@ - at 5% level of significance

**APPENDIX TABLE-4.17**

**REGRESSION RESULTS**

Income from Secondary income = f(Primary Income of Current Year)

$$Y_s(t) = \alpha + \beta Y_p(t) + \gamma DY_p(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	78482.2 (1.0212)	0.0542 (0.8053)	-0.0169 (-1.1538)	0.9833 [373.7953]	1.34
2. Haryana	88391.7 (0.7625)	-0.0278 (-0.7118)	0.0172 (0.9014)	0.9828 [361.8932]	0.74a
3. Andhra Pradesh	425891.3 (0.0799)	0.0159 (0.6542)	-0.0096 (-0.7333)	0.9852 [383.8811]	1.84
4. Maharashtra	392943.0 (0.6817)	0.1340 (0.5398)	-0.0376 (0.2222)	0.9243 [98.6129]	2.33
5. Karnataka	-12206.9 (-1.0222)	0.5674* (4.0983)	0.1462* (3.1732)	0.8817 [94.1406]	1.48
6. Gujarat	140263.4 (1.5368)	-0.0655@ (-1.8720)	-0.0054 (-0.1715)	0.9715 [273.2928]	1.54
7. Tamil Nadu	157220.5 (0.9189)	-0.0121 (-0.1216)	0.0609 (0.9926)	0.9305 [108.1260]	2.69
8. West Bengal	98904.2* (3.0875)	-0.0095 (-0.1498)	0.0213 (0.6853)	0.8475 [45.4570]	1.64
9. Bihar	189140.9 (0.4798)	-0.1024 (-1.5241)	-0.0053 (-0.1524)	0.9059 [78.0368]	2.42
10. Orissa	21278.1* (4.4133)	-0.0841@ (-1.7618)	-0.0142 (-0.4647)	0.7289 [22.5130]	1.76
11. M.P.	131634.8 (0.4782)	0.0029 (0.1124)	0.0417@ (2.0751)	0.9675 [239.0839]	2.15
12. Rajasthan	59948.0 (0.6558)	0.0173 (1.2828)	0.0040 (0.3390)	0.9667 (233.4751)	2.14
13. U.P.	-46533.3@ (-1.9440)	0.4422* (4.1979)	0.0885* (2.5791)	0.8777 [90.6947]	1.38
14. H.P.	963.1866 (0.7849)	0.2376* (2.5851)	0.0725* (3.9472)	0.7957 [36.0561]	1.26
15. J & K	20321.8 (0.4448)	0.0518 (0.7154)	0.0023 (0.0878)	0.9639 [214.4509]	2.42
16. Kerala	40330.3* (2.7630)	-0.0828 (-0.7630)	0.0435@ (2.1976)	0.9765 [290.2895]	1.93
17. Assam	-4523.1 (-1.0170)	0.2893* (3.5978)	0.0470* (2.5153)	0.8368 [44.5838]	1.34

Y<sub>s</sub> = Income from Secondary Sector.

Y<sub>p</sub> = Income from Primary Sector.

Note: \* - at 1% level of significance

@ - at 5% level of significance

APPENDIX TABLE-4.18

REGRESSION RESULTS

Income from Tertiary Sector = f(Primary income of the current year)

$$Y_{tt}(t) = \alpha + \beta Y_p(t) + \gamma DY_p(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	-24512.5* (-2.5780)	0.7623* (6.9457)	0.0365 (0.8988)	0.9742 [240.0071]	1.64
2. Haryana	128165.3 (0.5183)	0.0843 (1.1083)	0.0324 (0.8701)	0.9788 [293.0856]	1.47
3. Andhra Pradesh	628775.4 (0.0567)	0.1287* (4.4584)	0.0089 (0.5648)	0.9950 [1138.9]	2.63
4. Maharashtra	660722.0 (1.2614)	0.0726 (0.9295)	-0.0511 (-0.9565)	0.9929 [1125.7]	0.82a
5. Karnataka	293630.0 (0.1119)	0.0920* (6.0037)	-0.0042 (-0.4680)	0.9945 [1038.3]	2.05
6. Gujarat	334666.2 (0.7780)	0.0895@ (2.2807)	-0.0181 (-0.4680)	0.9880 [1038.3]	1.17a
7. Tamil Nadu	754325.2 (0.0795)	0.1607@ (2.0122)	-0.0160 (-0.2766)	0.9671 [169.7944]	1.95
8. West Bengal	263837.9 (0.3753)	0.2592* (2.8381)	0.0124 (0.2758)	0.9561 [175.3748]	2.35
9. Bihar	424077.7 (0.1315)	-0.0939* (-2.6469)	-0.0243 (-1.1530)	0.9802 [285.0190]	2.06
10. Orissa	2744.0 (1.6616)	0.2952* (9.6955)	0.0477* (3.1346)	0.949 [233.5270]	2.70
11. M.P.	-1738.2 (-0.1693)	0.4069* (4.4638)	0.1851* (5.9989)	0.8814 [93.84]	1.29
12. Rajasthan	146516.7 (0.4883)	0.1631* (4.5519)	-0.0425 (-1.3576)	0.9689 [250.1908]	1.93
13. U.P.	-1841.3 (-0.0930)	0.4334* (4.9740)	0.0833* (2.9313)	0.9074 [123.4873]	1.57
14. H.P.	29833.2 (0.4520)	0.0797 (1.1910)	0.0097 (0.3000)	0.9638 [151.6913]	1.90
15. J & K	-6806.2 (-4.3846)	0.9741* (8.3016)	0.0342 (0.8377)	0.9438 [211.1099]	1.59
16. Kerala	135500.9 (1.4762)	0.0499 (0.4883)	0.0560* (2.9923)	0.9940 [1318.9]	1.26a
17. Assam	-31900.1 (-4.2766)	0.9177* (6.8029)	0.0729@ (2.3263)	0.9223 [101.8645]	1.76

$Y_{tt}$  = Income from Tertiary Sector

$Y_p$  = Income from Primary Sector

Note: \* - at 1% level of significance

@ - at 5% level of significance

**APPENDIX TABLE-4.19**

**REGRESSION RESULTS**

Income from agriculture = f(Secondary Sector income of current year)

$$Y_A(t) = \alpha + \beta Y_B(t) + \gamma DY_B(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\bar{R}^2$	DW
1. Punjab	38340.0 $\theta$ (2.4835)	2.0551* (3.9108)	0.1769 (0.7928)	0.9536 [131.1331]	1.48
2. Haryana	31640.5* (4.7641)	1.1993 $\theta$ (2.3943)	0.2293 (0.8123)	0.8202 [46.6209]	1.61
3. Andhra Pradesh	115204.8* (9.4198)	0.3556 (0.8093)	0.5422 $\theta$ (2.1821)	0.7458 [37.6764]	1.77
4. Maharashtra	69700.7* (3.6569)	0.3710 $\theta$ (2.4479)	0.0127 (0.1519)	0.7967 [32.3504]	1.96
5. Karnataka	46469.3* (5.4612)	0.9761* (4.2263)	-0.0400 (-0.3137)	0.8420 [67.6029]	2.16
6. Gujarat	73793.7* (3.6244)	0.0201 (0.0435)	0.5359 $\theta$ (2.5130)	0.6446 [23.6755]	2.11
7. Tamil Nadu	84355.9* (6.4990)	0.0634 (0.2646)	-0.0167 (-0.1396)	0.0800 [0.0739]	1.56
8. West Bengal	29696.9 (1.0364)	1.2571* (3.0650)	0.2715 $\theta$ (2.4712)	0.7526 [39.0166]	1.57
9. Bihar	101681.1 (7.5733)	0.4017 (1.0232)	0.2048 (1.0344)	0.5179 [14.4275]	1.90
10. Orissa	114561.3 (5.9270)	-3.3904* (-2.9284)	0.7224 (0.9016)	0.7554 [25.7086]	2.49
11. M.P.	56340.8 (3.8966)	1.5865* (3.0254)	-0.2826 (-0.9838)	0.5281 [14.9883]	1.94
12. Rajasthan	-42312.5 (-1.8476)	5.5917* (4.7201)	-0.4434 (-0.9692)	0.8064 [53.0808]	1.56
13. U.P.	162408.3 (8.5435)	1.0863* (3.0980)	0.0868 (0.4057)	0.8337 [63.6442]	2.09
14. H.P.	3271.5 (1.4194)	1.9744* (3.5402)	-0.1537 (-0.8403)	0.6717 [19.4112]	2.24
15. J & K	8224.4 (11.9087)	1.2257* (5.5945)	0.0409 (0.2976)	0.9071 [122.9856]	1.71
16. Kerala	65516.2 (3.5285)	0.0756 (0.1513)	-0.1394 (-0.9280)	0.7899 [31.0815]	2.18
17. Assam	31208.5 (5.1318)	1.6443* (3.0884)	-0.0035 (-0.0155)	0.7714 [29.6833]	1.27

Note: \* - at 1% level of significance

$\theta$  - at 5% level of significance

**APPENDIX TABLE-4.20**

**REGRESSION RESULTS**

**Income from agriculture = f(tertiary sector income of the current year)**

$$Y_a(t) = \alpha + \beta Y_{tt}(t) + \gamma DY_{tt}(t)$$

States/Coefficients	$\alpha$	$\beta$	$\gamma$	$\frac{R^2}{R}$	DW
1. Punjab	42017.4* (6.2095)	1.0647* (6.1974)	0.0154 (0.1584)	0.9712 [214.7993]	1.72
2. Haryana	32287.8* (6.0059)	0.9167* (2.8673)	0.0011 (0.0054)	0.8477 [56.6760]	1.61
3. Andhra Pradesh	112639.5* (9.3551)	0.1974 (1.0221)	0.2310@ (2.1453)	0.7778 [44.7440]	1.83
4. Maharashtra	33939.6 (1.1829)	0.6078* (3.2085)	-0.1125 (-1.3213)	0.8291 [39.8008]	1.61
5. Karnataka	45593.6* (4.5021)	1.0185* (3.6143)	0.0365 (0.2547)	0.8253 [60.0363]	1.70
6. Gujarat	61183.6* (3.2669)	0.2382 (0.7474)	0.2397 (1.4333)	0.6504 [24.2580]	2.08
7. Tamil Nadu	91208.0* (8.0207)	-0.0432 (-0.2800)	0.0232 (0.2755)	0.0832 [0.0401]	1.59
8. West Bengal	50463.0* (3.8172)	0.7360* (5.0568)	0.0730 (1.1749)	0.8801 [92.7505]	1.71
9. Bihar	108345.0* (8.8321)	0.1733 (0.5914)	0.2004 (1.2321)	0.5065 [13.8813]	1.75
10. Orissa	-1330.6 (-0.3961)	2.7999* (15.7498)	-0.2765* (-3.0973)	0.9355 [117.0677]	2.48
11. M.P.	42027.8* (3.0606)	1.3116* (4.2080)	-0.3176@ (-1.8926)	0.6541 [24.6388]	1.95
12. Rajasthan	-2697.9 (-0.1980)	1.8711** (5.0148)	-0.0826 (-0.4562)	0.8536 [73.9020]	1.40
13. U.P.	95196.8* (3.6175)	1.2979* (4.7754)	0.0041 (0.0348)	0.8641 [80.4588]	2.28
14. H.P.	6062.9* (4.2465)	0.8520* (3.7488)	-0.1091 (-1.0526)	0.7274 [25.0190]	2.53
15. J & K	7074.7* (12.2104)	0.8060* (8.6412)	-0.0006 (-0.0111)	0.9546 [218.2311]	2.30
16. Kerala	43070.6* (5.0447)	0.3819@ (2.0934)	-0.0911 (-1.3537)	0.8126 [35.6939]	2.12
17. Assam	35846.4* (14.5911)	0.7503* (5.8895)	-0.0215 (-0.3105)	0.8888 [68.9077]	2.21

Note: \* - at 1% level of significance

@ - at 5% level of significance

CHAPTER - V

SUMMARY AND CONCLUSIONS

In the process of economic development, inter-sectoral linkages play an important role. One cannot overlook the problem of agriculture: nonagriculture linkage in a predominantly agricultural economy such as ours. Agriculture influences the non-agricultural sectors by providing raw materials, wage-goods and a market for the non-agricultural products. Naturally, in some way the performance of agriculture will reflect itself in the performance of the non-agricultural sectors. The problem of agriculture: non-agriculture linkage becomes more interesting because of highly unstable nature of Indian agriculture due to unpredictable weather conditions. Although there is near unanimity about non-agriculture being influenced by agriculture, we have conflicting studies on whether this dependence has strengthened or weakened over the period of time. We have the so-called resilience hypothesis so commonly talked about in policy circles in recent years. But the debate is on.

The main purpose of the present study was to have a broader look on the inter-sectoral linkages, especially those between agriculture and non-agriculture and do a preliminary test of the resilience hypothesis. For this purpose, we have taken non-agriculture as a whole and its various constituents like secondary and tertiary sectors. These sectors were further divided into sub-sectors like manufacturing (registered); manufacturing (unregistered) construction; transport, trade, communication and railways; banking, insurance, real estate etc. In the absence of time-series data for real input-output transactions among these sectors, we took con-

tributions of these sectors to net domestic/state product and tried to show their dependence on agricultural/primary income. We used the secondary data published by Central Statistical Organisation. Our period of study was from 1960-61 to 1984-85 for India as a whole and from 1960-61 to 1985-86 for most of the states under study. This exercise was done for India and seventeen major states.

We plotted the sectoral incomes graphically and tried to find a cut-off year tentatively basing upon the point of divergence of the plotted graphs. Naturally, the cut-off years were different for different states. The period of study was divided into two, as pre-and post-cut-off years. We tried to see whether inter-sectoral dependences have increased or decreased by running a number of regressions using suitable dummy variables. Before going to this exercise, we tried to show the structural transformations, structural growth rates and sectoral instabilities for India and different states.

The tentative hypotheses of the study were set as follows - Firstly, share of agriculture in national income has gone down over the period of time. Secondly, there still exists a high degree of fluctuation in the income originating in agricultural sector. Thirdly, agriculture continues to sizeably influence the non-agricultural sector, but the intensity has become weaker in recent years. Fourthly, agriculture also gets influenced by non-agricultural sectors, more so by the secondary sector than by the tertiary



sector, Fifthly, the inter-sectoral linkage are more pronounced in the states, where industries are largely agro-based. In other words, relatively more industrialised states (as distinct than these which are largely agro-industrial in nature) show less inter-sectoral linkages.

LIMITATIONS OF THE STUDY :

The present study has its own limitations. It will be better to take stock of these before proceeding to set out the main conclusions.

Regression analysis is not the ultimate answer for capturing the complicated inter-sectoral linkages those are operating in the economy. It may so happen that income from two different sectors increase/decrease simultaneously, but independent of each other. Admittedly, in the absence of real input-output transaction data, on a regular time series basis we were obliged to go by only the regression exercises, which would give only a broad picture of the underlying inter-sectoral dependencies.

Another major limitation of the study is regarding the analysis of inter-sectoral dependencies in the states. The states do not have close borders. So, one sector of one state might influence the second sector in another state. Our study is incapable of capturing this aspect and assumes that inter-sectoral linkages are confined to state boundaries. In any case, on a very broad plane, such complications would not distort the picture

on the independent economic functioning of each state. Accordingly, the above mentioned limitations do not make our study redundant. Its usefulness lies in bringing out a broad picture of the inter-sectoral linkages in Indian economy and state economies. Several important conclusions emerge from the study. A few of them need to be highlighted in particular:

#### BROAD CONCLUSIONS

1. It was found that both in the case of India and most of the states, the share of agriculture to national/state domestic product declined steadily over the period of time. This decline has been accompanied by the relative expansion of the secondary and the tertiary sectors. The relative expansion of the tertiary sector has been more pronounced than that of the secondary sector, the degree of adjustment varying from state to state. In broad terms, therefore, most of the state economies seem to be heading towards secundarisation and tertiarisation with the attendant consequences of inter-sectoral labour productivity getting widened over the period of time. In none of the states the decline in the share of agriculture has been commensurate with the decline in the share of workforce depending on agriculture. The latter decline has been only marginal and occurring extremely sluggishly since 1960-61, and so on. It, therefore, follows that per capita earning of people in those states where the share of agriculture declined only has nominally is very low, and poverty level is high.

2. The growth rates in the sectoral incomes of India as a whole showed high degree of fluctuations. However, these fluctuations were observed more in the agricultural sector than in the secondary sector. But this result was not simply reflected in the sectoral growth rates of the states. Most strikingly, the agriculturally developed states showed greater degree of stability in every aspect of their economy. The under-developed and drought-prone states continue to coparate with highly unstable agriculture. The states with a broad and more developed industrial base obviously showed stabler movements in the secondary sector.

Over the entire period of time, the non-agricultural growth is much higher than that in the agricultural one - this is true for India as a whole as well as for most of the states.

3. The process of actual commodity - flow between agriculture and non-agriculture, which could be studied only at the national level, for three points of time - 1964-65, 1968-69 and 1973-74 - showed a decline of linkage between the two sectors between the first two periods. However, after 1968-69, it started increasing.

The major portion of our analysis is based on numerous regression exercises run among different sectoral incomes. The regression equations threw up a rich crop of conclusions.

4. The dependence of non-agricultural sector of the Indian economy on its agriculture was strong and positively significant, which seems to have become even stronger after the mid-seventies. The result was reinforced by non-agriculture's dependence on lagged agricultural/primary sector performance.

5. Though the level of explanation captured by agricultural/primary sectoral income varies from one constituent to the other constituent of the non-agricultural sector, the above trend is observed in almost all the cases, the only exception being construction. Whereas in the case of other non-agricultural sectors, the inter-sectoral dependence with lagged agricultural/primary income reinforces the trend observed in the current model, construction does not follow it. The increasing inter-sectoral dependence observed between secondary and agriculture is primarily due to the increasing use of industrial inputs in agriculture, while in the case of services sector, it is due to indirect linkage between agriculture and banking, insurance, transport etc.

6. The significant inter-sectoral dependence is confirmed when <sup>we</sup> look at it independently from another angle, ie. agricultural income as a function of secondary, tertiary income.

7. The states did not show uniform inter-sectoral relationship. Generally, the under-developed states showed a positive and significant relationship between non-agriculture as a whole and agriculture in the first period barring a few exceptions. This trend was discernible more pronouncedly through the lagged model exercises. During the second period, this dependency has become stronger

practically among all categories of states including the underdeveloped ones, exceptions being again fewer in this case. In most of these underdeveloped states, non-agricultural sectors being still at the 'pre-take-off' stage naturally continues to depend heavily on agriculture.

8. The secondary sectors of the relatively industrialised states such as Maharashtra, Gujarat, Tamil Nadu, West Bengal show some degree of resilience from the agriculture/primary sectors. Most of these states have yet to make a decisive headway in the development of their agriculture. On the other hand the states such as Karnataka and Haryana, which have been expanding their industrial base continuously show higher degree of inter-dependence. The industrial sector of the first mentioned states have become matured, capital intensive, broad based and sophisticated enough to be influenced by agriculture/primary sector. But the inter-sectoral dependences has got strengthened over time in the industrially expanding states of Haryana and Karnataka.

9. The tertiary sector of most of the state economies show a high dependence on the agriculture, the three exceptions being Haryana, Maharashtra and Kerala. In their case, the growing pace of urbanisation and the fast expansion of industry-linked service sectors provide some explanation.

10. The agriculturally developed states like Punjab also show positive and significant inter-dependence between various non-agricultural sectors and agriculture, which has gone even stronger after mid-seventies. The agriculture: non-agriculture linkage is

more pronounced in lagged models than the current ones in these states.

We can conclude the study by saying that there exists a high inter-sectoral linkage in the various sectors of Indian economy which has increased over the period of time. We did not find any conclusive evidence in regard to the resilience hypothesis. Though Government of India declared in the Economic Survey, 1987-88 about the resilience of industrial sector from agriculture without considering the lagged effect of falling agricultural production, this year they became more realistic to conclude: "It is not possible to insulate industrial production completely from setbacks in agriculture in an economy where agriculture accounts for about a third of the total Gross Domestic Product."<sup>1</sup> The clear message that we draw from the present study is that the insulation of the non-agricultural activities from up and downswings of agricultural sector is not yet in sight. Perhaps, it will take many more years for the Indian economy to inject a degree of resilience of its secondary and tertiary activities; the fortunes of agriculture will remain an important constituent of total economic activity for some more years to come. A few Indian states seem to have got over this 'ruling supremacy' of agriculture, but many have yet to do so. Thus, the structural weakness of a large part of Indian economy stares us today as it did some two decades back.

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