THE NATURE AND SIGNIFICANCE OF RURAL INDEBTEDNESS:

A STUDY WITH SPECIAL REFERENCE TO SCHEDULED TRIBES OF ASSAM

(A CASE STUDY OF NORTH LAKHIMPUR SUB-DIVISION)

A Dissertation

SUBMITTED

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PARTIAL-FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF

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Supervised by
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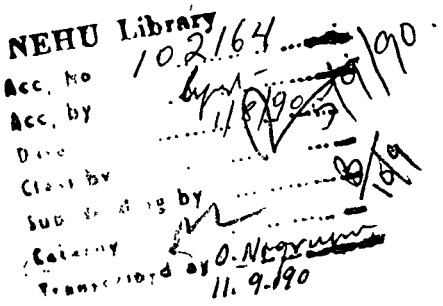
Thesis.



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CERTIFICATE

This is to certify that Mr. Mrinal Kanti Mitra has worked under my supervision for his M. Phil Dissertation entitled "The Nature and Significance of Rural Indebtedness: A Study With Special Reference to Scheduled Tribes of Assam (A Case Study of North Lakhimpur Sub-Division)" and no part of it has been submitted elsewhere for the award of any degree. This dissertation, in my opinion, is worthy of an award of the degree of Master of Philosophy in Economics.

15/5/87.

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PREFACE

This dissertation is a record of the experiences undergone by me in trying to understand the nature, significance, causes and consequences of rural indebtedness in the villages of Assam. Though this study is based on very limited number of observations and covers a very small area, I believe that it provides us with the first approximation of the truth about rural indebtedness. I believe that from the viewpoint of methodology as well, this research has been a rewarding endeavour. How to approach the study on rural indebtedness, how to define the concept of indebtedness in the Indian rural context, how to construct a measure of indebtedness, and further, how to proceed for investigating the causes and consequences of indebtedness have been the methodological contribution that, I believe, makes a background for further research on this subject.

But I alone should not be credited for the said contribution. Indeed, I am indebted(!), nay, thankful, to my supervisor, Dr. S. K. Mishra, Reader, Department of Economics, NEHU, Shillong, for his benevolent gesture and masterly guidance in carrying out this research. His practical experience in econometric methods, keen interest in interpretation of empirical findings and affiliation to planning have been my fortune.

I am also very much grateful to Prof. K. Bez, Prof. N. Srivastav, Prof. T. Mathew, Prof. Shri Prakash, Prof. E. D. Thomas, and Prof. T. Lawma, all of the Department of Economics, NEHU, Shillong, for love, guidance and inspiring suggestions. Prof. J. B. Bhattacharjee, Department of History, NEHU, Dr. P. S. Datta of the Sociology Department, NEHU, and Dr. A. C. Mohapatra, Department of Geography, NEHU, deserve my thanks for their inspiring suggestions.

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Sri B. N. Sarmah Baruah, Principal, Lakhimpur Commerce College has been very kind and cooperative in granting me a study leave. Without his cooperation, I am sure, I could not have been able to complete this work. I am also thankful to my colleagues, Shri Binod Dutta,

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I cannot go without acknowledging my thanks to Mr. Dilip Saikia (Chairman, Tribal Welfare Development Council, Government of Assam) and Mr. Utpal Dutta (State Flood Control Minister, Government of Assam) for their help and cooperation.

I acknowledge my sincere respect of Mrs. M. Mishra for her motherly treatment and encouragement while carrying out this study.

Mr. Joseph F. Khongbuh has helped me by his expertise in stencil cutting and cyclostyling the manuscript. I am very much obliged to him.

Last, but not the least, my thanks are due to my wife for her help, cooperation and encouragement for completing this work.

In spite of the best that I could receive from all whom I have acknowledged my gratitude by name, and many others who could not be mentioned here by name on account

of the human weaknesses of which, I believe, I share the larger portion, there may be errors and omissions that I do not see now, but may be so vivid when others look through this dissertation. For such errors and omissions I and I alone should be put to blame and criticism.

Mrinal Kanti Mitra

(M. K. MITRA)

SHILLONG
THE 15. 5. 1987.

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CHAPTER - I

INTRODUCTION

1. A Prologue to the Study of Rural Indebtedness

Indebtedness has been acknowledged as one of the most infamous stumbling blocks in the way of rural prosperity. It is cancerous; self-perpetuating, malignant and maleficent. It abates agricultural production, abashes social psyche, aggravates inequalities in the distribution of socio-economic opportunities and benefits, arrests social progress and misdirects social efforts.

In spite of appreciable industrial development in the post-independence years, Indian economy remains, largely and fundamentally, an agricultural economy in which about three-fourth of the people depend on agriculture for their livelihood. Under the condition of overpopulation, the economy has too little land to support too many people, unless farming is revolutionised. It has been a point of contention whether such a revolution can realise itself in the circumstances when most of the farmers own and cultivate the tiny plots of land that characterise uneconomic scale of operation and produce hardly enough to meet their subsistence requirements. A substantially large portion of labour force remains unemployed either explicitly or in disguise and its marginal productivity is barely above zero.

Historically, in rural areas land ownership has been the most dominant factor in acquiring power, prestige and privileges. Among the fundamental factors of production, land is the least perishable one and hence it qualifies for being owned, inherited and used as a fundamental source of forces captivating labour. As a result, in the process of historical evolution, the bargaining power of landowners grew stronger and stronger than the bargaining power of the labourers and eventually, land resources started concentrating in fewer hands expanding the size of landless labourer class larger and larger. This process is on and land is continually being concentrated in fewer hands.[1]

Indebtedness of the not-so well-to-do farmers and agricultural labourers is a natural consequence of the dynamics mentioned above. It also works as a cumulative causation factor as G. Myrdal would call it. Indebtedness accelerates concentration of land in fewer hands and the latter, in turn, intensifies and extends the former.

Within the given institutional structure of the Indian society it is felt that a cure for indebtedness is extremely difficult, if not impossible. It is so because poverty, coupled with unequal distribution of economic

resources, breeds indebtedness which, in turn, consolidates the causes of poverty and distributional injustice. This vicious circle can, of course, be broken, but it requires a strong social will and a manifestation thereof in determined efforts to eradicate the problem of rural poverty and indebtedness.[2]

There is a pressing need for identification of weaker links of the causal chain that makes the said vicious circle. A prudent strategy to break the vicious circle would attack on these weaker links. The task of identification of weaker links necessitates social research to be carried out.

The problem of rural indebtedness is not a pure economic problem. It is equally a political, a social and socio-ethical problem. It has its roots in the social, political, ethical and economic texture of the society. However, indebtedness of the rural weaker section has not been a central theme of social research work so far, although fact-finding survey reports are available. This problem has, no doubt, attracted the attention of research workers, but it has suffered a superficial, fragmentary and cursory treatment. We acknowledge that in India, for a period, numerous publications appeared that dealt with

marketed surplus of agricultural output and it was discussed that a large portion of marketed surplus consisted of "forced surplus" under the impact of indebtedness of small farmers.[3] Again, studies have been carried out that comprehensively indicate that indebtedness strengthens and consolidates traditional farming and arrests agricultural development. Off and on research studies have appeared to point out the bearings of indebtedness of small farmers on dynamics of land ownership. Effects of indebtedness on keeping the wages of agricultural labourers at subsistence level have been acknowledged.[4] Yet, integrated studies on the causes and consequences of indebtedness have drawn scanty efforts of research workers.

Reasons of scant research efforts devoted to the study of rural indebtedness are not far to find out. After independence Indian scholars were confronted with problems of rapidly increasing population and stagnant agricultural output. It was a common impression that such a situation would lead to the problem of food supply which would arrest industrial and urban development on which five year plans had given so much of a concentrated stress. In this milieu it is easy to explain why the structural problem like rural indebtedness could attract little attention of the mainstream researchers. Later when due to technological

innovations the problem of food supply became secondary, the mainstream of research in economics turned towards regional disparities since it was envisaged that this problem was more pressing than the problem of the silent sufferers under debt who were distributed throughout the rural India. The main thrust of the question of regional disparities was industrial development and in the subsequent five year plans this problem was taken care of.

Thus the problem of rural indebtedness is rather a sobbing — not even a cry — in the wilderness which cannot be heard in the atmosphere full of slogans, demands and pressures generated by that section of the society which can speak louder and nearer into the ears of those whose opinion carry weight and influence the public decision-making.

The solution of the problem of rural indebtedness is not easy either; partly because it is structural in nature and partly because it would demand too much of efforts. Because of the limitations of the possibilities of public intervention in matters of the fundamental causes of poverty and indebtedness, this problem may evade solution in the near future. Indebtedness is caused mainly on account of consumption expenditure for which institutional loan cannot be given. The problem of rural

unemployment has no solution that can be found out in the near future. Since indebtedness is largely based on these two cornerstones, it is comprehensible that no short term policy can help to eradicate it.

However, the acuteness of the problem does not pre-empt research efforts from understanding the structure, nature, significance and consequences of the problem. In this study we are mainly concerned to do the same.

2. The concept of Indebtedness

We envisage that indebtedness is a term surrounded by several overtones and the concept of indebtedness must be freed from the penumbra of fuzziness caused by the cacophony. In our context, the cacophony has been mainly due to the discordant overtones, some resulting from the indigenous background and others from the exotic one.

The lexicographic meaning of "indebtedness" is the state (of some person or commercial or industrial enterprise) of being under obligation (more often, financial obligation). This meaning is largely free from overtones; but it is too wide to represent the concept that we intend it to do. We are aware of the fact that many households borrow for enterprise and repay the debt to the lender in terms of a share of the gains from the enterprise. Depending upon the socio-

economic conditions, the dividend or the tribute paid to the lender has been acknowledged as "a payment or reward for abstinence from consumption", or "a reward for waiting", or "a reward for cooperation that has helped the enterprise to accrue gains", or "a reward for parting with the liquidity that has an opportunity cost of speculative gains - that is, a reward for speculative gains foregone", etc. When indebtedness has an overtone that reflects any of the meanings noted above, it refers to an enterprising society requiring financial resources for investment. A student of the history of economic thought in the West is aware of the theories of interest that developed after the industrial revolution.

The optimistic hue may, however, be illusive if we forget that under certain socio-economic conditions (quite familiar to us) the tribute paid to the lender is "a payment made by the victim of the socio-economic circumstances to those who command coercive powers and a social sanction for exercising these powers." The Marshallian "quasi rent" has, no doubt, an element of the same in it, but its imports have been burried under the gross optimism in the natural providence for the social progress. Thus, when we use the term "indebtedness", we at once are striking two strings — one of the harshness of our Indian experiences and the other

of our learnt optimism imported in effect of the economic theories of the standard economics.

History teaches us the account of the reproach received by the lenders and usurers from most of the religious scriptures and social reformers. Socrates had his last wish that they should not forget to repay his debt of a cock that he owed to pay. Then indebtedness must be a curse, a plight, a desolating experience. The social sanction for lending since the sixteenth century speaks volumes of the change in the socio-economic conditions of Europe while borrowing emerged as a means of financing enterprise and lost the connotation of the plight of the debtor. But the indebtedness of the Indian rural people is yet to lose the said connotation.

In the Indian rural context, therefore, "indebtedness" should be pre-empted of the overtones of optimism. Indebtedness is not a state of being under financial obligation undertaken on account of productive utilization of resources promoting economic achievement of the borrower; rather it is the state of being under the financial obligation undertaken on account of compulsion and being ensnared in the cobweb of usury. He need not repay his debt in terms of a pound of flesh, a pint of fresh blood would suffice.

Indebtedness of an Indian rural household often finds its genesis in the borrowing on account of certain exigencies like accidents or illness of a member of the household or a pressing need for certain social occasions, like marriage, etc. First, because a household hardly saves enough to meet such needs and second, because there is no provision for institutional borrowing in such cases, the only source of loan is the local money-lender who charges exorbitant interest for such loans. Now, the loanee has not enough sources of income to enable him repay the debt, the principal multiplies itself rapidly to ensnare him in the cobweb of usury. More often than not, he makes a provision of repayment by either mortgaging his land or his labour captivating his sources of income to disable him pay his debt off. Very soon he is drowned in debt.

Sometimes indebtedness originates in the loan incurred for productive activities as well. We know well that farming in most of the regions of India is to gamble with Nature. Flood, draught and untimely rainfall is any farmer's experience. A farmer who has financed cultivation through borrowing has a scant chance of repaying off his debt except only when the Nature has favoured him unusually. In general, if he has succeeded in raising some production, he is forced to dispose it off to the lender. In the

literature on agricultural economics in India we often come across the terms like "forced surplus", and "perverse supply curve of food grains", etc. Indebtedness of the Indian peasantry explains all these "surprises" and "paradoxes" of a "standard economist". If prices of the agricultural produce increase by a growth rate r_1 (during the period between the current and the next crop season) and the principal (debt) multiplies itself by a growth rate r_2 such that r_1 is less than r_2, the current value of the output X as a means to optimise the debtor's gain is the optimal one. Hence the farmer sells his produce at the harvest prices and pays his debt off.

We note therefore, that indebtedness in the Indian rural context must be resonant with the following overtones:

(i) Unproductive usage of loan.

(ii) Usurious ensnaring of the loanee.

(iii) Captivation of productive, income-generating resources like land and labour.

(iv) Exercise of coercive and exploitative economic and social powers by the lender.

(v) Compulsion, plight, misery and feeling of guilt and helplessness.

(vi) Erosion of the social status of the loanee.

Thus viewed, indebtedness is not to be taken lightly and certainly not with an optimistic shade portrayed by the "standard economists".

3. Measure of Indebtedness

In dealing with the problem of indebtedness, searching for the causal factors influencing it, analysing the consequences of indebtedness that may be reflected in reduction of productivity, or ensconcement of inequalities in distribution of income and sources of income, we may require to measure the degree or intensity of indebtedness. The intensity of indebtedness must be measured so as to represent the six characteristics mentioned above. It requires selection of some indicators of indebtedness. The following indicators may, in our opinion, serve this purpose:

(i) Amount of unproductive or consumption loans (per capita) observed by a household.

(ii) Per capita interest payment by a household.

(iii) Per capita loan as a ratio to the value of productive assets held by a household.

(iv) Loan per cultivable area of land owned by a cultivator household.

(v) Per capita loan as a ratio to the repaying capacity of a household. The repaying capacity of a household may be defined in terms of savings, that is, the net income of the household over and above consumption expenditure and working expenses.

(vi) Percentage of landholdings/labour days/other productive assets made available to the lender on the mortgage.

(vii) Forced sale of produce when prices are low (i.e. in the harvest season) or working for the lender in the seasons of peak demand for labour as a ratio to the total disposable produce/labour days available with the loanee.

(viii) Appropriate measures of the feeling of compulsion, guilt and helplessness.

(ix) Appropriate measure of the feeling of offence to social status/erosion of social status.

(x) Appropriate measure of feeling about the coercive powers exercised by the lender.

It is obvious that an empirical work on constructing the indicators noted above may face a number of operational difficulties. The last three indicators may invoke the techniques often applied in psychology and attitudinal sociology.

4. Objectives of the Present Study

We have remarked earlier that the problem of rural indebtedness is structurally imbued within the social, economic, ethical and political texture of the Indian rural society. As a result a student of this problem finds it very intricate to analyse the extent, causes and consequences of rural indebtedness. In view of the limitations on our part we are not in a position to invest ourselves commensurate with the demand made by this problem. Hence our modest attempt to analyse this problem proposes the following objectives of the study at hand.

(i) To study the extent of the incidence of indebtedness in villages.

(ii) To study the characteristic features of indebtedness in villages.

(iii) To investigate the factors that determine the degree or extent of indebtedness.

(iv) To analyse the consequences of indebtedness as far as it affects productivity and distribution of economic resources in the rural society.

(v) To derive certain policy measures to ameliorate this problem.

5. Methodology of the Study

For this study we have selected the North Lakhimpur Subdivision of the Lakhimpur District, Assam. North Lakhimpur is one of the underdeveloped subdivisions of Assam. The subdivision is inhabited by a large population of the scheduled tribes. Their main occupation is cultivation. They are plains tribes and unlike many of the hills tribes they are settled peasants and not shifting cultivators.

We suppose that the scheduled tribes of the North Lakhimpur Subdivision living in the villages are quite unaware and unexposed to the institutional agencies of credit supply run by the public and semi-public organisations. Hence they are more prone to be caught in the cobweb of usury. We suppose that a study of their indebtedness will provide us with a real picture of rural indebtedness.

We are not aware of any source that provide us with the secondary data on the indebtedness of the rural people of North Lakhimpur subdivision. Hence we have to collect data from the primary source. Keeping our constraints in mind we have selected four villages in the subdivision. These four villages are solely inhabited by scheduled tribes and they are located 6 to 7 Km away from the nearest township (North Lakhimpur).

From these villages we have decided to draw sample households to be interviewed. We have covered 50% of the population (households) by the samples drawn. We hold that this coverage will suffice to provide us with enough data which may be analysed to obtain the true picture of indebtedness in the population. We have adopted systematic sampling method for selection of interviewee households. One household is chosen randomly and after that every alternate household is chosen for interview. Pretested questionnaires have been filled in by the direct interview of the head of the household.

The filled in questionnaires thus obtained have been used to tabulate data on different characteristics of the sample households. The tabulated data have further been subjected to relevant statistical analyses to draw conclusions and test relevant hypotheses.

6. Organisation of the Work

In Chapter II, we have introduced the study area, that is, the North Lakhimpur Subdivision of the Lakhimpur District, Assam. Following this introduction we have given an account of the methodology by which we have chosen the villages for our study and selected samples from these villages.

In Chapter III, we have studied the extent of the incidence of indebtedness and its characteristic features as reflected in our sample data. We have tried to find out whether indebtedness has any systematic distribution and pattern or not. We have also ventured into the possibilities of measuring the degree of indebtedness and finding out the best representative measure of indebtedness. We have tried to construct a composite index of indebtedness.

In Chapter IV, we have made an attempt to analyse the consequences of indebtedness. Although we acknowledge the social and psychological consequences of indebtedness, but we have not been able to go in for such an analysis. Hence we have proceeded to analyse the consequences of indebtedness so far as it affects productivity and distribution of economic resources in the rural society. We have gone in to carry out a causal chain analysis to understand how indebtedness affects productivity and distribution of economic resources.

In Chapter V, we have made an attempt to search out the factors that determine the degree or extent of indebtedness. Our main motivation for doing so is to help enable us to derive certain conclusions that may be suggestive to formulate certain policy guidelines for eradication of the problem of rural indebtedness.

In Chapter VI, we have concluded our analysis and made certain suggestions for formulating the policies for eradication of the problem of rural indebtedness.

7. Limitations of this Study

We concede that the problem of rural indebtedness is at once an economic, social, political and ethical issue. But in view of our limitations we have not been able to carry out the study to the depth it calls for. Our approach has mainly been economic. We acknowledge that such a study is partial and may provide only a partial view of the issue.

From the viewpoint of methodology also our attempts have been limited. We have gone in for statistical analysis of data collected from only four villages and these data pertain to a point of time. We concede the limitations of statistical analysis. We are aware of the fact that the process of ensnaring in the cobweb of indebtedness, captivation of productive resources, and dynamics of distribution of resources under the influence of indebtedness cannot be studied properly unless we analyse data for a considerable length of time. Further, the generalisations made on a study of four villages have their limitations in their own right.

However, we hold that our humble attempt to analyse the problem of rural indebtedness has its own worth so far as it may provide us with the first approximation of the truth and thus may motivate us for proceeding into a more in-depth study which ultimately may be fruitful. It also provides us a basis on which a methodology of analysis of the problem of rural indebtedness may further be developed and enriched. It attracts our attention to the problems that one may face in dealing with the issue. We hold therefore that our attempt to analyse the problem of rural indebtedness has been fruitful in spite of all limitations put on it.

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CHAPTER - II

AN INTRODUCTION TO THE STUDY REGION AND SAMPLING METHODOLOGY

In this chapter our main objectives are twofold: first, to give an introduction to the study region and second, to describe how we have selected samples for our study.

1. The North Lakhimpur Subdivision: Location

The North Lakhimpur Subdivision, the region under our study, is one of the two subdivisions of the Lakhimpur District, Assam (the other subdivision is Dhemaji). The area of North Lakhimpur Subdivision is 1409.60 square Kms and it shares about 37% of the total area of the district of Lakhimpur. The subdivision is situated between $26^{o}50'$ and $27^{o}90'^{N}$ latitudes and between $93^{o}46'$ and $94^{o}20'^{E}$ longitudes.

The boundaries of the Subdivision extend in the north by Subansiri and Siang districts of Arunachal Pradesh, in the east by a part of Lohit district of Arunachal Pradesh and Dhemaji subdivision, in the south by Dhemaji subdivision and Sibsagar district of Assam and in the west by the Sonitpur district of Assam.

2. Physiographic Features

The subdivision is not a homogeneous unit; two distinct units can be demarcated as hilly tract and flat level plain. The quality of the soil is alluvial and composed of a mixture of sand and clay in varying proportions. The soil is highly acidic in character. The moisture retentive capacity of the soil is poor and hence the fertility is low.

3. Climate and Rainfall

The climate of the North Lakhimpur subdivision is characterised by the relative coolness, abundant summer rainfall, and a highly humid atmosphere throughout the year. The average maximum and minimum temperature is 27.9°C and 17.9°C, the average humidity is 81% and the annual total rainfall is 2544 mm (average for five years 1972-75)[1]. The period from June to about beginning of October is characterised as the South Monsoon season while October and November constitute of post monsoon season.

It rains nearly all the year round. Rainfall is the only source of water for growing crops. Because of heavy rainfall and numerous rivers and rivulets, the area is prone to frequent floods, devastating crops and lives.

4. Population

According to 1971 Census, the population of the subdivision was 398.4 thousand. The percentage of scheduled tribe population in the subdivision works out to be about 18.34 in 1971. Of the total population, 93.64% lived in rural areas and others in the urban areas.

It has been observed that the population of the subidivision is growing very rapidly at the rate of about 36% per decade. It is conjectured that a good part of this increase is attributable to immigrants from the neighbouring countries and other states of India. It is conjectured that immigrants form about 20% of the total population of the subdivision.[2]

5. Occupational Structure of Population

About 68.92 percent of the working population are cultivators and 7.50 percent are agricultural labourers. Thus, about 76.42% of the people directly depend on agriculture. In non-primary occupations commerce is dominant.

6. Landholding

An important feature of the economy of the subdivision is the predominance of small holdings of cultivable land. Skewness in the distribution is much less in comparison to other districts of Assam. The total area under

cultivation is about 86 thousand hectares and average holding size is about 1.69 hectares (about 3.17 acres). Nevertheless, it is conjectured that skewness in distribution of land is on an increase.[3]

7. Irrigation Facilities

The whole tract of cultivable land is rainfed. There has been no development of irrigation facilities, partly because of the underdevelopment of the subdivision in general and partly because of abundant rivers and frequent heavy rainfall. Cultivation is mainly prone to floods and not droughts. Development of irrigation facilities could have possibly controlled the severity of floods and it could have helped agricultural practices also to improve.

Out of the total land (area of the subdivision) about 20.87% is cultivable waste land, 55% is cultivable (unirrigated) and about 20% is not available for cultivation. About 1.94% of the total area is covered by forests. There are prospects for afforestation of the waste land.

8. Cropping Pattern

The principal crop is rice. Sali and Ahu are the varieties of rice cultivated extensively. Mustard and potato are other important crops. No trace of HYV rice cultivation is found.

9. Transport and Communication

The transport and communication network in the subdivision is not well-developed. The most important road is North Trunk road which is the main road link between North Lakhimpur Subdivision and Sonitpur district and Dhemaji subdivision. There is also another road called Kamalabaria PWD Road which covers a distance of 19 miles and connects the subdivision with Majuli. On account of several rivers criss-crossing the subdivision, coupled with heavy and frequent rainfall, most of the roads remain suspended during the summer and rainy seasons.

The village roads of the subdivision are unmetalled and during rainy seasons these roads go under water disrupting the transportation link.

10. Marketing facilities and commercial institutions

North Lakhimpur is the most important market centre of the subdivision. But due to poor transportation facilities, there is predominance of local markets. Farmers usually sell their product in these local markets and purchase other commodities from these markets. Thus the villagers exchange their commodities through middlemen.

Some banks are located in the town (North Lakhimpur). But they do not have their branches in the interior areas

of the subdivision. The people are quite unexposed to institutional sources of finance partly because of poor educational level and communication and transportation facilities and partly because of poor network of financial institutions. As a result, about 96% of the total credit is supplied by local money lenders.[4] Money lending and marketing of agricultural products are integrated activities. Middlemen often supply credit to the farmers. A survey[5] conducted in 1948-49 revealed that about 2/5 of the total number of households were under debt. For recent years we do not have any such information, but our conjecture is that the incidence of indebtedness has increased substantially.

10. Methodology of Selection of Villages

We have already mentioned in the introductory chapter of the study that four villages have been selected purposively for drawing sample households. Here we present the main points that we considered for selecting these villages.

First, we hold that distance from a township[6] has important effects on the way of life, economic and social characteristics and attitudes of the people. To keep these effects possibly constant, we have chosen the criterian of distance from town as a guiding principle in selection

of villages. Note that the towns are also the market places and distance from market place[7] affects the endeavours and characteristics of the economy. Hence, if we selected villages at different distances from the township/market place, we should have included "distance" also as an important explanatory variable. This would have increased complexity in analysis. Hence we designed it to select the villages which are at almost equal distance from the township and market place.

Second, we hold that tribals are relatively less exposed to institutional credit facilities and their population has less individualistic and atomistic elements. They are relatively more guided by social and religious principles than by so called market place rationality. We mean to say that the number of "Smithian Scotchman" is less in tribal societies. Since in such cases they are more prone to indebtedness, we have decided to select only those villages which have ethnically homogeneous population (and as a consequence, more closed societies) inhabiting them. Thus, one of the villages selected by us is inhabited exclusively by Boro tribe, another village is inhabited exclusively by Missings and two villages are inhabited exclusively by Sonowal tribe. These last two villages are ethnically one.

We hold that size of a village affects social and economic characteristics of the inhabitant population.[8] Hence we have tried our best to select villages which are similar in population size, such that differences due to population size are not important enough to be taken up for analysis.

Thus we selected four villages, namely Bori Mori (Missing) village, Bhati (Sonowal) Chachari village, Majgao (Sonowal) village and Chorimoria (Boro) village.

11. Selection of Sample Households from the Villages

After selecting the villages we counted the number of households in these villages and order-listed them (separately for each village) by the leading alphabetical character of the first name of the head of the household. The first two villages are inhabited by sixty households each while the third and the fourth villages are inhabited by 42 and 40 households respectively.

We generated four pseudo random numbers. The first two random numbers were such as to lie between 0 and 60 while the third and the fourth were to lie between 0 - 42 and 0 - 40 ranges respectively. These random numbers were generated such that they follow a uniform distribution. These numbers were generated by using a library program

of a programmable calculator TI programmable 58 - C (Texas instruments). These four random numbers were used to identify the first household in each village.

Once the first household was randomly selected in each village, we proceeded to select sample households by a systematic sampling procedure. Since we decided to collect 50% of samples from each village, every alternate household was to be selected. The list of households were used to identify these households and they were interviewed. By direct interview of the heads of the sample household we gathered information and completed our questionnaires. Over and above filling in the questionnaires, we had a discourse with the heads of the households on several issues of indebtedness and problems of the village. We had discourses with the headmen of these villages. The gist of these discourses were noted in a diary.

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CHAPTER - III

INCIDENCE OF RURAL INDEBTEDNESS IN THE STUDY AREA: A DESCRIPTIVE STATISTICAL ANALYSIS

1. Opening Remarks

In this chapter our main objective is to analyse (by means of descriptive statistics) the incidence, extent of spread and characteristic features of indebtedness in the villages under our study. First, we have presented the characteristic features of sample households according to the per capita amount of loan observed by the household. Following it we have made an attempt to investigate how we can present the incidence of indebtedness by some statistical-mathematical function. Next we have tried to quantitate the concept of indebtedness by several indicators and identify the best possible representative measure of the degree or extent of indebtedness.

We have tried if we can discriminate between loanee and non-loanee groups by certain criteria that might be correlated with indebtedness. We have also tried to investigate if we can discriminate among the three tribal populations in matters of their economic characteristics.

2. Characteristic features of sample households classified according to per capita amount of loan

It may be interesting to study the characteristic features of sample households according to the degree or intensity of the incidence of indebtedness. We hold that as a rough-and-ready measure of the degree of incidence of indebtedness we may use "per capita amount of loan observed by the household". The table 3.1 presents some characteristic features of the sample households.

A perusal of the class averages of variables representing various characteristic features of the sample households classified according to per capita loan immediately reveals that no clear pattern is discernible. There may be two possible alternative reasons for such a situation. The first that indebtedness is neither determined by nor is determining anything reflected in the characteristic features of the sample households. There may be some extraneous variables that may be correlated with indebtedness. If it be so, our attempts to study the nature and significance of indebtedness in the villages under our investigation are destined to be dommed. However, there may be another reason for the observed disorderliness of our sample data. That is that none of the variables, in their individual capacity, are able to explain, or to be explained by,

Table - 3.1: Characteristic features of sample households classified according to per capita amount of loan (in Rs.)

Per capita Amount of loan (Rs.) Class	No. of house-holds	Class Average of family size	Class Average of total landhold-ing (bighas)	Class average of cul-tivable landhold-ing (bighas)	Class Average of house-hold income (Rs.) per capita
0 - 20	21	9.33	20.05	17.10	1081
20 - 40	7	8.14	9.29	7.71	723
40 - 60	8	9.13	12.13	10.88	499
60 - 80	7	10.28	12.14	10.71	735
80 -100	5	10.2	14.80	13.20	585
100 -120	9	5.89	9.44	8.00	842
120 -140	6	8.67	11.00	9.33	1171
140 -160	4	12.75	7.50	6.25	694
160 -180	1	14.00	10.00	9.00	231
180 -200	1	8.00	20.00	16.00	700
200 -220	4	5.25	4.50	3.50	1025
220 -240	2	4.00	4.00	3.00	1091
240 -260	6	7.50	15.67	9.67	787
260 -280	2	11.00	8.50	7.00	495
280 -300	4	7.00	17.75	16.00	1444
300 -320	2	4.00	11.50	10.00	627
320 & above	12	4.75	13.58	10.92	3206
All Classes	101	8.08	13.34	11.15	1152 (875)

Table - 3.1 (Contd.)

Per capita amount of loan (Rs.) class	Class average of value of assets (Rs.)	Class average of investment (Rs.) in land	Class average of production in value terms (Rs.)	Retention in value terms (Rs.) Out of production class average
0 - 20	186	824	4650	3176
20 - 40	800	314	4114	3793
40 - 60	1225	350	3966	3741
60 - 80	1343	379	2912	2359
80 - 100	1400	1020	4383	4023
100 - 120	1278	322	3160	2780
120 - 140	750	158	4890	3990
140 - 160	625	500	3319	3319
160 - 180	2100	1600	3240	3240
180 - 200	1100	300	2880	1125
200 - 220	825	150	1690	1665
220 - 240	1050	550	2205	1525
240 - 260	1283	750	3833	3270
260 - 280	2100	650	2790	2700
280 - 300	3600	1975	4646	3184
300 - 320	1100	350	2363	2138
320 & above	258	5900	2643	1988
All Classes	935	592	3687	2990

Table - 3.1 (Contd.)

Per capita amount of loan (Rs.) Class	Class Average Highest education (in Years)	Class average of loan (Rs.)	Class average of mortga-ged land (bigha)	Class average of Interest paid (Rs.)	Class average of Depen-dency ratio
0 - 20	5	24	0.76	34.29	0.76
20 - 40	2	264	1.43	408.00	0.55
40 - 60	1	431	0.56	643.50	0.63
60 - 80	2	657	0.43	759.43	0.56
80 - 100	0	1160	2.50	1136.00	0.66
100 - 120	2	917	0.22	846.67	0.62
120 - 140	2	1117	1.67	1710.00	0.56
140 - 160	0	1900	0.25	2024.00	0.53
160 - 180	0	2400	0.00	4320.00	0.36
180 - 200	0	1500	0.00	1800.00	0.50
200 - 220	0	1050	0.50	1847.50	0.74
220 - 240	0	900	0.00	1620.00	0.50
240 - 260	3	1700	0.42	1700.00	0.61
260 - 280	8	3000	3.00	1920.00	0.50
280 - 300	9	2000	1.38	2400.00	0.66
300 - 320	5	1250	1.00	1236.00	0.75
320 & above	1	4317	2.80	442.00	0.91
All Classes	-	1332	0.80	893	0.67

any single variable. If it be so, for any analysis fruitfully to be carried out, it is required that a number of variables should together be taken up. It suggests that throughout we have to carry out multivariate statistical analysis to reach at any conclusion worth consideration. The analyses carried out in the proceeding chapters will testify that multivariate statistical and econometric techniques have indeed been successful in drawing meaningful conclusions. Thus, the apparent disorderliness of sample data is no matter of discouragement for our investigation.

At present we proceed to learn about the nature and characteristic features of sample households as much as it is possible to conclude by analysing sample means of the variables tabulated in Table 3.1. To begin, we observe that the average family size is considerably large (8) and the dependency ratio is roughly 2/3. A high dependency ratio is consistent with large family size. The average cultivable land holding (11.15) is not very small. But productivity of land is rather low (Rs. 330.6). It is so partly on account of the prevalence of traditional method of cultivation and partly due to the soil characteristics. It is to be noted that in the villages under our study there are no irrigation facilities and hence crops are rainfed. This is

one of the reasons why the traditional technology of farming is prevalent. As a consequence, productivity of land is low. It reflects on the per capita income (Rs. 875). However, income derived from farming constitutes only a part of the total income of the households, though it is a major constituent (52%). Note that Rs. 875 is the average p.c. income of the sample households excluding loanee group "320 and above". The overall sample mean p.c. income is Rs. 1152, rather inflated due to 12 outlier sample households.

A sizeably large portion of agricultural output (81%) is retained for household consumption. The rest of it is sold out either for meeting the needs for cash or for paying off the interest or the debt.

Incidence and intensity of indebtedness is considerable. The rate of interest charged on loan is very high, rather exorbitant. During a year's period, the principal is more than doubled. Incidence of mortgaging of land against loan is widespread. About 8% of the land is mortgaged against loans. Repaying capacity of the households is low in general. The low level of repaying capacity disables the loanees to pay off the debt or even the interest. As a result, persistence of indebtedness is reinforced.

Since indebtedness intensifies itself, a sizeable amount of resources flow out from the hands of the loanee households and very little is left to be invested in productive activities. Average per bigha investment in cultivation is very low. It affects agricultural productivity and as a result, repaying capacity of the loanee households remains low.

3. Size distribution of loanee households

Now we propose to analyse how loanee households are distributed in different loan (amount in Rupees) brackets and how we can capture their distribution by some mathematical or statistical functions.

We proceed with the oft-applied Pareto distribution.[1] Mathematically, Pareto distribution may be expressed as:

$$N(L) = aL^{b}\eta \qquad \ldots\ldots\ldots\ldots\ldots (3.1)$$

Where N(L) is the number of loanees with a debt exceeding Rs. L, η is the error term, and 'a' and 'b' are the parameters of the distribution. Our empirical curve fitted to the sample data is:

$$N(L) = 905.328\ L^{-0.67};\ R^2 = 0.829 \ldots\ldots (3.2)$$

The graphical presentation of the same is made in the diagram No. D3.1. A close scrutiny of the fitted Pareto

curve reveals that for the lower as well as the upper loanee group the curve does not fit well to the data. Moreover, the errors in the fitted curve are markedly systematic. Hence, in spite of the statistically significant value of the coefficient of determination, we have reasons to reject the suitability of the Pareto curve to represent the distribution inherent in the data.

The scatter of the sample data plotted on the graph paper indicates elliptical nature of the distribution. Hence we are tempted to fit an elliptical curve of the nature:

$$\frac{(\text{Log}(N(L)))^2}{a^2} + \frac{(\text{Log}\ (L))^2}{b^2} = 1 \quad \ldots\ldots\ldots \quad (3.3)$$

where Log is referring to the natural logarithm to the base e, and "a" and "b" are parameters of the distribution. The empirical curve obtained by fitting the elliptical model is:

$$\frac{(\text{Log}(N(L)))^2}{26.04} + \frac{(\text{Log}(L))^2}{48.33} = 1;$$

$$R^2 = 0.933 \qquad \ldots\ldots\ldots \quad (3.4)$$

In this case also, as one may observe, the errors show a systematic nature, as depicted in the diagram D.3.1. Hence,

we hesitate to accept this curve also as a suitable representative of the empirical distribution.

We have made further trials with linear and exponential curves. The linear curve fitted to the data is:

$$N(L) = 75.06 - 0.2126L;\ R^2 = 0.939 \quad \ldots\ldots \quad (3.5)$$

The exponential curve is:

$$\text{Log } (N(L)) = 63.749e^{-0.0000169\ L^2};\ R^2 = 0.959 \quad \ldots(3.6)$$

However, in both the trials above we have found that errors are systematic in nature. The systematic nature of errors may be observed in the diagrams D.3.1 and D.3.2. Lastly, we have fitted the curve of the nature:

$$(\log(N(L)))^2 = a - bL^{\frac{1}{2}}; \quad \ldots\ldots\ldots\ldots \quad (3.7)$$

In this case our empirical curve is

$$(\text{Log}(N(L)))^2 = 24.733 - 0.9664L^{\frac{1}{2}};\ R^2 = 0.970 \quad \ldots(3.8)$$

As may be observed in the diagram D 3.2, this curve fits the data quite well and the errors in the fit are no more systematic. Since throughout we have been searching for a fit in which errors show randomness or at least, an absence of a systematic pattern, we have concluded that the curve fitted in (3.8) suits the data well and represents the size distribution of loanees in the villages under our study.

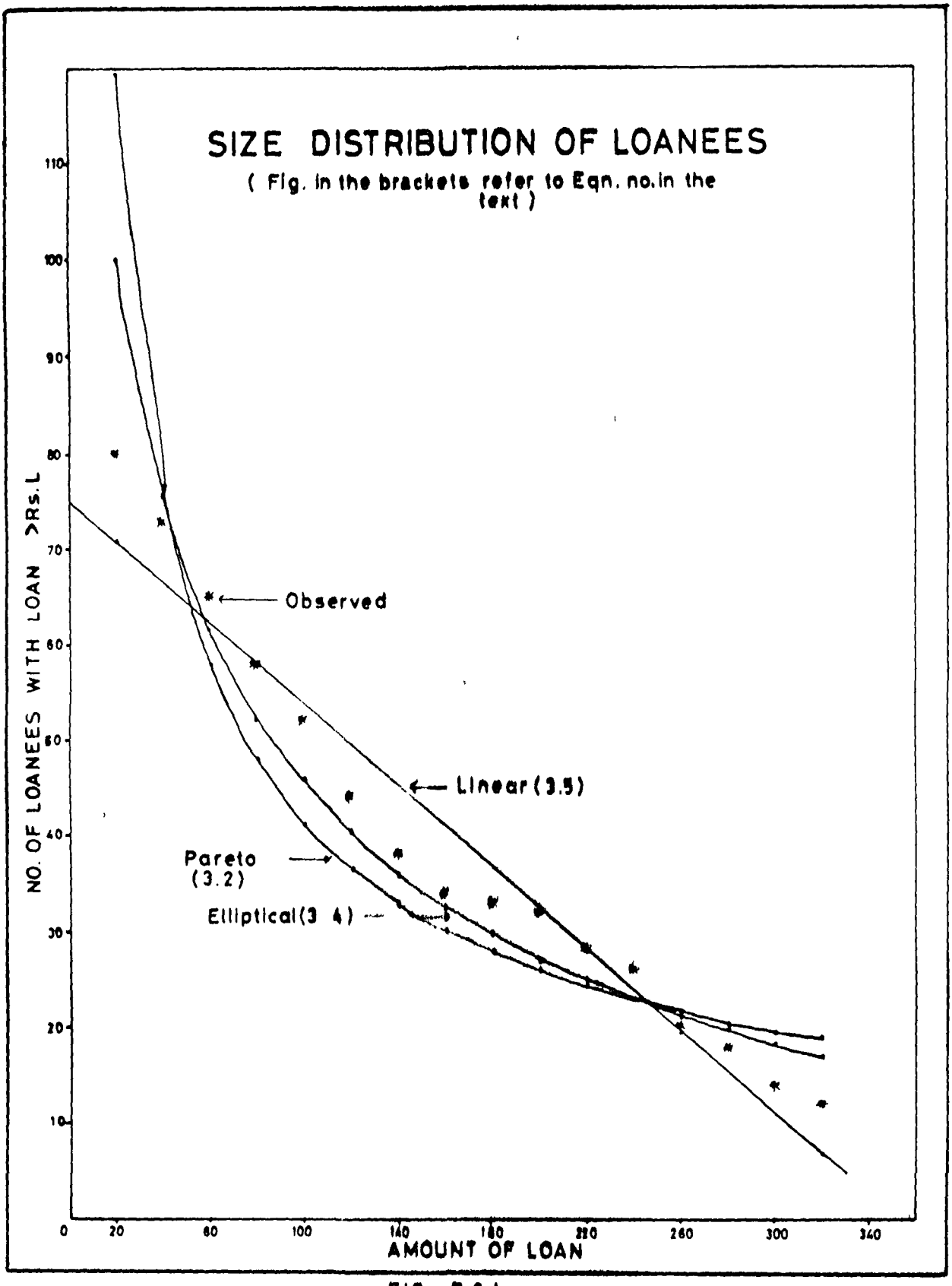
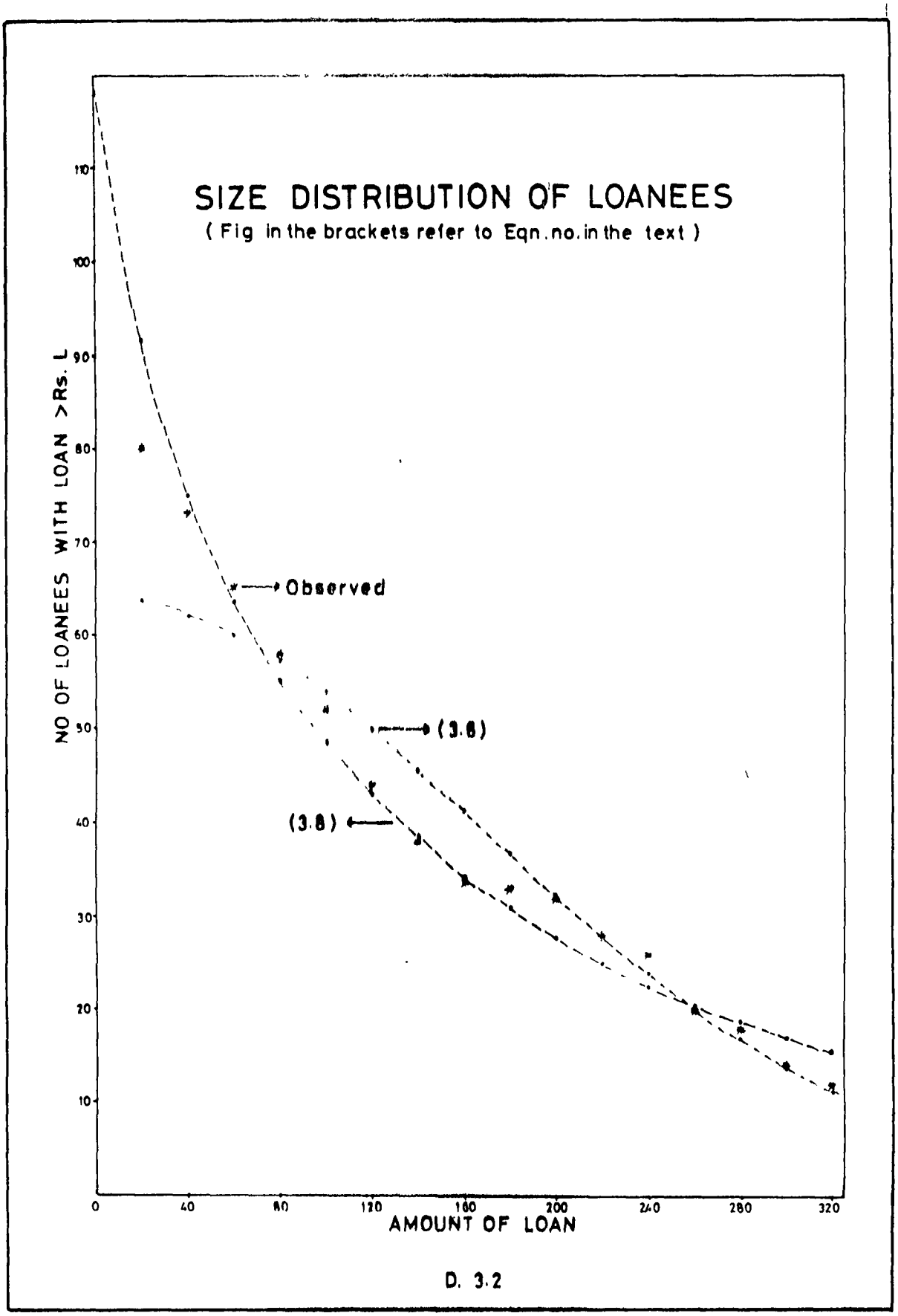

SIZE DISTRIBUTION OF LOANEES
(Fig. in the brackets refer to Eqn. no.in the text)
NO. OF LOANEES WITH LOAN >Rs.L
AMOUNT OF LOAN
Observed
Linear (3.5)
Pareto (3.2)
Elliptical (3.4)
0
20
60
100
140
180
220
260
300
340
10
20
30
40
50
60
70
80
90
100
110

FIG. 0.3.1


SIZE DISTRIBUTION OF LOANEES
(Fig in the brackets refer to Eqn.no.in the text)
NO OF LOANEES WITH LOAN >Rs. L
AMOUNT OF LOAN
Observed
(3.6)
(3.8)
110
100
90
80
70
60
50
40
30
20
10
0
40
80
120
160
200
240
280
320

D. 3.2

From the equation (3.8) some interesting inferences may be drawn. Since the limiting values of N(L) and L are zero (we cannot think of negative loan and negative number of loanee households), we find that when N(L) is at its minimum, L is at its maximum of Rs. 655 and when L is at its minimum, N(L) is at its maximum, 144. Out of 202 households, the maximum number of loanees can thus be 144, that is, the upper limit of the incidence of indebtedness is 71% of the households in the population. We have seen that in our sample of 101 households 82 are observed to be under debt. This difference may be due to sampling errors.

4. Size distribution of operational holdings

To analyse the size distribution of operational holdings in our study we have fitted the curve of the type:

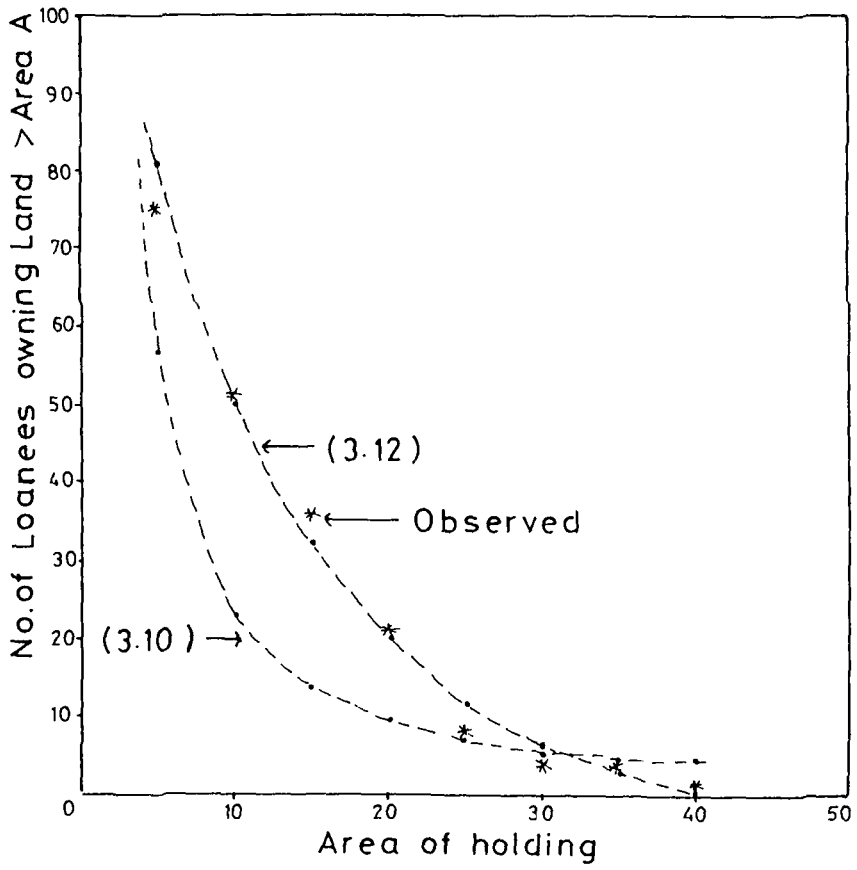
$$N(A) = aA^{b}\eta \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.9)$$

where N(A) is the number of households whose operational holding of land is exceeding A bighas, a and b are the parameters of the distribution and η is the error term. The empirical relationship in the data is found to be as:

$$N(A) = 468.6A^{-1.3138}; \; R^2 = 0.6825 \quad \ldots\ldots \quad (3.10)$$

SIZE DISTRIBUTION OF LOANEES AS PER HOLDING SIZE

(Fig in the brackets refer to Eqn in the text)



D. 3.3

A scrutiny of the graphical presentation of the fitted Pareto curve (3.9) reveals that it does not fit well to the data, and errors are systematic. Hence we reject the specification (3.9).

Further, we have searched for the best possible specification and found that the specification

$$N(A) = (a + bA^{\frac{1}{2}})^2 \quad \ldots\ldots\ldots\ldots\ldots \quad (3.11)$$

is best fitted to the data whose empirical estimate is given by:

$$N(A) = (11.52 - 1.984A^{\frac{1}{2}})^2; \; R^2 = 0.982 \quad \ldots\ldots \quad (3.12)$$

We may draw certain inferences from the equation (3.12). Since the limits of N(A) and A are zero (we cannot think of a household with a negative holding of land and the number of households cannot be negative), we find that when A = 0, N(A) is 133. Thus in the population of 202 households, the number of households owning operational holding greater than zero would not exceed 133 or that is to say, about 66% of the households own land and others are landless. The equation (3.12) gives us an idea about the maximum size of operational holding also. We find that A has a limit of 36 bighas of land. Our analysis of the sample data corroborates this finding. But the finding that about

66% of the households own land and others are landless is not in tune with the conclusions that we would draw from inspection of our sample data. Indeed, in the villages under our study hardly two or three households are landless. We conclude, therefore, that the equation (3.12) is not a very good representative of the distribution of landholding in our study population.

5. A measure of the degree of Indebtedness

In the introductory chapter of this study we have discussed the concept of indebtedness in the Indian rural context. We have also proposed that the concept of indebtedness should reflect certain characteristic features. Here we want to empirically construct the best representative measure of the degree of indebtedness and to identify the leading characteristic features of indebtedness in the villages under our study.

For such an endeavour we propose five indicators of indebtedness. Each of them measures one or the other aspect or feature of indebtedness. These indicators are:

(i) Per capita interest payment by the loanee household, call it X_0.

(ii) Per capita amount of loan observed by the household, call it X_2.

(iii) Amount of loan per capita cultivable area of land, call it X_4.

(iv) Amount of loan per rupee of repaying capacity (defining repaying capacity as the surplus of the household income over and above consumption expenditure and expenses on cultivation etc), call it X_5.

(v) Amount of loan per rupee value of agricultural assets owned by the household, call it, X_6.

Though the indicators proposed above represent different aspects of indebtedness, a remarkable degree of communality is expected to be present among them. A preliminary idea of the communality present among them is obtained by a perusal of the intercorrelation matrix given in table 3.2.

Table - 3.2: Intercorrelation Matrix of different indicators of Indebtedness.

Variables	X_o	X_2	X_4	X_5	X_6	Mean
X_o	1.0000	0.8712	0.6127	0.6805	0.2409	18.01
X_2	0.8712	1.0000	0.5390	0.7608	0.3693	157.93
X_4	0.6127	0.5390	1.0000	0.3595	0.0081	181.47
X_5	0.6805	0.7608	0.3595	1.0000	0.0714	0.1191
X_6	0.2409	0.3693	0.0081	0.0714	1.0000	0.1485
S.Deviation	9.33	91.81	148.86	0.1355	0.1230	-

We have carried out principal component analysis[2] to identify leading measures of indebtedness as represented by and contained in the five indicators mentioned above. We have extracted all the five principal components. The eigen values and eigen vectors of the above correlation matrix are given below in table 3.3.

Table - 3.3: Eigen values and vectors of the Intercorrelation matrix of the Indicators of Indebtedness.

Vectors	Variables					Eigen value
	X_o	X_2	X_4	X_5	X_6	
1st	0.980	1.000	0.720	0.850	0.334	3.012
2nd	-0.040	0.122	-0.390	-0.160	1.000	1.021
3rd	0.042	-0.157	1.000	-0.820	0.280	0.648
4th	1.000	0.262	-0.582	-0.830	-0.352	0.222
5th	-0.634	1.000	-0.031	-0.336	-0.213	0.097

The principal component analysis carried out by us indicates that X_2 is the leading measure of indebtedness. The first principal component explains about 60% of the total variation of the complex of five indicators of indebtedness. The coefficients of correlation of the first principal component with the indicators of indebtedness are: 0.93, 0.95, 0.69, 0.81 and 0.32 respectively for X_o, X_2, X_4, X_5 and X_6. It reveals that except for X_5, this principal

component has a great power of representation. The representative capabilities of the 1st and the subsequent principal components and their correlation with the indicators of indebtedness are given in table 3.4 below:

Table - 3.4: *Representative capabilities and correlation of principal components with indicator of Indebtedness.*

Principal components	Indicators					Representative power (%)
	X_0	X_2	X_4	X_5	X_6	
1st	0.93	0.95	0.69	0.81	0.32	60.24
2nd	-0.04	0.11	-0.36	-0.15	0.92	20.42
3rd	0.03	-0.09	0.60	-0.50	0.17	12.96
4th	0.32	0.08	-0.18	-0.26	-0.11	4.44
5th	-0.16	0.25	-0.01	-0.08	-0.05	1.94

The second principal component has a representative power of about 20%, but it is correlated significantly with X_6 and X_4 only. Indeed, X_6 and X_4 were poorly represented by the first principal component which have been now represented by the second principal component. The third principal component further represents X_4 and X_5 and makes up for the representative power of the first two principal components. These first three principal components together have a representative power that exceeds 93%.

This analysis immediately suggests that X_0 and X_2 represent one aspect or feature of indebtedness while X_6 represents a different feature of indebtedness. X_4 and X_5 represent some features which are intermediary in nature.

6. Discriminant Analysis[3] and the Correlates of Indebtedness

We have already noted that our sample data have reflected a pervasive incidence of indebtedness in the villages under our study. Our sample data report that out of 101 households surveyed, as many as 82 were found to be under financial obligation. Then it is natural to ask of the possibilities of discriminability of loanee and non-loanee households by the criteria of correlates of indebtedness (not including any variable that reflects indebtedness by definition or by implication). We have selected six correlates of indebtedness, namely:

(i) Level of Education obtained in the household (maximum number of year of schooling of a member of the household), designated by Z_1.

(ii) Investment in Land, in Rupees, designated by Z_2.

(iii) Per capita landholding owned and operated by the household, designated by Z_3.

(iv) Repaying capacity, the net surplus income after meeting consumption expenditure and productive expenses, designated by Z_4.

(v) Dependency Ratio; the number of non-working family members as a ratio to the working and earning members, designated by Z_5.

(vi) Per capita income, designated by Z_6.

Our sample households are grouped into two: the non-loanee group and loanee group. The first group comprises of 19 households while the second group comprises of 82 households.

The mean values of the six variables groupwise and aggregate are given below in table 3.5. The variance-covariance matrix is given in the table 3.6.

Table - 3.5: Group-wise mean for Loanee and non-loanee households: Six correlates of Indebtedness

Variables	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6
Mean for Nonloanee group	6.526	763.26	2.752	566.10	0.7879	1356.11
Mean for Loanee Group	2.719	568.32	1.910	664.98	0.6360	806.21
Aggregate Mean	3.436	604.99	2.069	646.38	0.6646	909.65

Table - 3.6: Variance-Covariance Matrix (101 samples) of Correlates of Indebtedness

Variable	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6
Z_1	23.0379	940.479	1.5542	-547.452	0.22782	823.003
Z_2		523987.06	447.046	-95425.89	10.8604	99597.13
Z_3			4.41621	62.8897	0.0969	482.797
Z_4				518327.98	19.9951	61110.135
Z_5					0.036504	15.91074
Z_6						432090.85

We have carried out discriminant analysis. The discriminant function obtained is given by:

$$D = 0.0902Z_1 - 0.000119Z_2 - 0.016161Z_3 - 0.0003737Z_4 + 3.413884Z_5 + 0.0010734Z_6 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.13)$$

The average value of discriminant scores for the aggregate $\bar{D} = 3.2082$, and those for loanee group, $\bar{D}_L = 2.9349$ and for non-loanee group $\bar{D}_{nL} = 4.3874$. To obtain a comparative view of discriminatory power of individual variables we have computed elasticities of discrimination presented in table 3.7 below.

Table - 3.7: Elasticities of discrimination between loanee and non-loanee households

Variables	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6
Nonloanee group	0.134	-0.021	-0.010	-0.048	0.613	0.332
Loanee group	0.084	-0.023	-0.011	-0.085	0.740	0.295
Aggregate	0.097	-0.022	-0.010	-0.075	0.707	0.304

These elasticities sum up to unity. As the elasticities indicate, the discriminatory power of dependency ratio is the highest while the per capita income stands second in this respect. Other variables have negligible discriminatory power.

7. Tribe Discriminatory Functions

Next, we pose the problem of discriminating among different tribes on the six correlates of indebtedness; that is to say, that we ask whether we can discriminate among the three tribal population by the criterion laid down in terms of the six variables noted in the preceding section.

To answer this question we have carried out the statistical classification analysis.[4] We have carried out this analysis for 82 loanee households only, since we are

no more interested* in analysing the characteristics of non-loanee households. Below, in table 3.8 we present the Inter-tribal differences in Means of the six variables.

Table - 3.8: Vectors of Intertribal differences in Mean of six correlates of Indebtedness

Variables	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6
$T_1 - T_2$	2.333	317.788	1.556	125.148	0.047	129.426
$T_2 - T_3$	1.281	262.146	0.148	-158.619	-0.040	212.581
$T_1 - T_3$	3.614	579.934	1.704	-33.472	0.006	342.007

Here T_1 stands for Missing Tribe, T_2 for Sonowal tribe and T_3 for Boro tribe.

The variance covariance matrix of the six correlate variables of indebtedness are given in table 3.9 below. Note that the variance-covariance matrix is constructed by the sample data on loanee households only (82 samples)

*In case we were interested to apply two criteria for classification, we would have carried out Statistical Taxonomy Analysis. But we feel that it would have been a significant digression from the principal line of our study.

Table - 3.9: Variance covariance matrix of loanee households, six correlates of Indebtedness

Variables	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6
Z_1	18.470	1099.577	1.7258	-360.3623	0.08887	295.484
Z_2		382869.41	208.548	-78410.16	3.3752	78576.10
Z_3			2.84758	131.8155	0.08236	138.916
Z_4				587188.84	26.9046	40700.36
Z_5					0.033166	-1.2776
Z_6						269067.83
Mean	2.7195	568.317	1.9104	664.982	0.6360	806.21

The tribe-discriminatory functions are given below:

$$D_{12} = 0.0607Z_1 + 0.00044Z_2 + 0.4713Z_3 + 0.000209Z_4 - 0.14516Z_5 + 0.00000986Z_6 - 1.37096 \quad \ldots\ldots (3.14)$$

$$D_{23} = 0.03522Z_1 + 0.00041717Z_2 + 0.011866Z_3 - 0.0001853Z_4 - 1.199648Z_5 + 0.000646Z_6 + 0.009989 \quad \ldots\ldots (3.15)$$

$$D_{13} = 0.095874Z_1 + 0.0008584Z_2 + 0.48315Z_3 + 0.00002418 3Z_4 - 1.344804Z_5 + 0.0006556Z_6 - 1.360968 \quad \ldots\ldots (3.16)$$

These functions may be used for the purpose of classification. We may state that for a sample household if D_{12} and D_{13} are both non-negative, it may be classified

as Missing. If D_{12} is negative and D_{23} is non-negative, it may be classified as Sonowal, and if D_{13} is negative and D_{23} also is negative the sample household may be classified as Boro. However, the probability of misclassification in Sonowal and Boro tribes is quite high, as they have shown almost equal value of D.

This analysis shows that while Missings can be discriminated from Sonowals and Boros; the Sonowals can hardly be discriminated from the Boros.

To investigate further deep into the issue as to why Missings have shown discriminability with Sonowals and Boros, while Sonowals and Boros have not shown strong discriminability with each other, we require further studies in economic anthropology. But we are constrained not to go in for such a study though we concede that it would have enriched our knowledge if we could pursue it further.

Notes and References

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CHAPTER - IV

CONSEQUENCES OF INDEBTEDNESS

1. The Opening Remarks

We have noted that indebtedness has been alleged to be a serious ailment of the rural economy. Allegedly, it abates agricultural productivity, aggravates skewness in income distribution, fastens the prevalent power structure and thwarts agricultural development.

Indebtedness in rural areas has been observed to manifest six characteristic features. These features, to reiterate, are:

(i) It often originates with nonfunctional consumption expenditure incurred on account of exigencies or ceremonial occasionalities.

(ii) It captivates resources of the debtor. Often it goes along with mortgaging of land or labour such that the repaying capacity of the debtor is paralysed.

(iii) It is often associated with an exorbitantly high rate of interest doubling the principal within a year.

(iv) It is associated with an exercise of coercive powers by the lender who wields such powers in the rural surroundings. Recovery of loan is often coercive and exploitative.

(v) It erodes social status of the debtor.

(vi) The debtor has a feeling of helplessness, plight and misery. The debtor often pays off the debt by selling his belongings[9] at a very low price.

We have seen in the earlier chapter that the degree of indebtedness can be measured by suitable indicators designed to quantitate the characteristics noted above. Further, these indicators may be employed to analyse the process in which they reinforce each other and, in turn, affect productive and distributive performance of the rural economy.

We propose in this chapter to identify the process or the causal chain through which it may be understood how indebtedness reinforces itself, becomes self-perpetuating, and paralyses the repaying capacity of the debtor. First we outline the methodology of causal chain analysis. Further, we carry out this analysis to understand the causal chain of indebtedness in our empirical study.

2. The Methodology of Causal Chain Analysis

We are aware of the fact that in careful discussions of scientific methodology, it is now customary to avoid any use of the notion of causation. In vogue is the use of

functional relations and interdependence among variables. This avoidance is derived from the role that the concept of causality has played in the literature on philosophy implicating itself into severe objectionable epistemological overtones. Nevertheless, causality has remained functional in scientific writings. It implies that we wish to retain the concept of causality,[1] though we want it not to be implicated in philosophical controversies. This causality — in the narrow sense — may be termed as "functional causality." Henceforth by causality we mean functional causality.

We may define functional causality as follows: In a deterministic setting we say that X_t is the functional cause of Y_s if s is greater than t and there is a function f_c such that $Y_s = f_c(X_t)$. Once errors are introduced, the relationship becomes $Y_s = f_c(X_t) + e$, and now we add one more conditional statement that there is a function f_c such that for all real numbers x.

$$E\,(Y_s/X_t = x) = f_c(x)$$

read as "the expectation (statistical) of Y_s given that X_t is equal to x is equal to the function of x.

Usually, causal relations are formulated for some definite set of variables before hand on the basis of

professional experience and the logic of the discipline backed up by real world experiences. But often it happens so that real world experiences and the logic of the discipline do not suffice to assert whether Y casuses X or X causes Y. It so happens that both seem to cause each other in turn or simultanesouly, and then we face the problem of circular causation.

We propose here a procedure to sail out from the calm, though explicitly noting that it is rather a heuristic procedure.[2] The heuristic proceeds like follows:

(i) Estimate the regression equation Y^* on X^* and the variance of error e^*_{yx}.

(ii) Estimate the regression equation X^* on Y^* and the variance of error e^*_{xy}.

(iii) Compute the ratio $\eta = \text{var}(e^*_{yx})/\text{var}(e^*_{xy})$.

For this analysis it is required that Y^* and X^* both should be measured such that their arithmetic means are equal, that is to say that $\bar{Y}^* = \bar{X}^*$. This condition can be fulfilled if we transform the variables Y and X (observed data) such that

$$Y_i^* = Y_i/\bar{Y};\ i = 1, 2, \ldots\ldots n$$

$$X_i^* = X_i/\bar{X};\ i = 1, 2, \ldots\ldots n$$

Now, if the ratio η^* is sufficiently less than unity, we say that Y^* is caused by X^* and vice versa. Of course, the ratio η^* may be approximately equal to unity leading to the indicisive state, but it would not occur very often.

Based on the decision of the causal direction obtained through the procedure noted above, we may formulate a model of causal relation as follows:

$$
\begin{aligned}
U_1^* &= X_1^* \\
U_2^* &= X_2^* - a_{12}X_1^* \\
U_3^* &= X_3^* - a_{13}X_2^* - a_{23}X_1^* \\
U_4^* &= X_4^* - a_{14}X_3^* - a_{24}X_2^* - a_{34}X_1^* \\
&\vdots \qquad \vdots \qquad \vdots \qquad\qquad \vdots \\
U_{k+1}^* &= X_{k+1}^* - a_{1,k+1}X_k^* \cdots\cdots a_{k,k+1}X_1^*.
\end{aligned}
$$

We can estimate the regression coefficients of the above presented model by some suitable method, say least squares method. The regression coefficient matrix, A, is triangular (or triangulable by suitable row-column interchange). The elements in the principal diagonal of A are all unity.

It is obvious that $X^* = A^{-1}U^*$, or by renaming $B = A^{-1}$, we may write $X^* = BU^*$. From B matrix we can compute C, the matrix of influence coefficients defined as

$$C_{ij} = \frac{b_{ij}}{\sqrt{\eta^*_{ij} + b^2_{ij}}}$$

where $\eta^*_{ij} = \text{var}(U^*_j)/\text{var}(U^*_i)$.

We note in passing that transformation of variables such that

$$X^*_i = (X_i - \bar{X})/\sigma_x$$

and computation of regression coefficients with X^* has several merits facilitating analysis and interpretation.

We note that in the formula for computing C_{ij} above, we have used η^*_{ij}. The numerical value of η^*_{ij} will be zero if and only if $\text{var}(U^*_j)$ is zero, and this is in conformity with our former heuristic. In case η^*_{ij} is zero, C_{ij} is equal to unity. Except in the case when η^*_{ij} is infinite, we have finite value of C_{ij} whose lower limit is zero and upper limit is unity (signed in accordance with the sign of b_{ij}). The magnitude of C_{ij} gives us the strength of functional causality while its sign gives us the direction of influence.

3. Effects of Indebtedness on Productivity

We have identified four main indicators of indebtedness that may be relevant to explain productivity. They are:

(i) Per capita amount of loan (Rs.) observed by the household.

(ii) Amount of loan per bigna of cultivable land owned by the household.

(iii) Amount of loan per rupee of repaying capacity of the household.

(iv) Amount of loan per rupee of the value of agricultural assets owned by the household.

These indicators represent some of the main characteristics of indebtedness that we noted previously. We concede that these indicators do not represent many other characteristics like erosion of social status of the loanee or feeling of compulsion or exploitation by the loaner. We regret our inability to incorporate relevant indicators to measure these characteristics.

As we have proceeded for analysing the effects of indebtedness on productivity we must define an operational measure of productivity. Productivity is defined here as the value of agricultural production per bigha of landholding owned by the loanee household. Thus, by productivity

we mean agricultural productivity, or more specifically, the productivity of resources like land, assets, and labour of the loanee employed for raising agricultural output. Note that in our sample all households own landholdings of different sizes.

However, we raise a pertinent question here. One may think that low productivity is the reason of low level of income of the household which makes the household susceptible to indebtedness. Given the condition that most of the farmers who are indebted are owning small areas of land barely enough to provide them subsistence (or not enough even for that) low productivity may reasonably account for indebtedness. Again, indebtedness, captivating productive resources and paralysing repaying capacity may reasonably weaken the efforts to maintain or raise productivity. Nevertheless, it is possible that both the processes hinted at above may be at work. We envisage, however, that the strength of both these processes must not be the same. One process may be leading while the other trailing. We take up here to resolve this issue.

A review of the literature on the determinants of productivity (operationally measured by the ratio of value

of agricultural output per unit area of land) suggests that holding size is one of the factors of relevance.[3] Since in the context of our empirical study at hand, utilization of family labour on farm is quite substantial, we have opted to use "per capita land owned by the household" as we think that it is a more suitable measure than the absolute holding size. Thus we envisage that the four measures of indebtedness, per capita land owned by the household, and productivity are the components of the causal chain.

We apply the heuristic mentioned in the beginning of this chapter to formulate the causal chain model. Below, we present the η^* matrix (where η^*_{ij} is the ratio of standardised variances, var (U_i^*)/var (U_j^*)) obtained by fitting regression equations X_i^* on X_j^* and X_j^* on X_i^*. These regression equations have been fitted by the ordinary least squares method.

Table - 4.1: Error-variance Ratio (η^*) matrix : $e^* \leftarrow U^*$.

	e_1^*	e_2^*	e_3^*	e_4^*	e_5^*	e_6^*
e_1^*	-	0.290	0.373	0.166	0.035	0.216
e_2^*	3.452	-	1.284	0.572	0.120	0.744
e_3^*	2.684	0.779	-	0.445	0.094	0.578
e_4^*	6.033	1.748	2.248	-	0.211	1.336
e_5^*	28.648	8.299	10.674	4.748	-	6.182
e_6^*	4.640	1.344	1.729	0.748	0.162	-

Henceforth the subscripts of variable X would be used to signify as follows in this chapter. 1. Productivity, 2. Per capita loan, 3. Per capita holding size, 4. Loan per cultivable area (bigha) of land, 5. loan per rupee of repaying capacity, 6. loan per rupee of value of agricultural assets.

A perusal of table 3.1 reveals that X_5 emerges as the most strong causal variable which influences all others but is not influenced by any variable. On the contrary, X_1 (productivity) is influenced by all variables but does not influence any. Thus, X_1 and X_5 are the two ends of the causal chain, the causal arrow running from X_5 to X_1.

Taking X_1 and X_5 apart, the relationship among X_2, X_3, X_4 and X_6 are interesting. X_2, X_4 and X_6 make a causal ring. X_4 influences X_6 and X_2; X_6 influences X_2 directly, and X_4, X_2, and X_6 influence X_3 directly and indirectly.

From the foregoing analysis we have learned that productivity is influenced by holding size (per capita) and indebtedness and not vice versa. Hence we specify that

$$X_1 = f_c (X_2, X_3, X_4, X_5, X_6) + e$$

and for the sake of simplicity and greater degree of falsifiability, we further hold that f_c is a linear function.

We estimated the regression equation by ordinary least squares method and obtained:

$$\hat{X}_1 = 526.817 + \underset{(0.26)}{0.460X_2} - \underset{(0.635)}{132.900X_3} - \underset{(0.113)}{0.180X_4} - \underset{(0.112)}{6.815X_5}$$

$$- \underset{(0.383)}{52.825X_6}; \; R^2 = 0.518$$

In the empirical regression equation above, the value of R^2 is quite high but none of the coefficients are significant (Figures in brackets are Students' t values). This led us to suspect that the residual vector was violating the standard assumptions of Gauss-Markov. We found that the error vector is highly correlated with X_1, the coefficient of correlation being equal to 0.70.

Analysis of residual vector suggested us to use a dummy variable. For the purpose of estimation, the use of dummy variable is permitted, but the dummy variable is not interpreted. If the dummy variable is suitable, it helps the estimation of coefficients to become unbiased and efficient. This respecified model with dummy variable (X_7) was estimated to give:

$$\hat{X}_1 = 483.776 + \underset{(0.72)}{0.275X_2} - \underset{(2.50)}{112.135X_3} + \underset{(0.60)}{0.210X_4} - \underset{(0.47)}{7.809X_5}$$

$$- \underset{(2.33)}{68.717X_6} + \underset{(4.60)}{116.239X_7}; \; R^2 = 0.979$$

We observe that the value of R^2 has increased substantially and coefficients associated with X_3, X_6 and X_7 are significant. Thus by using dummy we have enhanced the efficiency of the estimator.

The coefficients associated with X_2 and X_4 have shown unexpected sign (positive), but they are insignificant. We suspected specification error and dropped X_2 from the model and estimated the regression equation afresh. We obtained:

$$\hat{X}_1 = 451.706 - \underset{(2.87)}{84.967X_3} + \underset{(1.81)}{0.4208X_4} - \underset{(0.49)}{10.165X_5} - \underset{(1.80)}{63.519X_6} + \underset{(3.82)}{118.151X_7}; R^2 = 0.967.$$

We note that we have lost insignificantly by dropping X_2 from the model as there is a marginal fall in the value of R^2, but gains in the efficiency of the estimator are substantial. The coefficient associated with X_4 has turned out significant.

The coefficient associated with X_4, however, is positive, though we expected it to be negative since we hold that X_4 affects productivity adversely. Once again, therefore, we suspected that X_5, insignificant as it appears,

might be responsible for the estimation error on account of inclusion of irrelevant variable.[4] We dropped X_5 from the model and re-estimated the model. We obtained:

$$\hat{X}_1 = 456.457 - \underset{(2.80)}{89.113X_3} + \underset{(1.57)}{0.401X_4} - \underset{(1.65)}{64.929X_6} + \underset{(3.41)}{118.273X_7} \; ; \; R^2 = 0.959$$

By dropping X_5 we did not lose much in terms of the value of R^2, but the loss in efficiency is substantial, reflected in the increase of standard errors associated with X_4 and X_6. However, the coefficient associated with X_4 remained positive. We conclude, therefore, that by dropping X_5 we have lost efficiency without gaining anything.

Then we decided to retain X_5 and drop X_4 and expected the coefficient associated with X_5 to improve. The estimated regression equation by reinstating X_5 and dropping X_4 is given as:

$$\hat{X}_1 = 506.499 - \underset{(1.85)}{105.105X_3} - \underset{(0.09)}{3.922X_5} - \underset{(0.49)}{29.728X_6} + \underset{(1.66)}{101.985X_7} \; ; \; R^2 = 0.858$$

We observe that the effects of dropping X_4 are disastrous on the efficiency of the estimator.

We conclude, therefore, that productivity is negatively influenced by X_3 and X_6; positively influenced by X_4, and though negatively influenced by X_5 also, the influence of the same cannot be ascertained statistically. We conclude further that X_2 has proved to be an irrelevant variable. Lastly, we take note of the dummy variable. The coefficient associated with X_7 has remained positive and highly significant.

4. The causal chain of Indebtedness

Earlier we have noted that X_2, X_4 and X_6 make a causal ring. We have also mentioned that the heuristic of causal relation is indicated by the value of η^*. If the value of η^* is appreciably smaller than unity, we have a considerable evidence of causal relation between the variables. The qualifying term "appreciably" demands quantification. Again, heuristically, we decide that 0.70 might prove a good starting point, that is to say that if η^* is less than 0.70 we consider it to be considerably smaller than unity.

Once we derecognise the causal relations that have a value of η lying between 0.70 and 1.0, we observe that the causal ring of X_2, X_4 and X_6 has been opened. Now X_4 influences X_2, while X_4 and X_6 both influence X_3. Note that X_2 has ceased to influence X_3; X_6 does not influence X_2 and X_4 does not influence X_6. Now X_2 has become a terminal point in itself. This might be one of the reasons why X_2 was found insignificant and irrelevant in explaining X_1, productivity as we saw in the preceding section of this chapter.

Now that we have decided to drop out X_2 from our causal analysis, we formulate our recursive model with rest of the variables. We specify the system of equations as:

$$U_5^* = X_5^*$$
$$U_4^* = X_4^* - a_{12}X_5^*$$
$$U_6^* = X_6^* - a_{13}X_4^* - a_{23}X_5^*$$
$$U_3^* = X_3^* - a_{14}X_6^* - a_{24}X_4^* - a_{34}X_5^*$$
$$U_1^* = X_1^* - a_{15}X_3^* - a_{25}X_6^* - a_{35}X_4^* - a_{45}X_5^*.$$

The estimated regression equations are as follows: (note that these equations relate to the standardised variable X_1^* with mean zero and variance unity).

$$U_5^* = X_5^*$$

$$U_4^* = X_4^* - 0.13657X_5^*;\ R^2 = 0.019$$

$$U_6^* = X_6^* - 0.62996X_4^* - 0.02947X_5^*;\ R^2 = 0.403$$

$$U_3^* = X_3^* - 0.166503X_6^* + 0.441122X_4^* - 0.239016X_5^*;\ R^2 = 0.335$$

$$U_1^* = X_1^* + 0.65911X_3^* + 0.29768X_6^* - 0.19089X_4^* + 0.10190X_5^*;\ R^2 = 0.51.$$

The triangular* matrix, A (coefficient matrix of the model) has been presented in Table 4.2. The last row of this table presents the variance of errors, U^*.

We have inverted the matrix A. The Inverted A matrix, designated by B, has been presented in table 4.3.

The upper triangle cells including the main diagonal cells of table 4.3 present the elements of B, b_{ij}; $i \leq j$.

---

*Elsewhere we have presented variance covariance matrixes also in the triangular form. But those matrixes are symmetric, and hence their triangular form implies that the opposite triangular cells are not blank. But in the present case, A, B, and C are a really triangular matrixes; one triangle is full, the other is blank.

Table - 4.2: Triangular Coefficient Matrix, A.

X	1	3	6	4	5
1	1.000	0.659	0.298	- 0.191	0.102
3		1.000	0.167	0.441	-0.239
6			1.000	-0.300	-0.029
4				1.000	0.137
5					1.000
var(U^*)	0.514	0.665	0.597	0.981	1.000

Table - 4.3: Inverted Coefficient Matrix, B.

X	1	3	6	4	5
1	1.000	-0.659	-0.188	0.363	-0.315
3		1.000	-0.167	-0.546	0.309
6			1.000	0.630	-0.057
4				1.000	-0.137
5					1.000

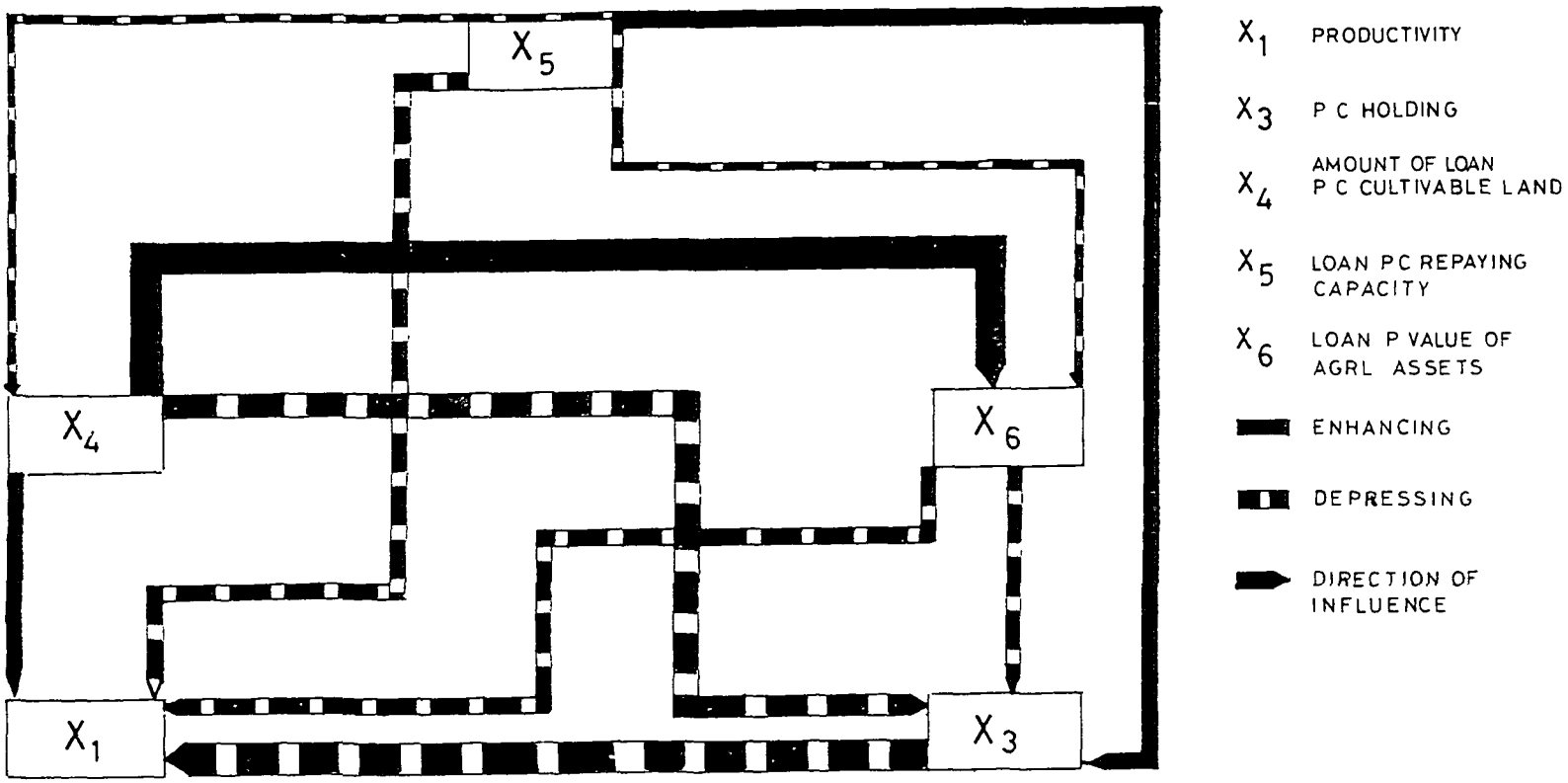
Using the relevant formula given before we have computed C_{ij}, the coefficients of influence. The influence coefficients are given in the matrix, C, presented in Table 4.4.

Table - 4.4: Influence Coefficient Matrix, C

X	1	3	6	4	5
1	-				
3	-0.501	-			
6	-0.172	-0.173	-		
4	0.254	-0.410	0.441	-	
5	-0.220	0.244	-0.137	-0.134	-

The influence coefficient C_{ij} measures the influence of ith variable on the jth variable. A perusal of the influence coefficients reveals that causal links are not strong. This is partly because we expect the reality to be quite complicated while our analytical method naive and data base insufficient and weak. We note here that for identifying causal chains efficiently we need time series data. At present we lack in time series data and this constraint puts us in a disadvantageous position.

However, we have been able to resolve the problem we started with, and conclude that productivity is influenced by indebtedness and not vice-versa. X_5 has a depressing influence on X_6 and X_4, while it enhances X_3. Further, X_6 and X_4 have depressing influence on X_3, while X_4 has an



THE CAUSAL CHAIN DIAGRAM

enhancing influence on X_6. The causal chain identified by the influence analysis has been presented in the Diagram that follows.

In this diagram positive influence has been presented by smooth line while negative influence has been presented by broken lines. The thickness of the line represents the strength of influence. We observe that $X_5 - X_4 - X_3 - X_1$ link is quite strong. We conclude that an increase in the amount of loan per rupee of repaying capacity burdens the cultivable area of land and reduces the per capita holding size (may be due to a transfer of land from the loanee to the loaner by way of sale or mortgaging of land). This has a positive effect on productivity. But since the elasticity of productivity with respect to per capita holding size ($E_{13} = 0.3$) is smaller than the elasticity of per capita holding size with respect to amount of loan per capita holding size ($E_{34} = 4.1$), the burden of loan on the household goes on increasing and thus, indebtedness becomes self-perpetuating. It is to be noted that increase in productivity is not synonymous with increase in production. Since a portion of the productive assets of the loanee are captured by indebtedness, he puts in extra efforts, especially labour, to produce enough for his

subsistence. This leads to an increase in the production per unit area of land cultivated by him. But the total production on his land decreases as the productivity increased on account of intensive application of labour on the land cannot compensate for the loss of production on account of land disposed off or mortgaged.

5. Distributive Consequences of Indebtedness

After investigating the productive consequences of indebtedness we may now turn to assess the distributive consequences of the same. A loanee household pays a portion of his income and resources to the loaner as a tribute. Thus, indebtedness has distributive consequences. Not only this, loanee households often mortgage land as a security against the debt. The loaner then possesses the land under mortgage and cultivates the land. Thus, indebtedness, by way of mortgaging, transfers the land resources from the loanee to the loaner. Such a transfer of land has distributive effects. Third, the loanee households often provide the services of the assets and labour days to the loaner against the debt. Further, loanees often sell their production at cheaper rates to the loaner, which has its distributive consequences.

First let us study how much amount is transferred from the loanees to the loaners in terms of interest.

Our sample data reveals that about 90 thousand rupees are paid as interest for the loan of Rs. 134.5 thousand. The total agricultural production (in value terms) is about Rs. 372.4 thousand. Thus about 36% of the agricultural income goes to the loaner. Of course, our sample households have other sources of income also. If we take these sources also into account, the total income of the sample households is about 707 thousand rupees. The interest paid from this dividend is about 19%. It is to be noted that the said share of interest in the income of our sample households is quite large.

Now let us turn to mortgaging of land against debt. Our sample data reveals that out of 82 loanee households 37 households have mortgaged a portion of their land against debt. The total area of land under mortgage is 117.5 bighas. The households who have mortgaged a portion of their land against debt own 556 bighas of cultivable land. Thus the percentage area of cultivable land mortgaged against debt is 21 . The average productivity of land is Rs. 330.6 per bigha. Thus the agricultural income of Rs. 38.8 thousand

is transferred from the loanees to the loaners by way of land mortgaging. If we add this amount to the transfer of income by way of interest, the total amount of transfer of income on account of indebtedness is Rs. 173.3 thousand which amounts to 24.7% of the total income of the households.

Sixteen households have reported that they worked in the fields of the loaner for about 19 days without any remuneration except food supplied to them. Had these people worked on the basis of market wages, they would have earned about 3 thousand rupees. This amount may be considered as a payment against debt. Further, helping the loaner with agricultural assets like ploughs, bulls, bullock cart, and services rendered to his household activities also may be accounted for as a payment to the lender. It is difficult to impute monetary values to many such services. Nevertheless, a rough measure may give us an amount of Rs. 4,000 or so. All these included together amount to Rs. 180 thousand. Thus, about 25% of the domestic product of the village is transferred on account of indebtedness. Indeed, it is a substantially large part of the pie.

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CHAPTER - V

DETERMINANTS OF INDEBTEDNESS

1. The Opening Remarks

In Chapter III, while constructing a composite index or measure of the degree of indebtedness we have found that X_2 (per capita loan observed by the household) is the best representative measure of indebtedness in so far as our sample data reveal. We have also found that X_2 has a high degree of association with X_5 (per capita loan as a ratio to the repaying capacity of the household) as the coefficient of correlation between X_2 and X_5 is as high as 0.76. Moreover, X_2 is highly correlated with X_4 (Amount of loan per capita cultivable area of land owned by the household) also.

In Chapter IV, we have noted that X_5, X_4 and X_3 are the variables that constitute the causal chain determining the productive performance of the household. We have seen how this causal chain helps indebtedness to be self-perpetuating. The process of self-perpetuation intensifies the degree of indebtedness which ultimately is reflected in an increase in the per capita amount of loan observed by the household.

In this chapter our main objective is to investigate into the possibilities of finding out the determinants of X_2, the extraneous variables that we have not yet included in our analysis.

2. Determinants of Indebtedness

At the outset we propose that the following three variables may be considered as the determinants of indebtedness.

i) Per capita income,

ii) Per capita credit-financed investment in farming or other productive activities, and

iii) Level of highest education (in years) obtained in the household.

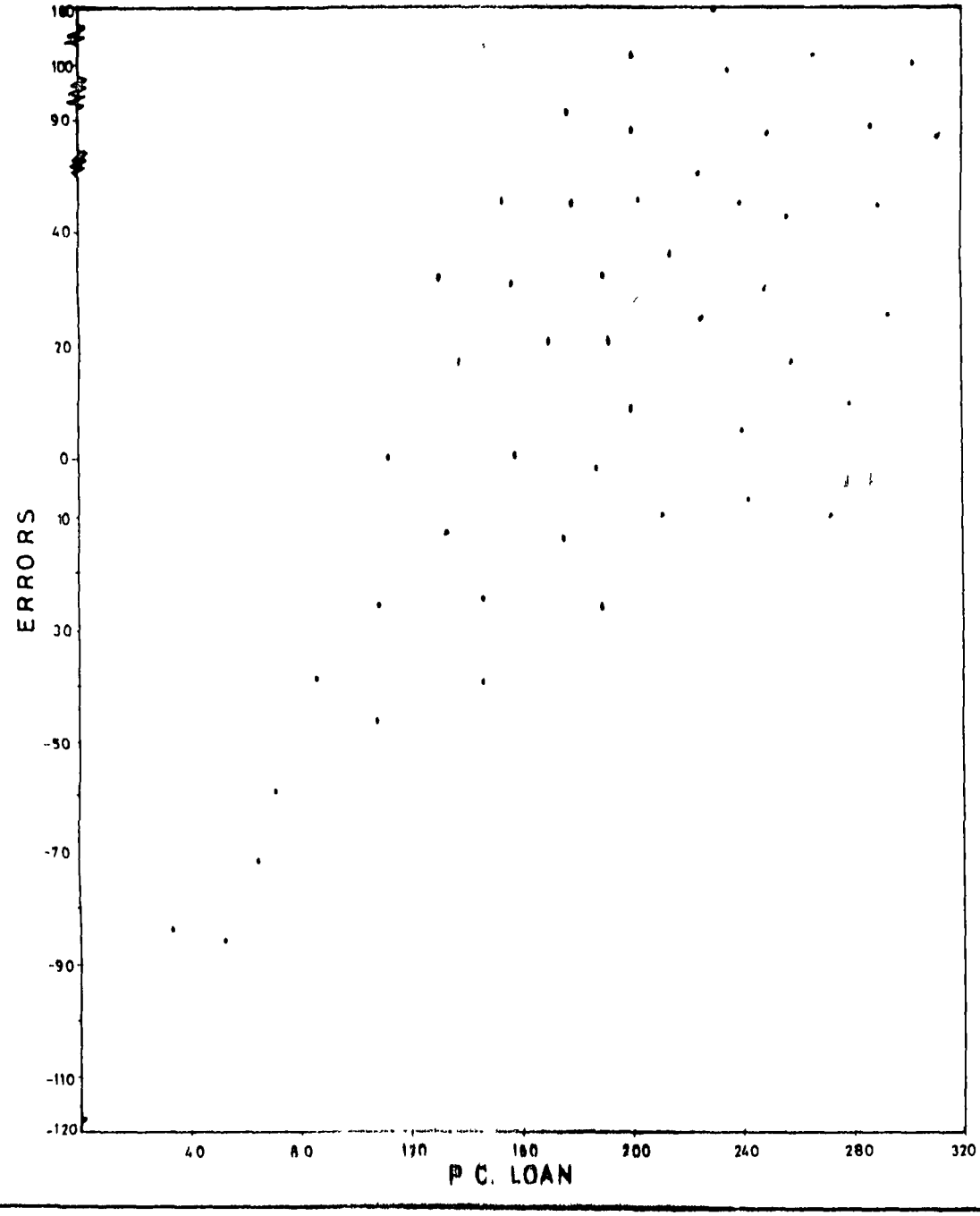
We envisage that per capita income may be one of the candidate variables that determine indebtedness. But we do not want to assert whether it will be positively or negatively associated with indebtedness. Higher level of per capita income may induce the household to be spendthrift and it may enhance conspicuous consumption on ceremonial occasions. We may not meet with the Scotsman[1] among the tribals of our study area. If it be so, indebtedness may be positively associated with per capita income.

Nevertheless, higher level of per capita income may be associated with lower degree of indebtedness. Hence we will not assert whether per capita income will be associated with the degree of indebtedness positively or negatively. We will simply assert that they are associated with each other.

Similarly, per capita credit-financed investment in farming (or other productive activities) may be positively or negatively associated with the degree of indebtedness. The direction of their associative movement depends on the fact whether the investment has been a profitable venture or not. Further, the level of highest education may be negatively associated with indebtedness so far as education leads to rational decision-making and induces frugality and prudence. Nevertheless, education may lead to snobbery, contempt for manual work,[2] conspicuous consumption and spend-thrift habits. In such a case it will lead to indebtedness. Hence we do not want to assert whether the level of education obtained by the household will be negatively or positively associated with indebtedness. We simply assert that it will be associated with indebtedness.

To statistically determine the association of indebtedness with the above three variables we have assumed the functional relationship as:

ERROR DISTRIBUTION OF P. CAPITA LOAN



D.B.I

$$X_2 = a_o + a_1X_8 + a_2X_9 + a_3X_{10} + e \quad \ldots\ldots\ldots (5.1)$$

and also that e_i is normally distributed with mean zero and constant variance, σ^2.

The OLS estimate of the regression equation as specified above is given by:

$$\hat{X}_2 = 166.0605 - 0.0671X_8 + 0.428X_9 + 4.525X_{10} \quad ..(5.2)$$
$$R^2 = 0.4409$$

where,

X_8 = Per capita income measured (in Rs.) annually.

X_9 = Per capita credit-financed investment (Rs.) in farming or other productive activities.

X_{10} = Level of highest education (in years) obtained in the household.

In the above regression equation, R^2 is quite high. But a scrutiny of the residuals reveals that $\hat{e}_i$ is not homoskedastic. Naturally, the standard errors of the estimated parameters are biased and not worth reporting.[3] The heteroskedastic nature of $\hat{e}_i$ is supported by the fact that the coefficient of correlation between X_2 and $\hat{e}$ is as high as 0.75. The diagram D 5.1 vividly indicates the heteroskedastic nature of the residuals.

3. Treatment of Heteroskedasticity

We have made an attempt to treat the problem of heteroskedasticity by weighted least squares method.[4] We have assumed that the weights are proportional to the reciprocal of the square of the expected value of X_2, or

$$W_i = 1/\hat{X}_2^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5.3)$$

which amount to the assumption:

$$\sigma_i^2 = \sigma^2 \hat{X}_{i2}^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5.4)$$

The above assumption is based on our perusal of the scatter of $\hat{e}_i$ against X_2.

The estimated regression equation (by Weighted Least Squares Method) is given by:

$$\hat{X}_2^* = 55.548 + \underset{(1.045)}{0.1136X_8^*} - \underset{(0.1727)}{0.4533X_9^*} - \underset{(0.6917)}{23.4476X_{10}^*};$$

$$R^2 = 0.6686 \quad \ldots\ldots\ldots\ldots \quad (5.4)$$

The asterisk in the variables reminds us that they are weighted. The figures in the brackets are Student's t values.

It might be seen that in the equation above, while R^2 is quite high, none of the coefficients are significantly

different from zero. A scrutiny of the residuals obtained in estimating the above equation has, however, revealed that now they show a peculiar regularity. For those observations which record the magnitude of X_2 below the median value (Rs. 170), all the residuals are negatively signed, while for the rest of the observations all the residuals are positively signed. We obtain thus a very important information through scrutinising the residual vector and this information may effectively be utilised for improving estimation.

4. Respecification of the Model

To use the information obtained through residual analysis, we design a surrogate variable. This variable represents the factors not included among the explanatory variables, though they are affecting variations in X_2. We concede, therefore, that our model as specified in the preceding section is suffering from the problem of mis-specification on account of exclusion of relevant variable. As a consequence, the estimators of the coefficients might be biased and inconsistent, and moreover, their variances as estimated above might be inflated.

We define S, the surrogate variable, such that;

$S_i = -1$ if X_2 less than Rs. 170

$= 1$ otherwise, and

respecify the model afresh as:

$$X_2^* = a_o + a_1 X_8^* + a_2 X_9^* + a_3 X_{10}^* + a_4 S + \eta_t \quad \ldots\ldots (5.6)$$

We estimate the model and obtain:

$$\hat{X}_2^* = 48.9213 + \underset{(2.24)}{0.12609} X_8^* - \underset{(0.58)}{0.76143} X_9^* - \underset{(1.20)}{20.18946} X_{10}^* + \underset{(1.77).}{35.72819} S \; ; \; R^2 = 0.9196 \quad \ldots\ldots\ldots\ldots (5.7)$$

We note that the value of R^2 above has increased substantially. The values of the coefficients associated with X_8^* and X_{10}^* remain remarkably stable, though there is a notable reduction in the standard errors of estimate, increasing the values of t. However, the coefficient associated with X_9^* has been unstable and remained insignificantly different from zero. The explicit gain from the inclusion of the surrogate variable, S, has been that 't' values associated with $\hat{a}_1$ and $\hat{a}_3$ have become larger. Thus, $\hat{a}_1$ and $\hat{a}_3$ are significantly different from zero at 2.5% and 12% levels of significance respectively. Moreover, $\hat{a}_4$ is significantly different from zero at 6% level of significance.

The regression equation (5.7) may be split up into two separate regression equations: one for those households

whose per capita amount of loan is below median level (Rs. 170) and the other for those whose per capita amount of loan is not less than Rs. 170.

$$\hat{X}_2^* = 13.19311 + 0.12609X_8^* - 0.76143X_9^* - 20.18946X_{10}^*$$

for below median loanees, and

$$\hat{X}_2^* = 84.64949 + 0.12609X_8^* - 0.76143X_9^* - 20.18946X_{10}^*$$

for others.

Considered so, it is revealed that at the median X_2 a structural break[5] in indebtedness takes place.

To understand and explain the structural break in indebtedness we must look into the basic characteristics of the sample data that we are analysing. A scrutiny of the same readily shows that indebtedness is correlated with per capita landholding of the households, although the nature of the relationship is quite peculiar. We observe that as we move away from the median value of per capita loan, the per capita landholding of the sample households increase. Mathematically, we may express the above stated relationship as:

$$ABS\ (M - X_2) = f(X_3) \qquad \ldots\ldots\ldots\ldots\ldots\ (5.8)$$

Where ABS ($M - X_2$) denotes the absolute value of the per capita loan measured as a deviation from the median value, M. (X_3 is the per capita landholding size of the household).

Economic explanations of the above observation may be readily provided. An increase in per capita landholding (X_3) implies higher per capita income in general, and we may expect richer farmers to finance their consumption expenditure and farming from their own savings. While exorbitant rates of interest prevail in the non-institutional credit market in rural areas, farmers would seldom borrow, could they finance their expenditure on their own. In doing so they might prefer to continue with the traditional method of farming and have to be contented with the meagre production, just enough for subsistence. Under the conditions of rainfed farming, farmers are greatly exposed to uncertainties leading them to risk-aversive decisions. Thus they may refrain themselves from borrowing. Furthermore, social prestige that flows from owning larger areas of land is greatly eroded away by being acknowledged as a debtor. Hence, no farmer would like to borrow if he could go on without it.

Nevertheless, borrowing may just as well be positively correlated with the holding size of land. We have noted

that landholding might work as a security base for the lender. If the condition of mortgaging is the basis for advancing loans, farmers owning larger areas of land have a greater propensity to borrow. Further, with larger holdings, greater finance requirements are generated for cultivation and it may be credit-financed. Nevertheless, certain non-economic reasons also may be in vogue to correlate greater degree of indebtedness with larger holding size. It might be so that better off farmers are supposed to keep up their social status by spending larger amounts on conspicuous consumption. In the Indian society in general, and in the tribal society in particular, social values have a greater say in explaining the human behaviour. Economists may take this observation with a pinch of salt, but it has been an amicable proposition for a sociologist and an anthropologist.

We take up, therefore, to replace our surrogate variable, S, by a transformed variable representing per capita landholding. This transformation is carried out as:

$$X_3' = X_3 \cdot S \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5.9)$$

Where X_3' is the transformed variable. This transformation amounts to assigning negative sign to X_3 if X_2 is less than Rs. 170 and positive sign otherwise.

We have re-estimated the model in which S is replaced by X_3'. The estimated regression equation is:

$$\hat{X}_2^* = 37.9437 + \underset{(3.176)}{0.1436}X_8^* - \underset{(0.777)}{0.8213}X_9^* - \underset{(1.713)}{23.1270}X_{10}^* + \underset{(2.304)}{18.9170}X_3' \; ; \; R^2 = 0.9475 \quad \ldots\ldots\ldots\ldots \quad (5.10)$$

We note that the estimated coefficients in the above equation are stable (confer 5.7) and the standard errors of estimate have been greatly lowered, enhancing the values of the 't' statistic. However, the coefficient associated with X_9^* continues to be insignificant.

5. Test of specification once again

A perpetual insignificance of the coefficient associated with X_9^* may suggest that it is an irrelevant variable and we may drop it from the model. Or, in other words, we may consider the model (5.6) mis-specified on account of inclusion of an irrelevant explanatory variable, X_9^*. However, if it is so, the estimation after dropping X_9^* would improve the values of 't' as we know that mis-specification of the said type affects the efficiency, and not the unbiasedness of the estimator.[6] Hence, we estimate the model after dropping X_9^*. Thus estimated regression equation is given as:

$$\hat{X}_2^* = 1.2857 + 0.1508X_8^* - 0.2516X_{10}^* + 19.0621X_3';$$

$$R^2 = 0.7932 \quad \ldots\ldots\ldots \quad (5.11)$$

We observe that dropping of X_9^* affects 't' values of the coefficients associated with X_8^*, X_{10}^* and X_3', though the estimated values of coefficients are stable. It amounts to say that by dropping X_9^*, we have affected the efficiency of the estimator adversely. Hence we conclude that X_9^*, forms a part of the correctly specified model, though we cannot put much reliability on this conclusion.

To sum up we observe that in an attempt to explain indebtedness by three variables, namely per capita income, credit-financed agricultural investment and educational status of the household by applying OLS for estimation of the regression coefficients we were faced with the problem of heteroskedastic residual vector that marred the reliability of the estimator. We treated heteroskedasticity by weighted least squares method. Residual analysis further suggested us to incorporate per capita landholding size also as an explanatory variable. By inclusion of this variable we successfully explain indebtedness. The final regression equation might be used for computing elasticities which, in turn, might be used for suggesting some policy guidelines to combat the problem of indebtedness.

The estimated elasticities of indebtedness (as measured by X_2^*) with respect to X_8^*, X_9^*, X_{10}^* and $X_3^!$ are 0.88, -0.11, -0.35 and 0.088 respectively. These measures of the elasticity for the original variables (provided that we hold that the coefficients reported in equation 5.11 are the closest approximation of the parameters in the population) are: 0.665, -0.324, -0.443, 0.043 respectively. The differences in the elasticities are due to the fact that while the first set of elasticities refer to the weighted variables, the second set of elasticities refer to the original variables. However, as we observe, in both the cases income elasticity of indebtedness is larger in comparison to the holding size elasticity of indebtedness. The education elasticity of indebtedness is quite stable. It may indicate that households with larger per capita income are more prone to indebtedness — may be due to their stronger propensities to conspicuous consumption. Education leads to reduce the incidence of indebtedness. As for the elasticity of indebtedness with respect to X_9^*, we would reserve our comment since the coefficient associated with X_9^* has remained insignificantly different from zero.

It suggests that rural indebtedness can possibly be ameliorated by the spread of education among the tribal

people. One may also hope that the credit-financed conspicuous consumption expenditure might be reduced once the tribal population is educated and the hold of traditional non-productive expenditure habits gives way to more rational, frugal, and prudent habits. Much of the success in this direction calls for institutional planning that may promote the attitudes of the people favourable to prudence and in turn to economic development.

6. Canonical Correlation Analysis

In the preceding sections we have made an attempt to explain X_2, the per capita amount of loan observed by the household. This we did because we hold that X_2 is the best representative measure of indebtedness. However, if we draw our attention to the fact that X_2 has a representative power of 60% only (that is, it can explain 60% of the total variation in the complex of five measures of indebtedness as discussed in the third chapter), our analysis remains partial.

Now we propose to carry out canonical correlation analysis[7] to look into the possibilities of explaining the complex of the measures of indebtedness by per capita income, highest level of education obtained by the household and holding size of the household. We add here that

dependency ratio also may explain the degree of indebtedness. So we include this variable also among the explanatory variables of indebtedness. Further, in the preceding section we have noted that X_9 is not a very potent variable in explaining indebtedness, though we do not have statistical reasons to deny its role as an explanatory variable. Nevertheless, we may suspect that it may be a variable that measures the incidence of indebtedness. Thus taken, it may be used as a constituent variable of the first set. In what follows, we have proceeded by taking X_9 as a constituent variable of the first set, that is, it is regarded as an index of indebtedness. We concede the inconsistency in our modelling, but since the nature of our investigation is exploratory, we may be excused of such inconsistencies. We do not have a well-founded theory to classify our variables among different well-conceptualised sets. Hence the inconsistencies creep into our analysis.

As we know, canonical correlation analysis tries to find out the degree of association between two sets of variables. The first set, in our case, is the set of the measures of indebtedness. The variables in this set are:

(1) Per capita payment of interest, X_0.

(ii) Per capita amount of loan observed by the household, X_2.

(iii) Amount of loan on per capita land owned by the household, X_4.

(iv) Amount of loan as a ratio to repaying capacity of the household, X_5.

(v) Amount of loan per rupee of the value of agricultural assets of the household, X_6.

(vi) Per capita credit-financed investment in farming or other productive activities, X_9.

The second set of variables, which may explain indebtedness, is constituted by the following variables:

(i) Per capita holding size, X_3.

(ii) Per capita income of the household, X_8.

(iii) Level of highest education attained by the household, X_{10}.

(iv) Dependency ratio, X_{11}.

The regression equations of the first set of variables on the second set of variables are given as follows:

$$\hat{X}_o = 0.2015X_3 + 0.5751X_8 - 0.0391X_{10} - 0.6629X_{11}$$

$$R^2 = 0.4314 \quad \ldots\ldots\ldots \quad (5.12)$$

$$\hat{X}_2 = -0.0179X_3 + 0.2778X_8 + 0.3407X_{10} - 0.2290X_{11}$$
$$R^2 = 0.1852 \quad \ldots\ldots\ldots \quad (5.13)$$

$$\hat{X}_4 = -0.7525X_3 + 0.1747X_8 + 0.4540X_{10} - 0.3119X_{11}$$
$$R^2 = 0.4727 \quad \ldots\ldots\ldots \quad (5.14)$$

$$\hat{X}_5 = -0.2986X_3 + 0.2744X_8 - 0.1054X_{10} - 0.0176X_{11}$$
$$R^2 = 0.1131 \quad \ldots\ldots\ldots \quad (5.15)$$

$$\hat{X}_6 = -0.3777X_3 - 0.1529X_8 + 0.1213X_{10} - 0.0631X_{11}$$
$$R^2 = 0.2156 \quad \ldots\ldots\ldots \quad (5.16)$$

$$\hat{X}_9 = -0.5171X_3 - 0.0897X_8 + 0.2626X_{10} + 0.1657X_{11}$$
$$R^2 = 0.1527 \quad \ldots\ldots\ldots \quad (5.17)$$

We denote the matrix of coefficients of these equations by $\hat{A}$. Thus $\hat{A}$ is a 6 x 4 Matrix.

The regression equations of the second set on the first set of variables are given as follows:

$$\hat{X}_3 = -0.1792X_o + 1.0871X_2 - 1.0141X_4 + 0.0023X_5 + 0.1078X_6 - 0.3297X_9; \; R^2 = 0.8180 \ldots\ldots (5.18)$$

$$\hat{X}_8 = 0.4657X_o + 0.3739X_2 - 0.5118X_4 + 0.3158X_5 - 0.3964X_6 - 0.0484X_9; \; R^2 = 0.6031 \ldots (5.19)$$

$$\hat{X}_{10} = -0.6676X_o + 1.1489X_2 - 0.2371X_4 - 0.0333X_5 - 0.2183X_6 - 0.0754X_9; \; R^2 = 0.3948 \ldots (5.20)$$

$$\hat{X}_{11} = -0.7746X_o + 1.0852X_2 - 0.7430X_4 + 0.0495X_5 - 0.0593X_6 - 0.0235X_9; \; R^2 = 0.5859 \ldots\ldots (5.21)$$

We denote the matrix of coefficients of these equations by $\hat{B}$. Thus $\hat{B}$ is a 4 x 6 matrix.

The Product Matrix of the two coefficient matrixes are given below. We have $\hat{B}$(4 x 6) and $\hat{A}$ (6x4). We get $\hat{C} = \hat{B}\hat{A}$. Thus $\hat{C}$ is a 4 x 4 matrix. Construction of the Product Matrix in this scheme economises our computational efforts in computing the canonical correlation.

Table - 5.1: The Product of Coefficients Matrix $\hat{C} = \hat{B}\hat{A}$

0.8368	0.5527	0.1548	0.4034
- 0.0356	0.4337	- 0.0751	- 0.2490
- 0.1568	- 0.2176	0.2672	0.0441
0.1247	- 0.2231	0.2552	0.4957

We have computed the eigen vector associated with the largest eigen value of the product matrix $\hat{C}$. The largest eigen value of the matrix $\hat{C}$ is equal to 0.82764. Thus the coefficient of canonical correlation between the two sets of variables is equal to 0.909 approx. We conclude that these two sets are highly correlated with each other. The eigen vector of the matrix associated with this eigen value is $[1.000, -0.5566, -0.00604, 0.7423]$. A perusal

of eigen vector readily indicates that X_3 (per capita holding size) is the leading variable followed by X_{11} (dependency ratio) and per capita income of the household (X_8). These findings give us an impression that indebtedness emergences mainly due to poverty (higher load of family on productive assets of the household) which may induce consumption loans.

For a deeper insight into the problem we have computed the second largest eigen value of the matrix and the associated eigen vector. The second eigen value is equal to 0.577 and the vector associated with it is $[-0.3501, -0.7489, 0.8621, 1.0000]$. It reveals that X_{11} (dependency ratio) is leading here, followed by X_{10} (highest education attained) and X_8 (per capita income of the household).

It is possible to compute subsequent coefficients of canonical correlation (the third and the fourth eigen values of the product matrix). But we do not see any benefit in doing so. The first two canonical correlation coefficients have shown very well that the four variables (X_3, X_8, X_{10} and X_{11}) can explain the measures of indebtedness quite efficiently.

We have also analysed the Product Matrix $\hat{A}.\hat{B}$. The eigen vector associated with the first (largest) eigen value (0.827) is found to be:

$$[0.101, -0.895, 1.000, -0.030, -0.131, 0.292]$$

It immediately reveals that X_4 (the amount of loan per capita land owned by the household) and X_2 (per capita loan observed by the household) are very powerful variables that represent indebtedness and are very closely associated with X_3, X_8, X_{10} and X_{11}.

The findings of canonical correlation analysis corroborates our findings on determinants of indebtedness obtained in the earlier sections of this chapter. We may assert now that indebtedness may be reliably explained by the variables identified by us. Our findings suggest us that for eradication of the problem of rural indebtedness we have to design policy measures to regulate education, dependency ratio and consumption expenditure of the loanee households.

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CHAPTER - VI

CONCLUDING REMARKS

1. A Summary of the Study

Now, before we close our investigation, it would be worthwhile to summarise our findings. To reiterate, our objective was to investigate the nature and significance of rural indebtedness. In Chapter I, we presented the reasons why the problem of rural indebtedness has attracted scanty efforts of researchers in social sciences in general and economics in particular. We have highlighted the importance of a thorough study on this issue, since it is one of the most stubborn and grave impediments in the way of rural prosperity. Unless we are in a position to understand the causal links of indebtedness we cannot lay our hands on controlling, ameliorating or eradicating the problem of rural underdevelopment and widespread poverty.

With a view to enquire into the nature, incidence, causes and consequences — the backward and forward linkages — of rural indebtedness we made a proposal to collect primary data from some villages of Assam. On certain considerations we chose to select four tribal villages of the North Lakhimpur Subdivision of the Lakhimpur District, Assam.

In Chapter II, we presented an introductory note to the region under study, namely the North Lakhimpur Subdivision. We have observed that this subdivision is one of the backward regions of Assam where traditional farming is in vogue, transportation and communication linkages are poor, level of education is low and indebtedness is widespread and deep rooted. In this chapter, we presented the methodology adopted for selection of villages and sample households for generating data base for analysing the nature and significance of rural indebtedness.

In Chapter III, we carried out a descriptive statistical analysis of the sample data collected from the four villages of the study region. First we presented some characteristic features of the sample households. We found that incidence of indebtedness is widespread and about 80% of the households are under debt. Interest rate charged on debt is as high as 12% per month. A large portion of the totalloan is accounted for consumption purposes. Mortgaging of land is very frequent.

Further, we tried to find out some statistical or mathematical regularity in the size classes of loanees. We have succeeded in our attempt, though the regularity found by us is peculiar, uncommon. They cannot ordinarily be

interpreted very well. Nevertheless, we interpreted our findings to the effect that the incidence of indebtedness is spread to about 70% of the households in the population.

In Chapter III, we made an effort to find out the best representative indicators of indebtedness and we could identify that per capita loan is the leading component of indebtedness. Further, we made an attempt to find the best discriminatory function that may be used to classify a household in loanee or non-loanee groups. We attempted to find out discriminatory functions to classify a household in different tribal groups also.

Chapter IV was devoted to assess the impacts of indebtedness on productive and distributive performances of the rural economy. We found that indebtedness affects productivity adversely and ensconces skewness in distribution of income and productive resources. It is obvious that these effects of indebtedness are detrimental to rural prosperity. We analysed the causal chain through which indebtedness affects productive and distributive performance of the economy, reinforces itself and becomes self-perpetuating.

Chapter V was devoted to analyse and identify the causes of indebtedness. This chapter reinforces and

corroborates our findings on causal chain of indebtedness that we established in Chapter IV. For a deeper insight we carried out canonical correlation analysis and found that loan per capita and loan per land area are two important variables correlated with dependency ratio, education level and consumption expenditure.

Our main findings are that indebtedness is due to low education level, high dependency ratio, high dependency on agriculture and primary sector occupations, non-functional consumption and poor facilities of institutional financing.

2. Some policy-guidelines for eradication of Rural Indebtedness

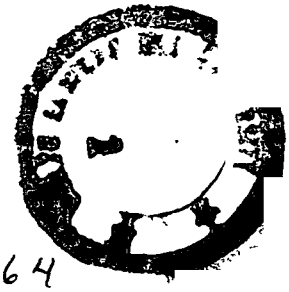
With all humility and awareness of the limitations of our investigation we propose that following suggestions emerging from our analysis may be considered for policy-making.

(i) Extension of education.

(ii) Development of transportation network.

(iii) Extension of village banks which may sometimes provide consumption loans also. These banks may advance loan on security of land (mortgaged - hypothecated to the bank).

(iv) Development of rural industries and cottage industries in the villages.



(v) Rural cooperatives for purchasing the product of villages at just prices and to eliminate middlemen may be set up.

(vi) Certain legal controls on usury and charging of high exorbitant rate of interest on private loans.

(vii) Policy measures to discourage ceremonial expenditure.

(viii) Measures for flood control.

(ix) Afforestation on the Waste Land.

We are of the opinion that banking institutions are philosophically based on commercial principles. This philosophy is not in tune with that of the long-range development policies. Of course, banks have their branches which prefer to be called development banks or lead banks. But if we analyse their working in practice we will be immediately convinced to note that they take up the issue of financing agriculture, industries or other enterprises in the spirit of commercial cost-benefit. The scope of commercial cost-benefit analysis is very narrow and conservative. It has been claimed by rural/development banks that to poor farmers and other villagers they advance loans even without any security. For rural industries also they claim to advance loans upto some limited amount. But a perusal of the total number of households to whom such loans have been

given reveals that indeed they cover a very low percentage. In our sample no household having less than 30 bighas of land has got such a loan, and those (three in number) who have got it are not poor. One may argue that poor farmers/ households do not approach to the banks for loan. But one will not love to borrow on higher rates of interest from village money-lender if one can get loan from bank on lower rates. Then what might be the reason? Is it only due to the ignorance of the people that they do not go to banks for loans, or is it also due to the reason that either there are some difficulties in getting bank loans or banks do not encourage expanding their activities when chances of recovery are less? It appears that this policy does not cope with the wider and modern objectives of a welfare state. We suggest that some new banks should be established by the government whose objective should be to protect people from being ensnared in the cobweb of usury. The benefits that flow from such a protection are immense. On the basis of commercial cost benefit principle such activities may be lossful, but on the principles of wider social welfare and long term economic welfare also this programme may be appreciated.

None will deny that certain big public enterprises have been running in loss for decades together. But when

such enterprises suffer a loss, it is justified on the principles that may be deceitful. However, if the organisations set up for eradication of rural indebtedness run a loss, one would invoke narrow criteria of commercial cost-benefit. We should be consistent in our approach and applaud losses on the identical principles. Nevertheless, we hold that programmes for eradication of rural indebtedness will never suffer a real loss.

Public enterprises hesitate to enter into petty industries on the arguments that amount to say that such industries should be the sphere of private investment. We hold that such arguments are based on flimsy ground and weak philosophical base. We do not understand why by entering into the petty enterprises the government should not motivate economic development. Such enterprises may generate very great employment opportunities. For consumer goods industries the government may provide capital and organisation; and labour may be provided by the unemployed people. We hold that the purpose should be economic development, not a dogmatic sticking to certain outdated industrial policies that have lost their significance in the contemporary situations. If new industrial policies are designed with such a heretic approach, we are sure that industrialisation will be accelerated.

For educational development also, the government should think afresh on the educational policy. We propose that every village should have a school and all the students of the school should be boarders. There should not be any provision for day scholarship. We understand that many parents cannot afford the boarding expenses. Hence the government should meet the expenses incurred on boarding. The expenses may be financed by new taxes (say Educational tax) levied proportionally or progressively on property or landholding. We understand that such an attempt will face opposition from many, but it is not difficult to justify such an attempt. We hold that without such a policy, "education for all" will remain a slogan for decades to come.

The problem of rural poverty and indebtedness can be ameliorated only if the government policies are firm to take up new vistas under their purview. We hold that the traditional measures are empty and impotent. They have shown their ineffectiveness. Hence it is high time when we should approach to the problems in novel ways. Only then we may hope that something spectacular can be achieved in a foreseeable future.

APPENDIX

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In what follows we present the computation procedures for some statistical techniques applied in our work.

1. Discriminant Analysis

Originally developed by R.A. Fisher, this statistical technique tries to answer the following questions.

Let there be two populations with common variance but different means. From these populations we draw n_1 and n_2 samples (respectively) on m characteristics. The question is: Can we discriminate between the two populations in so far as the sample data inform us? If a new sample is drawn from an unidentified population, can we statistically attach a probability to its belonging to the first or the second population? Discriminant analysis is computationally carried out as follows:

Step (i): Compute averages (of all variables) from n_1 samples of the first group. Call them

$$AV_1 = (\bar{x}_{11}, \bar{x}_{12}, \ldots\ldots\ldots \bar{x}_{1m})$$

Compute averages (of all variables) from n_2 samples of the second group, call them

$$AV_2 = (\bar{x}_{21}, \bar{x}_{22}, \ldots\ldots\ldots \bar{x}_{2m})$$

Compute the grand averages (by pooling both groups of sample together). These averages use all $n_1 + n_2 = n$ samples

$$AV = (\bar{x}_1, \bar{x}_2, \ldots\ldots\ldots \bar{x}_m).$$

Step (ii): Compute $\underline{D}$, defined as

$$d_j = \bar{x}_{1j} - \bar{x}_{2j} \quad \text{for } j = 1, 2, \ldots\ldots m.$$

Step (iii): Compute the variance-covariance matrix of the variables using pooled samples with n observations. Call it V. This Matrix will be a square matrix in m rows and m columns.

Step (iv): Invert the V matrix, call it V^{-1}.

Step (v): Compute $\underline{W}$ such that

$$\underline{W} = V^{-1}.\underline{D} = (w_1, w_2, \ldots\ldots w_m)$$

Step (vi): Compute $\bar{\delta}$ such that

$$\bar{\delta} = \sum_{j=1}^{m} w_j \bar{x}_j$$

Similarly, $\bar{\delta}_1$ and $\bar{\delta}_2$ for the two groups of sample may be computed as

$$\bar{\delta}_1 = \Sigma w_j \bar{x}_{1j}$$
$$\bar{\delta}_2 = \Sigma w_j \bar{x}_{2j}$$

For a sample from unknown population we may compute

$$\delta_s = \Sigma w_j x_{sj}$$

If $\delta_s < \bar{\delta}$, the sample s belongs to the group (population) 1 or 2 depending on the fact whether $\bar{\delta}_1 < \bar{\delta}$, or $\bar{\delta}_2 < \bar{\delta}$.

Whether $\bar{\delta}_1$ and $\bar{\delta}_2$ are significantly different from $\bar{\delta}$ or not may be tested by F statistic.

Further details are given in Tintner, G. (1952) Econometrics.

2. Principal Components Analysis

Originally developed by H. Hotelling this statistical technique tries to answer the following questions.

Let there be an observation Matrix X in n observations and m variables. Can we analyse X into Z such that

$$z_{ik} = \sum_{j=1}^{n} w_{ij} x^*_{jk} \; ; \qquad \begin{matrix} i=1, 2, \ldots \leq m \\ k=1, 2, \ldots, n. \end{matrix}$$

Moreover, $\underline{Z}_i$ and $\underline{Z}_j$ $(i \neq j)$ are orthogonal, that is

$$\sum_{k=1}^{n} z_{ik} z_{jk} = 0 \quad \text{for all i and j ; } i \neq j.$$

Here $x^*_{jk} = (x_{jk} - \bar{x}_j) / \sigma x_j$

$\underline{Z}_i$'s are called principal compoents. They may be less than or equal to m in number. They are orthogonal to each other. Further, it has also been proved that

$\sum_{j=1}^{m} r^2_{z_i x_j}$ is maximum if $\underline{Z}_i$ are principal components. The computational procedure is given as follows:

Step (i) : Compute

$$x^*_{jk} = (x_{jk} - \bar{x}_j)/\sigma_{x_j} \qquad \begin{matrix} j = 1, 2, \ldots\ldots m \\ k = 1, 2, \ldots\ldots n \end{matrix}$$

This step is meant for standardisation of variables so that they have 0 mean and unit variance.

Step (ii): Compute V, an m x m matrix

$$V = (X^*)' (X^*)\frac{1}{n}$$

That is

$$v_{ij} = \left(\sum_{k=1}^{n} x^*_{ik}\, x^*_{jk} \right)/n.$$

Step (iii): Compute as many eigen values and associated eigen vectors as needed (the number however cannot exceed m). This decision is made on the basis how many principal components an analyst wants to extract.

Step (iv): Compute W_{ij} (the weights or loadings to be given to variable $\underline{x}_j$) for constructing $\underline{Z}_i$

$$W_{ij} = e_{ij}/(\Sigma e_{ij}^2/\lambda_i)^{\frac{1}{2}} \qquad \begin{matrix} i = 1, 2, \ldots \leq m \\ j = 1, 2, \ldots m. \end{matrix}$$

Where λ_i is the ith eigen value and e_{ij} is the jth element of the eigen vector i associated with λ_i.

The W_{ij} are r_{zixj}, or the coefficient of correlation between ith principal component $\underline{Z}_i$ and jth variable $\underline{x}_j$.

Step (v) Compute z_{ik}

$$z_{ik} = \sum_{j=1}^{m} w_{ij}\, x_{jk}^{*} \qquad \begin{matrix} i = 1, 2, \ldots \leq m \\ k = 1, 2, \ldots n. \end{matrix}$$

Further details of this technique are given in Anderson's An Introduction to Multivariate Analysis, Tintner's Econometrics, and Theil's Principles of Econometrics.

3. Canonical Correlation Analysis

Originally developed by H. Hotelling, this technique tries to find out the coefficient of correlation between two sets of variables, each variable measured with mean zero and variance unity.

Let the first set be called Y^*. Y^* is in n observations on m variables. Let the second set be called X^*. X^* is in n observations on k variables. k need not be equal to m.

Then the largest canonical correlation is defined as the square root of λ_1, the eigen value (largest) of the matrix V, where V is defined as:

$$V = ((Y'^* Y^*)^{-1} Y'^* X^* (X'^* X^*)^{-1} X'^* Y^* - \lambda_1 I).$$

Since V may have as many as min (k, m) eigen values, there may be min (k, m) canonical correlation coefficients. However, in practice, the first two or three largest canonical correlation coefficients only are needed.

We define U as

$$U = ((X'^* X^*)^{-1} X'^* Y^* (Y'^* Y^*)^{-1} Y'^* X^* - \mu I)$$

The eigen values of V and U are identical. $\mu = \lambda$.

Since X's and Y's are normalised such that their means become zero and variance unity by the procedure.

$$X^*_{ij} = (x_{ij} - \bar{x}_j)/ \sigma x_j \qquad \begin{matrix} j = 1, 2, \ldots\ldots k \\ i = 1, 2, \ldots\ldots n. \end{matrix}$$

$$Y^*_{ij} = (y_{ij} - \bar{y}_j)/ \sigma y_j \qquad \begin{matrix} j = 1, 2, \ldots\ldots m \\ i = 1, 2, \ldots\ldots n. \end{matrix}$$

We may construct two composite variables

$$\underline{P}_s = X^* \underline{A}_s$$

$$\underline{Q}_s = Y^* \underline{B}_s$$

Where $\underline{P}_s$ is an n x 1 vector, and $\underline{Q}_s$ is an n x 1 vector.

The (bivariate) coefficient of correlation between $\underline{P}_s$ and $\underline{Q}_s$ is the canonical correlation, associated with λ_s. $\underline{A}_s$ and $\underline{B}_s$ may be computed as

$$a_{js} = e_{js} / (\Sigma e_{js}^2 / \lambda_s)^{\frac{1}{2}}$$

where e_{js} are the elements of the eigen vector associated with λ_s derived from V matrix. Similarly,

$$b_{js} = e_{js} / (\Sigma e_{js}^2 / \mu_s)^{\frac{1}{2}}$$

where e_{js} are the elements of the eigen vector associated with μ_s derived from U matrix.

Since both matrices V and U have multiple roots, one can see that many sets of $(\underline{P}_s, \underline{Q}_s)$ can be computed. In practice we are often interested in first few sets of $(\underline{P}_s, \underline{Q}_s)$ giving largest canonical correlation coefficients.

Further details of this method are available in Tintner's Econometrics, Anderson's Introduction to Multivariate Analysis, and Theil's Principles of Econometrics.

4. Computation of Eigen Values and Associated Eigen vectors

Computation of eigen values and vectors is an important mathematical operation. Here we present an algorithmic method to compute eigen values and eigen vectors of a matrix A (n x n) by power method.

Step (i): Define a vector $\underline{P}$ (n x 1) such that

$$p_j = 1 \text{ for all } j,\ j = 1, 2, \ldots\ldots n.$$

Step (ii): Compute $\underline{Q}$, such that

$$q_i = \sum_{j=1}^{n} a_{ij}\, p_j$$

Step (iii): Find out the largest (absolute) value of $\underline{Q}$, say it is L.

$$L = \underset{i}{\text{Max}}(\text{ABS}\ (q_i))$$

Step (iv): Divide $\underline{Q}$ by L, call it $\underline{Q}^*$

$$q_j^* = q_j/L \ ;\ \forall\ j$$

Step (v): Compare $\underline{Q}^*$ and $\underline{P}$.

If $\text{ABS}(q_j^* - p_j) \leq 0.0001$, say, $\forall\ j$

go to step (vi)

otherwise

replace $\underline{P}$ by $\underline{Q}^*$ and go to step (ii).

Step (vi): Note that L is the largest eigen value and $\underline{Q}^*$ is the associated eigen vector.

Step (vii): Define B (n x n) by cross multiplication of $\underline{Q}^*$ vector standardised by S

$$B = (\underline{Q}^*)(\underline{Q}^*)'/S$$

Where S is defined as

$$S = \sum_j (q_j^*)^2/L$$

Step (viii): Replace A by A - B

With this new A if we try to find eigen values we get the second largest eigen value and associated vector. This process can be repeated.

Note that this method of computing eigen values becomes computationally unstable if (L_i/L_{i+1}) is very close to unity. The rate of convergence of the iterative procedure is fast if (L_i/L_{i+1}) is considerably greater than unity.

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