CONTRACTUAL ARRANGEMENTS IN AGRICULTURE : SOME THEORY AND EMPIRICAL EVIDENCE

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A thesis submitted to the Indian Statistical Institute in partial fulfilment of the requirement for the award of the degree of
Doctor of Philosophy
1980

Acknowledgements

It is a pleasure and privilege to record my debt to my supervisor Prof. T. N. Srinivasan. Whatever worthwhile emerges from this thesis I owe it to his encouragement and guidance.

I am also indebted to Prof. Ashok Rudra for his provocative criticism and his constructive suggestions on various parts of the thesis. Dr. Satish Jain at the Jawaharlal Nehru University was always willing to listen and provided numerous useful suggestions and comments.

I am very grateful to the staff of the Economics Program at ICRISAT, Hyderabad and particularly to Drs. Hans P. Binswanger and James G. Ryan for allowing me free access to the data collected by them. Dr. N. S. Jodha always found time to discuss and clarify whatever doubts I had on the ICRISAT data and Dr. Binswanger gave valuable detailed comments on the empirical analysis of this data. To them all I am grateful.

I had the good fortune to present parts of the thesis at seminars at ICRISAT, Hyderabad, the Institute of Economic Growth, Delhi and at the Jawaharlal Nehru University, Delhi. I wish to thank the seminar participants for their constructive suggestions.

At ISI, my colleagues Rabindranath Mukhopadhya and Dr. Dipankor Coondoo provided valuable comments and computational assistance in the empirical analysis of data. I am grateful to them.

To Dr. T. Krishnan, the former Dean of Studies I owe a special debt for his understanding and his very helpful attitude at all times.

Finally, I express my gratitude to Shri Khagen Neogi for his excellent typing and to Shri Lal Mohan Das for efficient duplication.

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CHAPTER I

INTRODUCTION

I. Tenancy in agriculture is an arrangement between the landowner and tenant in which the tenant pays to the landowner a certain mutually agreed sum (or share) of produce in return for the right to cultivate and appropriate the output produced on rented land. There are different types of tenancy arrangements and often these differences relate to the form of payment of rent. Two of the more prevalent tenancy arrangements are sharecropping (or cropsharing) and fixed-rent tenancy. Under sharecropping, the rent is a contracted percentage of the output produced on rented land while in a fixed-rent contract the rent is a certain specified amount of cash or produce. This difference in the form of rental payment (a share in one and a fixed amount in the other) has an immediate implication. Under sharecropping, a shortfall in output (say due to bad weather or bad farming) results not only in a reduction in the tenant's income from land, but there is also a corresponding reduction in the landlord's rent. Conversely, the landlord shares in any increase in output on rented land. In contrast, in a fixed-rent contract the rent is independent of the actual level of output that is produced on rented land. Any increase or decrease in output affects the tenant alone.

In addition to these more common forms of tenancy arrangements there are other forms of tenancy which are also found to exist in different parts of the country. For instance, rent is paid not in terms

of output produced, but instead, it may be specified in terms of labour-services to be rendered by the tenant to the landlord[1/].

An essential feature of tenancy, of any form, is that the owner of the land is not cultivating the land himself. Though it is sometimes observed that the landowner does enter into an agreement with the cultivating-tenant regarding what crops to grow etc., it still remains a feature of tenancy that not all cultivating decisions are taken by the landowners unilaterally. Some of these decisions may be taken by the tenant alone while others may be taken jointly by the tenant and the landowner. This is in contrast to owner-cultivation where the owner of the land is solely responsible for cultivation. At this point we may emphasise one important difference between owner-cultivation (using wage-labour) and sharecropping. As we had just noted, under the former the cultivation decisions (when to plough, what crops to grow, how much of various inputs to be used, etc.) are the sole prerogatives of the landowner, with hired labour contributing manual labour only. In return, the labourers are paid the going wage rate which could be specified in terms of a proportion of harvested output[2/]. On the other hand, under sharecropping some of the cultivation decisions are taken by the tenant. Thus even though the form of payment under the two systems is

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1/ From the National Sample Survey (NSS) twenty-sixth round data we find that almost 22 % of total tenanted area in rural India was rented on terms other than sharecropping, fixed-rent or under usufructuary mortgage. Almost 30 % of holdings reporting leased-in area came under this residual category.

2/ This is particularly true for some operations, for example, labour hired for harvesting.

similar (with the wage-labourer and the tenant getting some proportion of of output produced, in both the arrangements) there is a crucial difference in the rights of the parties involved in the two contracts. We may also note a parallel between owner-cultivation with hired-labour and renting-out land under a fixed-rent contract. Under fixed-rent tenancy, the labourer-tenant is renting-in land for a fixed payment per hectare of land while under owner-cultivation the landowner is renting-in labour at a fixed payment per man-hour.

Having described in stark outline some of the tenancy arrangements, we discuss the importance of tenancy in Indian agriculture. We will first, very briefly, summarise some of the empirical findings pertaining to the extent and nature of tenancy in India. We will then go on to suggest various possible motivations for a study on tenancy and in the process consider some of the interesting questions that may have relevance from a policy point of view.

II. Quantitative significance of tenancy and its different forms

Some idea of the quantitative importance of tenancy in Indian agriculture can be had from the data obtained from the various land-holdings surveys conducted by the National Sample Survey (NSS). In fact, this is the only source giving data on tenancy (and its different forms) for all states and for the country as a whole. Moreover, it also permits comparison of the tenancy situation in the 1950's, 1960's and the seventies.

According to the latest NSS report on land-holdings[3/], a little more than one-tenths of total operated area was rented land during 1970-71, and almost one-fourths of the total number of operational holdings reported leased-in area. As far as the relative importance of different types of tenancy arrangements is concerned, sharecropping is most prevalent. Of the total area under tenancy in 1970-71, almost 48 % was under sharecropping. Excluding the quantitatively less-important forms of tenancy, we find that of the total area under sharecropping and fixed-rent, almost 64 % was under sharecropping. Thus, at the all-India level owner-cultivation is by far the dominant system of cultivation and tenancy accounts for only about 10 % of total operated area. Sharecropping is the most prevalent tenancy arrangement and fixed-rent tenancy is the other important form.

It may be argued that if tenancy is not a widespread phenomenon, a study on tenancy may not be worthwhile. We will argue against such an attitude. There are at least two reasons why the figures quoted above, and the inferences drawn from them need to be accepted with caution.

First, it can be argued that these figures under-estimate the actual extent of tenancy. As is well-known, there exists in India legislation discouraging and even prohibiting tenancy altogether. With such legislation, it may be expected that a landowner not wishing to cultivate land himself but wanting to retain ownership of land will have an incentive to conceal tenancy. More reliable information could be obtained

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3/ See NSS Report No. 215 and also see ChapterII of this dissertation.

by cross-checking with the tenant. But in conditions of land-scarcity, it is likely that the landowner's unwillingness to reveal the true extent of tenancy will make it difficult for the tenant to do so too.

Secondly, quite apart from the fact that the NSS estimates may be understating the extent of tenancy, there are inter-regional differences in the magnitude of tenancy which are not reflected in the all-India estimate. The incidence of tenancy is much higher in some states, even going by NSS data. In Punjab for example, leased-in area accounted for as much as 28 % of total operated area in 1970-71. In Haryana, the corresponding percentage was 23 and in West Bengal and Assam it was close to 20. Thus, even by NSS estimates tenancy is still quite prevalent in some parts of the country. Furthermore, there has not been any significant decline in the incidence of tenancy over the last decade for which data exists. Between 1960-61 and 1970-71, tenancy has declined by only 0.13 % in rural India as a whole. While the decline may have been more significant in some of the states, tenancy may have even increased during this period in some other states[4/].

Therefore, if as we have argued tenancy is not unimportant in Indian agriculture, we may wish to investigate some of the interesting aspects of tenancy which have relevance for agricultural policy. In the rest of this chapter we will indicate, briefly, some of these issues and leave the detailed exposition to later chapters.

4/ See, for example, Bardhan (1970) and Sanyal (1977).

III. Motivations for tenancy

The very fact that tenancy persists, despite tenancy legislation, suggests that under existing conditions it (tenancy) may be performing certain essential functions for both the landowner and the tenant. It would be interesting, therefore, to study the various motivations for the existence of tenancy. This is of relevance for policy. With a proper understanding of the various functions that tenancy may be performing under the existing conditions, it may be easier to devise alternative production arrangements that retain the 'good' features of tenancy and eliminate the undesirable features. In fact, without such an understanding any alternative arrangement sought to be introduced to replace tenancy may prove unsuccessful in so far as the landowner and/or tenant do not feel motivated to accept this change. It is also clear that to the extent different regions are characterised by different conditions, (in terms of resources available, market-conditions, climate, etc.,) the motivations for land-leasing may well be different. Thus, a change which is unacceptable to the landowner/tenant in one region may well be adopted in another region. This emphasises the need for a more open approach to land-tenancy. Be that as it may, there are a number of reasons which have been suggested for the existence of tenancy in Indian agriculture and we will mention some of these.

(1) Tenancy may be viewed as one possible arrangement which permits an agricultural household to adjust the land area operated by it to its fixed supply of other resources notably labour (both human

and draft-animal), when the market for these resources is non-existent or is functioning less than perfectly. For example, suppose land and labour are the only inputs in a constant-returns-to-scale production function. Further, assume that there is no market for land, though there does exist a market for labour and labour is perfectly mobile. In such a situation, an equilibrium (in the sense that the land/labour ratios are equal on all farms) is possible through labour movements alone. Thus a household that owns more(less) land in relation to its family-labour (so that owned land/labour ratio is higher(lower) than the equilibrium ratio) will hire-in(out) labour.

But suppose the labour market does not function. Then the same equilibrium can still be achieved if the land-lease market functions smoothly. A household having more(less) land in relation to its family-labour will lease-out (lease-in) land.

(2) Tenancy can also be viewed as a risk-spreading arrangement. Agricultural production being inherently risky, cultivators would be interested in spreading production-risks. Land-leasing could be one possible means of doing this. By leasing-out land a landowner transfers a part (or whole) of the risks in production on to the cultivating tenant. To what extent the risk-spreading property of tenancy is important depends, of course, on the riskiness of agricultural production in any particular region. It is also important to know whether there are any other feasible arrangements for risk-sharing. In case such arrangements do exist, and if the existence of tenancy is sought to be explained

in terms of its risk-spreading property alone, then it will be necessary to understand why tenancy is the preferred alternative vis-a-vis these other arrangements.

So far we have discussed tenancy without making any distinction between its different forms, particularly sharecropping and fixed-rent. But in the presence of production uncertainty, the risk-spreading properties of these two forms are quite different. Under sharecropping, risks in production are shared between the landowner and the tenant in proportion to their output shares. In contrast, under fixed-rent tenancy, all risk is transferred on to the tenant-cultivator. This difference could be an important consideration in the choice of tenancy contracts.

(3) Tenancy might be serving another important function, particularly when landowners do not possess sufficient information about the abilities of different workers that have to be hired for cultivation. When workers of different capabilities are all available for hire in the labour- arket at the same wage, the cultivator has no means of knowing the ability of the worker before he is hired. The workers who can work better are also under no obligation to do so since they receive the same wage irrespective of the quality of work done. Similarly, a landowner wishing to lease-out land may not be informed about his tenant's ability. Under these circumstances, it can be shown that by offering the workers different tenancy contracts, in addition to wage employment, the landowner can infer the quality of the workers by the contracts that they choose to accept. Thus, tenancy permits 'screening' of workers.

We have discussed, very briefly, some of the possible motivations for tenancy. It is equally important to understand the reasons for the existence of the different types of tenancy systems. Why is share-cropping prevalent in some regions and fixed-rent tenancy in others ? We will discuss all these aspects in greater detail later.

IV. An interesting aspect in a study on tenancy would be a comparative analysis of the different forms of tenancy and owner-cultivation, not from the point of view of the landowner and tenant, but from the viewpoint of society. One of the main problems in planning for agriculture is to devise suitable production arrangements consistent with the socio-economic goals of the economy. An evaluation of the different types of tenancy systems with respect to some of these objectives would be of obvious importance in planning. Consider some possible objectives :

(1) Output-maximisation : It has sometimes been argued that a share-tenant applies less inputs (and produces less output) than what he would have applied under a fixed-rent contract, at given input and output prices. In Marshall's words, "when the cultivator has to give to the landlord half of the returns to each dose of capital and labour that he applies to the land, it will not be in his interest to apply any doses the total return of which is less than twice enough to reward him. If then, he is free to cultivate as he chooses, he will cultivate far less intensively than on the English Plan (fixed-rent)"[5/]. Thus if output-maximisation was the only social objective being considered, and in so

5/ See Marshall (1959).

far as the above argument is valid, both self-cultivation and land-leasing under a fixed-rent contract would be superior alternatives to sharecropping. We will return to this argument in Chapter III. At this point we may only mention that the argument, if it is to be taken as a guide to policy, needs to be qualified in several ways some of which were pointed out by Marshall himself. To mention just one possible qualification, when production is risky, by reducing riskiness in production the cultivator may be induced to cultivate more intensively. To the extent sharecropping allows the tenant to share risks with the landowner, a sharecropper may cultivate more intensively than a fixed-rent tenant.

The composition of agricultural output may be another important policy consideration. Does the choice of tenancy contract influence the tenant's preference among different crops ? For example, since a share-contract permits risks to be shared, does this induce share-tenants to choose a relatively risky cropping-pattern with higher expected returns, as compared to his choice of cropping-pattern under a fixed-rent contract? Or, do share-tenants show a greater preference for food-crops compared to owner-operators ? In so far as the choice of tenancy-contract influences the tenant's preference among crops, a study on tenancy would be relevant in estimating the extent of effort that would be needed in achieving the desired output-mix. Would appropriate taxes and subsidies be sufficient, or would it require changes in production arrangements themselves ?

(2) Better income-distribution : Another important objective may be to reduce the disparities in income in agriculture. Given the importance of land in the agricultural economy and the significant disparities

in the ownership of land among rural households, how does leasing-in and leasing-out of land affect income-distribution between those who own land and those that do not ? What are the income distributional consequences of different contractual arrangements ? An answer to this question would allow us to answer the normative question : which arrangement leads to a desired income-distribution ? Do existing tenancy institutions accentuate income disparities between the landless or small landowning households on the one hand and the big landowners on the other ? If so, what should be the thrust of land-reform policies ? In this context, there are at least two important considerations that must be kept in mind.

(a) First, we need to clearly identify households that lease-in land and those that lease-out land. Do tenants belong more to the landless or small landowning households or do they belong, mainly, to the class of large owner-operating households ? Thus, if tenants are mainly the big landowning households leasing-in land to increase the size of their operational holding and if the leasing-out households are the small landowners not having adequate resources for cultivation, then the income-distributional consequences of tenancy may be quite different from the case where landless or small landowning households lease-in land from the big landowners.

(b) Secondly, it is essential to consider the terms and conditions of the tenancy contract itself. (For example, the level of rent, the extent of cost-sharing, the interest rate on loans in a tenancy-cum-credit interlinked transaction, etc.) Moreover, tenancy may influence the terms and conditions in related markets like those of labour or credit. For

example, if landless households previously working as wage-labourers are now allowed to lease-in land, this may not only increase their income directly but it may also provide additional advantages in transactions in other markets as well. It may increase the possibility of their getting credit, since in an imperfect credit market tenancy may serve as an acceptable collateral. Similarly, in a situation where most tenants are also wage-labourers, any impact of tenancy on the wage-rate would have an important bearing on the income of the tenant and/or labour household. These examples also illustrate the point that for a meaningful study on tenancy, its impact on other rural markets would also have to be worked out.

(3) Investment and adoption of new technology on land : Since the potentialities for increasing agricultural output depend on the quality of land and the infrastructure available for its cultivation, appropriate production arrangements would be needed to ensure increasing investment on land. Does tenancy prevent investment on land ? If, as is sometimes claimed, it does, then it is important to isolate those features of the arrangement that are mainly responsible and to determine whether these features are in any way essential to tenancy. For instance, if share-cropping leads to under-investment and fixed-rent tenancy does not, then it cannot be concluded that tenancy per-se inhibits investment. Similarly, tenancy as it exists today may be accompanied by other features (like insecurity of tenure, high rents, imperfections in different markets etc.,) and it may be these rather than tenancy per-se that act as impediments to investment in land. For example, one consequence of abolishing tenancy

without having an effective implementing machinery has been concealed tenancy where the landowners are unwilling to offer written tenancy contracts to the tenant. As a result, tenants cannot claim any title to land by continuity of cultivation. They also fail to secure credit because neither they nor the landowners are able or willing to offer tenancy as security against the loan. This may prevent any significant investment on the part of the tenant. Consider another example. Tenancy legislation, at least in principle, enabled the tenant to claim ownership rights on leased-in land if he could establish continuity of cultivation on that land. One consequence, as we just mentioned, was that landowners were unwilling to offer written tenancy contracts. Another consequence was that tenancy contracts were offered for much shorter durations. This results in greater insecurity for the tenant-cultivator who may no longer have any incentive to undertake investments that are profitable only in the long-run.

These features mentioned above are not essential to tenancy. For example, by offering written contracts of a long enough duration this under-investment by the tenant could be substantially reduced. There is another important consideration. Whether investment takes place or not, and to what extent, depends not only on the type of tenancy arrangement, security of tenure, etc., but also on the resources available to the tenant. Thus, it is important to know who the tenant is in respect of his access to inputs like credit. In the context of an imperfect credit market, and where land is leased-in by richer owner-operators from poorer small landowners, tenants may well invest more on leased-in land compared to what was being invested earlier by the landowners themselves.

Just as we are interested in the investment possibilities under different production arrangements, we may wish to understand whether tenancy (or any of its forms) would discourage the adoption of new technology. What production arrangement would facilitate the rapid spread of new technology ? To the extent the adoption of new technology involves additional investment on the part of the tenant, our comments in the last few paragraphs are equally relevant. But while the tenant may be unwilling to undertake the additional investment involved in the new technology, it is possible for the landlord to undertake this investment on behalf of the tenant if it is in his interest to do so.

There is, however, an argument which suggests that in the specific context of inter-related tenancy and credit transactions, it would, in fact, be in the landowner's interest to resist the adoption of new technology by the tenant. We will take this up in detail in a later chapter. Suffice it to mention that even if this argument is plausible, (and later we will discuss why it is not) it is not tenancy per-se but a combination of factors — market imperfections, inter-linkage of the land and credit transactions, and tenancy — which make it unprofitable for the landowner to accept the new technology. Thus, without first identifying the more important features on which this argument hinges, it would be hasty to conclude that tenancy impedes the spread of new technology, and is therefore not desirable.

V. Another interesting aspect in a study on tenancy would be to assess the likely impact of modernisation and development in agriculture on tenancy and its different forms. How would tenancy evolve ? What kinds

of qualitative changes would take place in tenancy, with the modernisation and commercialisation of agriculture ? Earlier, we had discussed the question whether tenancy would impede technological change. We now ask the obverse question : how would technological changes influence tenancy ? Would tenancy decline ? Would sharecropping increasingly give way to fixed-rent tenancy ?

In our discussion, we listed some possible motivations for the existence of tenancy. In so far as these motivations are governed by the existing conditions in the rural economy, (or within the household) any change in these conditions consequent to modernisation would influence tenancy. Consider mechanisation, particularly tractorisation. While the impact of tractorisation on the extent of labour-utilisation on cultivated land is ambiguous, it does reduce the requirement of draft-animal labour. In so far as the non-existence of a market for draft-animal hire provided the main motivation for tenancy, tractorisation (with an active market for tractor-services) will reduce the importance of tenancy.

Another important technical change is the rapid expansion of irrigation. This will have the following consequences :

(a) Since irrigated land is, in general, more fertile than unirrigated land and since it also facilitates double-cropping, for a landowning household the effect of irrigation is an increase in its land-ownership, when land is measured in 'efficiency' units.

(b) Irrigation reduces the cultivator's dependence on rainfall and thereby lessens the uncertainty and risk in production.

(c) Since HYV's of seeds have a higher yield on irrigated land and since new fertilizers are also more effective under such conditions, the use of these inputs becomes relatively more profitable.

Each of these factors may influence tenancy. For example, with production risks much reduced, a household leasing-out land previously to avoid risks need not do so now. Similarly, if the primary advantage of sharecropping over fixed-rent was that it served to reduce risks for the tenant-cultivator, this advantage may no longer be crucial since risks would anyway be small.

Yet another important development, at least in the case of some crops like wheat (and to a lesser extent, rice) is the introduction of newer and better varieties of seeds. In what way, if at all, is this likely to influence tenancy, especially in the context of imperfect credit markets ?

While technological changes are an important component of modernisation, institutional changes and changes in social attitudes and customs are also important dimensions. We have repeatedly mentioned some of the consequences for tenancy of imperfections in the markets for inputs, particularly credit. In so far as development is accompanied by the extension and intensification of banking and credit facilities in the rural areas, this will have an important bearing on tenancy. We had also suggested that in the context of an imperfectly functioning market for draft-animal labour, tenancy may be serving the function of adjusting the land-area operated by a household to its fixed supply of draft-animal labour. To the extent the market for tractor-services is active,

this (i.e., the developing market for tractor-services) will have a significant impact on tenancy. Similarly, in situations where the non-marketability of 'management' is the primary motivation for land-leasing, the emergence of a separate market for farm-managers may have an impact on tenancy. We will come back to some of these aspects in later chapters.

Changes in social attitudes and customs may also have a bearing on tenancy. To take an important example, the role of caste in the rural economy may diminish. Caste plays a significant role in determining the occupation of a rural household in at least some parts of the country. Often, in the absence, or imperfect functioning of rural markets, participation in and the terms and conditions of the different markets are governed by caste considerations. Caste may also be an important consideration in determining the 'suitability' of a tenant. In this context therefore, the diminishing role of caste will have some influence on land-leasing.

How would tenancy evolve as an institution ? What are the qualitative changes taking place in tenancy ? We have already considered one type of transformation — the shifting importance in tenancy of the two major forms, sharecropping and fixed-rent. Some other qualitative changes have also been reported in recent years.

(a) With the spread of new technology in agriculture, sharecropping is increasingly accompanied by cost-sharing by the landowner. Not all input-costs are being shared, however. In contrast to this emergence of cost-sharing in sharecropping, no such tendency has been reported in fixed-rent contracts. We may want to know why cost-sharing

has emerged and why it is confined to specific inputs only. Also, why is there no cost-sharing in a fixed-rent contract ?

(b) It is also becoming common for the landowners to advance production and/or consumption loans to their tenants, even though frequently very low interest rates are charged on these loans. Moreover, this system of advancing loans to tenants is not peculiar to any particular tenancy system. It is observed both under fixed-rent contracts as well as in sharecropping. What will be the consequences of this arrangement ?

(c) A third important qualitative change relates to the economic status of the lessors and lessees. Relatively speaking, in the fifties and sixties big landowners played a more significant part in leasing-out land to smaller landowners or landless households. In recent years, and in some parts of the country it is being observed that it is the small landowners who are increasingly leasing-out land. Even though this phenomenon is of relatively recent origin and is confined to only some regions, it points to a possibility that may become significant in the future. It may be interesting to explain why such a change is taking place. Is it due to a bias in the new technology ? What are its implications for policy ? We will discuss this in more detail in later chapters.

VI. In the preceding pages we have considered some ways in which tenancy is influenced by the nature and functioning of markets for labour and other inputs like credit. Clearly, a proper understanding of these markets would be essential in explaining the various aspects of tenancy and its different forms. Conversely, a study on tenancy would itself

help in understanding better the functioning of these markets. This is because, for a household, transactions in the land-lease market cannot be made in isolation from its decisions in markets like that of labour or credit. For example, a household's decision to opt for wage-employment will depend on the possibility of getting land on lease. Its demand for production-credit may depend on the extent of land cultivated by it, which in turn would depend on leasing possibilities. It also depends directly on the terms and conditions of the tenancy contract[6/]. Rural-urban migration may also be influenced by leasing possibilities. In so far as a household's decision to migrate is dependent on the possibilities of obtaining land on lease on suitable terms, a study on tenancy would provide valuable insights in understanding migration.

Some of these issues are of greater importance in regions where inter-linking of markets is observed. This happens when the same individuals transact with each other simultaneously in more than one market. For example, the landowner may be providing consumption loans to his tenant. It is said that in such cases the terms and conditions in any one contract (say the loan contract) are influenced by the terms and conditions in the other related contracts (like the tenancy contract) and therefore a study of transactions in any one market in isolation will be misleading. We may want to know why such interlinkages arise and in what precise way are the terms and conditions in different markets related.

6/ For example, the tenant's demand for credit will depend on whether the landlord shares in input-costs or not. It will also depend on whether the landowner is willing to supply him production-credit.

VII. In this chapter we have briefly discussed some interesting aspects in a study on tenancy. We have argued that tenancy cannot be viewed in isolation from other institutions and markets in agriculture. Moreover, tenancy serves several functions in the context of a less-developed agriculture and a proper understanding of these issues would be of relevance for land-reform policies. On the other hand, any assessment of tenancy based on any one of its many aspects could prove misleading, and we conclude this chapter by illustrating this by means of two examples both of which have received some attention in the theoretical literature.

For generations, economists and others have condemned sharecropping in contrast to fixed-rent tenancy and owner-cultivation[7/]. The basis of this bias often rests on the Marshallian argument presented earlier. For example, "..... From the standpoint of the tenant-cultivator these forms (where the payment of rent is in the form of fixed amounts of produce or fixed sum of money) are clearly preferable (to sharecropping) since, with a fixed-rent system he has the incentive to increase production and he gains the full benefit of any improvement on the land in so far as his tenancy is secure"[8/]. In so far as this argument is used as a rationale for condemning share-cropping in favour of fixed-rent tenancy, it is misleading. For it completely ignores the risk-sharing advantages of sharecropping. In the absence of alternative risk-sharing arrangements sharecropping, as we have seen, has an important function to perform.

7/ For an extreme view, see Arthur Young's description of the evils of sharecropping, quoted in Cheung (1969), page 34.

8/ Land Reform : Defects in agrarian structure as obstacles to economic development. U. N. Publication, 1951, page 16.

The other example relates to land-reform measures that seek to limit the crop-share to which the landowner can legally lay claim. This measure is presumably aimed at improving the welfare of the tenant. In fact, it follows from the Marshallian argument that by reducing the landlord's share of output the tenant can be induced to produce more output so that not only will the distribution of income become more favourable to the tenant but more of output will also be produced. However, a more careful study of sharecropping, at least in its present form, would lead one to be more cautious in rigidly fixing the rental share. In recent years, as we have already remarked, sharecropping is often accompanied by cost-sharing and the higher the landlord's share in costs, the higher is the share of output accruing to him. In such a situation, an arbitrary limit on the rental-share of the landowner may induce him to cut his share in the input-costs of the tenant. In the absence of alternative arrangements for providing inputs cheaply to the tenant, the result of a limit on the rental-share may well be a fall in output. Moreover, in the changing context of land being increasingly leased-in by the big owner-operators from small owners, tenancy measures like regulation of rent, security of tenure, right of purchase of tenanted land etc. would only perpetuate and increase inequality in the distribution of incomes and land.

In the third chapter we discuss these issues in detail with reference to the theoretical and empirical literature on the subject.

CHAPTER II

TRENDS IN TENANCY: AN ANALYSIS OF NATIONAL SAMPLE SURVEY (NSS) DATA

In this chapter we will investigate trends in some aspects of tenancy in rural India. For this purpose we will rely exclusively on NSS data obtained from their land-holding surveys.

A survey on land-holdings was first conducted in 1950-51 as part of the eighth round and it was subsequently repeated, with some changes, in 1960-61 (sixteenth round), 1961-62 (seventeenth round) and again in 1970-71 (as part of the twenty-sixth round). Thus our data comparison, though based on only three time points, would permit us to trace the evolution of tenancy over a sufficiently long interval of time.

The land-holding surveys sought to obtain information on land-ownership, the extent of leasing-in and leasing-out of land, and details of the different forms of tenancy arrangements. These data are available for each state and for the country as a whole, for rural and urban regions separately. For our purposes, we will utilise the State and all-India estimates for the rural areas only. Details of sampling procedures and the methods used in the collection of data can be obtained from the various NSS reports pertaining to the 8th., 17th., and 26th. rounds[1/]. Here we will only mention some of the concepts and definitions that we will repeatedly use in our analysis. Moreover, some of these definitions may have altered during the period under review and a time comparison would have to bear these changes in mind.

1/ See for example, Report Nos. 36, 66, 74 for the 8th round, No. 144 and Draft Report No. 177 for the 17th round and Report No. 215 for the 26th round.

A household was defined as a group of persons usually living together and taking their principal meals from a common kitchen for at least sixteen days out of a period of thirty days preceding the date of enquiry. However, for the purposes of collecting data on ownership of land, this definition of a household was modified. In preparing an inventory of land owned, all land owned by the 'usual' members of the household, irrespective of whether they had satisfied the basic criterion of membership or not, was taken into account except in cases where the usual members formed separate households elsewhere. The discretion as to whether a member of the household was a usual member or not was left to the household.

Ownership of land. In the 8th. round, a plot of land was owned by the individual if he had the right of permanent heritable possession, with or without right to transfer title. In the subsequent rounds, land held in owner-like possession was also included in land-owned. Thus, in the 17th. round, ownership right was defined as the right of permanent heritable possession with or without the right to transfer title. In addition, land held in owner-like possession directly from the government, or from others on long-term lease, was also considered as land owned by the household.

Since in the 8th. round, land held in owner-like possession is excluded by definition from the estimate of land owned, in terms of the 17th. round definition of land ownership the 8th. round estimates of land owned are underestimates. Conversely, in terms of the 8th. round

definition, the 17th, and 26th. round estimates of landownership are over-estimates.

Operational-holding. In the 8th. round, all land whether cultivable or not, directed or managed by one or more persons alone or with the assistance of others without regard to title, size and location constituted an operational holding. Some operational holdings were constituted by land which was exclusively used for non-agricultural purposes, for example house-sites, animal-husbandry etc.. In the subsequent rounds, this definition was modified. Unlike the previous definition, a holding constituted by land put to non-agricultural uses only or used exclusively as pastures or for livestock-rearing etc. was excluded from the scope of the survey. In terms of the 8th. round definition therefore, the 17th. and 26th. round estimates of land operated would be under-estimates.

Land leased-in. This was defined as land under physical possession over which the household has no ownership rights. The definition was unchanged in all rounds. But since the concept of ownership was modified in later rounds, this would affect the estimate of land leased-in. While in terms of the 8th. round definition of land-ownership land held in owner-like possession under a long-term lease would be classified as land leased-in, in terms of the 17th. (and 26th.) round definition it would be classified as land owned. Thus in terms of the 8th. round definition, the 17th. (and 26th.) round estimates of land leased-in are under-estimates.

Land leased-out was defined as land owned but not under physical possession of the household.

Apart from these definitional changes that need to be kept in mind while making inter-temporal comparisons, state-level comparisons are made more difficult because of the reorganisation of states that took place in 1956. The resultant boundary changes in some states makes it difficult to compare the post-reorganisation estimates with those obtained before the reorganisation. To mention just a couple of such changes :

(i) PEPSU and Punjab were integrated in 1956 to form an enlarged Punjab. Furthermore, some of the area in Punjab was transferred to Himachal Pradesh. Again, in the 1960's Punjab was divided into two states, Haryana and a smaller Punjab.

(ii) Andhra was substantially enlarged in 1956 by including in it large parts of the states of Madras and Hyderabad.

(iii) There was also a transfer of area from Bihar to West-Bengal.

We will now present and discuss NSS estimates of tenancy and some of its important features. In so doing we will often compare the estimates of three states, Punjab, Andhra Pradesh and West Bengal. These states provide a contrast in terms of the development of infrastructure and markets in agriculture. While in Punjab there is already a well developed infrastructure by way of irrigation, credit institutions etc.,West Bengal would represent states with relatively poorer infrastructural facilities. States like Andhra Pradesh represent an intermediate level of infrastructural development.

Extent of tenancy and its trend since 1953-54.

In Table 1 we present all-India estimates of tenancy in 1953-54, 1961-62 and 1970-71, using four different measures of tenancy.

Table 1 : Extent of tenancy : all-India, rural

Year	T_1	T_2	T_3	T_4
(1)	(2)	(3)	(4)	(5)
1953-54	20.34	39.84	11.42	12.03
1961-62	10.70	33.52	4.43	7.03
1970-71	10.57	25.68	5.57	9.87

T_1 = Percentage of operated area leased-in.

T_2 = Percentage of holdings reporting leased-in area.

T_3 = Percentage of owned area leased-out.

T_4 = Percentage of households leasing-out some land.

There is reason to expect that the estimates of tenancy given by T_1 and T_2 are better than the estimates given by T_3 and T_4. In estimating tenancy by the extent of owned area leased-out, the investigator relies on information provided by a respondent who owns land and may be leasing-out part of his land. In the context of land-tenancy legislation which seeks to prohibit leasing-out of land, there may be a tendency for such households to under-report the extent of land leased-out by them. Better estimates could be obtained by questioning households leasing-in land and this is what is done in estimating tenancy by T_1 and T_2.

A little more than 10 % of total operated area in 1970-71 is leased-in and as much as 26 % of all operational holdings report some

leased-in area. Thus, despite tenancy legislation, and despite a presumption that NSS estimates may be under-stating the extent of tenancy[2], it is still significant.

The table also reveals that as compared to 1953-54 there has definitely been a decline in tenancy in 1970-71, by whichever measure we compare. This decline has been more significant in terms of area (both the percentage of operated area leased-in and the percentage of owned area leased-out have been halved) and less so in terms of holdings reporting leased-in area or households leasing-out land. (The percentage of households leasing-out land has declined by only 17 %). It is possible that while in 1953-54 leasing-out households were large landowners, in 1970-71 such households are relatively smaller landowners.

We may also notice that most of the decline in tenancy has taken place during 1953-54 to 1961-62 and there has been hardly any further decline during 1961-62 to 1970-71. In fact, there may even have been a slight increase in tenancy during this period.

We have remarked that there were changes in the definition of land-ownership and operational holdings as between the 8th. round and the 17th. round. Do these changes affect our measures in any uniform manner ? To see this, we take each measure in turn.

2/ This has been the experience of many researchers who have conducted more detailed and extensive field investigations in selected villages in different parts of the country. See for example, Bell's (1978) estimate of tenancy in the Purnea district of Bihar or Bliss and Stern's (1980) estimate of tenancy in Palanpur village in East Uttar Pradesh, or the AERC (Delhi) estimates of tenancy in villages of Punjab, Haryana and West Uttar Pradesh as reported by Laxminarayan (1977).

Consider first

$$T_3 = \frac{(\text{land leased-out})}{(\text{total land owned})} \times 100$$

By definition

$$\frac{(\text{land leased-out})}{(\text{land owned})} = \frac{(\text{land owned but not in physical possession})}{(\text{land owned})}$$

$$= \frac{(\text{land owned}) - (\text{land owned and in physical possession})}{(\text{land owned})}$$

$$= 1 - \frac{(\text{land owned and in physical possession})}{(\text{land owned})}$$

While land owned is over-estimated in 1961-62 (in terms of 8th. round definition), the numerator may also have been over-estimated if some of the land held in owner-like possession is not under physical possession of the household. To take a concrete example, suppose a household has two plots of sizes A and B and in 1953-54 let the plot of size A (plot A) be owned and the plot of size B (plot B) be held in owner-like possession under a long-term lease. Suppose A_1 acres of plot A are not in physical possession of the household and similarly, assume B_1 acres of plot B are also not under physical possession of the household. Then, depending on whether we employ 8th. round definitions or the 17th. round definitions, we will have the following dimensions :

	8th. Round	17th. Round
Land owned	A acres	(A + B) acres
Land leased-out	A_1 acres	$(A_1 + B_1)$ acres
and		
T_3	$(A_1)/(A)$	$(A_1+B_1)/(A+B) = A_1/(A+B)+B_1/(A+B)$

Clearly if $B_1 = 0$, that is, if no part of land held in ownerlike possession is leased-out, then the 17th. round estimate of T_3 will be smaller than the estimate of T_3 using 8th. round definitions.

However, if $B_1 > 0$, then

$$(T_3) \text{ 17th. round } \begin{matrix} < \\ = \\ > \end{matrix} (T_3) \text{ 8th. round if } A_1/A \begin{matrix} > \\ = \\ < \end{matrix} B_1/B$$

Similarly, take

$$T_1 = \frac{\text{(land leased-in)}}{\text{(Total operated area)}} \times 100.$$

As we have already remarked, while the exclusion of holdings put solely to non-agricultural uses in the 17th. round reduces the estimate of total operated area, there is also a definitional reduction in the estimate of land leased-in. This is because land held previously in owner-like possession under long-term lease (and classified as leased-in area in the 8th. round) was classified as land owned in the 17th. round. Thus there is no clear-cut bias in T_1.

Consider $T_4 = \frac{\text{(No. of households leasing-out some land)}}{\text{(Total number of households)}} \times 100.$

Take the case of a household which cultivates all its owned land (8th. round definition) but only a part of land held in owner-like possession. Then, by definition, this household is not leasing-out any land because all the land owned by it is under its physical possession. However, by the 17th. round definition, this household will be classified as leasing-out some land since a part of its owned land (where owned land now includes land held in owner-like possession) is not under its physical possession. Thus, in terms of the 8th. round definition, the 17th. round

estimate of T_4 is an over-estimate. The decline in tenancy was therefore sharper than what is revealed in column (5) of table 1.

Finally, $T_2 = \frac{\text{(No. of operational holdings reporting some leased-in area)}}{\text{(Total number of operational holdings)}} \times 100$

Again, the 17th. round estimates of both the numerator and denominator are under-estimates, going by 8th. round definitions. There is no clear bias.

In Tables 2, 3 and 4 we present state-level estimates of T_1, T_3 and T_4 respectively, for 1953-54, 1961-62 and 1970-71. Tenancy was highest in Punjab and Haryana in 1970-71. However, it is also significantly large in the less-developed and modernised states like West Bengal and Assam. Generally speaking, tenancy is of lesser importance in the Central and Western Indian states of Gujarat, Madhya Pradesh, Maharashtra and Rajasthan. We also observe that while there was a decline in tenancy in almost all states during 1953-54 to 1961-62, the decline is much less during the later period 1961-62 to 1970-71. In fact, in many states there may have been an increase in tenancy during this period. These states are Assam, Bihar, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh and West Bengal. In terms of operated area leased-in, this tendency of a decline in tenancy followed by an increase during 1961-62 to 1970-71 is evident in all the Eastern states i.e., Assam, Bihar, Orissa and West Bengal. In fact, of the seven states where tenancy appears to have increased during 1961-62 to 1970-71, four states belong to the East. In all the Southern states there has been a continuous decline in tenancy during 1953-54 to 1970-71. This is also true in Punjab. Thus, though tenancy is still very high in the relatively more-developed states like Punjab, there has been a substantial reduction in tenancy in these

states[3/], whereas in the less-developed Eastern states (or even in Rajasthan and Madhya Pradesh), the decline in tenancy has not been very marked and there may even have been a tendency for tenancy to become more widespread.

Table 2. Extent of tenancy : Percentages of operated area leased-in.

States	1953-54 %	States	1961-62 %	1970-71 %
(1)	(2)	(1)	(2)	(3)
Uttar Pradesh	11.38	Andhra Pradesh	9.15	9.01
Bihar	12.39	Assam	15.36	19.69
Orissa	12.58	Bihar	10.25	14.50
West Bengal	25.43	Gujarat	5.83	3.91
Assam	43.54	Jammu & Kashmir	14.13	8.06
Andhra Pradesh	19.07	Kerala	15.30	8.59
Tamil Nadu	27.53	Madhya Pradesh	6.40	7.46
Karnataka	16.37	Tamil Nadu	16.55	13.07
Travancore-Cochin	23.63	Maharashtra	8.74	6.15
Bombay	26.81	Karnataka	18.16	15.90
Saurashtra	6.22	Orissa	10.75	13.46
Madhya Pradesh	18.61	Punjab	35.39	28.01
Madhya Bharat	19.54	Haryana	-	23.26
Hyderabad	18.04	Rajasthan	4.87	5.26
Vindhya Pradesh	21.33	Uttar Pradesh	8.06	13.01
Rajasthan	20.92	West Bengal	17.65	18.73
Punjab	40.42	Himachal Pradesh	-	10.20
PEPSU	37.71	All-India	10.70	10.57
Jammu & Kashmir	22.17			
All-India	20.34			

Sources : (1) 1953-54 : NSS 8th. round, Report No. 66.
(2) 1961-62 : NSS 17th. round, Report No. 159 and Draft Report No. 177.
(3) 1970-71 : NSS 26th. round, Report No. 215

3/ Even this has been disputed by Sanyal (1977). He shows that even in Punjab tenancy may have increased during this period.

Table 3 : Extent of tenancy : Percentage of owned area leased-out.

States	1953-54 %	States	1961-62 %	1970-71 %
(1)	(2)	(1)	(2)	(3)
Uttar Pradesh	5.84	Andhra Pradesh	5.33	8.93
Bihar	6.95	Assam	4.97	8.18
Orissa	8.02	Bihar	3.56	6.78
West Bengal	15.51	Gujarat	0.52	2.29
Assam	14.02	Jammu & Kashmir	3.96	3.21
Andhra Pradesh	15.03	Kerala	8.54	3.00
Tamil Nadu	15.37	Madhya Pradesh	3.70	3.62
Karnataka	15.89	Tamil Nadu	7.05	8.88
Travancore-Cochin	15.74	Maharashtra	3.96	3.20
Bombay	14.12	Karnataka	8.88	7.90
Saurashtra	3.75	Orissa	4.76	7.04
Madhya Pradesh	11.55	Punjab	13.68	17.69
Madhya Bharat	11.41	Haryana	-	8.06
Hyderabad	12.58	Rajasthan	0.72	4.09
Vindhya Pradesh	6.07	Uttar Pradesh	3.66	6.41
Rajasthan	6.42	West Bengal	7.22	8.95
Punjab	30.82	Himachal Pradesh	-	4.09
PEPSU	27.79	All-India	4.43	5.77
Jammu & Kashmir	16.13			
All-India	11.42			

Sources : (1) 1953-54 : NSS 8th. round, Report No. 66.

(2) 1961-62 : NSS 17th. round, Report No. 159 and Draft Report No. 177.

(3) 1970-71 : NSS 26th. round, Report No. 215, Table 3.

Table 4: Extent of tenancy : Percentage of households leasing-out some land.

States	1953-54 %
(1)	(2)
Uttar Pradesh	9.78
Bihar	12.80
Orissa	11.46
West Bengal	10.41
Assam	6.55
Andhra Pradesh	10.78
Tamil Nadu	13.63
Karnataka	15.19
Travancore-Cochin	14.68
Bombay	11.95
Saurashtra	5.22
Madhya Pradesh	11.64
Madhya Bharat	18.82
Hyderabad	11.45
Vindhya Pradesh	12.23
Rajasthan	8.83
Punjab	22.87
PEPSU	24.91
Jammu & Kashmir	15.77
All-India	12.03

States	1961-62 %	1970-71 %
(1)	(2)	(3)
Andhra Pradesh	6.95	12.05
Assam	6.50	12.00
Bihar	7.30	15.80
Gujarat	1.46	3.79
Jammu & Kashmir	5.76	3.73
Kerala	8.88	6.47
Madhya Pradesh	6.03	7.67
Tamil Nadu	7.96	8.44
Maharashtra	4.00	5.02
Karnataka	14.54	11.05
Orissa	5.46	13.11
Punjab	11.83	13.67
Haryana	-	11.48
Rajasthan	3.09	5.78
Uttar Pradesh	7.66	10.06
West Bengal	7.33	9.48
Himachal Pradesh	-	8.94
All-India	7.03	9.87

Sources : (1) 1953-54 : NSS 8th. round, Report No. 66.
(2) 1961-62 : NSS 17th. round, Report No. 159.
(3) 1970-71 : NSS 26th. round, Report No. 215, Table 2 & 3.

We now discuss some important features of tenancy and the trends since the fifties. Are tenants small-farmers ? Is it the big-landowners who constitute the bulk of leasing-out households or do small-landowners also lease-out land ? What is the pattern in different states ? In Table 5 below, we present the percentage share of total tenanted area (and number of operational holdings reporting leased-in area) accounted for by operational holdings in the less than 5 acres and the above 20 acres size-groups of operational holdings in the selected states, in 1970-71.

Table 5 : Percentage share of total tenanted area (number of holdings reporting leased-in area) accounted for by operational holdings in the below 5 acres and above 20 acres size-groups of operational holdings, 1970-71.

States	< 5 acres %	> 20 acres %
(1)	(2)	(3)
West Bengal	71.37 (87.42)	1.54 (0.17)
Andhra Pradesh	27.61 (63.51)	23.29 (5.77)
Punjab	9.72 (22.82)	22.14 (8.52)
All-India	36.97 (72.42)	19.41 (3.31)

At the all-India level, more than 70% of tenanted holdings are small holdings. In other words, tenant farms are mostly small farms and almost 37% of total rented land is leased-in by cultivators operating small holdings. This preponderance of small tenant farms is even more pronounced

in the case of West Bengal. However, in Punjab and also in Andhra Pradesh, a significant proportion of rented land is operated by big farmers.

In Tables 6(and 7), we present the share of total tenanted area (and the number of operational holdings reporting leased-in area) accounted for by the below 5 acres and the above 20 acres size-groups of operational holdings for all states during 1953-54, 1961-62 and 1970-71.

Table 6 : (i) Percentage share of total tenanted area accounted for by the below 5 acres size-groups of operational holdings.

States	1953-54 %	States	1961-62 %	1970-71 %
(1)	(2)		(2)	(3)
Uttar Pradesh	46.44	Andhra Pradesh	18.46	27.61
Bihar	55.78	Assam	63.45	70.20
Orissa	39.81	Bihar	60.53	69.62
West Bengal	46.05	Gujarat	12.56	11.22
Assam	32.14	Jammu & Kashmir	48.30	44.08
Andhra Pradesh	24.96	Kerala	59.97	69.10
Tamil Nadu	41.39	Madhya Pradesh	13.87	21.84
Karnataka	22.82	Tamil Nadu	47.62	61.39
Travancore-Cochin	53.18	Maharashtra	12.14	14.16
Bombay	10.20	Karnataka	8.39	19.53
Saurashtra	2.27	Orissa	45.68	56.70
Madhya Pradesh	7.96	Punjab	7.09	9.72
Madhya Bharat	5.37	Haryana	-	17.31
Hyderabad	6.38	Rajasthan	8.08	7.74
Vindhya Pradesh	14.40	Uttar Pradesh	42.79	51.49
Rajasthan	5.28	West Bengal	58.30	71.37
Punjab	6.40	Himachal Pradesh	-	62.99
PEPSU	3.61	All-India@	26.78	36.97
Jammu & Kashmir	46.31			
All-India*	19.77			

Table 3: (ii) Percentage share of total tenanted area accounted for by the above 20 acres size-group of operational holdings.

States	1953-54 %	States	1961-62 %	1970-71 %
(1)	(2)	(1)	(2)	(3)
Uttar Pradesh	11.08	Andhra Pradesh	27.94	23.29
Bihar	5.74	Assam	0.14	0.14
Orissa	13.32	Bihar	4.45	1.62
West Bengal	3.11	Gujarat	44.54	32.86
Assam	9.30	Jammu & Kashmir	1.88	0.00
Andhra Pradesh	29.38	Kerala	4.73	0.58
Tamil Nadu	16.03	Madhya Pradesh	34.77	23.59
Karnataka	23.88	Tamil Nadu	4.52	2.14
Travancore-Cochin	12.53	Maharashtra	53.13	43.92
Bombay	51.13	Karnataka	50.47	34.16
Saurashtra	77.32	Orissa	5.98	6.80
Madhya Pradesh	51.27	Punjab	33.56	22.14
Madhya Bharat	45.78	Haryana	-	29.87
Hyderabad	68.50	Rajasthan	58.17	54.02
Vindhya Pradesh	31.37	Uttar Pradesh	13.21	6.81
Rajasthan	64.50	West Bengal	2.31	1.54
Punjab	46.81	Himachal Pradesh	-	0.00
PEPSU	43.58	All-India@	28.29	19.41
Jammu & Kashmir	1.64			
All-India*	39.67			

Sources : (1) 1953-54 : NSS 8th. round, Report No. 66, Table 3.5
(2) 1961-62 : NSS 17th. round, Draft Report No. 177, Tables 4.(.) A.
(3) 1970-71 : NSS 26th. round, Report No. 215, Table 19, p. 88.

* Report No. 30, Table 5.6
@ Report No. 144, Table 10.

From Table 6(i),(ii) it is evident that in 1970-71 small tenant farms accounted for most of the land leased-in in all the Eastern states (Assam, Bihar, Orissa and West Bengal), whereas big tenant farms accounted for a larger share of total tenanted area in the Western and North Western states of Gujarat, Maharashtra, Punjab, Haryana and Rajasthan. There is no clear pattern in the Southern states. While in Andhra Pradesh and Karnataka large tenant farms accounted for a substantial share of total tenanted land, in Kerala and Madras (Tamil Nadu) small tenant farms predominate. Table 7 suggests that tenant farmers are predominantly small farmers in the relatively less-developed states while big tenant farmers are more common in the relatively more-developed states. (Tamil Nadu is an important exception in this regard.)

We also notice that at the all-India level there has been a steady increase in the share of small tenant farms in total tenanted area and this is matched by an almost similar decline in the share of big tenant farms in total tenanted area. Moreover, this trend towards small farmers increasing their share of leased-in area is discernible in almost all the states. Thus, while the time-series comparison suggests that with increasing development in agriculture land is increasingly leased-in by the small-farmers (in contrast to big farmers), the cross-section comparison earlier had revealed just the opposite : in relatively less-developed states small farmers accounted for a much larger share of total tenanted land.

Table 7 : (i) Percentage share of total holdings reporting leased-in area accounted for by the below 5 acres size-groups of operational holdings.

States	1953-54 %	States	1961-62 %	1970-71 %
(1)	(2)	(1)	(2)	(3)
Uttar Pradesh	76.75	Andhra Pradesh	47.96	63.51
Bihar	85.38	Assam	80.00	80.24
Orissa	74.79	Bihar	84.86	86.00
West Bengal	82.15	Gujarat	44.75	41.34
Assam	69.73	Jammu & Kashmir	66.98	65.36
Andhra Pradesh	67.10	Kerala	90.20	93.24
Tamil Nadu	84.37	Madhya Pradesh	35.66	54.57
Karnataka	57.42	Tamil Nadu	75.81	84.57
Travancore-Cochin	92.40	Maharashtra	44.26	48.96
Bombay	47.84	Karnataka	33.65	46.32
Saurashtra	51.08	Orissa	72.14	80.63
Madhya Pradesh	51.24	Punjab	25.22	22.82
Madhya Bharat	35.77	Haryana	-	27.59
Hyderabad	49.33	Rajasthan	38.08	n.a.
Vindhya Pradesh	60.12	Uttar Pradesh	72.65	79.35
Rajasthan	33.82	West Bengal	72.44	87.42
Punjab	37.27	Himachal Pradesh	-	79.30
PEPSU	20.23	All-India@	64.22	72.42
Jammu & Kashmir	71.79			
All-India*	67.78			

Table 7 : (ii) Percentage share of total holdings reporting leased-in area accounted for by the above 20 acres size-groups of operational holdings.

States	1953-54 %	States	1961-62 %	1970-71 %
(1)	(2)	(1)	(2)	(3)
Uttar Pradesh	1.61	Andhra Pradesh	9.10	5.77
Bihar	0.91	Assam	0.25	0.21
Orissa	1.94	Bihar	0.84	0.57
West Bengal	0.50	Gujarat	16.26	8.21
Assam	1.24	Jammu & Kashmir	0.00	0.00
Andhra Pradesh	5.26	Kerala	0.00	0.15
Tamil Nadu	1.22	Madhya Pradesh	12.37	7.64
Karnataka	5.94	Tamil Nadu	1.12	0.44
Travancore-Cochin	0.91	Maharashtra	18.89	11.19
Bombay	14.88	Karnataka	15.88	11.72
Saurashtra	29.34	Orissa	1.43	0.79
Madhya Pradesh	13.82	Punjab	15.54	8.52
Madhya Bharat	16.54	Haryana	-	10.24
Hyderabad	23.20	Rajasthan	16.15	n.a.
Vindhya Pradesh	8.44	Uttar Pradesh	2.53	0.77
Rajasthan	23.22	West Bengal	0.43	0.17
Punjab	14.15	Himachal Pradesh	-	n.a.
PEPSU	19.68	All-India@	5.58	3.31
Jammu & Kashmir	0.61			
All-India*	6.62			

Sources : (1) 1953-54 : NSS 8th round, Report No. 66, Table 5.5
(2) 1961-62 : NSS 17th round, Draft Report No. 177, Table 3.(.) A.
(3) 1970-71 : NSS 26th round, Report No. 215, Table 19, p. 88.

* Report No. 30, Table 5.6, p.21.
@ Report No. 144, Table 10.

So far we have not made any distinction between tenants owning land (landed-tenants or owner-tenants) and tenants owning no land (pure-tenants). In Table 8 below, we present estimates of the extent of landlessness in 1961-62 and 1970-71 in columns (2) and (3) respectively.

Table 8 : Percentage of households owning no land and percentage of landless households operating land, 1961-62 and 1970-71.

States	X_1		X_2	
	1961-62	1970-71	1961-62	1970-71
(1)	(2)	(3)	(4)	(5)
Andhra Pradesh	6.84	9.73	13.45	4.45
Assam	27.77	18.74	24.56	46.56
Bihar	8.63	2.78	25.49	15.83
Gujarat	14.74	16.32	7.53	5.03
Jammu and Kashmir	10.93	1.07	47.03	33.33
Kerala	30.90	11.94	30.78	30.22
Madhya Pradesh	9.14	7.74	15.10	28.17
Tamil Nadu	24.20	16.90	9.59	8.10
Maharashtra	16.03	15.78	13.41	6.45
Karnataka	18.64	14.97	27.04	11.36
Orissa	7.84	6.89	18.75	30.83
Punjab	12.33	4.77	30.41	10.87
Haryana	-	7.09	-	12.00
Rajasthan	11.84	4.02	81.42	26.98
Uttar Pradesh	2.78	3.11	18.34	16.90
West Bengal	12.56	11.30	23.01	14.20
Himachal Pradesh	-	4.35	-	20.00
All-India	11.68	9.17	19.18	15.04

X_1 = No. of households owning no land as percentage of total number of households.

X_2 = No. of landless households operating land as percentage of all landless households.

Sources : (1) 1961-62 : NSS 17th.round, Report No. 144, Tables 4 & 8, Appendix II.
(2) 1970-71 : Reserve Bank's All-India Debt and Investment Survey 1971-72, Volume I.

In 1970-71, less than 10% of all households owned no land (or owned less than 0.005 acres). While there are regional variations in the extent of landlessness, in no state did the percentage of landless households exceed 20. Roughly speaking, landlessness is much less in the Northern and North-Western states of Uttar Pradesh (3%), Punjab (5%), Haryana (7%), Himachal Pradesh (4%), Rajasthan (4%), and Jammu-Kashmir (1%) It is significantly higher in the Southern and Western states, for example Tamil Nadu (17%), Karnataka (15%), Kerala (12%), Gujarat (16%) and Maharashtra (16%).

During the period 1961-62 to 1970-71, there has been a decline in the extent of landlessness in almost all states. The exceptions are Andhra Pradesh where landlessness may have increased substantially and Gujarat and Uttar Pradesh where there may have been a slight increase in landlessness.

Of the landless households, what proportion lease-in land ? This is revealed (though not exactly), in columns (4) and (5) of Table 8. We see that in 1970-71, only about 15 % of landless households operate some land in rural India. A vast majority of landless households do not operate any land. This, however, does not strictly mean that they do not lease-in any land. Given our definition of area operated, some households may be leasing-in land but devoting all of it to non-agricultural uses. We also observe that since 1961-62, the percentage of landless households operating land has decreased from 19% to 15% in 1970-71. In fact, there has been a decline in most states, the exceptions being Assam, Madhya Pradesh and Orissa where there has been a significant increase.

In Table 9 below, we give estimates of the percentage of entirely leased-in holdings, mixed-holdings and entirely owned holdings in 1961-62 and 1970-71. Mixed holdings are holdings which are partly leased-in and partly owned.

Table 9 : Percentage of entirely owned holdings, entirely leased-in holdings and 'mixed' holdings.

States	Percentage of total holdings					
	Entirely owned		Entirely leased-in		Partly owned i.e., 'mixed'	
	1961-62	1970-71	1961-62	1970-71	1961-62	1970-71
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh	81.48	78.34	3.04	0.71	15.48	20.95
Assam	69.28	75.27	11.66	16.90	19.06	7.83
Bihar	74.41	60.22	3.10	0.73	22.49	39.05
Gujarat	85.92	90.68	3.10	0.69	10.98	8.63
Jammu & Kashmir	80.04	85.98	6.78	0.44	13.18	13.78
Kerala	72.14	82.68	14.76	7.39	13.10	9.93
Madhya Pradesh	83.80	78.95	2.12	5.31	14.08	15.74
Tamil Nadu	67.65	n.a.	5.05	n.a.	27.30	n.a.
Maharashtra	84.87	88.07	2.07	0.77	13.06	11.16
Karnataka	68.90	71.19	7.83	5.98	23.27	22.83
Orissa	70.20	67.76	3.92	4.55	25.88	27.69
Punjab	52.31	47.01	12.87	4.78	34.82	48.21
Haryana	-	62.65	-	3.62	-	33.73
Rajasthan	90.24	n.a.	4.17	n.a.	5.59	n.a.
Uttar Pradesh	79.02	n.a.	2.62	n.a.	18.36	n.a.
West Bengal	71.00	65.44	7.07	3.28	21.93	31.28
Himachal Pradesh	-	n.a.	-	n.a.	-	n.a.
All-India	76.48	n.a.	5.14	n.a.	18.38	n.a.

n.a. = not available.

Sources : (1) 1961-62 : NSS 17th.round, Draft Report no. 177.
(2) 1970-71 : S. K. Sanyal in Indian Journal of Agricultural Economics (IJAE) Conference No., July-September, 1976.

The incidence of mixed-holdings far exceeds the incidence of entirely leased-in holdings. Moreover, between 1961-62 and 1970-71, in most states there has been a decline in the share of entirely leased-in holdings and a corresponding increase in the share of mixed-holdings. This is true in less-developed states like West Bengal and Bihar as well as in the more-developed states like Punjab or Andhra Pradesh. Thus there appears to be an increasing tendency towards landowners (in contrast to landless households) leasing-in land. This reinforces the earlier observation that there has been a decline in the number of landless households operating land.

In Table 10 below, we present some more evidence in support of this hypothesis. This table gives the percentage of operational holdings reporting leased-in area and operated by landless tenants in 1960-61 and 1970-71.

Table 10 : Percentage of operational holdings reporting some leased-in area operated by landless tenants, 1960-61 and 1970-71.

States	1960-61 %	1970-71 %
(1)	(2)	(3)
Andhra Pradesh	16.42	3.28
Assam	37.96	13.67
Bihar	12.11	1.84
Gujarat	21.51	7.41
Jammu & Kashmir	33.97	3.09
Kerala	52.98	46.38
Madhya Pradesh	13.09	1.75
Tamil Nadu	15.61	13.58
Maharashtra	13.68	6.44
Karnataka	25.18	20.75
Orissa	13.16	14.11
Punjab	27.00	9.02
Haryana	-	9.69
Rajasthan	42.73	6.94
Uttar Pradesh	12.49	4.89
West Bengal	24.38	9.49
Himachal Pradesh	n.a.	6.68
All-India	21.85	15.03

n.a. = not available.

Again, the share of landless tenants in leased-in holdings has declined considerably in most states.

Thus we may conclude that (i) landlessness had declined in most states and moreover, (ii) there has been a reduction in the percentage of landless households operating land. This suggests the hypothesis that either those landless households leasing-in land previously have now acquired ownership rights on leased-in land (and landlessness has decreased), or they have turned away from cultivation altogether.

So far we have been concerned only with households leasing-in land. We will now discuss the land-ownership pattern of households leasing-out land. Are such households primarily large landowners or do small landowners also lease-out land significantly ?

In Table 11 below, we present the estimates of the number of small landowning households (ownership holding $\leq$ 5 acres) leasing-out some land, as a percentage of total number of households leasing-out land. In Table 12 is given the percentage of total leased-out area accounted for by the small landowners.

Table 11 : Number of households leasing-out some land in the below 5 acres size-group of household ownership holding as percentage of all households leasing-out some land.

States	1953-54 %
(1)	(2)
Uttar Pradesh	59.44
Bihar	70.54
Orissa	68.23
West Bengal	59.78
Assam	45.90
Andhra Pradesh	66.02
Tamil Nadu	67.55
Karnataka	47.94
Travancore-Cochin	80.55
Bombay	40.02
Saurashtra	16.22
Madhya Pradesh	36.17
Madhya Bharat	18.72
Hyderabad	40.66
Vindhya Pradesh	41.19
Rajasthan	32.65
Punjab	41.72
PEPSU	30.00
Jammu & Kashmir	60.98
All-India	n.a.

States	1961-62 %	1970-71 %
(1)	(2)	(3)
Andhra Pradesh	68.14	73.50
Assam	73.67	68.78
Bihar	70.53	76.48
Gujarat	48.58	53.21
Jammu & Kashmir	58.07	71.34
Kerala	77.82	82.64
Madhya Pradesh	26.31	41.32
Tamil Nadu	74.76	74.25
Maharashtra	29.71	46.99
Karnataka	51.90	57.36
Orissa	57.54	80.55
Punjab	37.62	46.72
Haryana	-	54.85
Rajasthan	32.97	29.13
Uttar Pradesh	48.91	75.07
West Bengal	77.12	79.44
Himachal Pradesh	-	65.07
All-India	62.12	68.88

n.a. = not available.

Sources : 1953-54 : NSS 8th round, Report No. 66.
1961-62 : NSS 17th round, Report No. 144.
1970-71 : NSS 26th round, Report No. 215 (Table 3).

Table 12 : Percentage of total leased-out area accounted for by the below 5 acres size-group of household ownership holding.

States	1953-54 %
(1)	(2)
Uttar Pradesh	27.98
Bihar	30.03
Orissa	28.52
West Bengal	22.31
Assam	14.43
Andhra Pradesh	18.87
Tamil Nadu	25.66
Karnataka	12.39
Travancore-Cochin	29.57
Bombay	8.46
Saurashtra	1.46
Madhya Pradesh	8.27
Madhya Bharat	4.67
Hyderabad	7.36
Vindhya Pradesh	12.33
Rajasthan	6.66
Punjab	7.69
PEPSU	8.47
Jammu and Kashmir	24.09
All-India	n.a.

States	1961-62 %	1970-71 %
(1)	(2)	(3)
Andhra Pradesh	22.37	31.14
Assam	56.89	48.95
Bihar	24.13	44.23
Gujarat	14.38	26.16
Jammu & Kashmir	25.40	66.48
Kerala	17.54	65.45
Madhya Pradesh	6.15	16.38
Tamil Nadu	32.30	30.21
Maharashtra	6.36	19.08
Karnataka	11.19	30.34
Orissa	25.06	53.49
Punjab	13.43	16.56
Haryana	-	14.78
Rajasthan	23.71	7.87
Uttar Pradesh	46.70	42.64
West Bengal	51.01	51.64
Himachal Pradesh	-	41.97
All-India	21.65	30.76

n.a. = not available.

Sources: 1953-54 : NSS 8th. round, Report No. 66.
1961-62 : NSS 17th. round, Report No. 144.
1970-71 : NSS 26th. round, Report No. 215 (Table 3).

Almost 69 % of all households leasing-out some land were small landowning households in rural India in 1970-71 and these households account for as much as 31 % of total land which is leased-out. Thus at the all-India level, the phenomenon of small landowners leasing-out land is fairly widespread. Generally speaking, the typical leasing-out household is a small landowner in the Eastern and Southern states. The typical leasing-out household is a relatively larger landowner in the Western, North-Western and Central Indian states. Earlier in Table 6 (and 7) we had seen that while in the Eastern states most of the farms reporting leased-in land were small farms, in the Western and North-Western states big tenant farms accounted for a larger share of total tenanted area. Thus while in the Eastern states most of the farmers renting-in land were small farmers and households leasing-out land were also small landowners, the role of big farmers (landowners) in leasing-in (leasing-out) is more evident in the Western and North Western states.

Between 1953-54 and 1961-62, in all states there appears to have been a substantial increase in the importance of small landowning households leasing-out land. During the period 1961-62 to 1970-71, in most states there has been an increase in the share of small landowners leasing-out land. The exceptions are Assam, Rajasthan and Uttar Pradesh, where there has been a considerable reduction in the share of land leased-out by small landowners.

In Table 13 below, we focus on households leasing-out their land entirely. Is this class of households increasing in number or is it decreasing ? What is the pattern in different states ?

Table 13 : Number of households owning but not operating land as percentage of total number of households, in 1961-62, 1970-71.

States	1961-62 %	1970-71 %
(1)	(2)	(3)
Andhra Pradesh	32.03	28.76
Assam	15.27	8.41
Bihar	15.28	16.99
Gujarat	11.78	20.35
Jammu & Kashmir	5.30	5.38
Kerala	1.88	1.92
Madhya Pradesh	10.69	12.44
Tamil Nadu	18.10	29.11
Maharashtra	12.41	16.77
Karnataka	10.51	17.94
Orissa	26.22	18.06
Punjab	30.51	53.06
Haryana	-	33.65
Rajasthan	9.64	10.19
Uttar Pradesh	18.49	19.75
West Bengal	24.21	24.44
Himachal Pradesh	-	4.13
All-India	17.42	18.06

Sources : 1961-62 : NSS 17th round, Report No. 144.

1970-71 : Reserve Bank's All-India Debt and Investment Survey, 1971-72.

Thus, about 18 % of all households own land and yet do not operate any land in 1970-71. The number of such households is very high in the agriculturally developed states of Punjab and Haryana (more than 50 % in Punjab) and it is significantly large in the Southern states of Andhra Pradesh (29 %), Tamil Nadu (29 %) and Karnataka (18 %). It is much lower in Assam, Jammu and Kashmir, Kerala and Himachal Pradesh. It is significant that a large percentage of households in Punjab, Andhra Pradesh, Tamil Nadu, Haryana and West Bengal are either absentee-landlords or have only non-agricultural land. (Or have leased-out that part of their land which was wholly or partly used for agricultural purposes.)[4/]

Comparing 1961-62 estimates with the 1970-71 estimates, we observe that there has been a substantial increase in the number of households owning but not operating land in states like Gujarat, Maharashtra, Tamil Nadu, Karnataka and Punjab. There was a slight increase in Bihar, Jammu & Kashmir, Kerala, Madhya Pradesh, Rajasthan, Uttar Pradesh and West Bengal. There was, on the other hand, a substantial reduction in Assam and Orissa. Generally speaking, the number of landowning households not operating land has tended to increase in the more agriculturally developed regions (with the exception of Andhra Pradesh) and it has tended to remain stationary or even decline in the less-developed regions.

To probe deeper into the landownership pattern of these absentee-landowners (ignoring those households owning non-agricultural land only, or those households leasing-out that part of land which is put to

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4/ Thus there may be households who have only enough land for putting up their houses. Such households own land but, by our definition, they do not operate any land. Or, a household may own land and use part of it for animal-husbandry etc. and the rest of the owned land may have been leased-out. These households are also included in our estimate of households owning but not operating land.

agricultural uses), we present in Table 14 below the number of very small owners (owning land in the range 0.01 acres - 0.5 acres) not operating any land as percentage of total number of households owning land but not operating, in 1970-71.

Table 14 : Number of very small landowning households (those owning land in the range 0.01 acres- 0.5 acres) not operating any land as percentage of total number of households owning but not operating land, 1970-71.

States	1970-71 %
(1)	(2)
Andhra Pradesh	86.28
Assam	65.64
Bihar	96.59
Gujarat	93.75
Jammu & Kashmir	76.67
Kerala	92.00
Madhya Pradesh	87.36
Tamil Nadu	92.90
Maharashtra	89.35
Karnataka	71.83
Orissa	82.35
Punjab	86.63
Haryana	91.85
Rajasthan	81.82
Uttar Pradesh	82.93
West Bengal	90.11
Himachal Pradesh	57.89
All-India	87.23

Source : Reserve Bank's All-India Debt and Investment Survey, 1971-72.

From Table 14 it is very clear that almost 87 % of all absentee-landlords (or those having non-agricultural land only) belong to the very small landowning households. This is true not only in the more-developed states like Punjab (87 %), Haryana (92 %), and Andhra Pradesh (86 %), but also in the less-developed states like West Bengal (90 %), Bihar (97 %) and Orissa (82 %).

We will now discuss the relative importance of different forms of tenancy arrangements. In Table 15 below, we present estimates of area under sharecropping as percentage of total area under tenancy.

Table 15 : Area under sharecropping as percentage of total area under tenancy.

States	1953-54 %	States	1961-62 %	1970-71 %
(1)	(2)	(1)	(2)	(3)
Uttar Pradesh	44.14	Andhra Pradesh	33.66	35.29
Bihar	58.99	Assam	48.76	41.85
Orissa	44.15	Bihar	71.12	78.28
West Bengal	79.26	Gujarat	37.22	39.39
Assam	18.60	Jammu & Kashmir	55.48	86.85
Andhra Pradesh	39.59	Kerala	14.38	7.33
Tamil Nadu	14.70	Madhya Pradesh	27.19	28.95
Karnataka	21.37	Tamil Nadu	25.14	42.31
Travancore-Cochin	6.29	Maharashtra	20.82	41.46
Bombay	43.07	Karnataka	32.93	39.06
Saurashtra	8.81	Orissa	32.56	42.20
Madhya Pradesh	50.35	Punjab	44.00	44.91
Madhya Bharat	29.47	Haryana	-	53.95
Hyderabad	28.53	Rajasthan	21.56	25.86
Vindhya Pradesh	16.04	Uttar Pradesh	33.75	55.11
Rajasthan	20.91	West Bengal	89.86	92.58
Punjab	55.09	Himachal Pradesh	-	49.90
PEPSU	22.98	All-India	38.22	47.87
Jammu & Kashmir	45.73			
All-India	37.48			

Sources : (1) 1953-54 : NSS 8th round, Report No.59.
(2) 1961-62 : NSS 17th round, Draft Report No.177 and Report No.144.
(3) 1970-71 : NSS 26th round, Report No. 215.

From Table 15, we observe that sharecropping is by far the most dominant tenancy arrangement in rural India. This is true in most of the states also, irrespective of their level of development. Thus while sharecropped area accounts for almost 93 % of total tenanted area in West Bengal, it is also the most prevalent system in Punjab and Haryana. In fact, with the exception of Andhra Pradesh, Kerala, Madhya Pradesh and Rajasthan, in all other states sharecropping accounts for at least 40 % of total tenanted area. The rest is constituted by land under fixed rent, both cash and produce, land rented in return for services, or land rented on other terms.

The prevalence of sharecropping is also suggested in Table 16 below. Almost 64 % of land leased-in under fixed-rent and sharecropping in rural India is devoted to sharecropping. While sharecropping is most dominant in the Eastern states of West Bengal and Bihar, it is of lesser importance in the Southern states. In the Western, Central and North-Western states of Gujarat, Madhya Pradesh, Maharashtra, Punjab, Haryana and Rajasthan sharecropping is relatively more widespread (compared to fixed-rent tenancy) though the difference in magnitude is not as large as in the Eastern states.

Table 16 : Area under sharecropping as percentage of total area under sharecropping and fixed-rent tenancy.

States	1953-54 %	States	1961-62 %	1970-71 %
(1)	(2)	(1)	(2)	(3)
Uttar Pradesh	54.17	Andhra Pradesh	37.70	45.36
Bihar	68.47	Assam	67.05	56.17
Orissa	60.28	Bihar	83.60	90.51
West Bengal	89.57	Gujarat	41.97	54.42
Assam	22.64	Jammu and Kashmir	61.49	90.79
Andhra Pradesh	43.05	Kerala	17.70	12.19
Tamil Nadu	21.53	Madhya Pradesh	48.88	55.10
Karnataka	24.72	Tamil Nadu	28.87	49.11
Travancore-Cochin	9.70	Maharashtra	23.88	51.62
Bombay	48.95	Karnataka	37.52	44.01
Saurashtra	18.13	Orissa	52.71	66.82
Madhya Pradesh	64.03	Punjab	65.39	52.79
Madhya Bharat	37.06	Haryana	-	72.04
Hyderabad	40.11	Rajasthan	26.72	55.98
Vindhya Pradesh	17.91	Uttar Pradesh	62.67	81.48
Rajasthan	23.21	West Bengal	92.53	96.44
Punjab	76.89	Himachal Pradesh	-	70.30
PEPSU	56.25	All-India	49.82	63.89
Jammu & Kashmir	67.31			
All-India	46.88			

Sources : (1) 1953-54 : NSS 8th. round, Report No. 59.
(2) 1961-62 : NSS 17th. round, Draft Report No. 177.
(3) 1970-71 : NSS 26th. round, Report No. 215.

From Tables 15 and 16 it is also evident that the incidence of sharecropping has increased since the fifties. Only 38 % of tenanted area was sharecropped in 1953-54. This rose only very slightly in 1961-62 but increased substantially during 1961-62 to 1970-71. This tendency is evident in almost all states. The only exceptions are Assam, Kerala and Punjab. While in Punjab the importance of sharecropping has been declining continuously since 1953-54, in Assam and Kerala there was a decline during 1961-62 to 1970-71 though over a longer time period 1953-54 to 1970-71 there may well have been a substantial increase in sharecropping.

Finally, are share-tenants smaller farmers compared to fixed-rent tenants ? In Table 17, X_1 and X_2 are respectively the percentages of total share-rented area and total fixed-rented area accounted for by the below 5 acres size-groups of operational holdings. X_3 and X_4 are respectively the percentages of total operational holdings reporting share-rented area and fixed-rented area accounted for by the below 5 acres size-groups of operational holdings. From columns 6 and 7 of Table 17 we observe that in 1970-71, at the all-India level, while 42 % of share-rented area is accounted for by the small farms, (with operational holdings less than 5 acres) only 28 % of fixed-rented land is accounted for by such farms. Thus, small farms are relatively commoner on share-rented land. Similarly, of all holdings reporting share-rented land, 73 % are small holdings while of all holdings reporting fixed-rented land, only 63 % are small holdings (see columns 8 and 9).

Table 17 : Percentage of total share-rented area, total fixed-rented area and total operational holdings reporting share-rented area and total fixed-rented area accounted for by the below 5 acres size-groups for 1961-62 and 1970-71.

States	1961-62				1970-71			
	X_1	X_2	X_3	X_4	X_1	X_2	X_3	X_4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	14.02	30.26	37.60	48.19	29.14	20.69	61.19	55.03
Assam	54.02	59.68	65.33	69.06	75.11	53.86	80.84	76.97
Bihar	61.47	51.59	85.16	76.86	71.57	70.37	88.34	79.02
Gujarat	21.87	5.90	59.13	37.11	7.30	19.71	22.06	53.52
Jammu & Kashmir	36.05	64.44	61.11	75.05	43.78	39.26	64.21	47.43
Kerala	82.19	48.95	94.54	81.22	91.61	62.17	94.86	88.81
Madhya Pradesh	13.22	16.14	32.67	41.81	15.83	18.47	36.37	54.14
Tamil Nadu	49.73	46.98	72.83	70.29	67.19	59.02	87.08	81.71
Maharashtra	2.69	14.98	17.07	47.27	6.47	15.19	27.47	46.35
Karnataka	5.78	9.18	19.14	31.90	9.96	22.14	41.82	45.47
Orissa	53.74	42.22	73.29	60.80	55.07	54.03	75.19	79.45
Punjab	7.21	10.17	23.36	27.65	11.75	7.34	24.11	17.56
Haryana	-	-	-	-	17.33	7.89	25.83	19.35
Rajasthan	9.68	5.03	47.62	32.54	6.43	7.84	23.02	22.64
Uttar Pradesh	48.28	40.79	74.33	68.39	55.33	45.14	76.75	74.59
West Bengal	57.69	68.41	72.08	73.14	71.24	79.39	86.25	90.50
Himachal Pradesh	-	-	-	-	66.84	66.02	81.70	81.79
All-India	32.02	21.80	66.69	55.96	42.31	28.02	73.59	63.12

X_1 = percentage of total share rented area accounted for by the below 5 acres size-group of operational holdings.

X_2 = percentage of total fixed-rented area accounted for by the below 5 acres size-groups of operational holdings.

X_3 = percentage of total operational holdings reporting share-rented area accounted for by the below 5 acres size-group of operational holdings.

X_4 = percentage of total operational holdings reporting fixed-rented area accounted for by the below 5 acres size-group of operational holdings.

Sources : (1) 1961-62 : NSS 17th round, Draft Report No.177 and Report No. 144, Table 10 & 11.
(2) 1970-71 : NSS 26th round, Report No. 215, Table 19.

This picture is not, however, evident in all states. In Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Rajasthan, West Bengal and Orissa, small farms are more common on fixed-rented land. In Andhra-Pradesh, Assam, Bihar, Jammu and Kashmir, Kerala, Punjab, Haryana and Uttar Pradesh on the other hand, small farms are more common on sharecropped land. As our listing reveals, there appears to be no uniforms pattern among agriculturally developed or less-developed states.

In Table 18 below, $(X_1 - X_2)$ is a measure of the difference in the areas accounted for by the small farms on sharecropped land and fixed-rented land. $(X_1 - X_2)$ is positive (negative) when small farms account for a relatively greater percentage of share-rented (fixed-rented) land. An increase in $(X_1 - X_2)$ would suggest a tendency for small farmers to increasingly take land on a share-contract rather than for a fixed-rent. Similarly, $(X_3 - X_4)$ measures the difference in the percentage share of small farms in the total numbers of farms having share-rented land and fixed-rented land. As the all-India figure illustrates, there has been an accentuation in the preference of small farmers for share-tenancy as compared to fixed-rent tenancy. This trend is also evident in the states of Andhra Pradesh, Assam, Jammu & Kashmir, Tamil Nadu, Maharashtra and Punjab to a lesser extent in Uttar Pradesh, West Bengal and Madhya Pradesh. On the other hand, there has been a reverse trend in the other states, notably in Bihar, Gujarat, Karnataka, Orissa, Rajasthan and to a lesser extent, in Kerala. If one contrasts the trends in West Bengal (or Orissa) with the trends in the more-developed states of Punjab, Tamil Nadu or Andhra Pradesh, we observe that while in the former group of states small farmers are increasingly taking to fixed-rent (compared to sharecropping), in the more-developed states small farmers show an increased preference for sharecropping.

Table 18 : Relative importance of small farms on share-rented and fixed-rented land in 1961-62 and 1970-71.

States	$X_1 - X_2$		$X_3 - X_4$	
	1961-62	1970-71	1961-62	1970-71
(1)	(2)	(3)	(4)	(5)
Andhra Pradesh	-6.24	8.45	-10.59	6.16
Assam	-5.66	21.25	-3.73	3.87
Bihar	9.88	1.2	8.30	9.32
Gujarat	15.97	-12.41	22.02	-31.46
Jammu & Kashmir	-28.39	4.52	-13.94	16.78
Kerala	33.24	29.44	13.32	6.05
Madhya Pradesh	-2.92	-2.64	-9.14	-17.74
Tamil Nadu	2.75	8.17	2.54	5.37
Maharashtra	-12.29	-8.72	-30.20	-18.88
Karnataka	-3.40	-12.18	-12.76	-3.65
Orissa	11.52	1.04	12.49	-4.26
Punjab	-2.96	4.41	-4.29	6.55
Haryana	-	9.44	-	6.48
Rajasthan	4.65	-1.41	15.08	0.38
Uttar Pradesh	7.49	10.19	5.94	2.16
West Bengal	-10.72	-8.15	-1.06	-4.25
Himachal Pradesh	-	0.82	-	-0.09
All-India	10.22	14.29	10.73	10.47

X_1, X_2, X_3 and X_4 defined in Table 17.

Sources : (1) 1961-62 : NSS 17th round, Draft Report No. 177 and all-India estimate from Report No. 144. Tables 10 & 11.

(2) 1970-71 : NSS 26th. round, Report No. 215, Table 19.

We may now summarise some of the broad features of tenancy in rural-India, as revealed in the NSS surveys of land-holdings.

(1) A cross-section comparison shows that tenancy is highest in the more-developed region of Punjab and Haryana. There is, thus, no evidence to show that tenancy would not be significant in the more-developed regions. Generally speaking, tenancy is of lesser importance in the Central and Western Indian states.

(2) If one compares the trends in tenancy in the three states of West Bengal, Punjab and Andhra Pradesh, we observe that while in Punjab and Andhra Pradesh there has been a continuous decline since the fifties, in West Bengal the decline during the fifties has been checked in the sixties. In fact, there may even have been a slight increase during the sixties in West Bengal. A tentative hypothesis may be that even though tenancy is still very high in the developed states like Punjab, in these states there is a declining trend while in the less-developed states like West Bengal (or Assam, Orissa, Bihar, Madhya Pradesh), there has been no significant fall in the magnitude of tenancy during the sixties.

(3) Contrasting Punjab and Andhra Pradesh with West Bengal, we observe that while in West Bengal tenants are predominantly small farmers, in Punjab and Andhra Pradesh a significant share of tenanted land is leased-in by the big farmers. While this suggests that tenants are relatively bigger farmers in the more-developed states compared to the less-developed states, Tamil Nadu is an important exception.

(4) However, over time, the share of small farmers in total tenanted area is seen to be increasing in almost all states, irrespective of the level of infrastructural development in these states.

(5) In 1970-71, about 9 % of households in rural-India did not own land. As between the three states of Andhra Pradesh, Punjab and West Bengal, landlessness was least in Punjab and maximum in West Bengal. However, it is not clear whether the extent of landlessness is related to the level of agricultural development. In Gujarat for example, landlessness is as high as 16 % while in a relatively backward state like Bihar it is relatively less, 3 %. Between 1961-62 and 1970-71 there has been a decline in landlessness in almost all states.

(6) It is significant to note that only 15 % of landless households in rural India operate land. Most landless households do not operate any land. These households include (i) landless households not leasing-in land and not cultivating, and (ii) landless households leasing-in land but devoting it entirely to non-agricultural uses. Moreover, the number of such households (those that do not own land and do not operate) has increased since the sixties from approximately 81 % to 85 % in rural India, and more significantly in major states like Andhra Pradesh, Bihar, Maharashtra, Karnataka, Punjab, Rajasthan and West Bengal.

(7) Of all households that lease-out land, almost 69 % are small landowners. Generally speaking, a typical leasing-out household is a small landowner in the less-developed states, for example, Bihar, Orissa and West Bengal. The phenomenon of large landowners leasing-out land is

more common in the developed states like Punjab, Haryana and Gujarat. (Rajasthan and Madhya Pradesh are the exceptions.)

(8) A significant proportion of landowning households do not operate any land. This is true not only in the developed states like Punjab, Haryana, Tamil Nadu and Gujarat but also in the less-developed states like West Bengal, Uttar Pradesh, Bihar and Orissa. However, it is to be noted that not all these households are absentee-landlords. Some of them may be owning land used entirely for non-agricultural purposes. Others may be leasing-out only that part of their land which is used for cultivation. During 1961-62 to 1970-71, the number of landowning households not operating land has tended to increase in the more-developed states, while it has remained stationary or even declined in the less-developed states.

(9) It is significant to note that most of the households owning but not operating land are very small landowning households (owning land less than 0.5 acres). This is true in the developed as well as the less-developed states.

(10) As between different types of tenancy arrangements, sharecropping is the single most important system in almost all states. Sharecropping is most prevalent in the Eastern states and less so in the Southern states. Moreover, the incidence of sharecropping has increased since the fifties in most states, whatever be their level of development. Punjab is the only exception, where the importance of sharecropping has declined.

(11) While at the all-India level small farms seem to be more prevalent on share-rented land compared to fixed-rented land, there is no uniform pattern in the states.

CHAPTER III

A REVIEW OF LITERATURE ON TENANCY

In the introductory chapter we had discussed, very broadly, some of the interesting aspects of tenancy and their implications for policy-making. In this chapter we will discuss and evaluate existing theoretical and empirical literature on tenancy, particularly with reference to India. We will address ourselves to the following issues :

I. Efficiency of alternative forms of tenancy, in particular sharecropping and fixed-rent.

II. Uncertainty and its relevance for choice of tenancy contracts.

III. Factors explaining the coexistence of sharecropping and fixed-rent tenancy.

IV. Markets and their role in shaping tenancy contracts. We will discuss -

(1) non-marketability of some commodities or services,
(2) imperfections in the land, labour, and credit markets including
(3) unequal access to credit and other inputs.

V. The impact of modernisation on tenancy. We will consider -

(a) technical changes, like increased irrigation, mechanisation, and the introduction of inputs like HYV seeds and chemical fertilizers,

(b) institutional changes, like the extension of credit facilities through the creation of banks and rural cooperatives, and

(c) social changes, like the diminishing role of caste in the rural economy.

I. Efficiency and Sharecropping

The early literature on tenancy was primarily concerned with the question of efficiency of different systems of production, particularly sharecropping, fixed-rent tenancy, and self-cultivation. A production plan is efficient if there is no other feasible allocation such that (i) as much of each output is produced using no more of any input and (ii) more of at least one output is produced or less of some input is used. Thus, production is said to be efficient when, given the technology and the resources available to the economy, the maximum output is being produced. In a decentralised production system where cultivators organise their production activities independently of each other, production will be efficient if any alternative pattern of use of available resources, including any reallocation of resources between cultivators, will not lead to an increase in output. Production efficiency is, therefore, an important consideration in evaluating alternative production arrangements. Is production efficient in an economy where owner-cultivation and tenancy coexist ? Would a reallocation of land from tenants to owner-operators increase total agricultural output ?

Under competitive conditions, a necessary condition for efficiency in production is the equality of the marginal-value-product of every input across different farms[1/]. For profit maximising farmers facing the same input and output prices, this condition is satisfied with each farmer equating the marginal-value-product of the input to its price. Under competitive conditions therefore, inefficiency in production is indicated

1/ This is a necessary condition at an interior efficient point only and not at the corner. We will concentrate on the interior solution.

by the divergence of the marginal-value-product of an input from its price.

Since the time of Marshall, a number of writers have argued that while owner-cultivation is efficient, not all forms of tenancy are. In particular, it has been argued that sharecropping is inefficient, even though fixed-rent tenancy is efficient. The argument consists in showing that sharecropping results in a less intensive application of variable non-land inputs by the tenant-cultivator, as compared to cultivation under fixed-rent or owner-cultivation. Since the latter, under competitive conditions, leads to an efficient allocation of resources, sharecropping must lead to an inefficient allocation of resources. Consider for simplicity the case of only one input other than land, labour. Under sharecropping, only a part of the marginal-product of labour accrues to the tenant-cultivator and the rest goes to the landowner as rent. A profit maximising tenant will then apply labour only to the point where his share of the marginal-product of labour equals the opportunity cost of labour. Clearly, labour so applied is less than what would be applied had he (the tenant) received the entire marginal-product of his labour.

Suppose the landlord's share of output is r. The tenant's income from sharecropping is $(1-r)F(h,l) - wl$. Here $F(.,.)$ is the production function, h is the amount of land leased-in by the tenant and l is the input of labour applied by the tenant on rented land. 'w' is the opportunity cost of the tenant's labour and it equals the wage-rate if the labour-market is perfect. The tenant chooses 'l' to maximise his income. This requires $(1-r)F_2(h,l) - w = 0$. That is, the marginal-product of labour,

$F_2(h, l)$, in equilibrium, exceeds its opportunity-cost, w. As we had mentioned, a necessary condition for production efficiency was the equality of the marginal-value-product of an input to its price. Therefore, under sharecropping, production is inefficient and a reallocation of resources can increase total output. We also notice that a sharecropper will apply less of labour than a tenant-cultivator leasing the same land under fixed-rent contract. Such a tenant will apply labour to the point where the marginal-product of labour will equal its opportunity-cost. Thus resource allocation under sharecropping is inefficient and a sharecropper applies less of variable non-land inputs on land compared to a fixed-rent tenant or an owner-operator. This is the inefficiency argument.

Johnson (1950) suggested three possible means by which a landowner could prevent inefficiency on share-rented land. These were :

(1) The landowner could specify in detail, as part of the share-contract, what the tenant must do on rented land. By specifying the levels of inputs that should be applied on sharecropped land, the tenant may not have the freedom to apply inputs less intensively.

(2) The landowner may lease-out land only for short durations. If production is not efficient on rented land, the share-contract may be discontinued in place of a 'better' contract. More precisely, if there is inefficiency, there exists a fixed-rent that will assure the landlord as much income as the given share under sharecropping and more income to the tenant on sharecropped land. Equally, there exists a self-cultivation arrangement which will assure the tenant as much income as under sharecropping, but more income to the landlord on the land sharecropped.

(5) The landlord may offer to share in the costs of inputs and thereby induce tenants to apply inputs more intensively.

Taking the cue from Johnson, Cheung (1969) challenged the inefficiency argument. He argued that with private property rights in land, resource-allocation under sharecropping would be no different from that under owner-cultivation or fixed-rent tenancy. The fact that the inefficiency argument does not hold within his framework is, however, not surprising, given the specific assumption that he makes : it is assumed that the landlord himself determines how much labour the tenant must apply on rented land. In his model, not only is the landlord free to set the cultivation intensity on the tenant's land but he also fixes the value of the rental-share, provided of course that the tenant's income from sharecropping, under competitive conditions, does not fall below his alternative income as a wage-labourer. Let 'H' be the total land owned by the landlord and suppose he decides to divide it into n equal parts. The landlord maximises his income from rented land, $nrF(H/n, L)$, with respect to n, r, and L subject to the constraint that the tenant's income from sharecropping, $(1 - r)F(H/n, L)$, equals his income from wage-employment, wL. For such a landlord,

(i) $F_2(H/n, L) = w$

and

(ii) $rF(H/n, L) - (H/n)F_1(H/n, L) = 0$,

Hence, the wage-rate equals the marginal-product of labour and the rent, $nrF(H/n, L)/H$, equals the marginal-product of land. Thus, there is no inefficiency under sharecropping.

We see, therefore, that while the Marshallian analysis leads to inefficient production under sharecropping, in Cheung's framework it does not. Since both the arguments are logically correct, it follows that the answers depend crucially on the assumptions made regarding the nature of the share-contract. In Cheung's formulation, the landlord is all powerful. He not only fixes the rental-share but he also decides on how much labour the tenant must apply on rented land. It is also implicitly assumed that there are no problems of enforceability, so that the tenant is unable to ignore any of the provisions of the contract even if it were in his interest to do so. This is particularly important in respect of the use of inputs by the tenant. In contrast, the Marshallian analysis permits the labour utilisation decision to be made by the tenant. At this point we may mention one important difficulty with the Marshallian analysis. Suppose the tenant can also decide how much land to lease-in, just as he decides on how much labour to apply on leased-in land. Under competitive conditions, the tenant chooses h to maximise his income $(1 - r)F(h, 1) - wl$. This requires $(1 - r)F_1(h, 1) = 0$, so that as long as the marginal-product of land is positive, there will be an excess demand for land at all rental shares[2/]. Equally, in the absence of other considerations, if both self-cultivation and sharecropping are feasible alternatives at given r and w, it can be shown that the landlord will prefer self-cultivation and sharecropping will not be observed[3/].

There have been attempts to verify, empirically, whether sharecropping is efficient or not. We will discuss some of the studies which

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2/ See Newbery (1974).

3/ See Bell and Braverman (1978).

use data from Indian agriculture. Here too, there is no firm conclusion which can be generalised for the country as a whole. In some parts of the country sharecroppers use relatively less inputs compared to owner-operators; in other regions this is not so.

Vyas (1970), on the basis of survey data for four villages in Gujarat, compares the performance of owner-operated farms and tenanted farms in the same size-group. He finds that, ceteris-paribus, tenant-operated farms are likely to be more efficient. Family labour, bullock labour and implements are used more intensively on tenanted land. Among purchased inputs, modern inputs like tractors and fertilizers figure as prominently on tenant holdings as on owner-operated holdings.

Aparajita Chakrabarty and A. Rudra (1973) compared the performance of tenanted and owner-operated land and came to the conclusion that ".....there were not very many marked differences in the input-output patterns of owner-operated and tenant-operated farms". For their analysis they used Farm Management data for some districts of West Bengal (1955-56), Andhra Pradesh (1957-58, 1958-59 and 1959-60), and Punjab (1955-56, 1970). The individual farms were first grouped into three size-classes : 0-5 acres, 5-10 acres, and 10 acres and above. This was done in order to reduce any 'farm-size' bias which could vitiate the comparison, in case there was any close association between size of farm and tenure-status.

For instance, if tenant farms were larger than owner-operated farms, then the observation that the use of labour input is less on tenant-operated farms could be consistent with two alternative hypotheses :

(1) that sharecropping leads to a less intensive application of inputs and is therefore inefficient, or

(2) that small farmers cultivate land more intensively.

Without eliminating the 'farm-size' effect it would not be possible to remove this indeterminacy.

They also classified all the sample cultivators into two groups called 'owners' and 'tenants' and defined as :

'Owners' : Cultivators who are owners of at least 50 % of land cultivated.

'Tenants' : Cultivators who cultivate land 50 % or more of which is leased-in.

For these two types of farmers a large number of variables were compared. Among these variables were :

(A) Variables relating to costs and benefits like (i) yield/acre and (ii) ratio of imputed costs to total costs.

(B) Variables relating to material-inputs like value of manure and fertilizers.

(C) Variables relating to land and capital, for example (i) value of bullock labour days/acre, (ii) proportion of net irrigated area to net sown area.

(D) Variables relating to labour-input, for example (i) input of human labour in man-days per acre, (ii) ratio of hired-labour to family labour.

They found that the proposition — that tenant farms do not perform as well as owner-operated farms — might be valid when the comparison is confined to small-sized farms. It is not valid when medium or big farms are considered.

As one of the authors has himself pointed out in a subsequent paper [27], the classification of cultivators into 'owners' and 'tenants' is extremely crude so that if a farmer leases-in 51 % of his operated area he becomes a 'tenant' while if he leases-in 49 % he is classified as 'owner'. This naturally reduces the significance of the results. As an illustration, consider two farmers one of whom is an'owner'and the other a 'tenant'. Suppose each of them cultivates two plots, one of which is leased-in and the other owned, and the dimensions are given in the table below :

Cultivator Type	Plot 1 Owned	Plot 2 Leased	Plot 1 + Plot 2 Operational-holding
(1)	(2)	(3)	(4)
'Owner'	60 * (6)	40 (2)	100 (4.4)
'Tenant'	40 (8)	60 (2)	100 (4.4)

* The figures in brackets refer to the yields per acre on owned and leased-in plots as well as the yield per acre on the entire operational holding, for both the 'owner' and 'tenant'.

It is clear from this example that even if the yield per acre is observed to be identical on the owner's and tenant's holding, (each being equal to 4.4) the yield/acre on owned land is thrice the yield/acre on leased-in land on the 'owner' farm, and the difference is even more pronounced on the 'tenant' farm. It also follows that with this classification into two groups of 'owners' and 'tenants', the results would be more accurate if the incidence of mixed-holdings were small. The more positive results in the 0-5 acres size-group could be because the incidence of mixed holdings is smaller in this size-group. We may also note

what even if the inefficiency hypothesis is valid only in the 0-5 acres size-group, this is by no means insignificant. At least in West Bengal, the below 5 acres size-group of holdings accounted for as much as 46 % of total tenanted area in 1953-54.

In a subsequent paper, instead of choosing a gross 'owner'-'tenant' classification, Dwivedi and Rudra (1973) define a continuous variable

x = (Land leased-in for cultivation)/(Net cultivated area).

Using data relating to the Hooghly district of West Bengal (1970-71), they try to relate x to the other variables like output/acre, labour-input/acre and material-inputs/acre.

The simple correlation coefficients between x and these variables was not found to be significant, but since the size-effect is not isolated, there is ambiguity in interpretation. In another test, they compare variable values for two values of x: $x = 0$, which represents the class of pure owner-operators, and $0.8 < x \leq 1.0$, which is the class of cultivators leasing-in more than 80 % of net cultivated area. The test was applied to two size-groups separately, those less than 2.5 acres and those greater than 2.5 acres. But how far such a crude division reduces the 'farm-size' effect is open to doubt. They find no difference between the input and output levels per acre for the two classes of farmers. In a third test, the authors overcome a limitation of the earlier tests. In the exercises so far, no account is taken of the fact that in input comparisons between tenants and owner-operators, the observed differences may arise from considerations other than tenancy. For example, in the

context of imperfect markets, access to inputs and/or aversion to risk may be different for owner-operators and tenants. Richer owner-operators may have better access to inputs and they may be less risk-averse than poorer tenants. In so far as these differences influence input-use, it would be desirable to control such factors that do not impinge equally on all individuals. One way in which this can be done is to compare input-use and output on the rented and owned parts of the same owner-tenant. This is what is done by Dwivedi and Rudra in their third test. They compare the use of material-inputs and output per acre on owned and leased-in land of the same farmer and find no significant differences.

Bliss and Stern (1980), in a study of wheat plots in the Palanpur village of West Uttar Pradesh, also come to the conclusion that the tenurial-status does not affect output per acre of wheat in any uniform way. Though the average output on sharecropped plots was lower than the average on owner-operated farms, the difference was not significant at the 5 % level. Similarly, when they look at the analysis of covariance between output and tenancy after taking into account direct agricultural inputs, the zero-one variable for tenancy turns out to be thoroughly insignificant. This finding, however, is not conclusive evidence against the inefficiency hypothesis in view of their observation that there exists a significant negative correlation between the tenancy variable and size of cultivated holding. Thus the insignificant coefficient of correlation between the tenancy variable and output/acre could be the result of two influences, each significant by itself, but acting in opposite directions. One, the farm-size effect, which leads to a greater

output/acre on smaller-sized tenanted holdings. And secondly, the tenure-effect, which leads to a smaller output/acre on tenanted holdings. In the absence of additional information, an insignificant coefficient of correlation between tenancy and output/acre is insufficient to invalidate the inefficiency hypothesis.

Clive Bell (1976a) has also attempted to test the inefficiency hypothesis. Using survey data from the Purnea district of Bihar, Bell compares the input and output patterns on owned and rented land, for the same owner-tenant. The farmer's access to inputs, traded or otherwise, and his aversion to risks are common features in his decision concerning allocation of resources on his owned and leased-in plots and therefore, in such a comparison, their influence is eliminated. While this test eliminates the effect of imperfections and other individual-specific differences, it does not eliminate the 'size' effect, in case there is a correlation between the size of farm and the tenure-status of the plots. For this problem Bell has proposed another test. If the Marshallian hypothesis is valid and "if pure-tenants have smaller holdings than owner-tenants and owner-operators, comparisons of input-intensities and yields across types of farmers by the tenure-status of the plots they cultivate will show differences smaller than (or even opposite to) those observed within owner-tenant holdings". This argument is not quite clear, as the following example will illustrate. Suppose the size of the pure tenant holding (B) is 10 acres and the size of the owner-tenant holding (RB) is 15 acres, so that the pure-tenant holding is smaller than the owner-tenant holding. Suppose further that the area of the owned plot on the

owner-tenant holding is 6 acres while the area of the leased-in plot is 9 acres. If the Marshallian inefficiency holds and farmers apply less inputs on leased-in land, and if there is also a 'farm-size' effect, would the results be as predicted by Bell ? Not necessarily. Comparing input-use on the pure-tenant holding (10 acres) and the owned part of the owner-tenant holding (6 acres), both the size and tenancy effects reinforce each other. By both counts therefore, we may expect input/acre to be more on the owned part of the owner-tenant holding. But this is true also in comparisons between the owned and leased-in parts of the owner-tenant holding (areas being 6 acres and 9 acres respectively).

Bell's analysis of data suggests that there is a significant difference in the input-use and output-yields on owned and rented land, for the same owner-tenant. Owner-tenants appear to divert more inputs/acre on owned land as compared to rented land. For the other hypothesis which involves comparison between pure-tenant farms and the owned parts of the owner-tenant farms, as well as that between rented and owned parts of the owner-tenant farms, the conclusion is that the difference in yields, though not in input intensities, is less pronounced in the former case than in the latter. Thus Bell concludes that though there is a 'farm-size' effect on resource-allocation, the tenancy effect is stronger.(See table below.)

Classification of tenant	Cropping Intensity	Intermediates Rs./acre	Hired labour Rs./acre	Yield Rs./acre
(1)	(2)	(3)	(4)	(5)
Pure-tenant :				
Group B	1.44	32.5	33.8	442.8
Owner-tenant:				
Group RB				
B	1.40	33.0	35.6	378.3
R	1.76	64.3	46.7	561.9

We saw earlier that when the landlord can specify and enforce input-intensities on rented land, sharecropping leads to the same allocation of resources as under owner-cultivation or fixed-rent tenancy. But, as we suggested, there is another way in which resource-allocation under cropsharing can be made to conform to that under fixed-rent tenancy and/or owner-cultivation. Suppose the landlord shares in the costs of inputs and let his share of input-costs be β. The tenant chooses the level of input i, x_i, to maximise his net income

$$(1-r)F(h, x_1, x_2, \ldots, x_n) - (1-\beta)\sum_{i=1}^{n} p_i x_i,$$

where p_i is the price of the ith input (i = 1, 2, ..., n). The tenant's choice of input levels is given by the equation

$$(1-r)F_i = (1-\beta)p_i \text{ ; or, when } r = \beta, \; F_i = p_i.$$

That is, when the landlord shares in the costs to the same extent as he does in output, the sharecropper applies input till its marginal-value-product equals its price and production is efficient. Resource allocation under sharecropping is identical to that under fixed-rent or owner-cultivation.

We may note, however, that this equivalence in the allocations under sharecropping (with costsharing) and under fixed-rent tenancy applies to the case when all input-costs are being shared in the same proportion as output. If, however, some input-costs are shared in the same proportion as output while other input-costs are not, then, in general, it is not true that there will be no misallocation in the use of the cost-shared inputs[4].

4/ For this to follow, the production function must be separable in these inputs.

How important is cost-sharing in Indian agriculture ? What are the input-costs that are commonly shared ? What is the relationship between the share of costs and the share in output ? As far as we are aware, no all-India, or even State-level estimates are available on the extent and nature of cost-sharing arrangements. However, a large number of empirical studies by independent scholars, for different parts of the country, are available. These suggest that cost-sharing is not at all an unusual phenomenon and that its importance is increasing with modernisation and commercialisation of agriculture. Moreover, though cost-sharing arrangements in different parts of the country (and sometimes in the same village) may differ in some respects, there are certain striking similarities too.

One of the common features in most cost-sharing arrangements is the absence of cost-sharing for human-labour-input and, very often, for bullock-labour-input too. These costs are generally borne completely by the tenant-cultivator. On the other hand, land-taxes and irrigation charges are paid by the landowner alone. Costs of inputs like seeds, manure and fertilizers are frequently shared in varying proportions. Thus in Gujarat, Vyas (1970) finds that tenants supply family-labour, bullocks, implements, seeds and seedlings whereas other input-expenses are shared equally. Rudra (1975) has reported in detail cost-sharing arrangements in West Bengal. In his survey, in a large number of cost-sharing arrangements the cost-shares and the cropshares were identical. Quoting, ".... one-fourth of cases observed are of seeds, fertilizers, and manure costs being shared between owner and tenant in the same proportion as crop-shares, most of which happen to be 50:50. Proportional cost-sharing of some (but not all)

of the three inputs occurs in another 32 % of cases observed". Interesting, in about 8 % of the cases, all costs are borne by the landlord with his share of output varying from two-thirds to one-fourths share of paddy in different cases.

If the pattern of cost-sharing in West Bengal is not very different from that in other parts of the country, we may link these observations to our a-priori arguments. In situations where human labour and draft animal labour are the only inputs in production, (this would be the case in the less developed regions) we may expect less than optimal utilization of these inputs by the sharecroppers, since these input-costs are not usually shared. However, in the more likely cases where inputs other than labour are used, for example seeds, fertilizers, and manure etc., there is a great diversity in the pattern of input sharing. Costs of some inputs are shared in proportion to output while for other inputs the landlord's share of input-costs exceeds (falls short of) his share of output. Given this diversity in cost-sharing arrangements, it is difficult to say anything definite about the efficiency of sharecropping. For example, when some input costs are shared in proportion to output, one can say that, for given levels of non-cost-shared inputs, reallocation of cost-shared inputs would increase output. However, it is not clear if output would not change if some of the non-cost-shared inputs are also included in cost-sharing.

We may recall a third possible way in which the landowner can ensure efficiency in input use on sharecropped land. By offering tenancy contracts for short durations, the landowner can continuously assess the

tenant's performance. If the tenant is incapable of producing enough output to ensure him a level of rent comparable to what he could obtain under a fixed-rent arrangement, (with the rent equal to that prevailing in the region on similar quality land) the landowner would discontinue the contract and lease-out the land to another tenant. In the long-run, it may be expected that such a procedure will ensure efficient production by the sharecropper. Newbery (1975a) has formally demonstrated that this will indeed ensure production efficiency on all farms, whatever the form of contract under which they are leased-in.

How prevalent is this practice ? What is the average duration of tenancy contracts ? How frequently do landowners change tenants ? Here again, evidence is fragmentary. Rudra (1975) reports that in West Bengal tenancy contracts are predominantly yearly contracts. About 75 % of tenancy contracts were annual contracts and there were some cases which were of durations longer than one year. (Two, three, or even four years.) However, most of the contracts were oral, and to that extent these numbers reflect only a tacit agreement regarding the approximate duration of the contract. It was also observed that of the 72 cases investigated, there were only 6 cases where the tenant had been with the same owner only for the last one year. In as many as 40 cases, the tenant had been with the same owner for 5 or more years. Thus, even though tenants may have been evicted for purposes of self-cultivation, evicting one tenant and giving that land to another tenant is not a common practice in West Bengal. This is consistent with the hypothesis that in West Bengal share-croppers are not inefficient since, had they been so, eviction of tenants and shorter

duration of tenancy contracts would have been more common[5/]. But it may also be true that since in West Bengal fixed-rent tenancy is insignificant, the dissatisfied landowner who is unwilling to cultivate land himself has no option but to change from one share-cropper to another. This he may not do if the transaction costs involved in frequent changes outweighs the expected gain from a change of tenant.

Bharadwaj and Das (1975), in a study of some villages in Orissa, report an increasing tendency towards shorter duration of lease contracts. However, this trend is not just confined to share contracts. It is also observed in fixed-rent contracts. This suggests that eviction and shortening of lease durations is not primarily aimed at ensuring efficiency of share-croppers. Bharadwaj and Das suggest that "..... by making the lease contract short enough and/or insecure, the landlord can raise the fixed rent to capitalise on the productivity gains for each new tenant or for the old tenant under threat of eviction". They also notice that lease durations are more and more crop and/or season based. For example, they point out that "..... with the shortened production cycle of the high-yielding-paddy, there appears to be an influx of tenants who immigrate from the neighbouring unirrigated regions and lease-in land only for summer-crop period".

We will summarise our discussion of the inefficiency question :

(1) We have argued that <u>if</u> the share tenant is free to choose his labour input (or other non-land inputs) on sharecropped land and if there is no cost-sharing and moreover, if tenants are not operating under a continuous

5/ Of course, it may be argued that it is not necessary for short duration contracts or frequent change of tenants to be actually observed. The threat of such a possibility may be enough. While this is certainly true, the threat is more plausible when it is occasionally exercised.

threat of eviction, then share-cropping results in a less intensive application of labour (or other inputs) on land, compared to fixed-rent tenancy or owner-cultivation.

If the share tenant is free to choose the amount of land he will lease-in, then there will be an excess demand for land at all rental shares as long as the marginal product of land is positive. Equally, at given rental share and wage rate, a landowner will always prefer to cultivate land with hired labour rather than lease out land under crop-sharing.

(2) The inefficiency of sharecropping may, however, be eliminated or reduced in one of the following ways.

(a) If the landowner is sufficiently powerful, he may be able to specify and enforce an efficient pattern of resource use on the tenant's land. Empirically, though it is sometimes observed that the landowner does specify details of input-use on tenanted land, this is by no means the most common situation. It is more common to observe tenants taking all production decisions on rented land[6/]. Quite apart from the specification of input-use by the landowner, there is the difficult problem of enforceability. By regular monitoring of cultivation on rented land the landowner may be able to supervise the agreement. Threat of eviction could be an indirect way of enforcing the provisions of the contract. This is the second possible way of ensuring efficient production.

6/ See Bliss and Stern (1980) and Cheung (1969), and Rudra (1975) and Bharadwaj and Das (1975) for contrasting evidence on decision-making on rented land.

(b) The landlord may lease-out land for short durations and use the implicit threat of non-renewal of contract to ensure efficient cultivation practises by the tenant. This was stressed by Johnson (1950) and rigorously established by Newbery (1975a). Empirically, there is no general tendency towards shorter duration contracts. Data available is too scanty to make any general comments. Where such a tendency has been reported to exist, it is not specific to sharecropping but extends also to fixed-rent contracts. Duration of tenancy contracts are often crop and/or season based. As such, shorter duration contracts may not be wholly due to a preoccupation with inefficiency but may be related to the introduction of newer varieties of seeds and technology.

(c) If the landowner shares in the costs of inputs to the extent he does in output, allocation of resources will be identical under sharecropping, fixed-rent tenancy and owner-cultivation. In the Indian context, labour costs are usually not shared. To that extent cost-sharing does not prevent under-utilisation of labour by sharecroppers.

(3) Empirical evidence on sharecropping and inefficiency is conflicting. For example, input-use and output patterns do not differ significantly on tenanted and owner-operated land in villages of West Bengal, West Uttar Pradesh, and Gujarat, while owner-tenants are found to use relatively more inputs on their owned land compared to their leased-in land in the Purnea district of Bihar[7/].

7/ See Bell (1976), Bliss-Stern (1980), Vyas (1970) and Aparajita Chakrabarty and Rudra (1973).

II. Uncertainty and Sharecropping

If sharecropping is inefficient and in all other relevant aspects provides no advantages to the tenant and/or landowner vis-a-vis fixed-rent tenancy, then clearly sharecropping is an inferior alternative to fixed-rent tenancy. On the other hand, if there are features in a share contract that make it more worthwhile for the tenant and/or landowner, then a ranking of alternative tenancy-contracts becomes more difficult. As we saw, the evidence on the inefficiency of share-cropping is not conclusive. But even if it were so, there is at least one feature of sharecropping that could make it relatively more advantageous for the tenant, compared to fixed-rent tenancy. For the landowner too, this aspect of sharecropping provides a distinct advantage over cultivation with hired labour. We are referring to the risk-sharing property of sharecropping.

Traditional agriculture is characterised by a high degree of uncertainty. This uncertainty arises from various sources. Most important among these, however, is the uncertainty in production arising out of the vagaries of weather. Also important is the uncertainty regarding availability of essential inputs like labour, at the right time and in adequate amounts. There is also the uncertainty arising from market conditions, which is reflected in the variability of prices for purchase of inputs and sale of output. These uncertainties affect the landowner and tenant differently, depending on the tenancy arrangement. Consider some possible implications under different tenancy systems. Cultivation of land with family labour carries with it the risks associated with production, like the variability of output and fluctuations in input and product prices. Cultivation with hired labour carries the additional risk of hiring

labour, like the non-availability of labour in the busy season. By renting-out land on a fixed-cash rent basis, the landowner can avoid the risks of production arising from either variability of output or fluctuation in product prices. Under fixed-kind rent he can avoid only the risks due to variability of output. However, in both cases, (fixed-cash rent or fixed-kind rent) the landowner faces the risk of default of rent by the tenant[8/]. As we have already observed, in a share contract the landlord and tenant share the risk in production in proportion to their output shares. From the tenant's point of view, while he must bear all (no) risk in production under a fixed-rent contract (wage contract), he can share risk with his landlord in a cropsharing contract. Similarly, while a landlord bears all (no) risk in production in cultivation with hired labour (under fixed-rent), in a share contract risks can be shared with the tenant. Therefore, if the tenant wishes to lease-in land, sharecropping provides one clear advantage over fixed-rent tenancy to the tenant. Similarly, sharecropping may be preferred to cultivation with hired-labour by the landowner.

Granted that sharecropping allows risks to be shared between the landowner and the tenant-cultivator, is it the only possible means of risk-sharing ? Or, is sharecropping the 'best' way of sharing risks ? If there does exist some other feasible arrangement which allows risks to be shared, and if this arrangement is in some sense 'better' than sharecropping, then the risk-sharing argument in favour of sharecropping is considerably weakened. One may then have to look elsewhere for a justification for the existence of

8/ That this may be important is indicated by the fact that owner-tenants were preferred to pure tenants and the latter to landless tenants by the landowners. The reason given was ".... security of obtaining rent". (See Bharadwaj and Das (1975).

sharecropping. There has been some discussion on this in the recent literature.

It is argued that if there was in existence a complete set of markets of the Arrow-Debreu variety, (that is, if markets existed for all 'contingent' commodities) then a suitable mix of fixed-rent and wage contracts would ensure efficiency in production. Under these conditions, therefore, the role of sharecropping as a risk-spreading institution would be superfluous. But clearly, such conditions do not exist in any real economy. However, as Bliss and Stern (1980) have explained, what is really needed for production efficiency under uncertainty is a system of crop-insurance. In such a scheme, the claims and liabilities would be related to the state-of-the-world that occurs and not to the actual output produced by the cultivator. If such a crop-insurance scheme were feasible, it would be the 'first-best' way of achieving risk-sharing. But there is a serious difficulty in establishing such a system of crop-insurance. The difficulty is that in case of a shortfall in output it is not easy to determine to what extent the shortfall is a result of unfavourable natural conditions and to what extent it is due to poor cultivation by the farmer. If, therefore, a low level of output is taken to mean that the tenant suffered from adverse natural conditions, crop-insurance provides a disincentive to the cultivator similar to what existed with sharecropping. For this reason, even though crop-insurance is, in principle, the 'best' way of risk-sharing, it may not be a feasible scheme[9/]. Indeed, crop-insurance on a large scale is hardly in existence anywhere.

9/ This problem does not arise, however, if instead of an individual-based scheme of crop-insurance, we establish an agro-climatically-homogeneous area-based scheme, assuming of course that there is no collusion among farmers in the area.

But there is another alternative means of risk-sharing. Suppose the landowner can cultivate land with hired-labour and he can also lease-out his land under fixed-rent contract. Similarly, suppose the tenant can also 'mix' wage and fixed-rent tenancy contracts, so that he can work as a wage-labourer and also lease-in land under a fixed-rent contract. Then, by entering into a fixed-rent and a wage contract simultaneously, the landowner and tenant can achieve the same division of risk as they would achieve if they had entered into a sharecropping contract instead. That is, a suitable combination of wage-labour contract and fixed-rent contract will produce a distribution of returns which is identical to that which would obtain under sharecropping. Suppose output, F, is a function of land, h, and labour, l. Uncertainty in production is represented by specifying output as a function of an uncertain parameter θ also, so that output, $F(h, l, \theta)$, is a random variable. Suppose F exhibits constant-returns-to-scale in h and l. Assume the tenant leases-in h_o units of land and applies l_o units of labour to it. Let r be the rental-share of the landlord. Then the tenant's income from sharecropped land is $(1-r)F(h_o, l_o, \theta)$. Can this distribution be achieved by the tenant if, instead of working as a sharecropper, he works partly as a wage-labourer and partly on land rented on a fixed-rent contract ? Suppose the tenant leases-in $(1-r)h_o$ units of land on a fixed-rent R and applies $(1-r)l_o$ units of his labour to this land. Suppose further that he hires-out the rest of his labour, rl_o, for wage-employment at a wage-rate, w. Then his total income from fixed-rent tenancy and wage-employment is

$$F((1-r)h_o, (1-r)l_o, \theta) + \left[rl_o \cdot w - R(1-r)h_o\right].$$

With constant-returns-to-scale in land and labour, this becomes

$$(1-r)F(h_o, l_o, \theta) + \left[rl_o w - (1-r)h_o R\right].$$

If $\left[rwl_o - (1-r)Rh_o\right]$ is zero, the tenant's income under a mix of wage and fixed-rent contracts is identical with that under sharecropping. This requires $(Rh_o)/(wl_o) = r/(1-r)$, and it has been shown that under certain assumptions this equation would indeed be satisfied. Thus, when a tenant can mix wage and fixed-rent contracts costlessly, sharecropping provides him no additional risk-sharing advantages. It can be similarly shown that the same will be true for the landowner[10]. Thus, risk-sharing by itself is not sufficient to explain the existence of sharecropping, when wage and fixed-rent tenancy contracts can be 'mixed' costlessly. But there may be other factors at work which have not been accounted for in this argument. Leasing-out land under cropsharing may be easier and more convenient than entering into two contracts simultaneously. This is particularly true when there is uncertainty in the labour market. The seasonal nature of production in agriculture leads to seasonal variations in the demand and availability of labour. During the 'slack' pre-harvesting season there is generally an excess-supply of labour and employment opportunities are uncertain. On the other hand, during the 'busy' harvesting season, there is a shortage of labour and the wage-rate is uncertain in this season. Under these conditions sharecropping may be the optimal risk-sharing arrangement from the point of view of both the tenant and the landowner. Newbery (1977) has established that if the labour-market

10/ See Newbery and Stiglitz (1978).

is risky then sharecropping offers additional risk-sharing advantages. In fact, as long as fixed-rent and risky wage-contracts are available, and if production risk is multiplicative, it can be shown that production will be inefficient. However, if sharecropping contracts are also permissible, then the economy may achieve production-efficiency. The same result holds when wages are certain but employment is not. However, Newbery's results depend crucially on his assumption that the landlord is able to specify and costlessly enforce the labour-input on the tenant's farm.

III. Coexistence of Sharecropping and Fixed-rent Tenancy

We have seen that when production is risky, sharecropping may be the best feasible arrangement for risk-sharing, particularly when employment or wage-rates are uncertain in the labour-market. Under these conditions the risk-spreading property of sharecropping provides a strong advantage, and an important reason, for its continued existence along with fixed-rent tenancy and self-cultivation. There may be other reasons too.

Stiglitz (1974) has emphasised the incentive aspect of sharecropping. He views sharecropping as a labour-hiring arrangement rather than a land-renting arrangement, like fixed-rent tenancy. Consider a landlord who wishes to cultivate his land. If he uses hired wage-labour, then, under a fixed wage-contract, the labourers get a fixed wage irrespective of the amount of effort they apply. When production is uncertain there will be an incentive for such workers to shirk work, since under these conditions, it will be difficult for the landowner to determine to what extent a shortfall in output is caused by lack of effort and how much of it is due to unfavourable natural conditions. If, on the other

hand, cultivation is left to sharecroppers, they have an incentive to work harder because the payment to them is an increasing function of the output produced.

While this incentive aspect of sharecropping may explain a landowners's preference for sharecropping vis-a-vis cultivation with hired labour, it does not explain the choice between fixed-rent and sharecropping contracts. More importantly, Stiglitz, while emphasising the incentive aspect of sharecropping, takes for granted that there are no differences between a sharecropper and a wage-labourer. To him, a sharecropper is a wage-labourer whose wage is specified as a proportion of output produced. While it may sometimes be true that there is no essential difference between hiring labourers on a wage (specified as a proportion of output) and sharecropping, this is certainly not true in general. Often, cultivation decisions — how much land to plough, what crops to sow, how much input to use and when, etc., — are taken by the sharecroppers. For example, Rudra (1975) reported that in 50 % of the cases considered, the sharetenants reported taking these decisions all by themselves. In another 28 % of the cases, these decisions were taken jointly by the tenant and landlord. In contrast, when cultivation is undertaken with hired-labour, such decisions are taken solely by the owner-cultivator. Given this important distinction, it will probably be more correct to consider sharecropping as a land-rental contract rather than as a labour-hiring contract. Bell (1976a), in his study of the Purnea district of Bihar, also makes this distinction. He views sharecropping as a land-rental contract and distinguishes it from a wage-labour contract. In the

latter contract, wage payments take two forms depending on the work performed. For operations other than harvesting (and often threshing too) the wage is a rate per man-day. For harvesting, however, the wage is specified as a fixed share of gross output harvested. Thus, while share contracts are not directly linked to any particular operation, hiring of labour under different payment schemes may be dictated by the nature of the work to be performed.

Cheung (1969) attempted to explain the coexistence of sharecropping, fixed-rent tenancy and cultivation with hired labour in terms of transaction costs and risk dispersion under the different production arrangements. Here, transaction costs include negotiation costs as well as enforcement costs. According to Cheung, a share-contract involves higher transaction costs compared to a fixed-rent tenancy contract. One reason is that, quite often, a share contract requires negotiations and agreement about factors other than rent, which is not found necessary in a fixed-rent contract. For example, share contracts often involve agreement about the inputs to be used, their quantities, and how these input-costs would be shared between landowner and tenant. It may also involve agreement on the cropping pattern to be adopted on rented land. To the extent these specifications are not found necessary in a fixed-rent contract, negotiation costs are more under sharecropping, for both tenant and landowner. Moreover, the cost of enforcing the terms of the contract will also be more under sharecropping. For example, since the rent to the landowner depends on the actual level of output in a share contract, it is in the sharecropper's interest to under-report yield. The landowner will therefore need to incur supervisory costs to verify the actual output on rented

land. No such costs are necessary when land is leased-out for a fixed-rent. Thus, both negotiation and supervisory costs are smaller in a fixed-rent contract for both parties, and more so for the landowner. If, therefore, tenancy contracts are chosen on the basis of transaction costs alone, both tenant and landowner would prefer fixed-rent to sharecropping.

But we saw earlier that while share tenancy permits the tenant to pass-on part of the production risks to the landowner, (and thereby reduce his risks) under fixed-rent he must bear all risks himself. Thus, purely from a risk reducing point of view, a risk-averse tenant may prefer a share contract to a fixed-rent contract. We note however, that there is no such advantage for the landowner. In fact, he would prefer a fixed-rent contract even from purely risk reduction considerations. He bears no risk under a fixed-rent contract while in a share contract he shares a part of the production risk.

Combining transaction costs and risk dispersion considerations, Cheung suggests that "a share-contract would be chosen rather than a fixed-rent or wage contract if the higher transaction costs is at least compensated for by the gains from risk dispersion". But, as we saw, this at best explains a tenant's preference for share tenancy as compared to fixed-rent. Given a choice between a fixed-rent and a share contract, a landowner would prefer fixed-rent if his choice is based on transaction costs and risk considerations. Similarly, it can be argued that, given a choice between a wage- contract and share tenancy, a landowner may prefer to lease-out land under share tenancy. (Since this has lesser risks and not very much more of transaction costs.) But a worker may very well

prefer a wage-contract if his choice is based solely on risk and transaction cost considerations. For, both risk and transaction costs are least for the worker in a wage-contract.

C. H. H. Rao (1971) attempts to explain the coexistence of different types of tenancy contracts in terms of the varying significance of entrepreneurial functions. The argument is that a tenant would prefer fixed-rent contracts in situations which provide scope for decision-making and entrepreneurship. This is so, Rao argues, because under fixed-rent the tenant can obtain fully the returns expected as a consequence of his decisions, and at the same time it protects the landlord against possible risks arising from the production decisions of the tenant. Since the scope for decision-making and entrepreneurship is likely to be more under conditions of uncertainty, fixed-rent contracts will be more prevalent under uncertainty. Conversely, landowners may agree to a share contract under conditions of relative economic certainty where the scope for decision-making is small. Rao has presented evidence in support of his hypothesis. He notes that in the West Godavari district of Andhra Pradesh, share lease and cash lease arrangements coexist, the latter being negligible in the rice-zone and predominant in the tobacco-zone. Using Farm Management Survey data, Rao finds the variance of profits is much lower for rice compared to tobacco. Similarly, data on the extent and pattern of irrigation, variation in rainfall and in prices suggests that cultivation of tobacco is done under a high degree of uncertainty whereas rice farmers operate under conditions of relative economic certainty.

There are a number of difficulties with Rao's hypothesis and we will come back to these again in a later chapter. First, Rao completely ignores the risk-spreading advantage under sharecropping. While fixed-rent tenancy allows the tenant the full reward of his entrepreneurship, he also bears the entire burden of risk. Without explicitly bringing-in the tenant's attitude to risk, it is not clear why a fixed-rent contract would be preferred. There is another problem, in that Rao ignores the quantitative dimensions involved in the choice of contracts. To take a simple hypothetical illustration, consider two situations, A and B, and consider a tenant's choice between share-tenancy and fixed-rent in A and B. Suppose A represents the more uncertain environment in the sense that, for given inputs, output is more sensitive either to weather fluctuations or to entrepreneurship. (Say, to the timing of a particular operation in cultivation.) For the same level of inputs used, suppose the output produced per acre by the tenant in A and in B are as given below[11]:

	Output in Kgs. in A	B
State of world 1	10	6
State of world 2	0	6

Clearly A is a relatively more uncertain environment and Rao's hypothesis would suggest that the tenant would always prefer a fixed-rent (share tenancy) contract to a share contract (fixed-rent contract) in situation A(B). But suppose the rental share in the share contract is half and the rent per acre in the fixed-rent contract is 5 Kgs. (Assuming this to be the same in both situations.) Then the income of the tenant in situations

11/ For simplicity, we are assuming that the output levels are the same irrespective of whether he takes land on fixed-rent or sharecropping.

A and B is given below :

	Income of tenant in Situation A		Situation B	
	s.o.w.1	s.o.w.2	s.o.w.1	s.o.w.2
Under sharecropping	5.0	0	3.0	3.0
Under fixed-rent	5.0	-5.0	1.0	1.0

Clearly, the tenant prefers a share contract in A as well as in B, contrary to what is predicted by Rao.

Ignoring these difficulties, can Rao's hypothesis be reconciled with Cheung's hypothesis that sharecropping will be more prevalent in the more risky environments ? Rao's argument, as we saw, emphasised the tenant's interest in appropriating the returns from decision-making and entrepreneurship and it ignored the possibility that in uncertain situations the tenant may want to reduce risks, as suggested by Cheung. Cheung, on the other hand, lays stress on the risk reducing behaviour of tenants under uncertainty. The two arguments, therefore, differ in their assumptions regarding the behaviour of the tenant under uncertainty. We may expect a relatively poor tenant to behave according to Cheung's assumption, while a rich tenant may act more according to Rao's assumption. Thus it may be the case that while Cheung's explanation is valid for tenancy-contracts among poorer tenants, Rao's explanation is valid for richer tenants.

We now discuss another possible explanation for the coexistence of share tenancy, fixed-rent tenancy, and self-cultivation. It is argued that in a situation where the landowner has no knowledge about the ability of

workers that need to be hired, by offering the workers a choice between share contracts, fixed-rent tenancy contracts and wage contracts, the landowner will be able to 'screen' workers according to their abilities and thereby increase his income. Here, the choice of agricultural contracts serves as a mechanism to transfer information about the worker's ability to the uninformed landowner. The coexistence of a system of share contracts, fixed-rent contracts, and wage contracts acts as a self-selection mechanism and segregates workers according to their abilities. This argument has been neatly explained by Hallagan (1978). Following Hallagan's example, suppose the landlord (who is looking for labour) cannot distinguish between workers who have entrepreneurial ability (E) and those who do not. Also, the application of entrepreneurship cannot be monitored since the effect of E on output can only be known after the harvest. Moreover, in the context of production uncertainty, even this may not be possible, since it cannot be known whether a poor harvest was due to no application of E or was caused by unfavourable weather etc.

Suppose, for convenience, that a farm unit is one unit of land combined with one unit of labour. Output per farm is

$Q = 100$ if $E = 0$ (when there is no input of entrepreneurship)
$Q = 150$ if $E = 1$ (when the farmer has entrepreneurial ability).

Consider a landlord who has two units of land, no labour, and one unit of E. Suppose there are two types of workers in the labour market : type-1 has no E, and type-2 has $E(=1)$. The landlord knows two types of workers exist but he does not know whether a particular worker is endowed with E or not. Consider the case when the landowner employs only hired labour

for cultivation. Each worker, whether he is type-1 or type-2, is paid the same wage rate w. Since type-2 workers, in such a wage contract, have no incentive to apply E, no worker provides entrepreneurship. The landlord's income will be (150 - w) on the land where he provides E, and on the other unit of land his income will be (100 - w). His total income under a wage contract is therefore,

$$Y_1 = 250 - 2w.$$

Consider an alternative scheme where the landowner offers two kinds of contracts to the workers, instead of a single wage contract as earlier. It can be shown that by offering an appropriate fixed-rent contract, in addition to a wage contract, the landowner separates the E-endowed type-2 workers from the unendowed type-1 workers and thereby increases his income. Thus, in this setting, the landowner will prefer to offer fixed-rent and wage contracts rather than wage contracts alone. To see this, suppose the landowner offers a wage-cum-rent contract such that the type-2 worker gets a premium, $z (z \geq 0)$, over the wage rate if he applies E. Suppose the fixed-rent, R, is such that

$$w + z = 150 - R, \quad \text{or} \quad R = 150 - (w + z).$$

As long as the premium, z, is greater than zero, type-2 workers will choose the fixed rent contract. The landowner will offer a fixed-rent contract on one unit of land if his income from the two contracts exceeds his income from a single wage contract. The income from the fixed-rent contract is R and income from cultivating one unit of land with type-1 workers is (150 - w), since the landowner applies E. Hence total income from a combination of self-cultivation and fixed-rent tenancy is

$$150 - w + R = 300 - 2w - z.$$

Fixed-rent contract will therefore be offered on one unit of land provided

$$300 - 2w - z > 250 - 2w, \quad \text{or} \quad z < 50.$$

But if z is so chosen, type-1 workers will opt for the wage contract because income from wage contract, w, will exceed his income from fixed-rent contract, 100-R. Thus, for an appropriate choice of z, type-1 workers will choose the wage contract, type-2 workers opt for leasing land for fixed-rent, and by offering a fixed-rent and wage contract the landlord increases his income. Moreover, by observing the worker's choice between the two contracts, the landowner can infer about the ability of the worker. Thus, in a situation of imperfect information, a system of wage and fixed-rent contracts transmits information about the worker's ability to the landowner.

Similarly, if there are three kinds of workers (say, there is a third type of worker (type-3) whose endowment of E is less than that of type-2 worker's but more than type-1's), then, exactly as before, it can be shown that a system of share tenancy contracts, fixed-rent tenancy contracts and wage contracts permits the landowner to segregate workers according to their endowment of E. Workers opting for the wage contract can be identified as type-1 workers, those opting for fixed-rent contract are the type-2 workers and type-3 workers prefer share contracts.

IV. Markets, Non-Marketability, Imperfections and Tenancy

We had said earlier that a household's decision to lease-in or lease-out land cannot be considered in isolation from its participation in other markets, notably those of labour, credit and other inputs in production like seeds and fertilizers. For example, a landowner's

inability or unwillingness to work as wage labour may prevent him from leasing-out his land. A landowner's decision to migrate may also, in part, depend on the possibility of renting his land on reasonable terms. Similarly, for the potential tenant, unfavourable conditions of work in the labour market (either low wages, or uncertain employment possibilities) may motivate him to lease-in land. Cost-sharing involves both the tenant and landowner in the markets for inputs like seeds and fertilizers. The credit market plays an important part in leasing decisions, as we shall see below.

If, as we have argued, land-leasing decisions are influenced by decisions in other markets, we may expect the pattern of tenancy to be influenced by the structure and nature of these markets as well. It has been observed that some of these markets are highly 'imperfect' and we will discuss how this influences leasing-decisions. By 'imperfections', we mean any departure from perfectly competitive market conditions. One aspect of perfectly competitive markets is the absence of market power for any participant. No individual participant in the market can influence the market price directly. Thus, when one or more participants can influence the market price by their actions alone, we may say the market is imperfect. Such conditions are said to exist in the land and credit markets of less developed rural economies. The notion of perfect markets has also been used in another sense. In a perfect market, the price of the same commodity or service in different parts of the same market that are separated in space and time (i.e., forward markets) cannot differ by more than the transportation costs. This notion is violated in rural markets

where not all individuals have the same access to various markets. Thus, relatively poorer households are often unable to obtain credit from rural banks and cooperatives because they lack suitable collateral. In these circumstances, their only source of credit is the local moneylender whose interest rates may be much higher than those prevailing in banks and cooperatives. Similar advantages accrue to the rich cultivators in the markets for inputs like chemical fertilizers and water from tubewells. Better information and closer links with the Govt. machinery, for example, give the rich farmers easier access to Govt. subsidised distribution of fertilizers. To the extent there exists this bias against the poorer cultivators, it has important implications for the pattern of tenancy. If cultivation is relatively more profitable for the richer farmers, there may be a tendency for poorer owner-operators to lease-out land to richer owner-cultivators and/or tenants. This has important implications for the distribution of incomes and assets in the rural areas. It has practical relevance for land reform policies, especially in the context of on-going technological changes in the rural economy.

Just as the lack of suitable collateral prevents access to credit, the initial resource-endowments of households determine, to a large extent, their ability to lease-in land. In fact, this too may be a consequence of the unequal access to credit. If all households could borrow at the same rate, the household's endowment of any resource that can be bought and sold would not be a constraint on its leasing decision. A household lacking a particular resource could borrow credit to buy that resource. But when credit is either not available, or is available at relatively higher rates,

the resource endowment of a household can be an effective constraint on the extent of land it can lease-in. In the Indian context, two such resources play a major part in a household's decision to lease-in or lease-out land. These are land and draft-animal labour.

We first consider land. Empirical studies reveal the preponderance of 'mixed' holdings relative to pure tenant holdings. 'Mixed' holdings are operational holdings constituted by land owned as well as leased-in, while pure tenant holdings are constituted by plots which are entirely leased-in. In 1960-61, 18.4 % of total holdings were mixed holdings and only approximately 5 % of holdings were entirely leased-in holdings. Of all households operating holdings which were either fully leased-in or partly leased-in, about 85 % were operating partly leased-in holdings in 1960-61[12/]. Bardhan (1976) has also pointed out that in 1970-71 in all states (except Kerala and Karnataka) more than 80 % of holdings reporting area under tenancy were cultivated by landed tenants. These observations suggest that households leasing-in land generally own land too and landless households are unwilling or unable to lease-in land. As we mentioned in another context, landowners preferred to lease-out land to owner-tenants as compared to pure tenants. One reason could be the security of obtaining rent from an owner-tenant as compared to a pure tenant. But there may be other reasons. The same household may lease-in and lease-out land so as to get a contiguous parcel of land to cultivate. Landownership may also be serving as an indication of experience and cultivating ability in a farmer. A landowner will prefer to lease-out land to the better tenant, specially if he can obtain a higher rent from them, as under sharecropping.

12/ See National Sample Survey Report No. 144 and Draft-Report No. 177. See also Chapter II of this dissertation.

Just as ownership of land provides an advantage to the household in the land-lease market, so does the ownership of draft-animals. (Referred to as bullocks also.) Bell (1978) points out that in the Purnea district of Bihar "owning a pair of bullocks is a sine-qua-non for obtaining a lease and this distinguishes tenants owning no land from the general class of landless labourers". Bliss and Stern (1980) also notice that to qualify as a tenant the individual had to possess the means to cultivate land, notably he had to own bullocks. Part of the reason could be that, just as in the case of landownership, ownership of draft-animals is an indication of experience and cultivating ability in the household. When the landowner has no means of finding out the farming ability of his potential tenant, he may use the tenant's endowment of bullocks and/or land as an index of his cultivating ability. A more important reason, however, is the reported absence of a market for draft-animal services.

In some regions it is observed that while there usually exists a market for buying and selling of bullocks, a market for bullock services is virtually non-existent. While in the former market there is a transfer of ownership, in the latter market only the use of bullocks is transacted and there is no transfer of ownership. Clive Bell reports that in Purnea ".... though there existed a daily rate for the hire of a bullock team season by season, it was extremely difficult in practise to hire. No cultivator could afford to rely on the hire-market, nor indirectly, could any landlord". In their study of the Palanpur village in West Uttar Pradesh, Bliss and Stern also report a similar situation. Though

the market for buying and selling of bullocks works fairly efficiently, bullocks are, with rare exceptions, not hired out for cash in Palanpur.

If the market for bullock-hire does not function, it is possible to understand why the ability to lease-in land depends on the tenant's ownership of draft-animals. For, if draft-animal labour is necessary for cultivation and if it cannot be hired, a household not owning bullocks can still lease-in and cultivate land only if it can buy bullocks. But when the credit market is imperfect, lack of suitable collateral will prevent some households from obtaining any credit for purchasing bullocks. Thus, for such households, (those not owning bullocks and not having suitable collateral) the non-existence of a market for bullock-hire services, coupled with an imperfect credit market, will rule out the possibility of leasing-in land. Of course, this would not apply to households where informal exchange and borrowing would be possible. The non-existence of a market for bullock-hire also suggests a motivation for tenancy. Those households having land in excess of what they can cultivate with owned bullocks may lease-out part of their land. Conversely, households having bullocks in excess of what they can utilise on their land may lease-in land to utilise their draft-labour more fully.

The non-existence of a market for bullock-hire calls for some comment. We know such a market has an important function to perform : households having more of draft-animal-labour than what they can utilise utilise on owned-land could hire-out this excess labour and households with inadequate draft-animal-labour would be able to hire-in more bullock-labour and cultivate their land more intensively. If there are advantages

to be had from a market for bullock-hire, why does it not exist ? Also, why does not someone set himself up as an exclusive bullock-team owner who hires out his bullocks (with himself operating the bullocks), this being his only occupation. Some rationalisations have been provided in the recent literature on tenancy and these have been summarised in [21]. We will mention some possible reasons.

From what we have said so far, it is clear that though a market for bullock-services would facilitate households in balancing their endowment of draft-labour with land under cultivation, it is not the only way of doing so. As we have already suggested, a household may adjust land cultivated by it to its endowment of draft-labour, rather than the other way around. This it can do by leasing-in or leasing-out land. Therefore, when a market for land-lease exists, a market for bullock-services is not essential for balancing the household's endowment of draft-animal labour with the land area cultivated by it. One can think of reasons why specialised bullock-service suppliers are not as common as one would expect. One disadvantage arises from the fact that since bullocks are utilised for certain operations only, (largely for ploughing but also to some extent in irrigation, transportation and threshing) income from bullock-hiring would be confined to only those periods in which such operations are undertaken. Given the seasonal nature of production in agriculture, this would be confined to particular periods in the year. (Say, before Kharif and Rabi sowing, if bullocks are used primarily in ploughing.) Thus, for the rest of the year the bullocks (and their owner) would be underemployed. This problem is more acute in regions where there is only one cropping season.

Moreover, even within, say, the ploughing period, it may not be possible to work on more than a few fields, given the fact that the seasonal nature of production necessitates ploughing at more or less the same time on all farms. Of course, this seasonality problem in the use of bullocks arises whether the bullocks are owned by cultivators or by a specialised agent and as such this is not a disincentive only for the specialised agent. Hiring of bullocks may be also discouraged due to caste-barriers. Bliss and Stern report that in Palanpur caste barriers may be important. If bullocks are to be worked by their owner, he may not have any incentive to work efficiently on the hirer's land. To ensure efficient use of bullocks, the hirer may, therefore, need to supervise work. If the hirer was of a lower caste this may not be possible. The high-caste owner would be reluctant to work beside a lower-caste hirer. However, as the authors themselves note, this reason can at best be only a partial explanation. While it may serve to explain why higher-castes do not hire-out to the lower castes, it does not explain why hiring is uncommon even within the higher castes.

We have already noted that whenever bullocks are hired, the owner of the bullocks is hired along with the bullock-team for working the bullocks. While this ensures that the bullocks are not misused, such a system may itself discourage bullock-hiring. For example, a household may decide to cultivate land in order to keep its family-labour productively employed. For such a household, bullock-hiring is disadvantageous to the extent the bullock-work is done by outside labour.

We have given some reasons which partly explain why a market for bullock-hiring may not exist in some regions. It should be emphasised, however, that this feature is not present in many other regions where a market for bullock-hiring is fairly active[13/].

We have listed two features by which the landlord may distinguish and discriminate among potential tenants. These are their endowments of land and draft-animal labour. We have discussed the reasons why ownership of land and/or bullocks may be essential for leasing-in land. Let us consider two other factors, 'management' and the size-composition of the household. We take 'management' first.

Cultivation involves various types of work and requires entrepreneurial and managerial ability. For example, to ensure that hired workers do not shirk work the cultivator must devote time to supervision. When [illegible] availability of labour is uncertain, he must plan his activities in such a way so as to minimise the loss due to shortage of labour during the 'peak' season. The farmer is also involved in decision-making regarding when to plough, plant, irrigate, fertilise, remove weeds, harvest, etc. He must decide how much land to cultivate under different crops, how much inputs to use, what proportion of labour to hire etc. These decisions are more complex under conditions of uncertainty and require experience and ability.

If 'management' were a tradeable input, (for example, if there were professional farm-managers who would sell their services to cultivators)

13/ For example, Rudra found bullock-hiring very common in his survey of the Eastern region. See also Sarvekshana, Vol. I, No. 2, October 1977, where NSS data shows that 68 % of the weaker-cultivators do not own bullocks because they find it economical to hire.

then the management endowment of a household would have been of no consequence in leasing decisions. The household that lacked 'management' would have bought it on hire. However, the very nature of the 'management' input suggests that such a market may not be able to function efficiently, if at all. In fact, the market for management ability would appear to illustrate Akerlof's suggestion (1970) that imperfect, asymmetrically held information would present a source of inefficiency in the operation of competitive markets. In the extreme case, such conditions would lead to market failure. Consider a situation where a landowner deficient in management wishes to hire workers with managerial ability. The problem arises because the application of management by the workers is not directly observable. Even when the yield is known, it is not possible to infer whether a poor harvest is due to workers not using their management ability or whether it was caused by random natural causes. In such a situation, if the landowner hires worker-managers at a market clearing price, these workers will have no incentive to supply management, even though they are paid to do so. Instead, management endowed workers will divert their abilities elsewhere. For this and possibly other reasons, a market for managerial abilities exists only very rarely under Indian conditions.

When 'management' is not tradeable, there is another motivation for tenancy. A household which is deficient in 'management' (that is, it is inexperienced in cultivation or is not as capable to supervise and manage the farm) may find it profitable to lease-out land to a household whidh is better endowed with managerial ability. However, if the landlord cannot identify potential tenants in terms of their management endowment, a system

of wage, sharecropping and fixed-rent contracts will operate not only as a screening device but it will also allow management unendowed landowners to attract management endowed tenants. Landowners without managerial ability will maximise income by offering fixed-rent contracts which will attract the better tenants; 'better' landowners will maximise income by offering wage contracts which attract workers with no managerial ability, and share contracts will be preferred by semi-endowed landowners and workers[14/].

We will next consider another instance of non-marketability and discuss the role of the size-composition of a household in its leasing decisions. It is sometimes the case that social customs and/or legislation prevent some members of a rural household from entering the labour-market. For example, children below a certain age cannot offer themselves for wage employment. Sometimes women are also not permitted, particularly for certain agricultural operations. Even if they do work, they receive a wage lower than what an adult male labourer would get for doing the same work. Similarly, caste or other social conventions may act as barriers to entry in the labour force. Higher caste households would be reluctant to allow their family members to work as hired labourers, especially if the hirer is from a lower caste. For example, Bliss and Stern note that in Palanpur, the high caste Thakur households "do not hire out their services as agricultural labourers. Traditionally, labour of any kind on the land would have been considered degrading and beneath them and agricultural labour considered much worse than cultivation of own land (or leased-in land). In fact, no Thakur household in Palanpur provides agricultural labour....". Female members of higher caste households are also often not permitted

14/ See Hallagan (1978).

to work outside their homes in Palanpur[15].

But while these members cannot work outside as wage labourers, they can work on owned or leased-in land. Thus, women and children who cannot offer themselves for wage-employment may be usefully employed on self-cultivated land. They can help in operations not involving much physical effort as, for example, live-stock grazing, weeding and planting. Similarly, members of higher caste households who cannot work as hired labourers can be employed on cultivation of owned or leased-in land. This suggests yet another motivation for tenancy.

If, for some members in a household, there are no employment opportunities except working on owned or leased-in land, that household may lease-in land to ensure fuller utilisation of all its family labour. Thus if a household has more labour than what it can productively use on its owned land, and if this excess labour cannot be offered for employment outside, it may be worthwhile for that household to lease-in more land. As we can see, the motivation for tenancy in this case is similar to what had been suggested earlier while discussing bullock labour and management. There, leasing performed the function of bringing in balance the area cultivated by the household and its endowment of bullock labour and management respectively, when these inputs were traded, if at all, in imperfect markets. Here, leasing balances the area cultivated with the household's endowment of labour, when some component of it is not tradeable at all.

Bliss and Stern (1980) have attempted to estimate a model of tenancy which lays stress on the non-marketability of inputs, primarily draft-animal

15/ See Bliss and Stern (1980).

services and family labour, as the main reason for land leasing in Palanpur. Suppose a household leases-in and leases-out land in order to adjust the land-owned by it to a size which it can comfortably cultivate, given its supply of bullock labour and family labour, both of which are tradeable in highly imperfect markets. This area which the household would like to cultivate is termed Desired-Cultivated-Area (DCA), and it is a function of the household's endowment of draft-animal labour (given by the value of bullocks owned, V_1) and family labour (given by the number of male agricultural labourers of working age 16-60 years, F_3).

If a household's DCA exceeds land-owned (LO) by the household, it will lease-in land; if DCA is smaller than LO, it will lease-out land and if DCA equals LO there will be no leasing-in or leasing-out by that household. If NLI represents the extent of net leasing-in by the household, we have

$$NLI = h\,[\,DCA - LO\,] = h\,[\,\phi\,(V_1, F_3) - LO\,]$$

Employing a linear approximation, they express NLI as

$$NLI = \gamma\,\phi_V\,V_1 + \gamma\,\phi_F F_3 - \gamma\,LO + \epsilon,$$

where

$$\gamma = \frac{d\,NLI}{d(DCA - LO)}, \quad \phi_V = \frac{d\,DCA}{d\,V_1}, \quad \phi_F = \frac{d\,DCA}{d\,F_3}$$

Thus, the net leasing of a household is expressed as a function of its endowment of bullock labour, family labour and land. This equation can be estimated, given household-level data on leasing-in, leasing-out, land-ownership, family-size and ownership of draft-animals. They estimate the response of DCA to a marginal increase in V_1 and F_3. These estimates were,

however, not very close to the actual observed values of land area cultivated per unit value (number) of draft-animals and male agricultural labourer respectively.

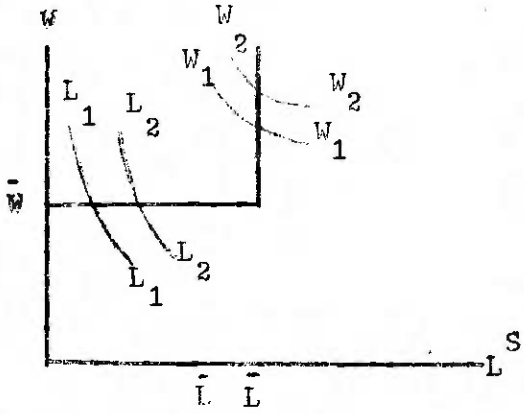
Though the authors have discussed, in detail, some of the difficulties with their model, there is one problem to which they have not provided an adequate explanation. While the choice of V_1, the value of draft-animal services, may be the best practical approximation to represent the availability of bullock labour for a household, the reasons for choice of F_3 are not as clear. As the authors themselves point out, the decision to work as agricultural labour depends very much on how much land can be leased-in and it is not very meaningful to take the number of family males engaged in agriculture as a given datum for the household. Moreover, as we mentioned earlier, women and children in a rural household can also be employed usefully on land cultivated by the household. There is no reason to exclude them in a specification of DCA. Since it is the non-marketability and imperfection in the labour market that necessitate the inclusion of family labour as an argument in DCA, it is all the more important to include the labour of women and children in the family. It is this component of family labour that is often not marketed, even though it can be used productively on the household's self-cultivated land. In fact, by representing family labour by the number of males in the age-group 16-60 years whose only occupation is agriculture, the authors appear to be minimising the impact of labour market imperfections on land-leasing. Leaving aside caste considerations, the authors themselves note that the labour market in Palanpur was more or less in balance at the wages prevailing. The

employers had no complaints regarding difficulty of obtaining labour, while the labourers had no complaint of lack of employment. They observed that for those households whose caste rules permit them to sell-out family labour as agricultural labour, a man who works on his own farm was in a real sense losing the opportunity to gain wages elsewhere. Under these circumstances, it hardly appears convincing to treat the family's endowment of adult male agricultural labour (F_3) as fixed, even in the short-run. Instead, family size, as represented by the number of family-members, say above the age of six years, may be a more appropriate variable in a household's determination of its DCA.

We have discussed in some detail the non-marketability of inputs and their importance for tenancy. We will now discuss some features of markets that do exist and their implication for land-leasing. We have already discussed the nature of the credit-market. Lack of suitable collateral prevents a landless household from borrowing very much. We indicated how this would affect tenancy, because those who cannot borrow to buy bullocks cannot also lease-in land, given the non-existence of a bullock-hire market and the virtual necessity of draft-animal labour in cultivation. We also saw how unequal access to credit may affect the pattern of leasing, with richer cultivators leasing-in land from the poorer owners of land.

Let us consider the rural labour market. It is a common observation that during the preharvesting season employment opportunities are limited. Thus in regions where there is an institutionally fixed wage below which it does not adjust, employment, is uncertain for labourers in the lean season. During the harvesting season, however, there is a heavy demand for

labour and shortage of labour is reflected in an uncertain wage rate for the employers. Moreover, it can be argued that this uncertainty in the labour market is a reflection of production uncertainty in agriculture, if we abstract from the influence of the non-agricultural sector. To see this, suppose the supply curve of labour is right angled in both seasons, as shown below.



The position of the L-curve reflects the employment uncertainty in the lean season, while the position of the W-curve reflects the wage uncertainty during the peak season.

The uncertainty lies in where the demand curve for labour intersects the supply curve on its horizontal stretch during the lean season, and on its vertical stretch during the peak season, it being ruled-out that the demand curve can intersect the supply curve in the vertical (horizontal) stretch in the lean (peak) season. But this uncertainty regarding the position of the demand curve reflects production uncertainty due to weather etc.

These uncertainties in the labour market could provide another motivation for tenancy. Landless households may be motivated to lease-in land because of the uncertain wage-employment opportunities in the 'lean' season, while landed households may want to lease-out a part of their holding if by doing so they can reduce their dependence on peak season labour.

However, leasing of land is not the only way by which a household can protect itself from peak season wage uncertainties. A landowner may hire workers for the entire crop cycle, rather than engage casual workers in the two seasons. While such an annual wage contract reduces peak season uncertainties for the landowner-cultivator, it has an obvious disadvantage if there is production uncertainty. In an annual wage contract, the wage bill is independent of the actual size of the harvest so that, even if there is a crop failure, labour costs cannot be reduced. If labour is hired in each season separately, labour costs could be reduced in case of harvest failure since less harvesting labour would be required. Therefore, when production risks are significant, land leasing may be a better means of reducing losses from labour market uncertainties.

Consider the land market. Two important features in rural India are the heavy demographic pressure on land and the highly skewed distribution of land-ownership[16/]. Under these circumstances it may be unrealistic to assume that landowners behave as price takers. In the theoretical literature, there have been two alternative formulations that attempt to take account of this imperfection. Some authors[17/] consider a situation where the landowner has monopoly power in the land lease market. This is formalised in the assumption that the rental share, in a share contract, is determined by the landowner who fixes it at a value which is optimal for him. This could be an extreme situation. It may be more realistic to assume that the terms of the tenancy contract, including the rental share, are determined jointly by the landlord and tenant and reflect the relative

16/ See K. N. Raj (1970).

17/ For example, Cheung (1969), Newbery (1975a).

bargaining strengths of the landlord and tenant. Bell and Zusman (1976) have pioneered an approach using a game theoretic model of bargaining between the landowner and tenant. In this paper they consider a situation where there are n identical tenants and a single landowner. In a subsequent paper, they consider tenancy contracts between a single landowner and n landless tenants who are, however, not identical. Their endowments of labour and other non-tradeable factors (like draft power, managerial skills, etc.) differ. It is shown that under certain restrictions, the landlords prefer to lease-out more land to the 'better' tenants. (That is, those tenants better endowed with managerial abilities, bullocks and/or family labour.) This is consistent with observations made in the fields[18/].

In the same paper, Bell and Zusman establish another interesting result which agrees well with empirical findings. Irrespective of the differences in endowments of the different tenants, the equilibrium rental share turns out to be identical in all tenancy contracts. In fact, if all tenants are identical and if production functions are Cobb-Douglas, the rental share is seen to lie close to half. This peculiar aspect of share contracts — the observed near constancy of the rental share centering around one-half — has not been adequately analysed nor explained in the literature. The Bell-Zusman work, therefore, is an important attempt at explaining this phenomenon. In this connection, Hurwicz and Shapiro (1977) have provided another interesting explanation. In its simplest version, suppose the tenant has a utility function that is linear in income and and quadratic in effort. Suppose output is a function of effort only and

18/ See for example, Bell (1976a), Bharadwaj and Das (1975) and Bliss and Stern (1980).

let it be of the form y = ke, where k is the output per unit labour. If the landowner can unilaterally fix the rental share, then they show that one-half will be the optimal value for the landlord, irrespective of the parameters of the tenant's utility function[19].

We may also mention an interesting exercise by Kutcher and Scandizzo (1976) where they analyse sharecropping contracts in North-East Brazil. They use a linear programming model which permits them to analyse cropping pattern preferences of the tenant and landowner. One of their important conclusions is that the observed rental share (= 0.5, 0.3, 0.3 for cotton, corn, and beans respectively) has the advantage that at this share, the landlord and tenant have full agreement on the farm-plan. Thus, at this share, the landlord need not supervise the tenant's work. Though it is not clear from the model whether agreement regarding production plans of other landlord-tenant pairs would also occur at the same share, their result suggests a plausible factor in the determination of the rental share.

We have discussed some of the features commonly observed in the markets for land, labour and credit and also how these influence tenancy. We now discuss the implications of another peculiar feature, the so-called inter-linking of markets. Inter-locking of markets is supposed to take place when there is a simultaneous trade in more than one commodity or service between

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19/ Let the tenant's utility be given by $U_t = ary - be^2$, where r is the tenant's share of output y, e is the labour applied by the tenant on rented land, and a and b are parameters of his utility function. For given r, a, and b, the tenant chooses e to maximise U_t which gives $\hat{e} = \frac{ark}{2b}$. The landlord's income from the share contract is $(1 - r)y(\hat{e}) = (1 - r)k(ark/2b) = (1 - r)(r)(ak^2/2b)$ and he chooses an r which maximises his income. This optimal choice is clearly half.

the same pair of individuals, and this linking of trade in different commodities or services is found to be essential because delinking is either infeasible or too costly. Thus, for example, delinking may be impossible if the market for some commodity exists only in conjunction with other markets, or if one of the parties has sufficient market power to insist on linking. One of the most reported forms of inter-linking is the simultaneous trading in the land-lease and credit markets. It is pointed out that sometimes the landowner provides consumption and/or production loans to his tenant, in addition to leasing him land. In the context of imperfect capital markets, this may be because a tenant lacking suitable collateral may find in his landlord the only source of credit, while the landlord may be willing to provide credit to his tenant because he has better information about his tenant's loan repayment capacity and also because he can accept collaterals which are not acceptable to other sources of credit, for example the standing crops on leased-in land, or the tenant's labour etc.

It is sometimes claimed that this interlinking of markets permits greater 'exploitation' of the tenant by the landowner[20/]. However, it is not clear whether 'exploitation' arises because of interlinking of markets or whether it is due to the monopoly-power of one of the partners in any one of the interrelated markets. As Newbery (1975) has pointed out, if the landowner-moneylender has monopoly power in any one of the markets for land or credit, his participation in the other market provides him no additional advantage. Thus, if the landowner-moneylender has monopoly power in both the land-lease and the credit market, then it does not matter to him whether

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20/ See for example, Bhaduri (1973, 1977) and Bharadwaj (1974).

he participates in the lease transaction or the credit transaction or in both transactions simultaneously. However, if his monopoly power is curtailed in one of the markets, and if he possesses monopoly power in another market, then the landlord may gain by linking transactions in the two markets.

Likewise, Braverman and Srinivasan (1979) show that linking, by itself, does not force the tenant to a utility level lower than what he could obtain in the absence of linking. In fact, it is suggested that a landowner will be interested in the tenant getting loan from the cheapest source, and if the landowner-moneylender's opportunity cost of capital is lower than that charged by the local moneylenders, the landlord will offer a tenancy-cum-credit contract. Hence linking is not imposed but is chosen—by the tenant, because it is the cheapest source of credit, and by the landlord, because cheaper borrowing induces the tenant to produce more on rented land. Linking is not, as claimed by Bhaduri, an instrument of exploitation.

Inter-locking may itself be a reflection of market power. For example, in the land-credit interlinking, if the landlord has monopoly power in the lease market he can keep the tenant's income from land at such a low level that the tenant finds it difficult to save. This may be one reason why such a tenant may not possess collateral which would allow him access to other sources of credit.

How prevalent is interlinking of markets ? Despite assertions that rural markets in India are quite often interlocked and exploitative, empirical support for interlinking is limited and this is even more so as far as the exploitative character of interlinking is concerned. For example, Bardhan and Rudra (1978), in an extensive survey of some villages in West Bengal,

Bihar and East Uttar Pradesh report that the landowner is an important, though not the only source of credit to his tenant. In West Bengal, 51 % of tenants reported taking consumption loans from their landlords. The corresponding figures for Bihar and East Uttar Pradesh were 50 % and 55 % respectively. Similarly, they report inter-relationships between tenancy contracts and obligatory labour on the part of the tenant's family. Fifty-two per cent of landless tenants in West Bengal reported rendering certain services for the landlord; the percentage was 9.9 for landed tenants. In Bihar, the corresponding figures were 55 % and 13 % respectively. The interesting point, however, is that interlinking is not generally associated with 'exploitation'. For instance, out of those tenants who take consumption loans from their landlords in West Bengal, 45 % of tenants got interest free loans. Similarly, of those tenants rendering labour services to their landlords, 92 % of the landed tenants and 58 % of the landless tenants reported being 'properly paid' for their services in West Bengal.

Bliss and Stern report similar conditions in Palanpur. In their survey, they noted that there were only two cases where a tenant took a loan from his landlord. Moreover, even in these two cases, the rate of interest was not different from the usual rates for private loans.

V. Technical Progress, Modernisation and Tenancy

One of the important motivations for a study on tenancy would be to know how tenure systems influence the adoption of new technology in agriculture and conversely, how the tenancy system would adapt itself to the introduction of new technology in the form of better irrigation, increased

mechanisation, and the introduction of high-yielding-varieties of seeds. Both questions are clearly important from the point of view of policy. For example, an answer to the first kind of question would partly explain why the spread of the new technology has not been as speedy as would be desired and would suggest tenancy reform measures. The second type of question would be of interest for predictive purposes, for example, to analyse potential changes in incomes and the distribution of income consequent to modernisation. Thus if, given the existing tenancy system, the new technology is seen to increase inequality in land ownership and/or incomes, adequate measures to improve the distribution would be easier to formulate. We will discuss the second type of question first. What will be the impact of the new technology on tenancy and its different forms ?

Bardhan (1976) has presented a theoretical framework for analysing this question. By incorporating some of the imperfections and inter-linkages in the different markets he is better able to study the implications of the new technology in the context of existing market structures. He can also predict the consequences of changing market conditions consequent to development. Bardhan considers a model where a landless worker leases-in land under sharecropping from a landowner who, on his part, leases-out land and retains part of his land for self-cultivation. Imperfection in the land lease market is reflected in the model by assuming that the landowner alone decides how much land the tenant will obtain under tenancy. The rental share is specified exogenously. Moreover, the credit and land lease markets are interlinked in the sense that the tenant must borrow for consumption and his only source of credit is the landowner. The interest rate is

exogenously given, though it is not clear why this should be so if the landowner is the sole supplier of credit to his tenant. Imperfections in the credit market are also reflected in the unequal access to markets for inputs like fertilizers and irrigation. The owner-cultivator can obtain these inputs at a smaller cost as compared to a pure tenant. Bardhan then derives the following comparative static propositions.

(1) Tenancy is higher where land is 'better' . In so far as improved land fertility is a consequence of better irrigation, this result implies tenancy will be more on better irrigated land. In the uncertainty free framework of Bardhan's, this could be explained as follows : the greater productivity of land makes tenancy more profitable for the tenant-labourer. While the landowner's profits from self-cultivation will also increase with greater irrigation, income from land-leasing would anyway increase in a share contract. If the landowner's relative preference between tenancy and self-cultivation does not change, the net impact of irrigation may be an increase in land-leasing by the tenant. While this may be one consequence of increased irrigation, there may be other ways in which irrigation may influence tenancy. One obvious impact of irrigation would be to reduce the dependence on weather and hence reduce risks in agricultural production. In so far as the primary motivation for leasing-out land was the unwillingness to take the risks associated with production, increased irrigation may result in a landowner resuming land for self-cultivation, with a consequent decline in tenancy. Consider another way in which irrigation can influence tenancy. We had observed that one possible motivation for leasing-out land was the uncertainty regarding availability of labour in the busy season. We

had argued that hiring of salaried workers on an annual contract could be another way of removing this uncertainty. However, this had the drawback that even if there was a crop failure and less labour was required in harvesting, labour costs could not be reduced. In so far as the possibility of such a loss is reduced with increased irrigation, we may expect a decline in tenancy[21].

(2) With labour-saving technical change, particularly one that reduces harvesting-labour requirements, tenancy will decline : This result can be explained in terms of our preceding discussion. Take the case of tractorisation. We had considered a possibility where the landowner leased-out land to avoid cultivation with hired-labour, when there was a shortage of labour in the peak harvesting season. To the extent tractorisation involves a reduction in the severity of peak-period labour constraint brought about by multiple cropping, this motivation for tenancy no longer remains. Another immediate consequence of tractorisation has been the reduction in the demand for draft-animals in agricultural production. We had argued that in certain regions the non-existence of a market for bullock-hiring provided a motivation for tenancy. In so far as the market for tractor-hire is more accessible, this factor too, suggests a decline in tenancy with mechanisation.

We have, so far, considered two important kinds of technical changes — irrigation and mechanisation — and their impact on tenancy. We now consider two important qualitative changes that are becoming increasingly evident, particularly in the agriculturally more progressive regions.

21/ The result that tenancy would decline with increased irrigation also goes against another of Bardhan's results : that a decrease in production uncertainty would lead to an increase in tenancy. Bardhan himself admits that his result is not supported by inter-temporal evidence from India which shows a decline in tenancy in most States while any index of land improvement showed a significant rise. He, however, attributes this decline mainly to tenancy legislation.

The first of these changes is the shift in the economic status of the lessors and lessees. It has been observed that more and more rich farmers are leasing-in land from the smaller owner-operators, a reversal of the traditional idea of rich landowners leasing out land to landless households[22/]. What could be the reason for this change ? It is said that the new-technology is dependent on assured supplies of water and inputs like chemical fertilizers and pesticides. Use of these inputs is critically dependent on the cultivator's access to credit and, in the context of imperfect credit markets, small farmers may find it difficult to obtain credit. With credit not available, or available in small amounts, these small operators may not find it feasible to adopt the new technology. On the other hand, big farmers gain by adopting the new technology. They may have better access to irrigation because they can obtain credit relatively easily for digging tubewells. Similarly, the big farmers may have better access to Govt. subsidised distribution of fertilizers. Under such conditions it is argued that the new-technology is biased in favour of the big farmers. This is reflected in the tendency of big owner-operators or owner-tenants to lease-in land from the small-landowners. Of course, since better employment opportunities in the rural and/or urban areas may also encourage small owners to shift to wage employment, it is not immediately obvious that the welfare of small landowners or landless households would decrease with the spread of new-technology.

22/ For example, Bardhan (1976) notes that "of all holdings reporting some area under tenancy, the percentage of those cultivated by landed tenants increased substantially between 1960-61 and 1970-71, in all states (except Orissa) ..... In many areas there is a distinct shift away from the smaller tenant-cultivators, particularly in areas of rapid growth in agricultural production".
See also Chapter II of this dissertation.

The other important qualitative change is the shift in the relative importance of different forms of tenancy, reported more in the regions where the new-technology has been introduced. In these regions it is reported that fixed-rent is taking the place of sharecropping as the dominant form of tenancy[23/]. In so far as the new-technology involves the exercise of entrepreneurial skills to a greater extent than the old, this tendency is consistent with Rao's hypothesis on entrepreneurship.

To understand why such a shift may occur, Bardhan (1976) modifies his earlier model to include two types of tenants — a sharecropper, who has no land of his own, and a fixed-rent tenant who also owns land. It is assumed that the fixed-rent tenant is better-off than the sharecropper. Since the market for credit is also imperfect, it is assumed that the prices of inputs are higher for the share-tenant vis-a-vis the fixed-rent tenant. For example, while the landlord is the only source of credit for the sharecropper, the fixed rent tenant can borrow from other sources and the interest rate charged by these sources is lower than that charged by the landlord. With this model, Bardhan analyses the impact of mechanisation on the distribution of leased land between sharecropping and fixed-rent. His analysis shows that in so far as mechanisation is labour saving, it leads to a shift from sharecropping to fixed-rent tenancy. The impact of a reduction in production uncertainty (say, due to increased irrigation) is not certain and would appear to depend on the risk-averseness of the two types of tenants.

So far we have focussed on the purely technological aspects of modernisation. We now consider the impact of some of the institutional changes

23/ See, for example, Bharadwaj and Das (1975), Vyas (1970), and N. Bandopadhya (1975).

that may also come about with modernisation. To take just one example, we have seen that imperfections in the credit market play an important part in leasing decisions. Modernisation and development of agriculture may involve the extension and creation of institutional sources of credit in the rural areas. To the extent credit becomes easily available to all, it will lead to a change in the extent and pattern of tenancy. However, it is not clear, on a-priori grounds alone, whether easier availability of credit will lead to an increase or decrease in tenancy. When the use of tractors is not widespread, we saw how the non-availability of credit and the non-existence of a bullock-hire market provides a motivation for tenancy. The force of this rationale would be much reduced if credit becomes easily available to all. If availability of credit encourages migration away from rural areas, we may expect more households to either sell-off land or to lease it out. On the other hand, migration may be dictated by non-availability of credit and in such cases easier credit would reduce migration and tenancy.

We had also discussed how the new-technology becomes biased in favour of the big tenant and/or owner-operator, in the context of credit-market imperfections. In so far as this led to a pattern of tenancy where big owner-operators or tenants leased-in land from small-landowners, we would expect this tendency to be less evident when credit is more easily available.

Some of these hypotheses are verified in Bardhan's analysis. He finds, for example, that the lesser the degree of imperfection in the market for credit, the larger is the area under tenancy. Since in his model, a pure-tenant is leasing-in land from an owner-operator (who has initially better access to inputs) cultivation becomes relatively more profitable for the

tenant when imperfections are reduced. He will therefore wish to lease-in more land. The same would be the impact of a lowering of interest rates on loans, which would happen if alternative sources of credit were made available to the tenant.

As for the shifts between different forms of tenancy, Bardhan predicts that the relative importance of sharecropping will increase with the expansion of credit facilities. Given the structure of Bardhan's model, this result is easily explained.

We have been concerned so far with the technological and institutional features of modernisation. But development involves changes in social customs as well. We will discuss briefly the influence on tenancy of one such change that may take place in the long-run — the diminishing role of caste in economic activities. We mentioned that caste considerations could be part of the explanation for the non-existence of a bullock-hire market. To the extent this is so, tenancy may decline with the decreasing influence of caste. While this is possible, it is extremely unlikely. By the time caste-barriers are reduced, use of tractors would very likely have replaced bullocks. It is often reported that caste and economic status are closely associated with each other so that lower caste households are generally poorer than the higher caste households. To the extent this is true, the impact of a reduction in imperfections and caste barriers would be similar. We also observed that for reasons of caste prejudices, some members in a household do not work outside their own farm. If, in the changed situation, these members can also work as wage-labourers, it will no longer be necessary for such a household to lease-in land to keep its family-labour

productively employed. Though we have suggested some ways in which considerations of caste may influence tenancy, not much work, either theoretical or empirical, has been done on this aspect of tenancy.

We now consider the question whether tenancy inhibits technical change and investment in land. Bhaduri (1973) has argued that when markets are inter-linked, a landowner, who in addition to leasing-out land to a share-cropper also provides him with consumption credit, may discourage the adoption of yield-increasing technical change on his tenant's farm. In his model, the landowner is the only source of credit to the tenant. Thus the landowner has two sources of income : one is his rent from share-rented land (which is a certain fraction of output) and the other is his interest income from usury. Technical progress, which increases productivity, increases the income from land for both tenant and landowner. If the tenant does not consume his entire additional income, a part of it can be used for loan-repayment, so that, over time, the tenant's credit-requirement is reduced. Therefore, the landlord's income from usury may decline and there may be circumstances where this decline is not fully compensated by the increase in income from rent. The landlord may not, therefore, encourage the adoption of productive-technology on rented-land.

Newbery (1975) has pointed out reasons why Bhaduri's argument is implausible. If the landowner is powerful enough to prevent the adoption of productive-technology by the tenant, then surely, he can as well alter the terms of the tenancy-contract in his favour to ensure that he gains from the improved technology. As for the inter-linking of markets which Bhaduri emphasises, this is clearly irrelevant if the landowner has monopoly power

in the land-market. More recently, Srinivasan (1979) has demonstrated the inconsistency of the Bhaduri model even within its own framework. A necessary condition for Bhaduri's argument to be valid is that borrowing is an inferior good. But, as Srinivasan has conclusively shown, under plausible conditions this is not likely to be the case. This result is not peculiar to credit-interlinking alone. Srinivasan (1979a) has shown that even if the tenant acts as a bonded labour for his landlord, the latter has no incentive to discourage yield-raising technology on the tenant's land.

Quite apart from the logical inadequacies of the Bhaduri-type explanation, there appears to be little empirical support for the proposition that landowners would gain by discouraging productive-technology on their rented land. In fact, what little evidence there is indicates that landowners are keen on their tenant adopting the new-technology. For example, Bardhan and Rudra (1978), in their survey of villages in East India, observe that landowners commonly provide production loans to their tenants, sometimes at zero interest rates. Apart from this, in a majority of cases the landowners also share in the costs of inputs like seeds and fertilizers. As they point out, "production-loans, as well as cost-sharing, obviously indicates a strong interest on the part of the landowner in productive-investment on the tenant's farm".

Shah (1972) studied the impact of land reform (mainly conferring of ownership rights to tenants) on technology in three districts of Maharashtra and Gujarat. He finds that in regard to irrigation, fertilizers, improved seeds, improved implements as well as the over-all level of technology, tenants are more progressive compared to owners. These tenants also used

improved resources more widely. He concludes that "evidence in regard to the use of improved technology does not seem to suggest that tenancy retards progress".

Does tenancy lead to under-investment in land ? There have been assertions that it does but little theoretical or empirical work has been done on this aspect. Of course, if investment is considered like any other input, then the Marshallian inefficiency under sharecropping would apply to investment as well. It seems to us, however, that decisions regarding investment are more appropriately made in a dynamic framework which explicitly recognises uncertainty regarding future prospects. In this context, it is sometimes asserted that since tenants are only temporary cultivators of land, they would be unwilling to invest in land if these investments are profitable only in the long-run. But even if this were true, the owner of land could himself undertake long-term investments and increase the rent on improved land. Insecurity of tenure is also supposed to lead to underinvestment. But this problem is not related to tenancy per-se. By lengthening the duration of the contract and by providing security of tenure, problems of underinvestment may be reduced. We may recall that insecurity of tenure was one possible means suggested to ensure efficient cultivation by the sharecropper. Empirical studies on the consequences of insecurity of tenure would be of help in determining which of the two forces dominate : the short-run efficiency in cultivation, or the long-run underinvestment in land.

In this chapter we have critically reviewed the existing literature on tenancy and its relevance in Indian agriculture. In the following chapters we will take up some of the issues discussed in this chapter for a more detailed analysis.

CHAPTER IV

TENANCY AND THEORY

In this chapter we present simple models which attempt to answer some of the questions that we had discussed in the earlier chapters. We will consider three aspects of tenancy.

1. When some inputs in production are not marketed or are marketed only in imperfect markets, what are the consequences for tenancy ? We will consider one such input — the 'management' input required in cultivation. We will also discuss the role of the size and composition of the cultivating households in their leasing decisions, particularly when some component of family labour is not marketed. (Section I).

2. Given that some households are richer than others and there are imperfections in the land and credit markets, how do these features influence the pattern of tenancy ? In particular, we discuss how some specific technological and institutional features of modernisation in agriculture influences (i) the distribution of tenanted area between the rich owner-tenants and the poorer pure-tenants (Section II), and (ii) the distribution of tenanted area between richer fixed-rent tenants and poorer sharecroppers.(Appendix 4).

3. In Section III we turn to a different set of questions. We study some of the implications of a particular institutional framework where the market for land-leasing and for credit are interlocked with the landlord being the sole supplier of credit to his tenant. We ask the question whether interlinking provides any additional benefit to the landowner in a situation where he has monopoly-power in the land and/or credit market. We also use

this framework to ask whether a landlord with monopoly power in both land and credit transactions would gain by discouraging yield improving technical change on his tenant's farm. Finally, in Section IV we will summarise our results in Sections I to III.

I

In this section we study some of the implications arising from the fact that one or more of the inputs in production are either non-marketed or are marketed in imperfect markets. In particular, we will consider two such inputs explicitly. One of these is the 'management' input required in cultivation. It is generally accepted that a market for management services exists very rarely in the context of Indian agriculture. The other input is the family-labour of the cultivating household. This becomes important because often some component of family-labour is not marketable, for example the labour of children of the family. There may be other inputs too that are not marketed (for example, bullock-labour services are not marketed in some regions) and this will be implicitly recognised in our model.

When 'management' is not marketed, tenancy would serve the purpose of adjusting the size of the household's operational holding to its fixed endowment of 'management'. Thus, a household deficient in 'management' (in the sense that the marginal product of land is less than what he would get by leasing it out) would prefer to lease-out land while a household having surplus 'management' in relation to its landholding would prefer leasing-in land.

Description of Model : The time spent in 'managing' the farm is treated explicitly as an input in production, in addition to inputs of land and labour

time engaged in ordinary operations (excluding land preparation). Thus, output Q is a function of land 'h', ordinary labour time 'l' and the time spent in 'managing' 'm', and we may write $Q = F(h, l, m)$. We also assume that to cultivate land a fixed amount of labour per acre is required in land preparation. Let 'a' be this amount of labour required in preparing one acre of land. Therefore, to cultivate h acres of land the total labour used is $(ah+l)$. To take account of the fact that we are ignoring other inputs, some of which may not be marketed (for example, bullock labour) and which are in fixed supply within a household, we assume that F exhibits diminishing returns in h, l, and m.

To distinguish between labour time engaged in 'managing' and in ordinary operations we assume that for the tenant household one hour spent in 'managing' is convertible to b_1 hours of ordinary labour time ($b_1 > 1$). We are therefore assuming that a member of the tenant household can work as ordinary labour and he can also 'manage' and b_1 represents the ease with which he can perform both functions. A household having a smaller b_1 would be one where the workers are 'better' in the sense that they can perform managerial functions better. b_1 could be interpreted in another way. A rise in b_1 would represent increasing managerial functions and their increasing complexity.

Just as in the case of the tenant household, assume that for the landowning household one hour spent in 'managing' is convertible to b_2 hours of time spent in ordinary operations. $b_1 \neq b_2$ reflects our assumption that the quality of labour available in the two households is not identical.

There is no market for 'management'. The time spent in 'managing' on both rented and self-cultivated land must therefore be provided from within the tenant household and the landowning household respectively. Thus, a labour household not leasing-in land can only offer itself for wage-employment and similarly, a landowning household cultivating its land must provide its own 'management'.

Suppose the landless household has $\bar{l}$ units of 'dependent' labour hours. This constitutes that part of its total labour which is not wage employable but which can nevertheless be utilised on work within the family farm[1/]. We assume that this labour can be utilised for ordinary operations which do not require much physical effort. 'Management' and strenuous work as in land preparation is ruled out for such labour. However, since we are assuming that this labour cannot be sold outside as wage labour, all of it will be utilised on family farm. In addition to the 'dependent' labour, the landless household has also $\tilde{l}$ units of wage employable labour which can perform all kinds of operations including 'management'.

Having described the endowments of the landless household we describe the choices available to it.

1. The household can lease-in land and devote its entire labour to cultivating it. It must then decide how much much land to lease-in and how to divide its labour time between 'managing' and other operations.

2. It may lease-in land but work mainly as wage labour.

3. It may work partly as wage-labour and partly on leased-in land. In this case it must decide on how much land to lease-in, how much labour to

1/ For example, the labour of children who cannot be employed outside as wage-labour due to child-labour legislation, or the labour of old men and women who are not preferred as wage-labour though they may be able to work.

use on leased-in land for ordinary operations and how much time to spend in 'managing'. What remains would be then offered for wage employment. We will be assuming that the landless household does not use hired labour for cultivation of leased-in land.

Let 'h' be the amount of land leased-in by the landless household. Sharecropping is the only form of tenancy contract that is available and let r be the crop-share of the landlord. To cultivate h units of land the household requires ah units of labour for land preparation. Additional labour required for routine operations is provided by the family's 'dependent' labour $\bar{l}$ and suppose l_1 units of wage employable labour is also utilised for ordinary work. If m_1 hours of labour time are utilised in 'managing' the farm then the total labour available for wage-employment is $(\bar{\bar{l}} - ah - l_1 - b_1 m_1)$. If $\bar{w}$ is the exogenously specified wage rate then the income of the tenant household is given by

$$y_t = (1-r)\, F(h, l_1 + \bar{l}, m_1) + \bar{w}\,(\bar{\bar{l}} - ah - l_1 - b_1 m_1).$$

The tenant chooses h, l_1 and m_1 to maximise y_t subject to the constraints that

(i) $l_1 \geq 0$, and

(ii) $\bar{\bar{l}} \geq ah + l_1 + b_1 m_1$.

Constraint (ii) reflects our assumption that the household does not use hired labour for cultivation. If (i) is binding, that is if $l_1 = 0$, this would be the case of a household which does not use any of its wage employable labour on leased-in land (other than that required for land preparation). In a rough sense, therefore, this household corresponds to a tenant household whose main occupation is wage labour. If (ii) is binding, that is if

$$\bar{\bar{l}} - ah - l_1 - b_1 m_1 = 0$$

this would be the case of a household which employs its entire labour force on rented land and does not enter the wage-labour market. This household represents the pure-cultivating household. When neither (i) nor (ii) is binding so that

$$l_1 > 0 \quad \text{and} \quad \bar{l} > ah + l_1 + b_1 m_1$$

then this represents a household which employs its wage-employable labour both as wage-labour as well as for work on rented land.

Confining our attention to the third type of household only[2], consider this household's interior maximum. The first order conditions[3] require :

$$(1 - r)F_1(h, l_1 + \bar{l}, m_1) - \bar{w}a = 0 \quad \ldots (1)$$

$$(1 - r)F_2(h, l_1 + \bar{l}, m_1) - \bar{w} = 0 \quad \ldots (2)$$

$$(1 - r)F_3(h, l_1 + \bar{l}, m_1) - \bar{w}b_1 = 0 \quad \ldots (3)$$

These are three equations which can be solved for h, l_1 and m_1 in terms of the endogenous r and the exogenously given parameters $\bar{l}$, $\bar{w}$, a and b_1. Given that F is concave, it can be shown that :

(a) $\dfrac{\delta h}{\delta \bar{w}} < 0$

Thus, as $\bar{w}$ increases, the opportunity cost of cultivation increases and wage employment becomes more profitable. Hence the household's demand for land-tenancy declines.

(b) $\dfrac{\delta h}{\delta a} < 0$

An increase in 'a' also increases the opportunity cost of cultivation since

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2/ Later on in this section we will consider a slightly simplified model with all three types of tenant households, just to illustrate the nature of the differences.

3/ Second order conditions are verified in Appendix 1.

to cultivate the same land more labour is needed. Hence the household's demand for land declines.

(c) $\frac{\delta h}{\delta b_1} < 0$

As b_1 increases, the opportunity cost of 'management' ($= b_1\bar{w}$) increases and again the household's demand for land declines.

We now describe the landowning household. Suppose it has $\bar{H}$ (without loss of generality assume this to be unity) units of land and $\bar{L}$ labour-hours. The household decides to lease-out q acres of land to the landless household and the remainder, 1-q, it cultivates with hired-labour. It is assumed that the landowning household does not work on land either as wage labour on other's land or on owned land. It does, however, devote its time to 'managing' its farm.

Let the landowning household employ l_2 units of wage-labour, in addition to the $a(1-q)$ units of labour required in land-preparation. The total wage-labour cost to the household is therefore

$$\bar{w}\left[l_2 + a(1-q)\right].$$

If the household utilises m_2 labour-hours in 'managing', then $\bar{L} - b_2m_2$ labour-hours are available for leisure. If $\bar{s}$ is the opportunity cost of leisure then the income of the landowning household is given by

$$y_1 = rF(q, l_1 + \bar{l}, m_1) + G(1-q, l_2, m_2) - \bar{w}(l_2 + a(1-q)) + \bar{s}(\bar{L} - b_2m_2)\ 4/.$$

4/ Actually, the landlord's income should be written as

$$y_1 = rF(q, l_1^a + \bar{l}^a, m_1^a) + G(1-q, l_2, m_2) - \bar{w}(l_2 + a(1-q)) + \bar{s}(\bar{L} - b_2m_2).$$

The landlord's optimisation is based on the assumption that the tenant will apply $(l_1^a + \bar{l}^a)$ units of ordinary labour-time on rented land and m_1^a units of labour in 'managing'. However, since in equilibrium we will

(footnote contd. in page 135)

The landlord chooses q, l_2, and m_2 given the other endogenous variables r, l_1 and m_1 and the exogenously given parameters $\bar{w}$, a, $\bar{s}$, $\bar{L}$ and b_2.

Assuming an interior maximum, the first order conditions[5] are :

$$rF_1(q, l_1 + \bar{l}, m_2) - G_1(1-q, l_2, m_2) + \bar{w}a = 0 \quad \ldots (4)$$

$$G_2(1-q, l_2, m_2) - \bar{w} = 0 \quad \ldots (5)$$

$$-G_3(1-q, l_2, m_2) + \bar{s}b_2 = 0 \quad \ldots (6)$$

From equations (4), (5) and (6) and given that F and G are concave, we can show that :

(a) $\frac{\delta q}{\delta \bar{w}} > 0$

As wage labour costs increase, self-cultivation is less preferred and more land is leased-out (q increases).

(b) $\frac{\delta q}{\delta a} > 0$

Again, an increase in a represents an increase in labour costs for the landowner. Hence he prefers to lease-out more land.

(c) $\frac{\delta q}{\delta b_2} > 0$

An increase in b_2 raises the opportunity cost of the landlord's managerial labour and makes leasing-out more profitable.

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footnote 4 contd. from page 134

be assuming that the $(l_1^a + \bar{l}^a, m_1^a)$ values assumed by the landlord in his maximisation equals their values $(l_1 + \bar{l}, m_1)$ as determined by the tenant in his maximisation, for our presentation we will ignore this notational distinction.

We should also mention that there is no assumption that the production functions are different for the tenant and the landlord. The symbols F and G are used only to indicate that the levels of inputs used on the landlord's and tenant's farms may be different. This convention will be adopted right through this chapter.

5/ Second order conditions are verified in Appendix 1.

We complete our description of the model with a specification of the markets and equilibrium.

The land-lease market is competitive in the sense that both the landless household and the landowning household behave as price-takers and are unable to influence the rental-share. Equilibrium in the market is given by the equality of the demand and supply of land, that is

$$h(r \mid \bar{l}, \bar{\bar{l}}, \bar{w}, \bar{s}, a, b_1, b_2) = q(r \mid \bar{l}, \bar{\bar{l}}, \bar{w}, \bar{s}, a, b_1, b_2) \quad \ldots\ldots (7)$$

Thus, if at a given rental-share the demand for land h exceeds (falls short of) the supply of land q, then the rental-share adjusts upwards (downwards) such that at the equilibrium rental-share the demand and supply for land are equalised.

In the labour market the wage rate is specified exogenously at $\bar{w}$ and at this wage the tenant household can get as much employment as it wishes. The landowning household also suffers from no shortage of labour.

There is no separate market for 'management'. But since time spent in 'managing' is convertible into time spent in routine operations, it may be thought that 'management' is indirectly tradeable. However, we are assuming that while the tenant and landowning households can utilise their labour endowment for 'management', labour-hours obtained in the form of wage-labour cannot (or do not) manage. Thus, while the landowning household hires wage-labour it cannot divert this for 'managing' but must use its own labour for 'managing'. Since the landowning household does not utilise its labour as cultivation-labour, we are, in effect, assuming that 'management' cannot be bought. Implicitly there are, therefore, three types of labour in our model :

(a) Tenant household's labour used on leased-in land. This labour can 'manage'.

(b) Tenant household's labour hired-out as wage labour. This cannot be used for managerial work, and

(c) Landowning household's family-labour which can 'manage'.

Results

Equations (1) to (6) and the equilibrium condition (7) give a system of seven equations in as many unknowns r, h, q, l_1, l_2, m_1 and m_2.[6/] Provided a solution exists, we can then derive the following comparative static propositions :

(1) $\frac{dh}{db_1} < 0$

As b_1 increases, the opportunity cost of managerial-labour for the tenant increases. His demand for tenancy therefore declines. Thus, in equilibrium better farmers lease-in relatively more land.

(2) $\frac{dh}{db_2} > 0$

As in (1), increase in b_2 increases the opportunity cost of the landowner's managerial-labour. He therefore supplies more land for tenancy. In equilibrium, better landowners lease-out relatively less land.

6/ Strictly speaking, there are really three equilibrium conditions.

One, Demand for land-tenancy h equals the supply of land q. This is our equation (7), that is h = q.

Two, $l_1^a + \bar{l}^a = l_1 + \bar{l}$, where l_1^a and $\bar{l}^a$ are the values of l_1 and $\bar{l}$ assumed by the landowner for his maximisation and l_1 and $\bar{l}$ are the actual values determined by the tenant.

Three, $m_1^a = m_1$, where the value assumed by the landowner for the tenant's input of 'management' on rented land equals the actual value determined by the tenant.

We are implicitly assuming that the second and third conditions hold and in our comparative static analysis we eliminate l_1^a and m_1^a using these two equations.

(3) $\frac{dh}{d\bar{w}} > 0$

A higher $\bar{w}$ raises the labour cost for the landowner and also makes wage-employment more profitable for the tenant. Thus, while the landowner's supply of land for tenancy increases, the tenant demands less land. The net effect appears to be positive. Tenancy is higher in higher wage regions.

(4) $\frac{dh}{da} > 0$

As in (3), the effect of an increase in **a** is to make cultivation less profitable for both the tenant and the landowner. While the latter increases his supply of land-tenancy, the tenant reduces his demand and the combined effect of these two opposing influences is positive. Tenancy will be lower in regions with more rainfall (smaller a).

(5) If there is unemployment and if $\bar{p}$ is the exogenously given proportion of labour supply that is employed[7/], then $\frac{dh}{d\bar{p}} < 0$. Obviously, as $\bar{p}$ increases wage-employment becomes more profitable and the tenant's demand for land declines. Tenancy will be less in regions with better wage-employment opportunities.

(6) If all of the landowning household's labour is used in 'managing' so that $\bar{L} = b_2 m_2$, then for such households $\frac{dh}{d\bar{L}} < 0$. That is, with an increase in the family-size they will lease-out less land.

7/ We had assumed that if the tenant household offered $(\bar{l} - ah - l_1 - b_1 m_1)$ units of labour for wage-employment, all of it was employed and the household's wage-income was therefore $\bar{w}(\bar{l} - ah - l_1 - b_1 m_1)$. Instead, we are now assuming that only a proportion $\bar{p}$ of total labour offered by the household is employed so that the household's income from wage labour is $\bar{w}\bar{p}(\bar{l} - ah - l_1 - b_1 m_1)$. The household's total income is therefore $y_t = (1 - r)F(h, l_1 + \bar{l}, m_1) + \bar{w}\bar{p}(\bar{l} - ah - l_1 - b_1 m_1)$, and the rest of the analysis is as before.

(7) (a) $\frac{dh}{d\bar{l}} = 0$ (b) $\frac{dh}{d\bar{\bar{l}}} = 0$

These two results show that when the labour market is perfect and if family 'dependent' labour $\bar{l}$ and the wage-employable labour $\bar{\bar{l}}$ are perfectly substitutable in some operations then the size and composition of the tenant household has no influence on its leasing behaviour. A large-sized family will offer its additional labour-hours in the wage-labour market and there need be no change in the extent of land leased-in.

It is also clear that some of our results, particularly (7), are over-simplified because of our interior maximum assumption. In our description of the labour household, we only considered the case of a household which devotes part of its labour to wage-employment and also works on rented land. We did not consider households that work entirely on leased-in land nor did we consider tenant households that work predominantly as wage-labour. With this simplification it is clear that the size and composition of the tenant household plays no part in its tenancy decisions. To see this, consider the tenant's maximisation problem. Maximising

$$y_t (+ h, l_1, m_1) = (1-r)F(h, l_1 + \bar{l}, m_1) + \bar{w}(\bar{\bar{l}} - ah - l_1 - b_1 m_1)$$

subject to the constraints that

(i) $l_1 \geq 0$ and (ii) $\bar{\bar{l}} \geq ah + l_1 + b_1 m_1$

is equivalent to maximising

$$y_t^* (h, l, m_1) = (1 - r)F(h, l, m_1) - \bar{w}(ah + b_1 m_1 + l')$$

subject to the constraints

(i) $l \geq \bar{l}$ and (ii) $ah + l + b_1 m_1 \leq \bar{\bar{l}} + \bar{l}$, where $l \equiv l_1 + \bar{l}$.

Assuming an interior maximum implies both the constraints are not binding and it is clear that the tenant's optimal choices do not involve either $\bar{l}$ or $\bar{\bar{l}}$.

To see more clearly how the size and composition of a tenant household affects its leasing decisions we reformulate our earlier model. We will consider three types of tenant households. To keep things simple we do not bring in 'management' explicitly. Output is therefore a function of land and labour alone, given by $Q = F(h, l)$, F exhibiting diminishing returns in h and l. As described above, a tenant household's income from cultivation and wage-labour is

$$y_t = (1 - r)F(h, l + \bar{l}) + \bar{w}(\bar{\bar{l}} - ah - l).$$

He maximises y_t subject to the constraints

$$(1)\ l \geq 0 \quad \text{and} \quad (2)\ ah + l \leq \bar{\bar{l}}.$$

Here, l is the wage-employable labour-hours used for routine operations on rented land and $\bar{\bar{l}} - ah - l$ labour-hours are offered for wage-employment. We are again ruling out labour-hiring by the tenant households.

We distinguish three types of tenant households depending on the nature of their maximisation.

Type-1 households : For such households, suppose $l > 0$ and $ah + l < \bar{\bar{l}}$. The type-1 household works both as wage-labour as well as on rented land. Let there be n_1 such households. Let each of these households lease-in h_1 units of land and let l_1 be the number of wage-employable labour-hours used for routine operations on rented land. The household's decision problem is to maximise its income

$$y_{t1}(h_1, l_1) = (1 - r)F(h_1, l_1 + \bar{l}_1) + \bar{w}(\bar{\bar{l}}_1 - ah_1 - l_1)$$ 8/

subject to the constraints that

$$(1)\ l_1 > 0 \quad \text{and} \quad (2)\ \bar{\bar{l}}_1 > ah_1 + l_1.$$

This requires :

8/ We are assuming that $\bar{l}_i$ and $\bar{\bar{l}}_i$ are respectively the number of 'dependent' labour-hours and the number of wage-employable labour-hours in the Type-i household, i = 1, 2, 3.

$$(1 - r)F_1(h_1, l_1 + \bar{l}_1) - \bar{w}a = 0 \quad \ldots\ldots (8)$$

$$(1 - r)F_2(h_1, l_1, + \bar{l}_1) - \bar{w} = 0 \quad \ldots\ldots (9)$$

Equations (8) and (9) can be solved for h_1 and l_1 in terms of r, given $\bar{l}_1$, $\bar{w}$ and a. We can then show that :

(i) $\frac{\delta h_1}{\delta \bar{w}} < 0$ and (ii) $\frac{\delta h_1}{\delta a} < 0$

That is, Type-1 household's demand for land declines as the opportunity cost of cultivation increases (through increase in $\bar{w}$ or in a).

(iii) $\frac{\delta h_1}{\delta \bar{l}_1} = 0$ and $\frac{\delta h_1}{\delta \bar{\bar{l}}_1} = 0$

That is, the Type-1 household's demand for land is not affected by family-size or its composition.

Type-2 households : For these households we assume the second constraint is binding so that $\bar{\bar{l}} = ah + l$. These households work full time on rented land. Let there be n_2 such households. Let h_2 be the amount of land leased-in by each of these households and let l_2 be the number of wage-employable labour-hours used on rented land. The household's decision problem is to maximise its income y_{t2}, where

$$y_{t2}(h_2, l_2) = (1-r)G(h_2, l_2 + \bar{l}_2) + \bar{w}(\bar{\bar{l}}_2 - ah_2 - l_2)$$

subject to the constraints

(i) $l_2 > 0$ and (ii) $ah_2 + l_2 = \bar{\bar{l}}_2$.

This is equivalent to maximising

$$L(h_2, l_2, \lambda) = (1 - r)G(h_2, l_2 + \bar{l}_2) + \bar{w}(\bar{\bar{l}}_2 - ah_2 - l_2)$$

$$+ \lambda(\bar{\bar{l}}_2 - ah_2 - l_2)$$

The household's maximisation requires :

$$(1-r)G_1(h_2,\ l_2 + \bar{l}_2) - (\bar{w} + \lambda)a = 0 \qquad \ldots \quad (10)$$

$$(1-r)G_2(h_2,\ l_2 + \bar{l}_2) - (\bar{w} + \lambda) = 0 \qquad \ldots \quad (11)$$

and

$$-ah_2 - l_2 + \bar{\bar{l}}_2 = 0 \qquad \ldots \quad (12)$$

Equations (10), (11) and (12) can be solved for h_2, l_2 and λ in terms of r and the exogenous parameters $\bar{l}_2$, $\bar{\bar{l}}_2$, $\bar{w}$ and a. We notice from (10) and (11) that

$$G_1(h_2,\ l_2 + \bar{l}_2) = aG_2(h_2,\ l_2 + \bar{l}_2)$$

and with (12) this gives two equations to solve for h_2 and l_2. Clearly, h_2 so obtained is independent of $\bar{w}$ and is only a function of a, $\bar{l}_2$ and $\bar{\bar{l}}_2$. Thus a change in the wage rate will not affect the Type-2 household's demand for land. We can also show that :

(i) $\dfrac{\delta h_2}{\delta \bar{\bar{l}}_2} > 0$

(ii) $\dfrac{\delta h_2}{\delta \bar{l}_2} > 0$

That is, an increase in either the number of 'dependent' labour-hours or in the number of wage-employable labour-hours results in greater leasing-in by the Type-2 household.

(iii) $\dfrac{\delta h_2}{\delta \bar{\bar{l}}_2} = \dfrac{\delta h_2}{\delta \bar{l}_2}$

This suggests that for the Type-2 households it is the size of the family that matters in leasing decisions and not the distinction between 'dependents' and 'workers'.

Type-3 households : For such households suppose $l = 0$. Thus while the household cultivates leased-in land, it uses the minimum of its wage-employable labour for work on rented land. All the wage-employable labour (except the minimum required in land-preparation) is offered for wage-employment. Let there be n_3 such households. Let the household lease-in h_3 units of land and let l_3 wage-employable labour-hours be utilised on rented land. The household's decision problem is to maximise its income y_{t3}, where

$$y_{t3}(h_3, l_3) = (1-r)J(h_3, l_3 + \bar{l}_3) + \bar{w}(\bar{\bar{l}}_3 - ah_3 - l_3)$$

subject to the constraints

(i) $l_3 = 0$ and (ii) $\bar{\bar{l}}_3 > ah_3 + l_3$.

This is equivalent to maximising

$$(1-r)J(h_3, \bar{\bar{l}}_3) + \bar{w}(\bar{\bar{l}}_3 - ah_3).$$

Interior maximum requires

$$(1-r)J_1(h_3, \bar{l}_3) - \bar{w}a = 0 \qquad \ldots \quad (13)$$

Equation (13) can be solved for h_3 in terms of r, $\bar{l}_3$, $\bar{w}$ and a. We can then show that :

(i) $\dfrac{\delta h_3}{\delta \bar{w}} < 0$

(ii) $\dfrac{\delta h_3}{\delta a} < 0$

As before, as the opportunity cost of cultivation increases (through increase in $\bar{w}$ or in a) the Type-3 household's demand for land declines.

(iii) $\dfrac{\delta h_3}{\delta \bar{l}_3} > 0$

(iv) $\dfrac{\delta h_3}{\delta \bar{\bar{l}}_3} = 0$

Thus, for the Type-3 households the presence of more 'dependents' increases their demand for land. Moreover, for such households it is the composition that matters in leasing decisions and not the size of family. Thus, if there is an increase in the number of 'workers' (i.e., $\bar{l}_3$) it does not influence the extent of land demanded by the household. If there is an increase in the number of 'workers' which is matched by an equal reduction in the number of 'dependents' so that family-size remains unchanged, then the household will demand less land.

To keep our analysis simple, we assume that the total land available for tenancy is given at $\bar{H}$, so that in equilibrium we must have

$$n_1 h_1 + n_2 h_2 + n_3 h_3 = \bar{H} \qquad \ldots \quad (14)$$

Equations (8) to (14) can be solved for the unknowns h_1, h_2, h_3, l_1, l_2, r and λ. If a solution to this system of equations exists we can derive the following comparative static results :

$$(1.1) \qquad \frac{dh_1}{d\bar{H}} > 0$$

$$(1.2) \qquad \frac{dh_2}{d\bar{H}} = 0$$

$$(1.3) \qquad \frac{dh_3}{d\bar{H}} > 0$$

As tenancy increases, the distribution of leased-out land shifts from Type-2 households to Type-1 and Type-3 households. This is not difficult to see within our model. As we have shown from equations (10), (11) and (12), h_2 is independent of $\bar{H}$ so that any increase in $\bar{H}$ will be distributed between Type-1 and Type-3 households.

(2.1) $\frac{dh_1}{da} > 0$

(2.2) $\frac{dh_2}{da} < 0$

(2.3) The sign of $\frac{dh_3}{da}$ is not clear.

With improvement in soil quality (say with better rainfall) less labour is required in land-preparation (a falls) and the distribution of leased-out land shifts from Type-1 to Type-2 households.

(3) $\frac{dr}{d\bar{w}} = -\left(\frac{1-r}{\bar{w}}\right) < 0$

This implies $\left(\frac{d\bar{w}}{\bar{w}}\right) = -\left(\frac{dr}{1-r}\right)$ or $\bar{w} = k(1 - r)$ or $\left(\frac{1-r}{\bar{w}}\right)$ is a constant in equilibrium. This has an important implication, as our next result shows.

(4.1) $\frac{dh_1}{d\bar{w}} = 0$

(4.2) $\frac{dh_2}{d\bar{w}} = 0$

(4.3) $\frac{dh_3}{d\bar{w}} = 0$

Thus in our model, a change in the wage-rate does not influence the distribution of leased-out area between the three types of households. For the Type-2 household this is, of course, easily explained since this household does not enter the wage-labour market at all. To see why a change in wage-rate does not influence the allocation of rented land between the Type-1 and Type-3 households we observe that their respective maximands can be written as following :

$$y_{t1} = (1-r) \{ F(h_1, l_1 + \bar{l}_1) + (\frac{\bar{w}}{1-r}) (\bar{\bar{l}}_1 - ah_1 - l_1) \}$$

$$y_{t3} = (1-r) \{ J(h_3, l_3 + \bar{l}_3) + (\frac{\bar{w}}{1-r}) (\bar{\bar{l}}_3 - ah_3 - l_3) \}$$

Clearly, the optimal choice for both Type-1 and Type-3 households depends only on $(\frac{\bar{w}}{1-r})$. As long as this remains unchanged their optimal choices, h_1 and h_3 respectively, would be unchanged. But we have just seen that any change in $\bar{w}$ is matched by a change in r such that in equilibrium $(\frac{\bar{w}}{1-r})$ is unchanged. Thus a change in $\bar{w}$ leaves h_1 and h_3 unaltered.

(5.1) $\frac{dh_1}{d\bar{l}_1} = 0, \quad \frac{dh_2}{d\bar{l}_1} = 0, \quad \frac{dh_3}{d\bar{l}_1} = 0$

(5.2) $\frac{dh_1}{d\bar{\bar{l}}_1} = 0, \quad \frac{dh_2}{d\bar{\bar{l}}_1} = 0, \quad \frac{dh_3}{d\bar{\bar{l}}_1} = 0$

Thus, in equilibrium, neitherr the family-size nor its composition influences the Type-1 household's leasing decision.

(6.1) $\frac{dh_2}{d\bar{l}_2} > 0, \quad \frac{dh_1}{d\bar{l}_2} < 0, \quad \frac{dh_3}{d\bar{l}_2} < 0$

(6.2) $\frac{dh_2}{d\bar{\bar{l}}_2} > 0 \quad \frac{dh_1}{d\bar{\bar{l}}_2} < 0 \quad \frac{dh_3}{d\bar{\bar{l}}_2} < 0$

Thus in contrast to Type-1 households, large-sized Type-2 households lease-in more land in equilibrium. This is intuitively plausible. For households not entering the labour market any increase in the availability of family-labour can be utilised by leasing-in more land.

$$(7.1)\qquad \frac{dh_1}{d\bar{l}_2} = \frac{dh_1}{d\bar{\bar{l}}_2}$$

$$(7.2)\qquad \frac{dh_2}{d\bar{l}_2} = \frac{dh_2}{d\bar{\bar{l}}_2}$$

$$(7.3)\qquad \frac{dh_3}{d\bar{l}_2} = \frac{dh_3}{d\bar{\bar{l}}_2}$$

Thus in equilibrium, it is the family-size of the Type-2 household that is important in leasing decisions. Thus any reduction in the number of 'dependents'($\bar{l}_2$), if it is matched by an equal increase in the number of 'workers' ($\bar{\bar{l}}_2$) will leave the extent of land leased-in by the Type-2 household unchanged in equilibrium.

$$(8.1)\qquad \frac{dh_3}{d\bar{l}_3} > 0, \qquad \frac{dh_1}{d\bar{l}_3} < 0, \qquad \frac{dh_2}{d\bar{l}_3} = 0$$

$$(8.2)\qquad \frac{dh_3}{d\bar{\bar{l}}_3} = 0, \qquad \frac{dh_1}{d\bar{\bar{l}}_3} = 0, \qquad \frac{dh_2}{d\bar{\bar{l}}_3} = 0$$

For Type-3 households, an increase in the number of 'dependents' induces greater leasing-in of land. Unlike the Type-2 households, a reduction in the number of 'dependents'($\bar{l}_3$) even if matched by an equal increase in the number of 'workers' ($\bar{\bar{l}}_3$) will result in the household leasing-in less land in equilibrium.

We have thus shown that for Type-1 households the equilibrium amount of land leased-out is independent of the size and composition of the household. In the case of Type-2 households, the 'dependent'- 'worker' composition is immaterial in its leasing decision but, in equilibrium, more land

is leased-out to larger Type-2 households. Among Type-3 households, relatively more land is leased-out to households with relatively more 'dependents' and family-size per-se does not affect the extent of land leased-out to the household.

II

In section I we developed a model which incorporated one important feature of agriculture in some parts of the country, viz., the non-marketability of an input like 'management' or some component of the cultivating household's family-labour. In this section we consider a model which introduces yet another important aspect. Suppose some tenants are wealthier than others and further assume that some markets, notably those for credit and/or inputs like chemical-fertilizers are imperfect in the sense that the price for the same commodity is less for the wealthier tenant vis-a-vis the poorer one. Thus, in the Indian context it is said that credit is available relatively more cheaply to the richer households who have suitable collateral while the poorer households borrow at higher rates. Similarly, inputs like fertilizers are also more easily available to the richer households. In this context we would be interested in how technological changes and modernisation in general influence the distribution of leased land between the rich and poor tenants. This is obviously important for policy. We will discuss this question in a simplified setting.

Description of model : There are three types of households. A Type-1 household is a pure landowning household which leases-out all its land.[9] We

9/ For example, lack of an essential input which is not marketed, say, management ability, may be the reason for not cultivating any land.

call this household the landlord household. Let $\bar{H}_1$ be the total acres of land held by this household. The Type-2 household also owns land. However, it cultivates land by hiring wage-labour. Family-labour is not used in cultivation by this household. We call this household the owner-tenant household. Suppose it owns $\bar{H}_2$ acres of land. It may lease-in more land from the Type-1 household and it can also lease-out some of its owned land to the Type-3 household, which we will call the pure tenant household. The Type-3 household does not own any land. However, it cultivates land by leasing-in land from the Type-1 and/or Type-2 household. We assume that this household uses only family-labour for cultivation and it also works as wage-labour. Let $\bar{L}$ be the household's endowment of family-labour. Thus, while both Type-2 and Type-3 households lease-in land and cultivate, we have already introduced the following differences in them :

(i) The Type-2 household owns land and it leases-in and leases-out land. Type-3 is a landless household and can only lease-in land.

(ii) The Type-2 household uses only hired wage-labour for cultivation. The Type-3 household employs only family-labour in cultivation.

(iii) The Type-2 household does not work as wage-labour, while the Type-3 household works as wage-labour in addition to cultivating rented land.

As between the Type-2 and Type-3 households, a Type-3 household corresponds more closely to the poorer sharecropper. A Type-2 household represents the relatively better-off owner-tenant household. The Type-1 household represents the big landowning household leasing-out all its land.

We will be implicitly assuming that in terms of wealth and 'power' (which is a result of the extent of land-ownership etc.) the Type-1 household

is most powerful, followed by the Type-2 owner-tenant household and the Type-3 pure-tenant household. This is reflected in our model partly by the set of feasible alternatives available to the different households. For example, in tenancy contracts with the Type-1 landlord household, households of Type-2 (owner-tenant households) have greater degree of freedom compared to the Type-3 (pure-tenant) households. Specifically, we assume that the pure-tenant household has no say in the amount of land that will be leased-out to him by the landlord household. He accepts whatever land is offered to him on lease by the landlord household.[10/] This is not the case in tenancy contracts between the landlord household and the owner-tenant household where the amount of land leased-out is influenced by the owner-tenant's demand for land. Thus the superior bargaining strength of the landlord household vis-a-vis the pure-tenant household gives the former the freedom to lease-out any amount of land it wishes. However, its 'power' is not sufficient to enable it to act the same way in transacting with the owner-tenant household.

We will be assuming that in tenancy contracts between the landlord household and the owner-tenant household and in contracts between the owner-tenant household and the pure-tenant household competitive conditions prevail in the sense that the land allocation and the rental shares are not determined by any one party alone. A possible rationale for this assumption is that while the wide disparity in wealth and power between the landlord household and the pure-tenant household allows the former to unilaterally decide how much land to lease-out to the latter, the disparities between

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10/ We may think of a situation when the pure-tenant household wishes to utilise its large 'dependent' labour force which cannot get outside employment. To do so it leases in whatever land is offered to it by the landlord household, if the landlord household gives it an all- or-none choice.

the landlord and owner-tenant household (as well as between the owner-tenant household and the pure-tenant household) are not sufficient to provide any one party any monopoly-power in tenancy transactions.

However, imperfections in the markets for credit and/or other inputs like fertilizers etc., lead to inequality in access to such inputs. Such imperfections may, in extreme cases, prevent the poorer pure-tenant from having access to yield-improving inputs like fertilizers. Thus for the same amount of land and labour inputs, better access to new technology and inputs allows the owner-tenant to produce more than the pure-tenant household. For simplicity, we focus on only one form of tenancy, sharecropping[11/].

Markets : The main focus is on the land-lease market. The market is perfect in the sense that neither the tenants nor the landlord can influence directly the rental-shares. However, the nature of the equilibrium in contracts between the landlord and the pure-tenant household and in contracts between the landlord and the owner-tenant household differs. While in the latter the equilibrium is defined by the equality of the demand and supply of land-lease, in the former any land offer from the landlord household is acceptable to the pure-tenant household and constitutes an equilibrium.

In the labour market, there is an exogenously given wage rate $\bar{w}$ and $\bar{p}$ is an exogenously given proportion of labour supplied that gets employed in the wage-labour market.

Given this framework we analyse the impact of the following exogenous changes :

(1) Better possibilities of wage employment, given by an increase in $\bar{p}$.

(2) Reduction in the labour required for land-preparation.

(11/ In Appendix 4 we consider a model with sharecropping and fixed-rent.

(3) An upward shift in the parameter representing neutral technical progress.

(4) Reduction in the inequality of access to new technology and inputs.

We will discuss the impact of these forces on (i) the extent of tenancy, (ii) the pattern of tenancy, i.e., the distribution of leased-out area between owner-tenants and pure-tenants and (iii) the distribution of total operated area between owner-tenants and pure-tenants.

We now describe the model in detail. The Type-1 landlord household has $\bar{H}_1$ acres of land. It must choose how much land to lease-out to the pure-tenant household and the owner-tenant household. The household has two sources of income — rental income from land leased-out to the owner-tenant household and rental income from land leased-out to the pure-tenant household. Let the cropshare of the landlord household be r_1. If h_1 is the land leased-out to the owner-tenant household then the landlord household's income is

$$y_1 = r_1 \Big[\underbrace{k\rho F^1(h_1, l_1)}_{\substack{\text{rental income from land leased-out to the owner-tenant household}}} + \underbrace{\rho G^1(\bar{H}_1 - h_1, l_2)}_{\substack{\text{rental income from land leased-out to the pure-tenant household}}} \Big]$$

Here $k\rho F(h, l)$ is the production function for the owner-tenant household. ρ is the neutral technical progress parameter and k represents the advantage accruing to the owner-tenant household due to better access to the new technology and inputs. F^1 and G^1 are identical and exhibit diminishing returns in h and l[12]. l_1 is the labour used by the owner-tenant household on rented land and similarly, l_2 is the labour used by the pure-tenant

12/ As discussed earlier, the presence of a third input which is not marketed and is in limited supply would be sufficient to assure diminishing returns.

household on rented land. The landlord household chooses h_1 to maximise y_1. Assuming an interior maximum, the first order condition[15] is

$$r_1 \left[k \rho F_1^1 (h_1, l_1) - \rho G_1^1 (\bar{H}_1 - h_1, l_2) \right] = 0 \qquad \ldots (15)$$

Equation (15) can be solved for h_1 in terms of r_1, given l_1, l_2 and the exogenous parameters k, ρ and $\bar{H}_1$. We can show that

$$\frac{\delta h_1}{\delta k} > 0$$

That is, if the access to new technology becomes more equal (k falls) the landlord household will want to lease-out more land to the pure-tenant household.

The Type-2 owner-tenant household has $\bar{H}_2$ units of land. It leases-in q_1 units of land from the landlord household. It also leases-out some of its owned land, say h_2, to the pure-tenant household[14]. Let the crop-share in this contract be r_2. The Type-2 household cultivates the rest of its owned land, $\bar{H}_2 - h_2$, with hired labour. The owner-tenant household has two sources of income :

(1) Income from cultivating rented land and owned land.

(2) Rental income from land leased-out to the pure-tenant household.

The income of the Type-2 household is given by

$$y_{ot} = \{(1-r_1)k\rho F^1(q_1, l_1) - \bar{w}(l_1 + aq_1)\} +$$

$$\{k \rho F^2(\bar{H}_2 - h_2, 1) - \bar{w}(1+a(\bar{H}_2 - h_2))\} + r_2 \rho G^2(h_2, l')$$

15/ Second order conditions are verified in Appendix 2.

14/ The household may lease-in and lease-out land simultaneously to obtain a contiguous operational holding.

The terms in the first curly bracket refer to the income from land leased-in from the landlord household. The second bracket gives the income from self-cultivation with hired labour and the remaining term outside the brackets is the rental income from land leased-out to the pure-tenant household. As in the earlier model, we are assuming that to cultivate land a fixed amount of labour per acre is needed in land preparation and a is the labour required for preparing one acre of land. As before, all production functions are identical and the different symbols only indicate different input levels on different farms.

The owner-tenant household chooses q_1, l_1, h_2 and l to maximise y_{ot}. Assuming an interior maximum, the first order conditions are[15/]:

$$(1-r_1)\, k\, \rho F_1^1 (q_1, l_1) - \bar{w}a = 0 \qquad \ldots (16)$$

$$(1-r_1)\, k\, \rho F_2^1 (q_1, l_1) - \bar{w} = 0 \qquad \ldots (17)$$

$$\rho\left[-kF_1^2 (\bar{H}_2 - h_2, l) + r_2 G_1^2 (h_2, l')\right] + \bar{w}a = 0 \qquad \ldots (18)$$

$$k\, \rho F_2^2 (\bar{H}_2 - h_2, l) - \bar{w} = 0 \qquad \ldots (19)$$

Equations (16) to (19) can be solved for q_1, l_1, h_2, and l. It can be shown that :

(i) $\dfrac{\delta q_1}{\delta \bar{w}} < 0$ and $\dfrac{\delta h_2}{\delta \bar{w}} > 0$.

As the wage rate increases the demand for land by the owner-tenant household declines (q_1 falls) and more land is leased-out by the owner-tenant household to the pure-tenant household.

(ii) $\dfrac{\delta q_1}{\delta a} < 0$ and $\dfrac{\delta h_2}{\delta a} > 0$.

15/ Second order conditions are verified in Appendix 2.

15/ Second order conditions are verified in Appendix 2.

As before, an increase in a makes cultivation less profitable. Hence there is a decline in the demand for land by the owner-tenant household and an increase in its supply of land to the pure-tenant household.

(iii) $\frac{\delta q_1}{\delta k} > 0$ and $\frac{\delta h_2}{\delta k} < 0$

That is, as disparities in access to new technology are reduced (k falls) the owner-tenant household prefers to lease-in less land from the landlord household and lease-out more land to the pure-tenant household.

The Type-3 pure-tenant household has no land. It leases-in whatever land is leased-out to it by the landlord household (i.e., $\bar{H}_1 - h_1$) at a crop-share r_1. In addition, it leases-in t_2 acres of land from the owner-tenant household and the owner-tenant household's crop-share in this contract is r_2. The pure-tenant household applies part of its labour on cultivating rented land and the rest is offered for wage-employment. The household's income from cultivating leased-in land as well as wage-employment is

$$y_{pt} = \underbrace{(1-r_1)\rho G^1(\bar{H}_1-h_1, l_2)}_{\text{income from land rented from landlord household}} + \underbrace{(1-r_2)\rho G^2(t_2, l')}_{\text{income from land rented from owner-tenant household}} + \underbrace{\bar{w}\bar{p}\left[\bar{L} - l_2 - l' - a(t_2+\bar{H}_1-h_1)\right]}_{\text{wage income}}$$

The pure-tenant household chooses l_2, t_2 and l' to maximise y_{pt}. Assuming an interior maximum, the first order conditions are[16]:

$$(1-r_1)\rho G_2^1(\bar{H}_1 - h_1, l_2) - \bar{w}\bar{p} = 0 \quad \ldots (20)$$

$$(1-r_2)\rho G_1^2(t_2, l') - \bar{w}\bar{p}a = 0 \quad \ldots (21)$$

$$(1-r_2)\rho G_2^2(t_2, l') - \bar{w}\bar{p} = 0 \quad \ldots (22)$$

16/ Second order conditions are verified in Appendix 2.

Equations (20), (21) and (22) can be solved for l_2, t_2 and l' in terms of r_1, r_2, h_1 and the exogenous parameters. We can then show the following :

(i) $$\frac{\delta t_2}{\delta \bar{w}} < 0$$

(ii) $$\frac{\delta t_2}{\delta \bar{p}} < 0$$

(iii) $$\frac{\delta t_2}{\delta a} < 0$$

Thus, when the opportunity cost of cultivation increases (through increases in $\bar{w}$, $\bar{p}$ or a) the pure-tenant household will want to lease-in less land from the owner-tenant household.

(iv) $$\frac{\delta t_2}{\delta \rho} > 0$$

With the availability of better technology (represented here by an upward shift in the neutral technical progress parameter ρ) the pure-tenant household will desire more land.

In <u>equilibrium</u> two further conditions must hold. First, the land leased-out by the landlord household to the owner-tenant household must equal the land leased-in by the owner-tenant household from the landlord household. That is

$$h_1 = q_1 \qquad \ldots \quad (23)$$

Secondly, the land leased-out by the owner-tenant household to the pure-tenant household must equal the land leased-in by the pure-tenant household from the owner-tenant household. That is

$$h_2 = t_2 \qquad \ldots \quad (24)$$

This completes the description of the model. Equations (15) to (24) are ten equations in as many unknowns. (The unknowns are r_1, r_2, h_1, q_1, h_2, t_2, l_1, l_2, l^s and l). Assuming an equilibrium solution exists for this system of equations[17], we can derive the following comparative static propositions. Let

$$\delta \equiv \text{Total land leased-out} = \bar{H}_1 + h_2.$$

$$\lambda \equiv \frac{\text{Area leased-in by the owner-tenant household}}{\text{Total leased-out area}} = \frac{h_1}{\bar{H}_1 + h_2}$$

$$\mu \equiv \frac{\text{Area operated by owner-tenant household}}{\text{Total operated area}} = \frac{\bar{H}_2 + h_1 - h_2}{\bar{H}_1 + \bar{H}_2}$$

Then we can prove the following results :

Variation in $\bar{p}$

(1) $\frac{dh_1}{d\bar{p}} > 0$

(2) $\frac{dh_2}{d\bar{p}} < 0$

$\longrightarrow$ $\delta \downarrow$, $\lambda \uparrow$, $\mu \uparrow$

With better employment opportunities, tenancy declines and there is a shift in both the distribution of leased-out area and operated area in favour of the owner-tenant households.

Variation in a

(3) $\frac{dh_1}{da} < 0$ if $F^1_{12}\ G^1_{22} > \bar{p}\ G^1_{12}\ F^1_{22}$

(4) $\frac{dh_2}{da} > 0$

$\longrightarrow$ $\delta \uparrow$, $\lambda \downarrow$, $\mu \downarrow$

With technological changes reducing the labour required in land-preparation, tenancy will decline. Or, if rainfall improves soil quality and reduces the

17/ In Appendix 3 we work out an explicit solution using Cobb-Douglas production functions.

labour required in land-preparation then our result suggests that tenancy will be less in better rainfall regions. It may also shift the distribution of leased-out land and operated area in favour of the owner-tenant households.

Variation in ρ.

$$(5)\quad \frac{dh_1}{d\rho} = 0 \qquad (6)\quad \frac{dh_2}{d\rho} < 0 \qquad \longrightarrow \quad \delta \downarrow,\ \lambda \uparrow,\ \mu \uparrow$$

Neutral technical progress does not affect the extent of land-leasing between the landlord household and the tenants. It does, however, lead to a reduction in tenancy as well as a shift in the distribution of both leased-out area and total operated area in favour of the owner-tenant household. This is clearly a consequence of the biased impact of the technology.

Variation in k.

$$(7)\quad \frac{dh_1}{dk} > 0 \qquad (8)\quad \frac{dh_2}{dk} < 0 \qquad \longrightarrow \quad \delta \downarrow,\ \lambda \uparrow,\ \mu \uparrow$$

With a reduction in the inequality in access to the new technology there will be an increase in tenancy. There will also be a shift in the distribution of leased-out area as well as operated area in favour of the pure-tenant households.

These results are summarised in the table below.

Effect of / on	Increase in $\bar{p}$	Decrease in a	Increase in ρ	Decrease in k
Extent of tenancy	↓	↓	↓	↑
Area leased out to the owner-tenant household as % of total tenanted area	↑	↑	↑	↓
Area operated by the owner-tenant household as % of total operated area	↑	↑	↑	↓

III

In this section we discuss another feature of the rural economy which has been much discussed in the Indian context. It is said that markets are often 'interlocked' in the sense that the same individuals transact with each other simultaneously in two or more markets. For example, it is said that the landowner not only leases-out land but he also provides consumption/production loans to his tenant. In this context it is sometimes asserted that interlocking enhances the 'power' of the landowner-creditor and this leads to greater 'exploitation' of the tenant. Another claim is that in the context of interlinked land and credit markets, when these markets are themselves imperfect, a landowner would discourage the adoption of yield-increasing innovations on his tenant's farm. We will discuss these aspects in a specific context.

We assume that the landowner is the sole supplier of credit to his tenant. Suppose further that he has monopoly-power in the land-lease as well as the credit market. We then show the following :

(i) The landowner may not always prefer inter-linked transactions, even though he is the sole supplier of credit and has monopoly-power in the land and credit transactions. In fact, he may so adjust the terms of the tenancy and credit contracts that the tenant is induced not to borrow at all.

(ii) When there is interlocking, the interest rate charged on the loan is zero. Thus there is no additional income from usury and interlocking does not lead to 'exploitation' through high interest rates on consumption loans to tenants. Any advantage from interlinking must presumably be arising from the impact of cheap borrowing on production on rented land.

These results depend on our assumption that the landlord has monopoly power in both the land and credit transactions. We also study the consequences for the landlord when his monopoly-power in any of the two markets is curtailed. It is seen that if the landlord's power in the land-lease market is curtailed in the sense that he cannot set the rental-share r above a certain level $\bar{r}$, then, even though he retains his power in the credit market his (landlord's) welfare will be less compared to the situation when he has monopoly-power in both markets. Thus, in our model, a restriction on the landlord's power in the land market does affect him adversely, even though there is interlinking and he retains complete monopoly-power in the credit market. It is not true, in general, that if the landlord has monopoly-power in one of the transactions, monopoly-power in another interlinked transaction gives him no additional advantage.

It is shown, however, that a restriction on the landlord's power to set the interest rate on loans has no adverse impact on the landlord's welfare, provided he retains his freedom to set the rental-share in the tenancy contract.

Thus, our model suggests that in the context of interlinked tenancy and credit transactions, policies aimed at improving the welfare of the tenant by imposing restrictions on the landlord's power to set the interest rate are bound to be ineffective, if the landlord retains his power in the tenancy transaction. A more appropriate policy would be to restrict the landlord's power to set the rental-share.

We also show that the landlord always stands to gain from yield-increasing technological innovations on the tenant's land. Thus, landlords will not discourage the use of better technology on rented land.

We now describe the basic outline of the model. The details of the solution can be found in Appendix 5.

Model : Suppose the tenant leases-in land from a single landowner who is also the sole supplier of credit to him. Assume that the landowner has monopoly-power in the land-lease as well as the credit market. In our model we take this to mean that the landowner can unilaterally fix the values of both the rental-share in the tenancy contract and the interest rate in the credit transaction.

We assume there are two periods. All production activities are completed in the first period and the second period is devoted solely to consumption.

The landlord has a fixed amount of land (say, one unit) which is completely leased-out to the tenant at the beginning of period one. Let the landlord's crop-share be r. By assumption, the landlord does not cultivate any land.

The tenant household leases-in land at the beginning of period one. Suppose he has one unit of labour. Part of this labour is utilised on rented land during the first period. The rest is offered for wage-employment in period one. We assume production takes time so that 'c' units of labour applied during the first period results in one unit of output only in the beginning of the second period. Thus, income from land accrues only during the second period. The tenant's consumption in period one can come either from wage income or from borrowing. His decision problem is to choose the level of output to produce on rented land (in other words, decide how much of his labour to use on rented land and how much to utilise in wage-employment) and to choose his level of borrowing.

Suppose the tenant wishes to borrow an amount B in period one and assume he produces y units of output from rented land. To produce y units in the beginning of the second period, the tenant must use cy units of labour on rented land in period one. If $\bar{w}$ is an exogenously specified wage rate in period one, then the tenant's income from wage employment in period one is $\bar{w}(1-cy)$. If $\bar{c}'_t$ is the initial endowment of the tenant then his consumption in period one and period two, C_{t1} and C_{t2} respectively, is given by

$$C_{t1} = \bar{c}'_t + \bar{w}(1-cy) + B = \bar{c}_t + B - c\bar{w}y, \quad \text{where } \bar{c}_t = \bar{c}'_t + \bar{w}.$$

$$C_{t2} = (1-r)y - (1+i)B.$$

For simplicity, we assume the tenant has a utility function of the form

$$U_t(C_{t1}, C_{t2}) = \alpha_1 \log C_{t1} + \alpha_2 \log C_{t2}.$$

Then the tenant chooses y and B to maximise U_t subject to the following constraints:

$$C_{t1} \geq c_s \qquad \ldots (25)$$

$$C_{t2} \geq c_s \qquad \ldots (26)$$

$$B \geq 0 \qquad \ldots (27)$$

and

$$0 \leq y \leq \bar{y} \left(= \frac{1}{c}\right) \qquad \ldots (28)$$

Constraints (25) and (26) require that the tenant's consumption in period one and period two must exceed some minimum c_s. For simplicity we assume that c_s equals zero. Constraint (27) reflects our assumption that the tenant cannot lend to the landowner. In (28) we are assuming that given one unit of labour the tenant can at most produce 1/c units of output on rented land and moreover, we are assuming that some output has to be

produced on land leased-in. In other words, we do not permit the tenant to lease-in land and not put any labour on rented land.

The tenant's maximisation gives the optimal levels of production $\hat{y}$ and borrowing $\hat{B}$ as functions of i and r.

For any choice of i and r the landlord's consumption in period one and period two, C_{11} and C_{12} respectively, is given by :

$$C_{11} = \bar{c}_1 - \hat{B}(i, r)$$

$$C_{12} = r\,\hat{y}(i, r) + (1 + i)\,\hat{B}(i, r)$$

$\bar{c}_1$ is the initial endowment of the landlord.

We are assuming that the landlord gives to the tenant whatever loan is asked for. We are also assuming that the landlord knows how much the tenant will produce and borrow for different values of i and r. Suppose the landlord's utility function is also of the form

$$U_1(C_{11}, C_{12}) = \alpha_1 \log C_{11} + \alpha_2 \log C_{12}$$

His decision problem is to choose values of r and i which will maximise U_1 subject to the following constraints :

(i) $0 < r < 1$[18] and (ii) $i \geq 0$.

The solution to this maximisation, $\hat{i}$ and $\hat{r}$, is the equilibrium in our model. The corresponding equilibrium levels of output and borrowing are $\hat{y}(\hat{i}, \hat{r})$ and $\hat{B}(\hat{i}, \hat{r})$. We work out the solution in detail in Appendix 5.

18/ For the model to make sense, r must be less than unity. For r = 1, any choice of y and B gives to the tenant zero or negative consumption in period two and the entire transaction becomes meaningless. In other words, we assume sharecropping exists which implies r is less than unity.

IV

In this section we put down all the results obtained in sections I-III.

Impact of technology on tenancy

With the introduction of labour-saving technology :

(i) Tenancy declines.

(ii) The distribution of leased-out area shifts in favour of the owner-tenants.

(iii) The distribution of total operated area also shifts in favour of the owner-tenants.

With neutral technical progress :

(i) Tenancy declines.

(ii) The distribution of leased-out area shifts in favour of the owner-tenants.

(iii) The distribution of total operated area also shifts in favour of the owner-tenants.

With a lessening in the inequality of access to new technology/inputs:

(i) Tenancy declines.

(ii) The distribution of leased-out area shifts in favour of pure-tenants.

(iii) The distribution of total operated area also shifts in favour of pure-tenants.

(iv) The pattern of tenancy will shift in favour of sharecropping vis-a-vis fixed-rent tenancy (see Appendix 4).

Tenancy and labour market conditions :

With greater ease of availability of wage employment :

(i) Tenancy declines.

(ii) The distribution of leased-out area shifts in favour of owner-tenants.

(iii) The distribution of total operated area also shifts in favour of owner-tenants.

(iv) The pattern of tenancy shifts in favour of fixed-rent at the expense of sharecropping (see Appendix 4).

With an increase in the wage rate :

(i) Tenancy increases.

(ii) There is no change in the distribution of leased-out area between (a) tenants working partly as wage labourers, (b) tenants working mainly as wage labourers and (c) tenants not working as wage labourers.

Tenancy and resource endowment :

(i) 'Better' tenants lease-in more land.

(ii) 'Better' landowners lease-out less land.

(iii) The effect of the size and composition of a tenant household on its leasing decision depends on the type of tenant household that is being considered. For instance, for a tenant household working partly as wage-labour and partly on leased-in land an increase in family-size or a change in its composition will not affect the extent of land leased-in by it. For a tenant household which does not devote any of its labour to wage employment but uses it solely on rented land an increase in family-size would result in it leasing-in more land. However, the composition of the household (in terms of 'dependents' and 'workers') will not matter. On the other hand, for a tenant household that works mainly as wage-labour an increase in the number of 'dependents' leads to an increase in area leased-in. For such households, family-size does not matter as much as its composition.

Tenancy and interlocking of markets

When the landlord is the sole supplier of credit to his tenant and possesses monopoly-power in both the land-lease and credit transactions then :

(i) Inter-linking of the two transactions may not always be beneficial to the landowner.

(ii) When interlinking takes place, the interest rate charged may be very low (in our model it is zero).

(iii) Restriction on the landlord's power to fix the rental-share will adversely affect the landlord's welfare and benefit the tenant, even if the landlord retains his freedom to unilaterally determine the interest rate on loans. However, any policy which restricts the power of the landlord-creditor to fix the interest rate is not likely to affect either the landlord nor the tenant, if the landlord has the freedom to set the rental-share. Thus in some sense the land market is more crucial to the landlord money-lender.

(iv) The landlord always gains from the adoption of yield-increasing technology on his tenant's farm.

CHAPTER V

TENANCY, RESOURCE ENDOWMENTS, CROPPING PATTERN AND INPUT-USE
- An Analysis of Household-level data

I

In this chapter we will use one body of data to illustrate the importance of land-leasing for an agricultural household. We will be mainly concerned with three aspects of tenancy :

(1) The importance of a household's resource-endowments in determining the extent of land it will lease-in or lease-out (Section II).

(2) We will compare the cropping pattern on leased-in and self-cultivated land to see whether the cultivator has a different cropping pattern preference on leased-in land vis-a-vis owner-operated land. Specifically, we look for differences in the tenant's and owner-operator's preference for risky cropping patterns (Section III).

(3) Finally, we will discuss input-use pattern on rented and self-cultivated land. In particular, we will check whether sharecroppers use less non-land inputs per acre of cultivated land as compared to owner-operators (Section IV).

For our analysis in this chapter, we utilise data obtained from the Village-Level-Studies (VLS) initiated by the ICRISAT in May 1975. This data pertains to six villages, all located in the Semi-Arid-Tropical (SAT) regions of India. Three districts were selected representing major agro-climatic zones within the SAT regions. Extent of rainfall, soil-types, as well as the predominant cropping pattern in the districts were some of the factors considered in the choice of districts. The three districts that were

selected are (i) Mahbubnagar (Andhra Pradesh), (ii) Sholapur (Maharashtra), and (iii) Akola (Maharashtra). In Table 1, some important differences in the districts are listed.

Table 1 : Selected District Characteristics

Characteristics	Mahbubnagar	Sholapur	Akola
(1)	(2)	(3)	(4)
Soil-type	Shallow, Medium-deep Alfisols	Deep-medium Vertisols	Medium-deep Vertisols
Rainfall (Annual average)	713 m.m.	Bi-modal, 691 m.m.	817 m.m. (assured)
Cropped Area Irrigated	14.5 % (Tank-irrigation)	10.7 %	1.5 %
Important Crops	Sorghum, Groundnut, Castor	Post-rainy Sorghum, Pearl-millet	Sorghum, Cotton, and Groundnut
Other features	Sorghum and Pulses are largely grown as mixed-crops during the rainy season	Rainy season fallowing is widely practised	This represents the agriculturally stable SAT region

Within the selected districts, talukas were selected. A selected taluka within a district reflected the situation in the majority of talukas in the region and was therefore representative of a broad region around the selected district. For selection of villages within the taluka, a village was chosen only if it represented the typical characteristics of the taluka (in terms of cropping pattern, land-use, irrigation etc.). Villages having special programs or more than normal resource transfers from outside were not considered. We have given the names of the selected districts, talukas and villages in Table 2 and also we list some important village characteristics in Table 3.

Table 2 : Sample Villages

District (1)	Taluka (2)	Village (3)
Mahbubnagar	1. Kalwakurthi	1. Aurepalle
	2. Atmakur	2. Dokur
Sholapur	1. Mohol	1. Shirapur
	2. North Sholapur	2. Kalman
Akola	1. Murtizapur	1. Kinkheda
	2. Murtizapur	2. Kanzara

Table 3 : Important Village Characteristics

Village (1)	Percentage of landless households (2)	Percentage of land-owners leasing-out all land (3)	Percentage of land operators (4)	Irrigable area as % of total cropped area (5)	Important crops (6)
Aurepalle	27.52	1.47	71.01	12.04	Sorghum, Castor, Pearl-millet, Paddy, Pigeonpea
Dokur	13.10	7.03	97.87	32.28	Paddy, Castor, Groundnut, Sorghum, Pigeonpea
Shirapur	23.56	14.82	61.62	8.23	Rabi-Sorghum, Pigeonpea, Chickpea, Wheat
Kalman	24.11	26.00	49.89	9.19	Rabi-Sorghum, Pigeonpea, Chickpea, Wheat
Kanzara	32.54	2.96	64.50	4.45	Cotton, Wheat, Sorghum, Groundnut, Mungbean
Kinkheda	40.56	1.40	58.04	0.93	Cotton, Wheat, Sorghum, Groundnut, Mungbeam

From each of the sample villages, a sample of forty households was selected to ensure representation to all categories of households-labour households, small-farmer households, medium farmer households and big farmer households. To select the labour households, a random selection was made from households owning less than 0.2 hectares of land and whose main occupation and source of income was agricultural labour. Ten such households were selected. For cultivator households, farm-size categories were first determined from the size-composition of holdings in each village. The cultivating households were then divided into three size strata with identical number of households in each strata and from each strata ten households were selected at random. This ensured that all size-categories of farmers were represented equally. Thus in each village thirty cultivator households were selected, in addition to the ten labour households.

Type of data collected : Investigators interviewed the sample households every fifteen to twenty days to elicit information on various aspects of traditional farming practices. The data collected includes :

(i) The resource-endowments of sample households. Some of the resources for which data are recorded are land, family labour livestock, farm machinery and irrigation equipment.

(ii) Cultivation details, including input-output data for each crop or crop mixture on each of the cultivated plots.

(iii) A separate schedule records the family's utilisation of its owned resources, along with estimates of the extent of unemployment of these resources and the wage rates.

(iv) In other schedules, all transactions undertaken by each of the sample households are recorded. These include details of income, expenditure, savings, debts and credit.

Having briefly described the sampling procedure and the type of information that is collected as part of the survey[1/], we now turn to the specific features that are of interest to us.

II

In this section we will utilise a part of the information collected in the survey to determine to what extent a household's leasing decision is influenced by that household's resource endowments. In particular, we will discuss how the household's endowment of land, family labour and bullock labour affects the extent of land leased-in (out) by the household. As we had discussed earlier, in the context of imperfectly functioning markets for credit and/or inputs like labour (human or bullock), the household's ability to cultivate land is partly determined by its ownership of essential inputs like human labour and bullock labour. Thus a household which owns land but has insufficient bullock labour to cultivate all of it may lease-out a part of its land, while a household having less land in relation to what it could cultivate with its bullocks may want to lease-in more land. This is likely in situations where the reverse is not feasible. (That is, a household having relatively more land cannot hire-in more of the complementary inputs and a household having less land in relation to its endowment of resources cannot hire-out the services of these resources.) Thus a possible hypothesis is : Ceteris paribus, households with relatively greater (lesser) endowment of labour (human or draft-animal or both) or some other necessary input will lease-in relatively more (less) land.

1/ For a more detailed description of the survey methodology, see Jodha, N.S., Asokan, M., and Ryan, J. G. (1977) : "Village Study Methodology and Resource Endowments of Selected Villages in ICRISAT's Village Level Studies". Occasional Paper 16, ICRISAT, 1977.

Before discussing our data base, we briefly comment on an earlier analysis by Clive Bell (1976a) on this aspect of tenancy. Bell uses survey data from the Purnea district of Bihar. To test the hypothesis that the area leased-in by the tenant will be such as to match the household's resources, Bell computes correlation coefficients between the size of operational holdings of each household and variables like (i) the number of family members (F), (ii) the number of children in the household (C), (iii) the number of males in the household (M), and (iv) the number of adults in the household (AD). His findings were the following :

(1) Holding-size is positively related to the number of children (C) as well as the number of family members (F) in the pure tenant household group. For this group, there is also a positive (and significant) correlation between holding-size and the number of males in the household. However, the correlation coefficient in this case is smaller than that between holding-size and F (or C). There is also a positive correlation between holding-size and the number of adult members of the household, but this is not significant.

(2) As far as the owner-tenant household (RB) group is concerned, holding-size is positively related to the household variables listed above. However, unlike the case of the pure tenant households, the correlation coefficients are not statistically significant.

Since for the pure tenant households the correlation coefficient between holding-size (H) and the number of family members (F), as well as between H and the number of children (C) is much stronger than that between H and the number of adults in the household (AD), Bell interprets this to suggest that it is the family's subsistence needs that are more important

in its leasing decision than the 'working-ability' of the household (as measured by the total adult-labour available in the household). We may also rationalise this finding in another way. Since the labour market (at least the market for adult labour, male or female) is functioning smoothly (in the sense that at the going wage rate availability of labour is no problem and there is no unemployment), any shortage (surplus) of labour in relation to land ownership can be corrected by hiring-in (out) labour. To that extent there is no reason to expect any correlation between leasing and the number of adults in a household. On the other hand, there is generally no market for child labour and since this can often be productively employed on the household's operational holding, households with more child labour may prefer to lease-in more land. Thus the significant positive correlation between holding-size and the number of children in the household. Moreover, the positive (though statistically less significant) correlation between the number of males (M) and holding-size may also be partly explained by the inclusion of male child labour in M.

Bell does not explain the reasons for the observed differences between the pure-tenant and the owner-tenant households. Why does the number of children in the owner-tenant household not influence the extent of land leased-in (out) by it ? In so far as the owner-tenant households are economically better-off than the pure-tenant households, one explanation could be that in such households the practice of employing children in farming is less common (for example, school-going may be more common among children of better-off owner-tenant households). To the extent this is valid, the number of children in such households will not influence their leasing decision.

Bell also tests the relationship between leasing and ownership of draft-power. For this he runs a linear regression with the tenant's draft animal stock (D) as the dependent variable and the land area cultivated (H) as the independent variable. Separate regressions are run for the pure-tenant and the owner-tenant groups. He finds the relationship strong for both groups and concludes that the ownership of draft power is important in the household's leasing decision. This is consistent with his observation that the market for bullock-hire services does not function in Purnea.

There are two small points that could be made regarding Bell's regression.

(1) In the regression, the value of draft labour stock is treated as the dependent variable and holding-size is treated as the independent variable. While it is understood that a regression, by itself, does not suggest causation, the argument regarding tenancy and ownership of resources suggests that holding-size would be the more appropriate dependent variable. To the extent the sample variation in D is more than in H, the relationship between D and H (given by $\frac{\Delta H}{\Delta D}$) may be smaller than what is obtained from Bell's regression[2].

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2. Bell estimates the equation

$$D_i = \alpha_1 + \beta_1 H_i + \varepsilon_i \qquad \ldots (1)$$

and the estimated equation is

$$\hat{D}_i = \hat{\alpha}_1 + \hat{\beta}_1 H_i, \text{ where } \hat{\alpha}_1 = 238.6, \ \hat{\beta}_1 = 52.5 \text{ and } R^2 = 0.311.$$

If instead, we estimate the more appropriate formulation

$$H_i = \alpha_2 + \beta_2 D_i + u_i \qquad \ldots (2)$$

then given $R^2 = 0.311$, $\hat{\beta}_1 = 52.5$ and $\hat{\beta}_1 \hat{\beta}_2 = R^2$, we have $\hat{\beta}_2 = \frac{0.311}{52.5}$.

If now, from (1) we estimate $\frac{\Delta H}{\Delta D}$, the extent by which a household increases the size of its operational holding in response to greater availability of draft-power, we find this is equal to $\frac{1}{52.5}$, whereas from (2) it equals only $\frac{0.311}{52.5}$.

(2) It is also not clear why the exercise has been confined to tenant households alone. To check whether ownership of bullocks has any relationship with the holding-size, should we not also include households neither leasing-in nor leasing-out but operating their owned land ? In fact, it would be appropriate to include all sample households except those households that neither own land nor cultivate any land.

We now describe our data. We will utilise ICRISAT data available from the following schedules : The VLS-C schedule gives for each of the sample households details of its family-size, age-sex composition, educational qualification of each member and the main occupation of every member of the family. Also included are similar details regarding permanent servants attached to the household. Thus this schedule provides an estimate of the labour available within the household. In estimating the household's endowment of human-labour we need to decide whether permanent servants should be included or not. In so far as the decision to hire permanent/attached servants is taken after the household decides on the extent of land it will cultivate, clearly for our purposes permanent servants should not be included in estimating the labour available within the household. However, it is possible that a permanent servant is available to the household prior to its decision to lease-in (out) land. For example, in return for credit a labourer may agree to work on the cultivator's land and this transaction may have been undertaken in an earlier period. In such cases the cultivator may lease-in land taking account of the extra labour available to him[3/]. Recognising this possibility, we have done our analysis first by excluding permanent servants

3/ This is more likely in situations where land is available for lease for short durations only. If the lease contract is long-term then the household cannot easily take advantage of a random short-term availability of labour.

and later by including them in estimating family-size and the labour available within the household. However, we find little qualitative difference in the conclusions and we will report the results for the case where permanent servants have been excluded.

The VLS-C schedule also provides for a 'degree of disability' code for each member of the household. This indicates whether that member is suffering from any permanent disability or disease and is unable to work. Disability due to old age is also included. This information can be utilised to provide an estimate of the number of dependents in the family. The other possible estimate of the number of dependents is the number of old males and females (that is, those above 65 years of age) plus the number of children below the age of 14 years. But again we find that the choice of our definition does not alter our conclusions and we therefore present our results for the case where the number of dependents equals the number of old males and females plus the number of children below 14 years of age. The rest of the family members, that is, the number of males and females in the age-group 14-65 years we call 'workers'. Thus the VLS-C schedule gives estimates of (a) the total availability of labour in the household, given by the number of 'workers' in the household, (b) the consumption requirements of the household, as measured by the total family-size and (c) the dependent-worker ratio in the household.

The VLS-D schedule provides for each sample household the following details :

(i) For each plot cultivated by the household, it records the area of that plot, its ownership status (that is, whether it is owner-operated

or leased-in or leased-out and under what terms) and the command area[4/] under irrigation on that plot. From this we can obtain estimates of -

(a) the extent of cultivable land owned by the household. This is obtained by adding the cultivable areas of all plots owned and operated by the household plus the areas of all plots leased-out by the household.

(b) the extent of land leased-in or leased-out by the households.

The VLS-E schedule gives our estimate of the household's ownership of draft power. The schedule provides an inventory of the total livestock owned by the household, both in numbers and in value terms. This includes items like cattle, buffaloes, cows, goats and sheep etc. We record the total value of bullocks owned by each household and use this as a proxy for the availability of draft power in the household.

Finally, VLS-F schedule gives the household's endowment of farm-machinery. This includes ploughs, seed-drills, levellers etc., as well as major machinery like tractors, threshers etc. We add the value (in Rupees) of different items of farm-machinery to arrive at our estimate of the household's ownership of farm-machinery.

Our analysis is based on the combined data for two years, 1975-76 and 1976-77. Following our discussion earlier, we wish to set up a regression model which will illustrate whether the extent of land-leasing serves to adjust the household's endowment of land, labour and bullocks (or farm-machinery) to the land-area cultivated by it.

4/ This is the area which under normal circumstances could receive irrigation.

In our first version we regress the dependent variable (Y) on the independent variables X_1, X_2, X_3 and X_4 where

Y = Net leased-in area per worker

X_1 = Land owned per worker (β_1)

X_2 = Value of bullocks owned per worker (β_2)

X_3 = Value of farm-machinery owned per worker (β_3)

X_4 = Dependent-worker ratio (β_4)

In so far as our discussion was plausible we would expect $\hat{\beta}_1$ to be negative. That is, households with fewer workers in relation to land ownership would lease-in less land compared to households with more workers relative to land owned. We may also expect $\hat{\beta}_2$ to be positive. In other words, households with relatively more bullocks lease-in more land to utilise them more fully. We cannot be sure of the sign of $\hat{\beta}_3$. If the market for farm-machinery was also imperfect then one could, just as in the case of bullocks, expect $\hat{\beta}_3$ to be positive. That is, households with more machinery would lease-in more land to utilise this more fully if the surplus machinery cannot be sold out. Moreover, the greater availability of farm-machinery may be an index of the household's better ability to cultivate land, in the sense that households with relatively more experience and skill in cultivation would be more willing to invest in farm machinery. If this is true, then a positive $\hat{\beta}_3$ would suggest that better cultivators tend to lease-in more land. However, $\hat{\beta}_3$ could be negative. If the extent of ownership of farm machinery is only a reflection of that household's asset and wealth position so that households with more farm-machinery are also the relatively wealthier households, and if we assume that cultivation is less attractive for such households vis-a-vis

poorer households, then $\hat{\beta}_3$ may be negative. This is more likely when the market for farm machinery functions smoothly. Similarly, $\hat{\beta}_4$ could be positive or negative. If, as we have argued, dependents are not wage-employable but can nevertheless be employed on the household's operational holding for some operations at least, then we may expect $\hat{\beta}_4$ to be positive. Households with more dependents lease-in more land to utilise its dependent labour fully. Furthermore, a larger proportion of dependents in a household would impose a greater burden on the working members of the family and the household may have to lease-in more land to ensure its subsistence needs, particularly when wage employment opportunities are limited. However, $\hat{\beta}_4$ can be negative. If the dependents are largely infants and/or disabled or very old members who cannot be productively employed even on self-operated holdings, then some proportion of the 'working' member force may be diverted to the care of such dependents. Thus in such cases not all adult males and females may be available for work on land. The higher the number of such dependents in a family the less is likely to be the number of members available for work on owned land and therefore leasing-in will be less.

The results of the regression are presented in Table 4 below.

Table 4 : Estimated coefficients of regression equation.

Dependent variable = Net leased-in area per worker.
Independent variables and their coefficients are given below

Village	Constant term ($\hat{\beta}_0$)	Land owned per worker ($\hat{\beta}_1$)	Value of bullocks owned per worker ($\hat{\beta}_2$)	Value of machinery owned per worker ($\hat{\beta}_3$)	Dependent worker ratio ($\hat{\beta}_4$)	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kalman	1.2298**	-0.2485**	0.005461*	-0.0008561	-0.4506	0.3252
Shirapur	1.2729**	-0.5515*	0.002730**	0.0000224	0.1282	0.3686
Kalman + Shirapur	1.3395*	-0.3716*	0.005036*	-0.0002935	-0.4168	0.3138
Kinkheda	0.4324*	-0.2108*	0.0026214*	0.001499**	-0.1891	0.2042
Kanzara	0.6254	-0.1888*	0.003327*	-0.0010207	-0.0431	0.1713
Kinkheda + Kanzara	0.4666**	-0.1649*	0.002787*	-0.0005427	-0.0488	0.1545
Aurepalle	0.4108*	-0.1926*	0.0004614	0.0003789*	0.0359	0.6743
Dokur	-0.1588	-0.2299*	0.000974	0.000678*	0.4006	0.1670
Aurepalle + Dokur	0.0169	-0.2065*	0.0006217	0.0005612*	0.2856*	0.2804

* t significant at 5 % level.

** t significant at 10 % level.

We observe from Table 4 that :

(1) $\hat{\beta}_1$ is negative in all villages. Households with a larger number of workers (relative to land ownership) lease-in more land.

(2) $\hat{\beta}_2$ is positive in all villages and this is significant everywhere except in Aurepalle and Dokur. Thus the larger the family's endowment of bullock labour the more land it will lease-in.

(3) In a majority of villages the extent of ownership of farm-machinery has a positive impact on land-leasing. In Aurepalle, Dokur and Kinkheda $\hat{\beta}_3$ is positive and significant. In Shirapur also it is positive but it is not significant. $\hat{\beta}_3$ is negative in Kanzara and Kalman but the coefficients are not statistically significant.

(4) The effect of the dependent-worker ratio on tenancy is not the same in the different villages. However, in no village is the regression coefficient statistically significant.

In Table 5 below we present the estimates of a slightly different regression equation. Here the dependent variable is the net leased-in area per family member. Similarly, the independent variables are the same as in the earlier equation except that they are specified in relation to family-size.

Table 5 : Estimated coefficients of regression equation.

Dependent variable = Net leased-in area per family member.
Independent variables and their coefficients are given below.

Village	Constant term ($\hat{\beta}_0$)	Land owned per family member ($\hat{\beta}_1$)	Value of bullocks owned per family member ($\hat{\beta}_2$)	Value of farm machinery owned per family member ($\hat{\beta}_3$)	Dependent worker ratio ($\hat{\beta}_4$)	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kalman	0.7843	-0.1784	0.005531*	-0.0008257	-0.45023	0.3289
Shirapur	1.0633*	-0.4410*	0.002165	-0.0000840	-0.3798	0.2425
Kalman + Shirapur	0.8039*	-0.2346*	0.005019*	-0.00040	-0.4730*	0.2787
Kinkheda	0.3369*	-0.1531*	0.001845*	0.001136	-0.1719	0.1962
Kanzara	0.3578*	-0.0840	0.002637*	-0.0006005	-0.2155	0.1366
Kinkheda + Kanzara	0.3030**	-0.1302*	0.002569*	-0.0003285	-0.1344	0.1322
Aurepalle	0.3431*	-0.1863*	0.0004741	0.0003966*	-0.1085**	0.6579
Dokur	0.1120	-0.3312*	0.002264*	0.00007123	0.0927	0.1146
Aurepalle + Dokur	0.1354	-0.1922*	0.001372*	0.0001631	0.00753	0.2005

* t significant at 5 % level.

** t significant at 10 % level.

From Table 5 we observe that :

(1) Households with relatively more family members will lease-in more land.

(2) As in the earlier version, the endowment of bullocks is positively related to the extent of land leased-in by the household.

(3) The positive impact of ownership of farm machinery on land-leasing which we observed in our earlier regression is no longer in evidence in this formulation.

(4) The effect of the dependent-worker ratio on the extent of land leased-in by the household is not significant.

(5) A comparison of R^2 in Tables 4 and 5 suggests that the per-worker specification is more appropriate.

Finally, we run a third regression. The dependent variable is the net area leased-in by the household. The independent variables are :

X_1 = Land owned by the household (β_1).

X_2 = Value of bullocks owned by the household (β_2).

X_3 = Value of farm-machinery owned by the household (β_3).

X_4 = Size of family (β_4).

X_5 = Dependent-worker ratio in the household (β_5).

The estimated regression coefficients are presented in Table 6 below.

Table 6 : Estimated coefficients of regression equation.

Dependent variable = Net area leased-in by household.
Independent variables and their coefficients are given below.

Village	Constant term ($\hat{\beta}_0$)	Area of land owned ($\hat{\beta}_1$)	Value of bullocks owned ($\hat{\beta}_2$)	Value of farm machinery owned ($\hat{\beta}_3$)	Size of family ($\hat{\beta}_4$)	Dependent worker ratio ($\hat{\beta}_5$)	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Kalman	9.5109*	-0.4618*	0.005384*	-0.0004054	-0.4672	-1.7832	0.3279
Shirapur	-0.6034	-0.1575	0.001804**	-0.0007273	0.6111**	-1.3881	0.2274
Kalman + Shirapur	3.8847*	-0.2360*	0.003835*	-0.0005672	0.0108	-1.4797**	0.2344
Kinkheda	0.9468	-0.2426*	0.002424*	0.002068**	0.2306	-1.0919**	0.2170
Kanzara	2.6544	-0.2153*	0.004693*	-0.002013*	-0.1361	-0.2370	0.2425
Kinkheda + Kanzara	1.7779	-0.2056*	0.003708*	-0.001048**	-0.0469	-0.1748	0.1817
Aurepalle	0.4587	-0.1812*	0.000252	0.0004340*	0.2566*	-0.6606	0.6680
Dokur	0.7846	-0.2929*	0.001525*	0.0003189	-0.0430	0.3786	0.1054
Aurepalle + Dokur	0.4428	-0.1870*	0.000805*	0.000370**	0.0669	-0.0153	0.2685

* t significant at 5 % level.
** t significant at 10 % level.

As expected, for given family-size, households owning more land lease-in less land while nouseholds with relatively more draft power lease-in more land.

We summarise the results of this section :

1) Households with relatively more family labour (workers) in relation to land owned lease-in more land and vice-versa.

(2) Ownership of bullock power is positively related to the extent of land leased-in by the household.

(3) Households with more family members (in relation to land ownership) lease-in more land.

(4) The dependent-worker composition does not affect the extent of land leased-in by the household.

(5) The ownership of farm machinery does have a positive impact on tenancy but this is not in evidence in all villages.

We may also mention one limitation of our analysis. In our analysis we are assuming that the regression equation that we estimate is the same regardless of whether the household leases-in land or leases-out land. However, it is possible that imperfections in markets and in institutions may lead to an asymmetry (both in respect of opportunities and responses) between those on the two sides of the tenancy transaction. In such circumstances it would be more appropriate to consider the behaviour of lessors and lessees separately. However, given the fact that in our sample the number of households in each group is not very large, we did not separate the two groups of households.

III

In this section we ask the question whether there are any reasons for a tenant (and in particular a sharecropper) to choose a cropping pattern different from one that would be chosen by an owner-operator. In other words, does the form of tenancy contract influence the cultivator's preference among crops ? To make this more precise, consider the same individual cultivating the same land under the following alternative situations :

(i) He has leased-in land under a share tenancy contract. Assume the rental share is the same for all crops and the tenant chooses the amount of land to lease-in and the cropping pattern on leased-in land.

(ii) He leases-in the same land but under a fixed-rent contract. The rent is specified in terms of the crop sown by the tenant and he chooses the cropping pattern on leased-in land.

(iii) Finally, suppose the tenant buys the same land so that he becomes an owner-operator. He then decides on the cropping pattern on this land. We want to know whether the cropping pattern choices of the same cultivator will be different in the three situations and if so, in what way and why.

In the literature on this subject two competing hypotheses have been suggested. We will briefly discuss both.

(a) Since a share-contract allows the tenant-cultivator to share risks in production with the landowner, production risks for the cultivator in a share contract are likely to be less than under a fixed-rent contract or in self-cultivation. Suppose cropping pattern preferences are based on expected returns and risks. Then, since for any cropping pattern a share-tenant faces less risks, he may be induced to prefer a relatively more risky cropping

pattern provided it has a larger expected return. Thus, in the context of production uncertainty, a possible hypothesis could be :

H.1 : Under sharecropping a cultivator adopts a relatively more risky cropping pattern with higher expected returns as compared to the cropping pattern preference of the same cultivator operating his own land or cultivating fixed-rented land.

Testing this hypothesis in its exact form would be very difficult, however. At the very least it would require us to consider only those cultivating households who operate both owned and leased-in land of the same quality. For all such cultivators we would then compare the cropping pattern on the owner-operated and leased-in plots. Even this would not be strictly correct, however. For it is quite possible that the choice of crops grown on share-rented land may be influenced by the crops grown on the owner-operated plots by the owner-tenant. In other words, cropping pattern decisions on the share-rented plots may not be completely independent of the cropping decisions on owned land.

Even if we ignore this difficulty, it is clear that in practice it may not be even possible to confine our test to only those cultivators owning as well as leasing-in land. Quite often there may be just too few such households in the sample. In such cases the only alternative may be to compare cropping patterns on share-rented and owner-operated land, regardless of whether the owner-operated land and the tenanted areas are cultivated by the same cultivator or not.

Interpersonal differences may then vitiate H.1. For example, if fixed-rent tenants and/or owner-operators are more wealthy than share tenants and if risk-aversion decreases with wealth, cropping pattern differences predicted

by H.1 may not be observed. Similarly, differences in irrigation facilities between richer owner-operators and poorer share tenants would reduce cultivation risks for the owner-operators and permit them to adopt more risky cropping patterns with higher expected returns. These qualifications need to be kept in mind in interpreting the results.

(b) The second hypothesis has been suggested by C. H. Rao (1971). As we had discussed in detail in Chapter III, Rao predicts that fixed-rent tenancy will be more prevalent in regions characterised by greater uncertainty, while sharecropping will be more common in relatively stable environments. In terms of cropping preferences, this argument suggests that fixed-rent tenants would prefer a more risky cropping pattern (with higher expected returns) as compared to share tenants. Call this H.2. We have already pointed out (in Chapter III) a number of problems that arise in properly formulating this hypothesis. However, limitations of availability of suitable data do not permit us to take account of these problems and we will therefore test the hypothesis as it stands.

Before presenting our data, we briefly summarise some empirical findings that have been reported in the literature. Cheung (1969), reporting on Taiwanese agriculture found support for H.1. He noted that in Taiwan share tenancy was more common in the wheat region than in the rice region. He computed the per-hectare yield (in terms of value) for both rice and wheat and found this to be larger for wheat than for rice. Rao (1971) on the other hand finds support for H.2 from Indian data. He noted that in the West Godavari district of Andhra Pradesh share-lease and cash lease arrangements coexist, with share-tenancy being more common in the rice zone and cash-lease being more common in the tobacco zone. Using Farm-Management data

on prices, profits as well as the extent of rainfall and irrigation he was able to show that cultivation of tobacco is done under a high degree of uncertainty while rice farmers operate under conditions of relative economic certainty. Bharadwaj (1974), using the published reports of the Farm Management studies referring to the years 1954-57, compared the cropping pattern on owner-operated and tenanted holdings in some states. In Punjab she finds share-rented land have a higher percentage area under food crops and less under cash crops as compared to owner-operated and fixed-rented land[5/]. In Madras, however, she finds that food-crops predominate on all types of holdings. But owner-operated holdings were found to have a more diversified pattern within food-crops. Finally Bell (1976a), using micro-economic evidence from the Purnea district of Bihar, found a significant difference in the cropping pattern on owner-operated and share-rented plots. The difference arises, according to Bell from ".....disproportionately large allocations of R (owner-operated) land to wheat and certain high-value crops (such as tobacco) in 'others' which require relatively heavy inputs of variable capital per (gross) acre and close supervision, and whose cultivation entails the possibility of a large loss, even under irrigated conditions".

Most of the empirical studies on tenancy and cropping rely on data collected for other purposes and as such, information on tenancy and cropping pattern are often published at a very aggregated level. The most disaggregated-level data on tenancy and cropping pattern, available from Farm Management Surveys, can be obtained from their Volume II tables which

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5/ Food crops constituted 60 % of self-cultivated and cash-rented area and 63 % of share-rented area — not a very significant difference.

give, for each of the operational holding in the sample, the area under each crop as well as the share of owned land and leased-in land on that holding. One difficulty in using this data for our purposes is that quite often the sample contains too few holdings having any leased-in land. Moreover, it does not give the cropping pattern on the owned and rented parts of the holding separately. While it may be possible to group holdings on the basis of the extent of land leased-in on these holdings and then study the cropping pattern across these groups (and we will ourselves be doing this later), such aggregation may well distort the true relationship.6/

Ideally, one would want to have the cropping pattern on tenanted and owner-operated land separately. We will utilise plot-wise data from the VLS-D schedule for this purpose. For each plot in the operational holding this schedule gives the tenure status and the cropping pattern on that plot. If there are no systematic relationships between tenancy and other factors (like irrigation), it may be possible to relate cropping pattern differences to differences in tenure.

6/ Suppose we have two holdings, each of 10 acres. Let there be two plots in each holding, one owner-operated (A) and the other leased-in (B). Let the sizes of plots and the crops grown on them be as shown below :

	Holding 1	Holding 2
Owned plot (A)	6 acres	4 acres
Leased-in plot (B)	4 "	6 "
	10 "	10 "

	Holding 1		Holding 2	
	A	B	A	B
Wheat	5	0	4	2
Cotton	1	4	0	4
	6	4	4	6

Thus both on holding 1 and holding 2 most of the area under owner-operated plots is devoted to wheat (5 acres out of 6 acres on holding 1 and all 4 acres on holding 2), while most of leased-in area in both holdings is devoted to cotton (all of it on holding 1 and 4 out of 6 acres on holding 2). But if the same data is recorded in operational holding aggregates, we get the following :

	% of operated area leased-in	% of operated area devoted to wheat (cotton)
Holding 1	40	50 (50)
Holding 2	60	60 (40)

Thus the aggregated data reveals a positive association between tenancy and area devoted to wheat, which is misleading.

We now discuss the cropping data. The analysis is based on the combined data for two years, 1975-76 and 1976-77.

Importance of fallowing : As Table 7 clearly shows, fallowing of land is an important feature of semi-arid tropical agriculture.

Table 7 : Importance of fallowing. Area (Number of plots) kept fallow as percentage of total area (Number of plots) in sample.

Village	Kharif season	Rabi season
(1)	(2)	(3)
Kalman	60.6 (52.6)	34.5 (39.5)
Shirapur	59.2 (55.8)	36.7 (35.0)
Aurepalle	30.2 (31.6)	84.8 (73.4)
Dokur	32.1 (34.6)	78.5 (78.4)
Kinkheda	3.7 (34.6)	91.0 (86.3)
Kanzara	1.6 (4.1)	94.6 (86.1)

In table 8 below we give a more detailed summary of the extent of fallowing and cropping in the two seasons.

Table 8 : Distribution of total sample area (Number of plots) between fallowing-cropping in the two seasons.

Village	Percentage of total area (No. of plots) in each category			
	Kharif Fallow Rabi Fallow	Kharif Fallow Rabi Cropped	Kharif Cropped Rabi Fallow	Kharif Cropped Rabi Cropped
(1)	(2)	(3)	(4)	(5)
Kalman	1.5 (4.8)	59.1 (47.8)	33.0 (34.8)	6.4 (12.6)
Shirapur	4.2 (5.2)	55.0 (50.6)	32.5 (29.8)	8.3 (14.4)
Aurepalle	23.8 (20.2)	6.4 (11.4)	60.9 (53.2)	8.8 (15.2)
Dokur	18.4 (22.3)	13.7 (12.3)	60.1 (56.1)	7.8 (9.3)
Kinkheda	0.6 (2.7)	3.1 (3.9)	90.4 (83.6)	5.9 (9.8)
Kanzara	0.6 (2.2)	1.0 (1.9)	93.7 (83.9)	4.7 (12.0)

It is clear that alternate fallowing and cropping is by far the most common practice in all villages. Keeping land fallow in both seasons or cropping in both kharif and rabi is of lesser importance. However, while in the two Sholapur villages kharif fallowing followed by rabi cropping is the most common practice, in the other villages kharif cropping and rabi fallowing is more prevalent.

Fallowing of land may be motivated by different reasons. One reason, which is particularly relevant for kharif fallowing, is that by keeping land fallow during the monsoon season the cultivator conserves moisture in the soil which can then compensate him for a possible shortfall in water availability during rabi cropping. Thus kharif fallowing acts as an insurance against shortage of moisture for rabi cultivation. In so far as this is valid[7/], the extent to which land is kept fallow in kharif and cultivated in rabi would indicate the cultivator's attitude to risks in rabi cultivation. This is particularly true in the Sholapur villages where rabi cropping depends entirely

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7/ It is possible that kharif fallowing stores moisture for rabi sowing and early growth and not necessarily as an insurance against rabi rainfall since this occurs in the middle or late in the rabi season by which time the moisture would have evaporated. The risk reduction motivation for fallowing, even if it were plausible, does not explain rabi fallowing. Presumably other factors are also involved, for example the need to ensure soil quality. In some seasons fallowing may be the only option if cultivation is either not feasible or is extremely hazardous. For example, Jodha refers to the difficulty of kharif cropping in the Sholapur villages where the soil becomes extremely difficult to work on during the monsoon season. (See, Jodha, N. S. : "Resource Base As A Determinant Of Cropping Patterns". ICRISAT Occasional Paper 14, April 1977).

Land may also be kept fallow if a household does not wish to lease-out its land (say, because it fears loss of ownership rights) and is also unable to cultivate it during a particular season because it lacks the resources to do so.

on rains during the preceding monsoons. Moreover, in these two villages the deep black soil allows the cultivator to store sufficient moisture in the soil. In the Mahbubnagar and Akola villages, the limited extent of kharif fallowing may be because these villages have greater and more stable rainfall and to that extent rabi cropping is less dependent on kharif rainfall. Moreover, in the Mahbubnagar villages rabi cropping without irrigation is in any case not possible because these have red soils.

Do share tenants devote less land for kharif fallowing (and thereby take greater risks in rabi cropping in exchange for higher returns in the kharif season)? Or more precisely, do share tenants rely less on kharif fallowing for rabi cropping ? In Tables 9 and 10 below we present the details of fallowing by tenure group in the kharif season.

Table 9 : Comparison of fallowing on tenanted and owner-operated land — kharif season.

Village	Area (No. of plots) under fallow as percentage of total area (No. of plots) in each category		
	Share-rented	Fixed-rented	Owner-operated
(1)	(2)	(3)	(4)
Kalman	60.4 (59.1)	- (-)	60.6 (50.7)
Shirapur	64.2 (52.3)	- (-)	58.0 (56.5)
Aurepalle	- (-)	20.7 (25.0)	30.6 (32.1)
Dokur	60.3 (57.1)	- (-)	25.4 (31.9)
Kinkheda	8.3 (10.0)	- (-)	3.4 (6.3)
Kanzara	- (-)	0 (0)	1.8 (4.5)

From Table 9 it is clear that a larger percentage of area (and plots) is devoted to fallowing on sharecropped land vis-a-vis owner-operated land in each of the share tenancy villages.However, some of these differences appear to be small and we cannot be sure if they are statistically significant. In the fixed-rent villages, Aurepalle and Kanzara, owner-operators devote more

land to fallowing as compared to fixed-rent tenants. To compare share-tenants and fixed-rent tenants, we compare fallowing on fixed-rented land and share-rented land in Aurepalle and Dokur in Mahbubnagar, and in Kanzara and Kinkheda in Akola district. Share tenants allocate more land to fallowing compared to fixed-rent tenants.

Table 10 : Distribution of total area (No. of plots) under tenancy and owner-cultivation between fallowing-cropping in kharif and rabi seasons.

Village	Tenancy	Percentage of total area (No. of plots) in each category			
		Kharif Fallow, Rabi Fallow	Kharif Fallow, Rabi Cropped	Kharif Cropped, Rabi Fallow	Kharif Cropped, Rabi Cropped
(1)	(2)	(3)	(4)	(5)	(6)
Kalman	Share-rented	1.5 (5.8)	58.9 (53.2)	37.8 (36.8)	1.8 (4.1)
	Owner-operated	1.5 (4.5)	59.1 (46.2)	31.4 (34.1)	7.9 (15.2)
Shirapur	Share-rented	0.7 (2.3)	63.5 (50.0)	30.7 (40.9)	5.1 (6.8)
	Owner-operated	5.1 (5.8)	52.9 (50.7)	32.9 (27.4)	9.1 (16.0)
Aurepalle	Fixed-rented	13.4 (20.0)	7.3 (5.0)	79.3 (75.0)	0.0 (0.0)
	Owner-operated	24.2 (20.3)	6.4(11.8)	60.3 (51.7)	9.1 (16.2)
Dokur	Share-rented	24.1 (28.6)	36.2 (28.6)	38.6 (39.3)	1.1 (5.5)
	Owner-operated	17.0 (21.6)	8.4 (10.4)	65.2 (58.1)	9.4 (9.9)
Kinkheda	Share-rented	0.0 (0.0)	8.3 (10.0)	87.1 (80.0)	4.6 (10.0)
	Owner-operated	0.6 (3.0)	2.8 (3.4)	90.6 (83.9)	6.0 (9.7)
Kanzara	Fixed-rented	0.0 (0.0)	0.0 (0.0)	99.0 (92.9)	1.0 (7.1)
	Owner-operated	0.7 (2.4)	1.1 (2.1)	93.0 (83.0)	5.2 (12.5)

From Table 10, comparing the extent of kharif fallowing and rabi cropping it can be seen that except in Kalman (where the difference is insignificant), in the other villages where sharecropping is prevalent the dependence on kharif fallowing for rabi cropping is more on share-rented land vis-a-vis owner-operated land. The same is true in relation to fixed- rent tenants and share tenants.

Comparing the incidence of successive kharif and rabi cropping, this is relatively more on owner-operated land in all four villages where share-cropping exists. Between owner-operators and fixed-rent tenants, successive cropping in kharif and rabi seasons is more on owner-operated land. Thus, though owner-operators appear to rely more on kharif fallowing for rabi cropping (Table 9), they also allocate more land to successive cropping in comparison to fixed-rent tenants.

These results suggest that in so far as fallowing-cultivation decisions are related to risk-reduction for rabi cropping, share tenancy does not induce cultivators to choose more risky options. However, since we are not considering the crops sown in the season following or preceding fallowing, it is difficult to judge whether the differential risk-reducing aspect of fallowing is offset by the differential returns on crops grown.

Importance of Mixed cropping : Another distinct feature of SAT agriculture is the practice of mixed cropping, as is clearly revealed in Table 11 below :

Table 11 : Importance of mixed cropping. Area (No. of plots) under mixed crops as % of total area (No. of plots) cropped.

Village (1)	Kharif season (2)	Rabi season (3)
Kalman	68.5 (53.3)	33.0 (24.1)
Shirapur	18.6 (14.0)	18.5 (13.2)
Aurepalle	38.0 (30.6)	8.6 (6.0)
Dokur	28.1 (16.5)	1.4 (1.8)
Kinkheda	90.2 (80.3)	0.0 (0.0)
Kanzara	74.0 (56.9)	0.0 (0.0)

On a mixed-cropped plot the cultivator grows two or more crops. This he may do either by mixing the seeds together before sowing or by planting separate patches or lines under different crops, each patch or line having one crop only.

Mixing of crops may have different motivations in different contexts. One important reason on which we will focus is that mixed cropping reduces risks for the cultivator. For example, suppose there is uncertainty regarding the extent of rainfall during a cropping season. Then, growing a mixture of two crops, one of which is drought-resistant but and the other capable of withstanding water-logging may be a better strategy than putting the entire area under any one of the two crops. However, the importance of mixed cropping in risk-reduction depends on the way the crop mixture has been sown. Consider two alternative strategies. First, suppose seeds of two or more crops are mixed together and then sown on an acre of land. This is the usual practice and what is referred to as mixed-cropping. The second

alternative is to divide the same acre of land into plots in which each crop of the crop mixture is sown as a pure crop. Both ways of achieving a given crop mixture appear to have the same return and risk so that in the second alternative a portfolio of pure crops seems to have the same return and risk as mixed cropping. In fact, however, this is not true. Returns under mixed cropping will be larger than under a portfolio of pure crops. This is because mixed cropping permits the surviving crops in a crop mixture to use the fertility of the land released by the crops that failed while dividing the land into plots and sowing pure crops will not have this advantage.

Given that mixed cropping may be a risk-reducing strategy[8/], we will check whether there is any difference in the allocation of cropped land to mixed cropping on tenanted and owner-operated land. Do share tenants devote more land to cultivation of single crops ? The evidence is presented in Table 12 below.

Table 12 : Importance of mixed cropping on tenanted and owner-operated land. Area (No. of plots) under mixed cropping as percentage of total area (No. of plots) cropped in each tenure category.

Village	Kharif season			Rabi season		
	Share-rented	Fixed-rented	Owner-operated	Share-rented	Fixed-rented	Owner-operated
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kalman	69.7 (60.0)	- (-)	68.3 (51.5)	27.0 (19.4)	- (-)	34.7 (25.5)
Shirapur	20.7 (14.3)	- (-)	18.3 (14.0)	31.2 (20.1)	- (-)	15.0 (12.0)
Aurepallo	- (-)	38.1 (26.7)	37.9 (30.8)	- (-)	0.0 (0.0)	8.4 (6.1)
Dokur	25.0 (25.0)	- (-)	28.4 (15.9)	0.0 (0.0)	- (-)	1.7 (2.0)
Kinkheda	95.0 (89.0)	- (-)	90.0 (79.6)	0.0 (0.0)	- (-)	0.0 (0.0)
Kanzara	- (-)	83.1 (64.3)	72.7 (56.1)	- (-)	0.0 (0.0)	0.0 (0.0)

8/ That this may indeed be the case is indicated in Table 12. The incidence of mixed cropping is more in kharif than in rabi. In the Rabi season the need of mixed cropping in reducing risks is limited because water-availability is more or less known at the time of rabi sowing.

In the kharif season, the incidence of mixed croppingis more on share-rented land vis-a-vis owner-operated land. The differences are not very significant, however. No clear tendency is discernible in the allocation of cropped land to mixed cropping on share-rented and fixed-rented land. In the rabi season, mixed cropping is insignificant in all villages except Kalman and Shirapur. But since there is in effect little uncertainty regarding water-availability and since, in the Sholapur villages, rabi cropping depends entirely on kharif rainfall, mixed cropping may be motivated by considerations other than risk-reduction. The evidence shows no systematic difference in the allocation to mixed cropping on tenanted and owner-operated land. This may also reflect different wealth positions of tenants and owner-cultivators.

Cropping pattern on single cropped plots : For single cropped plots we have information on the area under the crop and the tenancy status of the plot. We compare the cropping pattern on owner-operated plots and tenanted plots and relate cropping differences to the 'riskiness' of alternative cropping patterns. We concentrate on production risks only and ignore risks arising from possible fluctuations in the prices of different crops[9/]. Two important sources of production risks are losses due to attack of pests and/or diseases and weather. We found it difficult to quantify and compare the susceptibilities of different crops to diseases and pests and in the absence of a suitable yardstick for comparison, we were unable to take account of such risks in our analysis. Moreover, since the SAT areas are

9/ Yield risk was found to be the major component of overall variability in the SAT region. See, Binswanger, Hans P., Jodha, N. S., and Barah, B. C. : "The Nature And Significance Of Risk In Semi-Arid Tropics". Paper presented at the ICRISAT Workshop on Socio-economic Constraints to Development of SAT Agriculture. February 1970.

characterised by low and uncertain rainfall and since irrigation facilities are typically rather limited, the major source of risk and uncertainty in cultivation arises from the uncertain supply of water. Crops that are less susceptible to shortfalls in water-availability are therefore likely to be less risk-prone in these regions. Thus, the extent of allocation of cropped land to such crops would be an indication of the cultivator's attitude to risks.

However, our attempt to rank different crops on the basis of their sensitivity to water-availability could not proceed much farther than an earlier attempt made by Jodha[10/]. The main reason was the lack of sufficiently detailed and comparable information on different crop characteristics, which follows in part from the conceptual difficulty of comparing characteristics of different crops grown under different soil and climatic conditions. For our present analysis we therefore rely on Jodha's categorisation. He distinguishes two groups — crops that are drought-resistant (D.R. crops) and those that are drought-sensitive (D. S. crops). The crops in the two categories are:

(i) Drought-Resistant Crops : Pearl-millet (Bajra), Sorghum (Jowar), Finger-millet (Ragi), other minor millets, Pigeonpea (Redgram/Tur), Chickpea (Bengalgram), Blackgram, Castor, Greengram, Sunflower, and Safflower.

(ii) Drought-Sensitive Crops : Paddy, Wheat, Maize, Groundnut, Sesamum, Mustard, Linseed, Cotton, Sugarcane and Vegetable crops.

This classification does not allow us to distinguish between crops within a category even though they may differ in their susceptibility to drought. For example, jowar and bajra are both classified as drought-resistant

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10/ See, Jodha, N. S. : "Resource Base As A Determinant Of Cropping Pattern". ICRISAT Occasional Paper No. 14, April 1977.

though bajra is generally preferred when rainfall is inadequate for jowar, since bajra is more tolerant to drought conditions.

We will compare the allocation of cropped land on tenanted and owner-operated plots between drought-sensitive and drought-resistant crops. In passing we will also, whenever possible, compare crops on the basis of their input requirements, particularly the input of labour. A partial ranking of some of the crops in terms of their labour requirements is given below, in decreasing order[11].

(1) Cotton, (2) Groundnut, (3) Wheat, (4) Sugarcane, (5) Paddy, (6) Jowar and Bajra, (7) Castor, and (8) ..... etc.

In Table 13 below, we compare the allocation of single-cropped land to drought sensitive crops on tenanted and owner-operated land in the kharif and rabi seasons.

Table 13 : Importance of drought-sensitive crops on single cropped plots in the kharif and rabi seasons. Area (No. of plots) under drought-sensitive crops as percentage of total area (No. of plots) under single crops in each tenure category.

Village	Kharif season			Rabi season		
	Share-rented	Fixed-rented	Owner-operated	Share-rented	Fixed-rented	Owner-operated
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kalman	4.5 (25.0)	- (-)	70.9 (73.0)	2.4 (15.2)	- (-)	7.5 (16.4)
Shirapur	53.9 (55.5)	- (-)	32.3 (47.4)	13.7 (22.5)	- (-)	16.9 (33.4)
Aurepalle	- (-)	8.1 (18.2)	20.5 (40.3)	Negligible Single Cropping		
Dokur	53.1 (55.6)	- (-)	70.7 (78.4)	100.0 (100.0)	- (-)	96.9 (91.7)
Kinkheda	Negligible Single Cropping			Negligible Single Cropping		
Kanzara	- (-)	6.8 (30.0)	56.1 (49.5)	Negligible Single Cropping		

11/ See, Bharadwaj, K. (1974).

In the kharif season, of the three villages where share tenancy and single cropping exist, in two (Kalman and Dokur) the allocation of area (and plots) to drought-sensitive crops is significantly larger on owner-operated land. However, in Shirapur relatively more area (and to a lesser extent, plots too) is devoted to drought-sensitive crops on share-rented land. In the two fixed-rented villages Aurepalle and Kanzara, owner-operators have more area under drought-sensitive crops. In the rabi season these differences are not significant in any of the villages, which may be expected for the reasons mentioned earlier.

We now look at the distribution of single cropped area (and plots) among different crops in each of the five villages where single cropping is prevalent[12/].

KALMAN : Table 14 gives the cropping pattern on single-cropped plots in the kharif season and the rabi season.

12/ In Kinkheda there are too few tenanted plots with single crops, in both seasons. We will therefore not include Kinkheda in our analysis of cropping differences on single cropped plots.

Table 14 : Cropping pattern on single cropped plots of Kalman village. Area (No. of plots) under each crop as percentage of total area (No. of plots) under single crops in each category.

Crops (1)	Owner-operated (2)	Share-rented (3)	D.R.C./D.S.C. (4)
	Kharif		
Paddy L. V.	28.6 (24.1)	4.2 (21.4)	D.S.C.
Maize L.V.	15.5 (16.1)	0.3 (3.6)	D.S.C.
Jowar H.Y.V.	2.0 (1.4)	5.6 (3.6)	D.R.C.
Maize H.Y.V.	1.5 (2.2)	- (-)	D.S.C.
Other Minor Millets	2.7 (2.2)	4.2 (3.6)	D.R.C.
Groundnut	19.5 (16.1)	- (-)	D.S.C.
Sunflower	3.7 (5.1)	15.3 (10.7)	D.R.C.
Redgram	5.8 (14.4)	40.4 (25.0)	D.R.C.
Blackgram	1.8 (1.4)	- (-)	D.R.C.
Greengram	- (-)	3.3 (3.6)	D.R.C.
Other pulses	12.8 (11.7)	26.7 (28.5)	D.R.C.
Onions	1.3 (2.2)	- (-)	D.S.C.
Chillies	2.6 (7.3)	- (-)	D.S.C.
Other Vegetables	0.2 (1.4)	- (-)	D.S.C.
Lemon	0.4 (1.4)	- (-)	D.S.C.
Sugarcane	1.3 (2.2)	- (-)	D.S.C.
Others	0.2 (0.7)	- (-)	
All Cereals	50.3 (46.0)	14.3 (32.2)	
All Pulses	20.4 (17.5)	70.4 (57.1)	
All Oilseeds	23.2 (21.2)	15.3 (10.7)	
All Vegetables	4.5 (12.3)	- (-)	
	Rabi		
Jowar L. V.	85.2 (70.0)	95.4 (75.9)	D.R.C.
Jowar H.Y.V.	0.2 (0.4)	- (-)	D.R.C.
Wheat L.V.	6.1 (12.5)	2.2 (13.9)	D.S.C.
Wheat H.Y.V.	0.1 (0.4)	- (-)	D.S.C.
Bengalgram	7.0 (13.3)	2.2 (8.9)	D.R.C.
Onions	0.5 (0.8)	0.2 (1.3)	D.S.C.
Other Vegetables	0.3 (0.8)	- (-)	D.S.C.
Lemon	0.1 (0.8)	- (-)	D.S.C.
Sugarcane	0.4 (1.1)	- (-)	D.S.C.
All Cereals	91.6 (83.3)	97.6 (89.8)	

It is clear that in the kharif season :

(1) Owner-operators allocate relatively more land to cereals and less to pulses.

(2) A higher allocation by owner-operators to oilseeds is largely on account of the greater allocation to groundnut which is a drought-sensitive crop.

(3) There is a larger allocation by owner-operators to vegetable crops which are also drought-sensitive.

(4) Among cereals, owner-operators prefer drought-sensitive crops like maize and paddy more than sharecroppers.

(5) Share tenants show a greater preference for drought-resistant crops like sunflower, redgram and other pulses.

In the rabi season there is not much difference in the allocation of land between broad groups like cereals, pulses etc. Within cereals, owner-operators prefer the drought-sensitive wheat crop while share tenants prefer the drought-resistant jowar crop. We may also note that of the two, wheat is more labour-intensive.

SHIRAPUR : Table 15 gives the cropping pattern on single cropped plots in the kharif season and the rabi season.

Table 15 : Cropping pattern on single cropped plots. of Shirapur village. Area (No. of plots) under each crop as percentage of total area (No. of plots) under single crops in each category.

Crops (1)	Owner-operated (2)	Share-rented (3)	D.R.C./D.S.C. (4)
	Kharif		
Groundnut	7.3 (5.8)	14.8 (11.1)	D.S.C.
Sesamum	1.0 (1.3)	- (-)	D.S.C.
Sunflower	- (-)	2.4 (2.8)	D.R.C.
Other Oilseeds	0.5 (0.6)	- (-)	D.R.C.
Maize L.V.	5.4 (11.0)	7.1 (2.8)	D.S.C.
Paddy L.V.	5.7 (6.5)	23.2 (25.0)	D.S.C.
Other Cereals	0.8 (2.0)	4.7 (5.5)	D.R.C.
Cotton L. V.	1.3 (2.0)	- (-)	D.S.C.
Lemon	0.5 (1.3)	- (-)	D.S.C.
Redgram	38.7 (23.4)	19.0 (16.7)	D.R.C.
Greengram	1.0 (2.0)	- (-)	D.R.C.
Other Pulses	26.0 (22.1)	17.7 (16.7)	D.R.C.
Sugarcane	5.5 (9.1)	4.2 (2.8)	D.S.C.
Onions	2.9 (3.9)	3.5 (8.3)	D.S.C.
Chillies	2.1 (5.2)	1.1 (5.5)	D.S.C.
Green Fodder	0.7 (2.6)	2.3 (2.8)	
Other Vegetables	0.6 (1.3)	- (-)	D.S.C.
All Cereals	11.9 (19.5)	35.0 (33.3)	
All Pulses	65.7 (47.5)	36.7 (33.4)	
All Vegetables	6.1 (11.7)	4.6 (13.8)	
All Oilseeds	8.8 (7.7)	17.2 (13.9)	
	Rabi		
Groundnut	0.1 (0.4)	- (-)	D.S.C.
Linseed	2.0 (3.0)	- (-)	D.S.C.
Safflower	2.6 (5.4)	- (-)	D.R.C.
Jowar L.V.	64.8 (42.1)	67.5 (47.5)	D.R.C.
Maize L.V.	1.5 (1.6)	- (-)	D.S.C.
Maize H.Y.V.	0.1 (0.4)	- (-)	D.S.C.
Wheat L.V.	7.1 (16.5)	11.1 (20.0)	D.S.C.
Wheat H.Y.V.	0.6 (0.4)	- (-)	D.S.C.
Lemon	0.3 (0.8)	- (-)	D.S.C.
Redgram	- (-)	0.7 (2.5)	D.R.C.
Bengalgram	15.5 (18.2)	16.0 (22.5)	D.R.C.
Other Pulses	- (-)	2.1 (5.0)	D.R.C.
Sugarcane	4.4 (8.3)	2.6 (2.5)	D.S.C.
Onions	0.3 (0.4)	- (-)	D.S.C.
Brinjal	0.1 (0.8)	- (-)	D.S.C.
Fodder Crops	0.2 (0.8)	- (-)	
Other Vegetables	0.4 (0.8)	- (-)	D.S.C.
All Cereals	74.1 (61.0)	78.6 (67.5)	
All Pulses	15.5 (18.2)	18.8 (30.0)	
All Oilseeds	4.7 (8.8)	- (-)	
All Vegetables	1.1 (2.8)	- (-)	

In the Kharif season owner-operators grow relatively less of cereals and oilseeds and more of pulses. This pattern is in contrast to the trend observed in Kalman. Among cereals, there is a significantly larger allocation to the drought-sensitive paddy crop on share-rented land. Among pulses, owner-operators allocate significantly more land to redgram which is drought-resistant.

As expected, in the rabi season cropping pattern differences are not significant. A slightly higher allocation to cereals on share-rented land is on account of a larger allocation to jowar which is drought-resistant and to wheat, which is drought-sensitive. The higher allocation to oilseeds on owner-operated land is on account of drought-sensitive crops (like linseed) as well as drought-resistant crops (like safflower). In Shirapur therefore, cropping pattern on single cropped land does not suggest that share tenants prefer less risky crops compared to owner-operators.

DOKUR : Table 16 gives the cropping pattern on single cropped plots in the kharif season and the rabi season.

Table 16 : Cropping-pattern on single-cropped plots of Dokur village. Area (No. of plots) under each crop as percentage of total area (No. of plots) under single crops in each category.

Crops (1)	Owner-operated (2)	Share-rented (3)	D.R.C./D.S.S. (4)
	Kharif		
Groundnut	6.3 (5.1)	- (-)	D.S.C.
Jowar L.V.	14.6 (11.6)	5.9 (11.1)	D.R.C.
Ragi	4.2 (5.1)	- (-)	D.R.C.
Other minor Millets	5.3 (3.6)	41.0 (33.3)	D.R.C.
Paddy L. V.	1.5 (3.0)	53.1 (55.6)	D.S.C.
Paddy H.Y.V.	61.3 (67.4)	- (-)	D.S.C.
Wheat L. V.	0.3 (0.7)	- (-)	D.S.C.
Other Pulses	5.1 (1.4)	- (-)	D.R.C.
Chillies	1.3 (2.2)	- (-)	D.S.C.
All Cereals	87.2 (91.4)	100.0(100.0)	
All Pulses	5.1 (1.4)	- (-)	
All Oilseeds	6.3 (5.1)	- (-)	
	Rabi		
Paddy L. V.	3.0 (4.2)	12.3 (11.1)	D.S.C.
Paddy H.Y.V.	59.5 (58.3)	9.2 (33.3)	D.S.C.
Wheat L. V.	0.3 (2.1)	- (-)	D.S.C.
Ragi	3.1 (8.3)	- (-)	D.R.C.
Tomato	0.2 (2.1)	- (-)	D.S.C.
Groundnut	33.9 (25.0)	78.5 (55.6)	D.S.C.
All Cereals	65.9 (72.9)	21.5 (44.4)	
All Oilseeds	33.9 (25.0)	78.5 (55.6)	
All Vegetables	0.2 (2.1)	- (-)	

In the kharif season, owner-operators devote relatively more land to groundnut and pulses while share-tenants prefer cereals. In Dokur an important difference between share-tenants and owner-operators is that owner-operators show a preference for high-yielding varieties while sharecroppers prefer the local variety.

In the rabi season, owner-operators allocate significantly more land to cereals while share tenants devote significantly more land to oilseeds. The higher allocation to cereals is mainly due to the preference of owner-operators for H.Y.V. paddy. Share tenants devote a much larger area to groundnut which is a drought-sensitive crop. The link between tenure and 'riskiness' of crops is therefore not very clear in the rabi season.

In Aurepalle and Kanzara we compare the cropping pattern on fixed-rented and owner-operated plots.

AUREPALLE : Table 17 gives the cropping pattern on single cropped plots in the kharif season.

Table 17 : Cropping pattern on single cropped plots of Aurepalle village. Area (No. of plots) under each crop as percentage of total area (No. of plots) under single crops in each category.

Crops	Owner-pperated	Fixed-rented	D.R.C./D.S.C.
(1)	(2)	(3)	(4)
Castor	72.4 (50.4)	85.9 (72.7)	D.R.C.
Paddy L. V.	3.7 (10.8)	5.9 (9.1)	D.S.C.
Paddy H. Y. V.	11.8 (21.6)	- (-)	D.S.C.
Other Pulses	2.7 (4.3)	- (-)	D.R.C.
Chillies	5.0 (7.9)	- (-)	D.S.C.
Other Vegetables	- (-)	2.2 (9.1)	D.S.C.
Jowar L. V.	4.4 (5.0)	5.9 (9.1)	D.R.C.
All Cereals	19.9 (37.4)	11.8 (18.2)	
All Pulses	2.7 (4.3)	- (-)	
All Oilseeds	72.4 (50.4)	85.9 (72.7)	
All Vegetables	5.0 (7.9)	2.2 (9.1)	

There is a significantly larger allocation to cereals on owner-operated land while relatively more land is allocated to oilseeds on fixed-rented land. Among cereals there is a relatively larger allocation to H.Y.V. paddy on owner-operated land while the higher allocation to oilseeds on fixed-rented land is on account of castor which is drought-resistant. Thus in Aurepalle owner-operators prefer the more risky crops in comparison to the cropping preferences of fixed-rent tenants.

KANZARA : Table 18 gives the cropping pattern on single cropped plots in the kharif season.

Table 18 : Cropping pattern on single cropped plots of Kanzara village. Area (No. of plots) under each crop as percentage of total area (No. of plots) under single crops in each category.

Crops (1)	Owner-operated (2)	Fixed-rented (3)	D.R.C./D.S.C. (4)
Groundnut	13.3 (8.3)	- (-)	D.S.C.
Sunflower	0.2 (0.8)	- (-)	D.R.C.
Sesamum	0.7 (0.8)	- (-)	D.S.C.
Bajra L. V.	0.2 (0.8)	- (-)	D.R.C.
Jowar L. V.	10.8 (10.7)	56.5 (40.0)	D.R.C.
Jowar H. Y. V.	27.3 (29.0)	31.1 (20.0)	D.R.C.
Paddy L. V.	5.9 (14.0)	6.8 (30.0)	D.S.C.
Greengram	4.4 (8.3)	5.6 (10.0)	D.R.C.
Bengalgram	0.9 (0.8)	- (-)	D.R.C.
Cotton H. Y. V.	6.2 (6.6)	- (-)	D.S.C.
Cotton L. V.	28.3 (13.2)	- (-)	D.S.C.
Sugarcane	0.1 (0.8)	- (-)	D.S.C.
Onions	0.2 (0.8)	- (-)	D.S.C.
Chillies	1.4 (5.0)	- (-)	D.S.C.
All Cereals	44.2 (54.5)	94.4 (90.0)	
All Pulses	5.3 (9.1)	5.6 (10.0)	
All Oilseeds	14.2 (9.9)	- (-)	
All Cotton	34.5 (19.8)	- (-)	
All Vegetables	1.6 (5.8)	- (-)	

Owner-operators reveal a greater preference for high-valued, more input-intensive and drought-sensitive crops like cotton and groundnut while tenants prefer a less risky cropping pattern.

Summarising the results of comparison of cropping patterns on single cropped plots :

(1) Tenure status does not appear to influence choice between crop categories like cereal-pulses, food crops-cash crops etc.

(2) Owner-operators show a greater preference for more risky, more labour-intensive and high-valued crops like cotton, wheat, paddy, groundnut and sugarcane while tenants prefer less risky crops like jowar, safflower, pulses and castor. However, very often these differences are not significant, particularly in the rabi season.

Cropping pattern on mixed-cropped plots : On plots where crop mixtures are grown the data does not provide the area under each crop in the mixture. It only specifies the name of the dominant crop in the mixture, the dominant crop being the crop which occupies the maximum area among all crops in the mixture[13/]. The names of the second and third crops are also given. We will compare the allocation of area and plots to different crop mixtures, where crop mixtures will be identified by the drought-sensitivity (or drought-resistance) of the dominant crop in the mixture.

13/ This is determined by the relative weights of seeds of each crop in the total weight of seeds per hectare.

KALMAN : Table 19 gives the cropping pattern on mixed cropped plots in the kharif season and the rabi season.

Table 19 : Cropping pattern on mixed cropped plots of Kalman village. Area (No. of plots) under crop mixtures dominated by crops below as percentage of total area (No. of plots) under mixed crops in each category.

Crops (1)	Owner-operated (2)	Share-rented (3)	D.R.C./D.S.C. (4)
	Kharif		
Redgram	79.8 (67.8)	88.5 (85.7)	D.R.C.
Other pulses	4.4 (7.5)	1.2 (2.4)	D.R.C.
Blackgram	1.5 (2.7)	- (-)	D.R.C.
All Pulses	85.7 (78.0)	89.7 (88.1)	D.R.C.
Paddy L. V.	7.2 (11.0)	6.7 (9.5)	D.S.C.
Maize L. V.	2.2 (4.1)	- (-)	D.S.C.
Jowar H.Y.V.	1.0 (2.0)	- (-)	D.R.C.
Jowar L. V.	0.3 (0.7)	- (-)	D.R.C.
Minor millets	0.5 (0.7)	- (-)	D.R.C.
Groundnut	0.6 (0.7)	- (-)	D.S.C.
Sunflower	1.0 (0.7)	- (-)	D.R.C.
Sesamum	1.2 (0.7)	- (-)	D.S.C.
Onions	0.2 (1.4)	- (-)	D.S.C.
Drought-Sensitive Crops	11.4 (17.9)	6.7 (9.5)	
	Rabi		
Jowar L. V.	95.4 (82.2)	96.0 (89.5)	D.R.C.
Wheat L. V.	1.9 (8.9)	- (-)	D.S.C.
Bengalgram	2.0 (5.6)	4.0 (10.5)	D.R.C.
Onions	0.2 (2.2)	- (-)	D.S.C.
Sugarcane	0.6 (1.1)	- (-)	D.S.C.
Drought-Sensitive Crops	2.7 (12.2)	- (-)	

In the kharif season, redgram-dominated mixtures are more common on share-rented land while crop mixtures dominated by drought-sensitive crops like maize, paddy, groundnut, sesamum and onions are more common on owner-operated land.

In the rabi season, owner-operators allocate more land to crop mixtures dominated by drought-sensitive crops. These crops, for example wheat and sugarcane are also more labour-intensive.

SHIRAPUR : Table 20 gives the cropping pattern on mixed cropped plots in the kharif and rabi seasons.

Table 20 : Cropping pattern on mixed cropped plots of Shirapur village. Area (No. of plots) under crop mixtures dominated by crops below as percentage of total area (No. of plots) under mixed crops in each category.

Crops	Owner-operated	Share-rented	D.R.C./D.S.C.
(1)	(2)	(3)	(4)
	Kharif		
Redgram	37.2 (28.0)	27.3 (16.7)	D.R.C.
Blackgram	3.3 (4.0)	- (-)	D.R.C.
Other pulses	30.6 (16.0)	72.7 (83.3)	D.R.C.
All pulses	71.1 (48.0)	100.0(100.0)	D.R.C.
Groundnut	7.6 (12.0)	- (-)	D.S.C.
Sesamum	4.4 (8.0)	- (-)	D.S.C.
Maize L. V.	2.2 (8.0)	- (-)	D.S.C.
Vegetables	2.7 (12.0)	- (-)	D.S.C.
Fodder Crops	12.0 (12.0)	- (-)	
Drought-Sensitive Crops	16.9 (40.0)	- (-)	
	Rabi		
Jowar L. V.	79.1 (57.6)	95.5 (70.0)	D.R.C.
Wheat L. V.	4.0 (9.1)	- (-)	D.S.C.
Sugarcane	8.3 (15.2)	1.5 (10.0)	D.S.C.
Groundnut	0.9 (3.0)	- (-)	D.S.C.
Safflower	3.6 (3.0)	- (-)	D.R.C.
Bengalgram	3.2 (9.1)	3.0 (20.0)	D.R.C.
Vegetables	0.9 (3.0)	- (-)	D.S.C.
Drought-Sensitive Crops	14.1 (30.3)	1.5 (10.0)	

From Table 20 we observe that in the kharif season pulse-dominated crop mixtures are more common on share-rented land while owner-operators prefer crop mixtures dominated by drought-sensitive crops like groundnut, sesamum, maize and vegetables.

In the rabi season we notice that drought-sensitive crops like wheat, sugarcane, groundnut and vegetables are relatively more important dominant crops on owner-operated land. Drought-resistant crops like jowar and bengalgram dominate crop mixtures more commonly on share-rented land.

KINKHEDA : Table 21 gives the cropping pattern on mixed cropped plots in the kharif season.

Table 21 : Cropping pattern on mixed cropped plots of Kinkheda village. Area (No. of plots) under crop mixtures dominated by crops below as percentage of total area (No. of plots) under mixed crops in each category.

Crops	Owner-operated	Share-rented	D.R.C./D.S.C.
(1)	(2)	(3)	(4)
Cotton L. V.	48.6 (46.0)	46.0 (56.2)	D.S.C.
Cotton H. Y. V.	0.3 (0.6)	- (-)	D.S.C.
Groundnut	2.8 (5.7)	- (-)	D.S.C.
Greengram	1.4 (1.1)	- (-)	D.R.C.
Jowar L. V.	44.9 (43.8)	54.0 (43.8)	D.R.C.
Jowar H. Y. V.	2.0 (2.3)	- (-)	D.R.C.
Drought-Sensitive Crops	51.7 (52.3)	46.0 (56.2)	

As in the other villages, owner-operators show a greater preference for crop mixtures dominated by drought-sensitive crops like cotton and groundnut while share tenants reveal a greater preference for jowar-dominated mixtures.

KANZARA : Table 22 gives the cropping pattern on mixed cropped plots in the kharif season.

Table 22 : Cropping pattern on mixed-cropped plots of Kanzara village. Area (No. of plots) under crop mixtures dominated by crops below as percentage of total area (No. of plots) under mixed crops in each category.

Crops (1)	Owner-operated (2)	Fixed-rented (3)	D.R.C./D.S.C. (4)
Cotton H. Y. V.	1.2 (1.3)	- (-)	D.S.C.
Cotton L. V.	64.8 (58.7)	39.9 (44.4)	D.S.C.
Groundnut	11.1 (12.3)	22.9 (16.7)	D.S.C.
Jowar H. Y. V.	2.2 (3.9)	- (-)	D.R.C.
Jowar L. V.	20.8 (23.9)	37.2 (38.9)	D.R.C.
Drought-Sensitive Crops	77.1 (72.3)	62.8 (61.1)	
H. Y. V.s	3.4 (5.2)	- (-)	

From Table 22 owner-operators allocate more land (and plots) to both drought-sensitive crops and high-yielding-varieties as compared to fixed-rent tenants. Groundnut-dominated mixtures are more common on fixed-rented land while cotton-dominated mixtures are more common on owner-operated land.

Finally, in Table 23 below we compare the cropping pattern on mixed cropped plots on share-rented and fixed-rented land. For this we compare the cropping pattern on share-rented land in Kinkheda with the cropping pattern on fixed-rented land in Kanzara.

Table 23 : Comparison of cropping pattern on share-rented land in Kinkheda and fixed-rented land in Kanzara. (Area (No. of plots) under crop mixtures dominated by crops below as percentage of total area (No. of plots) under mixed crops in each category.)

Crops	Share-rented land in Kinkheda	Fixed-rented land in Kanzara	D.R.C./D.S.C.
(1)	(2)	(3)	(4)
Cotton L. V.	46.0 (56.2)	39.9 (44.4)	D.S.C.
Groundnut	- (-)	22.9 (16.7)	D.S.C.
Jowar L. V.	54.0 (43.8)	37.2 (38.9)	D.R.C.
Drought-Sensitive Crops	46.0 (56.2)	62.8 (61.1)	

While cotton-dominated mixtures are more common on share-rented land, groundnut-dominated mixtures are more prevalent on fixed-rented land. Drought-sensitive crop-dominated mixtures are more prevalent on fixed-rented land compared to share-rented land in Akola district.

On the basis of a simple comparison of the cropping pattern on tenanted and owner-operated plots we have seen that :

(1) Share tenants do not appear to adopt a more risky cropping strategy as compared to owner-operators. On the contrary, owner-operators reveal a slightly greater preference for the more risky crops. This tendency is more in evidence in the kharif season. The same is true in comparisons of cropping pattern on fixed-rented and owner-operated plots.

(2) Crops requiring heavier inputs of labour but which are also high-valued crops like wheat, paddy, groundnut, cotton and sugarcane are grown more on owner-operated land. High-yielding varieties are also more prevalent on owner-operated land.

However, since we cannot say whether these differences are statistically significant or not, we only suggest that our data does not reveal share tenants adopting a more risky cropping strategy compared to owner-operators. Moreover, in our analysis we do not take account of irrigation differences. It is therefore possible that a household may devote more area to drought-sensitive crops like paddy, but since its area is better irrigated, this decision may not necessarily reveal a greater inclination to take risks. Thus a larger area devoted to drought-sensitive crops does not necessarily imply that a household is adopting a more risky cropping strategy. To overcome this problem we could eliminate all irrigated plots from our analysis and discuss cropping pattern differences on unirrigated plots only. However, since this reduces our sample size significantly in some of the villages, we do not do this.

Instead, we try to explain the preference of a household for drought-sensitive crops (in its cropping pattern) in terms of variables like (i) the extent of tenancy on the household's operational holding, (ii) the extent of irrigation on the operational holding as well as (iii) the size and composition of the cultivating household.

In Table 24 we present the estimated coefficients of our regression equation :

$$Y_i = \beta_o + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + u_i$$

where

Y_i = Area under drought-sensitive crops as percentage of total cropped area in the kharif season on holding i.

X_{1i} = Leased-in area as percentage of total operated area on holding i.

X_{2i} = Command area under irrigation as percentage of total operated area on holding i.

X_{3i} = Dependent-worker ratio in household cultivating holding i.

X_{4i} = Area operated per worker in household cultivating holding i.

Table 24 : Cropping pattern regression analysis.

Dependent Variable = Area under drought-sensitive crops as percentage of total cropped area in kharif season.

Independent Variables and the estimates of corresponding coefficients are given below :

Village	Constant term ($\hat{\beta}_o$)	Leased-in area as % of total operated area ($\hat{\beta}_1$)	Command area under irrigation as % of total operated area ($\hat{\beta}_2$)	Dependent-worker ratio ($\hat{\beta}_3$)	Area operated per worker ($\hat{\beta}_4$)	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kalman	22.6936*	-0.18851	0.14399	-4.34164	1.14057	0.0666
Shirapur	28.3228*	-0.02935	0.87315*	1.135087	-1.23277	0.4056
Kalman + Shirapur	23.8499*	-0.04653	0.70059*	-0.19206	-0.32829	0.2141
Kinkheda	50.5580*	-0.07810	0.39837	2.68401	0.241095	0.0206
Kanzara	74.8814*	-0.10719	-0.30769@	0.11793	-0.086309	0.0712
Kinkheda + Kanzara	60.3804*	-0.16137	-0.10696	3.46580	-0.001243	0.0238
Aurepalle	4.7804	-0.08531	0.10858	0.45983	0.80325*	0.138
Dokur	43.5209*	-0.01188	0.48258*	-6.88955	2.943905	0.2487
Aurepalle + Dokur	9.1517	0.01247	0.82639*	0.34222	0.40848	0.6031

* t significant at 5 per cent level.

@ t significant at 10 per cent level.

From Table 24 we see that :

(1) $\hat{\beta}_1$ is negative in all villages. Thus the adoption of drought-sensitive crops is more on owner-operated land as compared to tenanted land. However, in no village is this difference significant. Thus we can only assert that our data does not support the hypothesis that share tenants would devote a greater proportion of their cropped area to more risky crops compared to owner-operators.

(2) $\hat{\beta}_2$ is positive in all villages (except Kanzara). Thus increased irrigation facilitates the adoption of drought-sensitive crops. In fact, this is the only variable which has a significant effect on the allocation of land to drought-sensitive crops in most villages. This is also plausible since irrigation reduces risks of water shortage and makes cultivation of drought-sensitive crops less risky.

(3) The size/composition of the cultivating household does not appear to influence its allocation of land to drought-sensitive crops in any significant manner in any of the villages.

Thus we conclude that tenure does not appear to significantly influence the cultivator's preference between more risky and less risky crops. The only variable that has a significant role in explaining the allocation of cropped land to drought-sensitive crops is irrigation.

IV

In this section we will report our results relating to the use of inputs on share-rented and owner-operated land. In an earlier chapter we had referred to the debate regarding the inefficiency of sharecropping. It was argued that since sharecroppers receive only a fraction of the marginal-product of the input they apply on rented land, they would not utilise as much input as would an owner-operator. As against this hypothesis, Cheung and others have argued that if the landowner is powerful enough he can specify the input-intensity on leased-out land and to the extent this is feasible and enforceable, there will be no inefficiency. Even in situations where the input-intensities cannot be unilaterally fixed by the landowner (or if this is unenforceable anyway), there are other ways (for example, cost sharing) by which the landowner can induce the sharecropper to use inputs more intensively.

We also referred to some of the empirical studies on this aspect of tenancy. We found that while in certain regions of the country (for example, in districts of West Bengal, as reported in [23], [27]) there was no evidence that input-use was less intensive on sharecropped farms, in other regions (for example, in the Purnea district of Bihar, as reported in [9]) owner-tenants were found to use less inputs per acre on their sharecropped plots compared to their owned plots.

Our analysis is based on the 1975-76 data for two villages of the Sholapur district of Maharashtra. These villages are Kalman and Shirapur. We have chosen only two of the six ICRISAT villages because sharecropping is relatively more widespread in these villages. In the other villages, the number of farms which are sharecropped and for which input-output data is recorded are too few for meaningful inferences to be drawn.

Before presenting the results we briefly discuss the data we have used. As in the earlier sections, we use VLS-D schedule which gives for each plot cultivated by the sample household its area, ownership status as well as the command area under irrigation. The VLS-H schedule records, for each of the cultivated plots listed in VLS-D, the details of inputs used in each season. The schedule records the nature of agricultural operation, its timing and the quantities of different inputs used during every operation during a crop cycle. By adding the amount of an input used in the different operations throughout the crop cycle we can arrive at an estimate of the total amount of that input used during the entire crop cycle.

The data have a number of interesting features. First, it records input-output data for each plot in the sample separately. Since in the investigations a plot was classified as either share-rented or owner-operated (and not share-rented and owner-operated in parts), by recording inputs and outputs for each plot separately we can get a sharper idea about the utilisation of inputs on the two kinds of land. Some of the earlier studies[14/] relied on farm-level data. Since they presumably did not have data on input-output on the leased-in and owned parts of the holding separately, they could relate input-use to tenancy only indirectly, by regressing, say, the total input used per acre of operational holding on the percentage area leased-in on the holding. Our data permits us to directly test for input-use differences at the plot-level.

While plot-level data are more useful it is clear that recording such data is relatively more difficult. The farmer having a number of plots may be allocating his inputs without paying particular attention to its

14/ See for example, Aparajita Chakravarty and A. Rudra (1973), and Harendranath Dwivedi and A. Rudra (1973).

division between the different plots. In such a case, while the farmer may be able to give an accurate assessment of his total input use on his operational holding, he may find it difficult to give as accurate an estimate of input use on each of the plots. This problem may be more pronounced in the case of output data. Very often several plots are threshed together and it may be difficult to tell how much of output came from each plot. These difficulties need not always be serious, however. For example, the farmer may be devoting different plots to different crops (or crop mixtures) and these crops may have different input requirements. In such cases the farmer may have a better assessment of the inputs used on different plots. Determination of output from each of the plots would also be easier if the different plots grow different crops, and particularly if these crops mature at different times.

Another feature of the input use data is that a distinction has been made between hired and owned inputs, whenever this was possible. Thus as regards the input of human labour, family labour input and hired labour inputs are recorded separately. Similarly, a distinction is made between hired and owned bullock labour inputs.

A third feature of the data is that a distinction is made between inputs of male adult, female adult and child labour on operated land. This permits us to test whether share-tenants or owner-operators reveal any preference between, say, male and female labour.

We will now mention some of the limitations in our use of the data.

(1) In our analysis we have added together the number of hours worked by adult males and females as well as children to arrive at the estimate of total labour-hours worked during any operation. But since one hour's work

done by the male adult can achieve much more than an hour's work done by a child (or female adult, in certain operations at least), a weighted addition would have been more appropriate. However, since in our sample the incidence of child labour is rather limited (only about ten per cent of total cultivated plots in Kalman and Shirapur use some child-labour), we do not expect this to make any difference to our conclusions. We must also point out that the labour-hours utilised in any operation includes the time taken in reaching the place of work. However, since we cannot think of any reason for this component to be systematically higher or lower on tenanted land, this is not likely to affect our comparisons.

(2) We record bullock-labour input in terms of the number of hours worked by a bullock pair. We are, therefore, ignoring differences in the quality of bullocks. Also, just as in the case of human-labour, the number of hours taken in going to the place of work is included in the recorded data.

(3) Input of different kinds of fertilizers and manure used are given separately in terms of kilograms and quintals respectively. We will test for differences in the use of each type of fertilizer and manure separately.

(4) The quantity (in kg.) of seed used on each plot is recorded. For some crops like sugarcane, chillies and onions etc. the number of seedlings is recorded. In comparing seed-inputs therefore, we will consider only those plots where the seeds are recorded in terms of kilograms. We will be excluding (for seed-input comparison only) those plots which grow sugarcane, onions, chillies etc.

(5) The data does not provide information on the quantum of water that isused for irrigation in any operation. However, one of the operations listed in the schedule is "irrigating crops". The total number of times the "irrigating crops" operation is undertaken on a plot could be taken as an indicator of the importance of irrigation on that plot. The larger this number, the greater is the use of irrigation. Clearly, in the absence of information regarding the quantum of water available during each such operation, this measure is at best a crude one. It makes no distinction between different types of irrigation and their quality differences —irrigating crops using tank water and from tube-wells is not the same thing. Moreover, a farmer who has an abundant supply of water may be able to irrigate his entire plot of land in one operation while another farmer who does not have sufficient water may be forced to irrigate different parts of his plot at different times. In such cases, while the second farmer is irrigating his plot no better than the first, a simple counting of the number of times "irrigating crops" operation is undertaken would lead one to such a conclusion. Despite these shortcomings, in the absence of data on the quantity of water used, we will make our comparisons on the basis of the number of times a plot is irrigated.

Another indirect estimate could be obtained from the number of pump-set hours that were required during the irrigation operation. If instead of pump-sets bullock labour was used, then bullock labour hours are recorded. While these may be reasonable indicators of the extent of irrigation, comparison across plots is difficult if some plots use pump-sets and others do not. Moreover, when irrigation is from a tank with gravity flow neither bullock labour hours nor pump-set hours are recorded and in such cases the extent of irrigation is under-reported.

Finally, we must mention another simplifying procedure that we had to adopt. This applies to all inputs, but particularly to labour input. While recording input data it was sometimes the case that labour and other inputs were applied on a plot A at the land preparation stage. Subsequently, for sowing the plot was divided into sub-plots AA and AB/planted to different crops. To determine the total input on AA and AB it is necessary to know how the inputs applied on A were distributed on the parts that later became AA and AB. Since this is not recorded, we are forced to distribute the total inputs applied on A between AA and AB in proportion to their respective areas.

In Tables 25 and 26 we present simple mean-input comparisons on sharecropped and owner-operated land in Kalman and Shirapur respectively.

Table 25 : Average input per acre on share-rented and owner-operated plots in Kalman, 1975-76.

Average per acre input of / On	Share-rented plots $\bar{x}_s$	Owner-operated plots $\bar{x}_o$	Difference $\bar{x}_o - \bar{x}_s$	t
(1)	(2)	(3)	(4)	(5)
Male family labour hours	31.04	64.37	33.329	1.385
Female family labour hours	15.915	38.051	22.116	1.701*
Child family labour hours	-	0.722	0.722	1.027
Total family labour hours	46.96	103.119	56.159	1.551
Male hired labour hours	31.351	51.056	19.705	1.161
Female hired labour hours	55.566	84.745	29.179	0.545
Child hired labour hours	-	0.28	0.28	0.988
Total hired labour hours	86.916	136.084	49.168	1.178
Total labour hours	133.87	239.203	105.333	1.646*
Owned Bullock labour hours	22.813	38.858	16.045	1.248
Hired Bullock labour hours	1.395	6.208	4.813	1.786*
Total Bullock labour hours	24.208	45.066	20.858	1.503
Kgs. of Urea fertilizers	-	2.45	2.45	1.612
Kgs. of Complex (15:15:15) fertilizer	-	0.8	0.8	1.25
Kgs. of all fertilizer-types combined	-	5.784	5.784	2.253*
Kgs. of farmyard manure	0.22	2.221	2.001	2.37*
Kgs. of manure from penning of sheep etc.	-	-	-	-
Kgs. of all manure-types combined	0.217	3.463	3.246	1.44
Number of irrigations	1.138	2.889	1.751	1.421
Kgs. of seeds	7.698	10.072	2.374	0.747

No. of owner-operated plots (n_1) = 288

No. of share-rented plots (n_2) = 77.

The tabulated t value is 1.645 at the 5 % level of significance ($d.f. = n_1 + n_2 - 2$)

Computed $t = \frac{\bar{x}_o - \bar{x}_s}{S_{\bar{x}_o - \bar{x}_s}}$ where $\bar{x}_o$, $\bar{x}_s$ are the average input-intensities on owner-operated and share-rented plots respectively, and

$$S_{\bar{x}_o - \bar{x}_s} = \text{Square root } \left\{ \frac{\left(\left(\sum_1^{n_1} X_{oi}^2 - \frac{(\sum X_{oi})^2}{n_1}\right) + \left(\sum_1^{n_2} X_{si}^2 - \frac{(\sum X_{si})^2}{n_2}\right)\right) \times \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}{(n_1 + n_2 - 2)} \right\}$$

Table 26 : Average input per acre on share-rented and owner-operated plots in Shirapur, 1975-76.

Average per acre input of / On	Share-rented plots $\bar{x}_s$	Owner-operated plots $\bar{x}_o$	Difference $\bar{x}_o - \bar{x}_s$	t
(1)	(2)	(3)	(4)	(5)
Male family labour hours	26.2535	114.947	88.6935	1.8836*
Female family labour hours	43.7857	81.735	37.9493	1.157
Child family labour hours	1.25	5.05	3.8	0.726
Total family labour hours	71.2893	201.734	130.4447	1.795*
Male hired labour hours	18.5071	26.386	7.8789	0.549
Female hired labour hours	44.2928	91.514	47.2212	0.793
Child hired labour hours	-	0.129	0.129	0.381
Total hired labour hours	62.80	118.029	55.229	0.847
Total labour hours	134.096	319.763	185.667	1.53
Owned Bullock labour hours	9.9464	26.0376	16.0912	1.40
Hired Bullock labour hours	3.50	12.838	9.338	1.606
Total Bullock labour hours	13.4464	38.8709	25.4245	1.821*
Kgs. of Urea fertilizers	-	2.7	2.7	0.85
Kgs. of Complex (15:15:15) fertilizers	-	0.62	0.62	0.32
Kgs. of all fertilizer-types combined	-	3.356	3.356	0.727
Kgs. of farmyard manure	0.13	3.72	3.59	1.03
Kgs. of manure from penning of sheep etc.	-	0.558	0.558	0.93
Kgs. of all manure-types combined	0.1357	4.204	4.0683	1.092
No. of irrigations	-	3.7318	3.7318	1.248
Kgs. of seeds	7.8821	7.6499	-0.232	0.089

No. of owner-operated plots (n_1) = 201.

No. of share-rented plots (n_2) = 14

The tabulated t-value is 1.645 at the 5 % level of significance ($d.f. = n_1 + n_2 - 2$)

t has been computed as in Table 25.

We see that :

(1) In both Kalman and Shirapur, input-intensities on owner-operated plots are more than on sharecropped plots. This applies to all inputs, whether they are hired or not. However, the differences are more marked in the case of owned inputs.

(2) About the relative preference between hired and owned labour, we find that in Kalman both share tenants and owner-operators use more of hired labour while in Shirapur both categories use relatively more of owned labour. However, in both the villages a much larger proportion of total labour-hours come as hired labour on sharecropped land vis-a-vis owner-operated land.

(3) Coming to differences in the use of male and female labour, we observe that as far as family labour is concerned relatively more of male labour is used on both share-rented and owner-operated plots. However, this is not true for hired labour. More of hired labour input is female labour. There is another interesting distinction. The difference in input use is more for male labour compared to female labour in the case of family labour (where male labour is the larger component of total family labour input). This is reversed in the case of hired labour (where female labour is the larger component of total hired labour input).

(4) We tested the null hypothesis that the average input-intensities are the same on owner-operated plots and share-rented plots against the alternative hypothesis that the average input-intensities are larger on owner-operated plots. We found that : (i) In Kalman, inputs of female family

labour, total labour, hired bullock labour, fertilizers and farmyard manure are significantly more on owner-operated land. (ii) In Shirapur, inputs of male family labour, total family labour and total bullock labour are significantly more on owner-operated land. (iii) Inputs of irrigation, seeds and fertilizer-types are not significantly different on owner-operated and sharecropped land in either of the two villages.

Our simple mean comparisons provide some insights regarding the use of inputs on rented and owner-operated land. However, in these comparisons we do not control for the other important factors which may be influencing the use of inputs. One important variable would be the cropping pattern. Thus, differences in input-use could arise because of differences in cropping pattern rather than tenancy per-se. Irrigation is another important variable. It allows more intensive cropping and it influences the cropping pattern itself, as we saw in the last section. In either way it is likely to influence the extent of use of inputs. We are also ignoring, in our comparisons, cultivator-specific differences which could influence the pattern and extent of input-use.

To take account of some of these limitations we report results from a multiple regression analysis where we seek to explain variations in the use of inputs per acre in terms of independent variables like the extent of tenancy on the holding, the command area under irrigation, the area allocated to drought-sensitive crops and the dependent-worker ratio in the cultivating household. This data is available for each holding cultivated by the sample households.

In Table 27 below we report the estimated regression coefficients in the regression equation where the independent variables are :

X_1 = Area leased-in as percentage of total operated area.

X_2 = Command area under irrigation as percentage of total operated area.

X_3 = Area under drought-sensitive crops as percentage of total cropped area in both seasons.

X_4 = Land owned per worker.

X_5 = Dependent-worker ratio.

The dependent variables and the estimated coefficients for each equation are given below :

Table 27 : Table showing the estimated regression coefficients
(human labour input)

Dependent variable	Constant $(\hat{\beta}_0)$	X_1 $(\hat{\beta}_1)$	X_2 $(\hat{\beta}_2)$	X_3 $(\hat{\beta}_3)$	X_4 $(\hat{\beta}_4)$	X_5 $(\hat{\beta}_5)$	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Family Male labour hrs. per acre							
Kalman	44.2026*	-0.1248	0.3378	0.03806	-2.7484@	-2.8257	0.2445
Shirapur	140.6159*	-1.4217	0.6889	0.50482	-7.4224	-36.5055	0.2459
Combined	93.9058*	-0.7357@	-0.3170	1.23884@	-7.8776*	-10.6494	0.2542
2. Family Female labour hrs. per acre							
Kalman	23.9465*	-0.0795	0.1679	0.1004	-3.0867*	9.2231*	0.4596
Shirapur	64.6517*	-0.6313	0.3504	0.36254	-9.8517*	19.5070	0.6179
Combined	47.1634*	-0.3893*	-0.2388	1.09388*	-7.1957*	12.9827*	0.6095
3. Total Family labour hrs. per acre							
Kalman	68.0294*	-0.1937	0.4987	0.15504	-5.8145*	6.5149	0.4345
Shirapur	205.2344*	-2.0839	-0.9372	0.96304	-16.8352@	-16.1883	0.3915
Combined	141.7979*	-1.1482*	-0.6313	2.40525*	-15.0627*	3.1825	0.4342

* t significant at 5 % level

@ t significant at 10 % level.

contd..../-

Table 27 : (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
4. Hired Male labour hrs. per acre							
Kalman	11.0636	-0.1272	0.3320	0.97056	-0.01592	2.1694	0.2182
Shirapur	22.7349	-0.0699	-0.0539	0.85999	-1.9661	1.8949	0.2256
Combined	23.2834*	-0.1301	0.0125	0.51198@	-0.27016	-0.8340	0.1379
5. Hired Female labour hrs. per acre							
Kalman	9.4910	-0.1047	0.2559	1.40194	1.86181	-4.1526*	0.2583
Shirapur	5.2515	-0.0671	2.7877@	1.5963	2.2796	-0.5092	0.7477
Combined	-7.4851	-0.1009	0.9155	3.00343*	-0.08426	3.8097	0.6466
6. Hired Total labour hrs. per acre							
Kalman	20.3817	-0.2288	0.590	2.3741	1.86225	-1.9185	0.2428
Shirapur	29.2645	-0.0187	2.2761	2.41456	0.19675	1.4814	0.6955
Combined	16.3125	-0.2351	0.9261	3.50935*	-0.39147	2.9944	0.5933
7. Total labour hrs. per acre							
Kalman	88.4100*	-0.4225	1.0887	2.52908@	-3.98196	4.5961	0.3583
Shirapur	234.4981*	-2.1026	3.2133	3.37761	-16.6382	-14.7073	0.6621
Combined	158.1106*	-1.3833@	0.2948	5.91461*	-15.4541*	6.1767	0.6377

From Table 27 we see that :

(1) Households leasing-in more land use less labour per acre. This is regardless of whether it is female labour or male labour. However, this difference in use of human labour on leased-in land is significant for family labour but not so for hired labour. Thus owner-tenants appear to divert more of their family labour to their owned land.

(2) While relatively more labour appears to be used on holdings with better irrigation facilities, the regression coefficient for irrigation is not statistically significant. This is regardless of whether it is male or female labour, or whether it is hired or family labour.

(3) The use of labour is significantly more on holdings devoting relatively more land to the drought-sensitive crops.

(4) Households with relatively larger number of 'workers' in relation to their land ownership utilise more family labour per acre. This is true for both male and female labour. The use of hired labour does not appear to be related to the number of workers in the household. As far as the total labour input is concerned, it is seen that families with a larger number of workers will apply labour more intensively on operated land.

(5) The use of male family (hired) labour is relatively less (more) on holdings cultivated by households with relatively larger number of dependents. Conversely, the use of female family (hired) labour is relatively more (less) on holdings cultivated by households with a larger number of dependents. These differences are, however, not significant (except for the use of female family labour). This result appears to be counter-intuitive. If the number of dependents is large in relation to the

number of workers we would expect a relatively greater proportion of the female labour-hours to be spent in non-cultivation work, for example in taking care of children and the old and disabled members of the household. To that extent therefore, one would expect the use of female family labour on land to be less on holdings cultivated by households with a larger number of dependents. However, it is also possible to imagine older dependents taking care of the younger ones at home and thereby releasing female labour for work on land.

In Table 28 below, we present the estimates of the regression coefficients for the case of bullock labour input. The independent variables are :

X_1 = Area leased-in as percentage of total operated area.

X_2 = Command area under irrigation as percentage of total operated area.

X_3 = Area under drought-sensitive crops as percentage of total cropped area in both seasons.

X_4 = Value of bullocks owned per acre of land owned.

X_5 = Dependent-worker ratio.

The dependent variables and the regression coefficients are given below.

Table 28 : Table showing theeestimated regression coefficients
(Bullock labour input)

Dependent variable	Constant ($\hat{\beta}_o$)	X_1 ($\hat{\beta}_1$)	X_2 ($\hat{\beta}_2$)	X_3 ($\hat{\beta}_3$)	X_4 ($\hat{\beta}_4$)	X_5 ($\hat{\beta}_5$)	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Owned Bullock labour hours per acre							
Kalman	7.0768	-0.1231	0.0993	0.40361@	0.10256*	-3.1228	0.5506
Shirapur	5.6651	0.0564	0.2546	-0.02837	0.05979*	0.5725	0.4956
Combined	9.048*	0.0104	0.1825	0.12691	0.05889*	-2.7974	0.459
Hired Bullock labour hours per acre							
Kalman	10.4110*	-0.0402	0.03726	-0.19742@	-0.0455*	1.6041	0.5415
Shirapur	24.4150*	-0.2727	-0.09665	0.31933	-0.03603*	-8.3095	0.3676
Combined	13.6667*	-0.1743*	-0.09621	0.17542	-0.02694*	-0.6813	0.245
Total Bullock labour hours per acre							
Kalman	17.4884*	-0.1632	0.13661	0.20614	0.05706*	-1.5173	0.354
Shirapur	30.0813*	-0.2163	0,15798	0.29094	0.02376	-7.7376	0.443
Combined	22.7146*	-0.1638	0.08633	0.30228*	0.03196*	-3.4777	0.419

* t significant at 5 % level.

@ t significant at 10 % level.

From Table 28 it is clear that :

(1) Householdsleasing-in more land tend to use less bullock labour on operated land. However, the influence of tenancy on use of bullock labour is not statistically significant (except possibly for the hired component).

(2) Similarly, while irrigation encourages greater use of bullock labour, its influence is not statistically significant.

(3) As far as the total input of bullock labour hours is concerned, it is more on holdingswith a greater percentage area under drought-sensitive crops. However, the cropping pattern does not appear to affect the use of owned as well as hired components of bullock-labour input separately in any uniform manner.

(4) By far the most important variable affecting the use of bullock-labour on land is the household's ownership of bullocks. Households owning more bullocks (in terms of value) use significantly more bullock-labour on their land.

In our mean comparisons we found that the use of fertilizers (all types) and manure (all types) was larger on owner-operated area vis-a-vis sharecropped area. This difference, however, was not significant. This finding is confirmed by our regression. In Table 29 below, we present the estimates of the regression coefficients. The independent variables are :

X_1 = Leased-in area as percentage of total operated area.

X_2 = Command area under irrigation as percentage of total operated area.

X_3 = Area under drought-sensitive crops as percentage of total cropped area in both seasons.

X_4 = Land owned per worker.

X_5 = Dependent-worker ratio.

The dependent variables and the regression coefficients are presented below :

Table 29 : Table showing estimated regression coefficients
(Total fertilizer and total manure input.)

Dependent variable	Constant ($\hat{\beta}_0$)	X_1 ($\hat{\beta}_1$)	X_2 ($\hat{\beta}_2$)	X_3 ($\hat{\beta}_3$)	X_4 ($\hat{\beta}_4$)	X_5 ($\hat{\beta}_5$)	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total Fertilizers per acre							
Kalman	1.400	-0.0668	-0.02458	0.4286*	-0.5479	1.3253	0.2998
Shirapur	-1.9131@	0.00262	0.08453@	0.09089@	0.0503	0.7509	0.8288
Combined	-1.1775	-0.01435	0.06875	0.1274*	0.1313	0.4598	0.3071
Total Manure per acre							
Kalman	0.9920	-0.0090	0.11332*	0.01701	-0.0277	-0.8195	0.3516
Shirapur	-1.2009	-0.0252	0.03019	0.18857*	-0.1372	0.9744	0.7090
Combined	0.338	-0.02065	0.08642	0.13402*	-0.1722	0.0283	0.6045

* t significant at 5 % level.
@ t significant at 10 % level.

We observe that :

(1) The input of fertilizers and manure is relatively less on holdings with a larger area under tenancy. However, the tenancy coefficient is not statistically significant.

(2) Cropping pattern is by far the most important variable influencing the extent of use of fertilizers and manure. In both villages, the use of fertilizers and manure is significantly larger on holdings with a larger percentage area devoted to drought-sensitive crops.

(3) The use of manure (but not fertilizers) is significantly more on better irrigated holdings.

(4) Neither the number of workers nor the composition of the household has any significant influence on the use of manure or fertilizers.

CHAPTER VI

SUMMARY AND CONCLUDING REMARKS

In the previous chapters we have discussed some aspects of tenancy in Indian agriculture which we felt were interesting and also relevant for policy. In this concluding chapter we attempt to integrate our discussion within a wider framework and speculate on the possible evolution of tenancy in Indian agriculture. We will also mention some areas for further research. But first, we recapitulate some general features of our work.

We have presented a series of models on different aspects of tenancy in different institutional contexts. Thus, for example, we studied the implications for tenancy of technological changes in a situation where competitive conditions prevail in tenancy transactions. We also considered, at the other extreme, situations where the landowners are relatively more wealthy and powerful vis-a-vis the tenants and this is reflected in their monopoly power in the land market. We have discussed the implications of interlinked transactions in land and credit but there is no presumption that this interlinking is a widespread feature in rural markets. Indeed, we discuss the implications of various kinds of market imperfections— outright non-existence of markets, unequal access to credit and other inputs, market-power for one of the participants etc.

This disaggregation over different institutional contexts is essential in studying tenancy in a country such as India. As we saw in Chapters II and III, there is a great diversity in agricultural conditions in different parts of the country. Not only is there a difference in the extent of technological and infrastructural development in different regions,

but the extent of development of institutions and markets varies. Markets exist and function smoothly in some regions while in other regions they do not exist or function imperfectly.

In the context of imperfect markets, it also becomes necessary to distinguish between different types of tenant households, depending on their ownership and access to resources. As we saw, empirical studies reveal a wide disparity in the economic status of the tenant in different parts of the country as well as in the same region. While some tenants own significant land and other resources, others come largely from the class of landless or small landowning households. In our work we make an attempt to distinguish tenant households, both in terms of their ownership of resources (and consequently, in the opportunities available to them and their responses) as well as in terms of their occupations. (For example, whether they are predominantly wage-labour households or peasant households.) This disaggregation across institutional contexts and across household-types underlines our belief that a study on tenancy, for it to be meaningful and relevant, must take note of the diversity in tenancy arrangements across the country. We now briefly summarise our results.

One aspect of our study was a discussion of the role of a household's resource endowments in its leasing-decision, and we analysed, in a simple framework, in what way the size/composition as well as the managerial ability of the tenant household influenced the extent of land leased-in by it. We showed that while landowners would tend to lease-out more land to 'better' tenants and 'better' tenants tend to lease-in more land, the influence of the size/composition of a household on the extent of land

leased-in depends on the pattern of utilisation of family labour by the tenant-household. Thus, tenant households that work entirely on leased-in land tend to lease-in more when family-size increases, but for tenant households whose main occupation is wage employment, the size of family does not influence tenancy though its composition does.

We also discussed how technological changes influence the pattern of distribution of leased-out land between richer owner-tenants and poorer pure tenants as well as between sharecropping and fixed-rent tenancy, when market imperfections bias the new technology in favour of the owner-tenant. Our general finding was that as long as market imperfections remain, technical change (whether it is labour-saving or neutral) will lead to a decline in tenancy and to a shift of tenanted area from pure tenants to owner-tenants. Moreover, in so far as owner-tenants can also enter into fixed-rent contracts and pure tenants cannot, there is a trend towards fixed-rent tenancy. These tendencies are reinforced by the expansion of wage employment opportunities consequent to the introduction of new technology. However, in so far as modernisation is also accompanied by a reduction in the inequality of access to inputs and technology between the owner-tenants and pure tenants, these tendencies are likely to be checked.

We also studied some of the implications of interlocked transactions in land and credit. We saw that when the landlord has monopoly power in the land and credit transactions, then interlinking may not be preferred by him. Even when there is interlinking, the landlord does not 'exploit' the tenant by charging usurious interest rates on loans. In fact, the optimal interest rate for the landlord is zero. We also showed that in our model the land

market was in some sense more important for the landlord. While a restriction in the landlord's power to fix the rental-share reduced his welfare, a restriction on his power to set the interest rate on loans left him unaffected, as long as no restrictions were imposed on his power to fix the rental share. We were also able to show that in our framework, under no circumstances would the landlord lose from yield improving technology.

We tried to examine whether tenants (particularly share-croppers) tend to adopt a cropping pattern different from that adopted by owner-operators. Our analysis, based on data from six villages of the Semi-Arid-Tropical regions of Maharashtra and Andhra Pradesh, showed that there were no significant differences in the cropping patterns on the two types of land. We also observed that, by and large, input-use differences on share-rented and owner-operated plots were also not significant.

Given our results and the discussion of the literature, we may speculate on the evolution of tenancy under the influence of modernisation and technological development in agriculture. We have already seen that in plausible situations tenancy per-se would not discourage the adoption of new technology. The diversity in tenancy arrangements permits sufficient flexibility to both landowners and tenants to take advantage of any improvement in technology, provided it can be made available to the tenant. To discuss how technological and other changes would influence tenancy, let us distinguish between four types of rural households :

Type -a : Pure landowners leasing-out their entire land. As our data suggests, most of these households are very small landowning households. They lease-out land either to landless households or to landed tenants.

Type-b : Landless households leasing-in land either from Type-a households or from Type-c households.

Type-c : Landowning households leasing-in and/or leasing-out land but also operating some part of owned land, and

Type-d : Landowning households neither leasing-in nor leasing-out but cultivating owned land.

First, consider the impact of technological change, given existing imperfections in the markets for credit and other inputs. Increased irrigation serves to reduce risks in production. If land-owners leased-out land primarily to transfer part or all the risk in production on to the tenant cultivator[1/], it is likely that with increased irrigation, leased-out land will be taken back for self-cultivation and there will be a decline in tenancy. Thus landowning households (Type-c) who were previously leasing-out some land to either landless or landed tenants will take back their land. Landless households leasing-in land from landowning households will now shift to wage employment. While increased irrigation may not, by itself, motivate pure landowners (Type-a) to take back land for self-cultivation, in the presence of credit market imperfections access to irrigation would be easier for the richer landowners. Thus it is likely that by taking back leased-out land from landless tenants and leasing it out to better-off landed tenants the pure landowners may obtain a higher level of rent. Thus bothe Type-a and Type-c landowning households will take back land from landless tenants. The latter will increasingly shift to wage employment

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1/ This is more likely to be the case with Type-c households. The pure landowners leasing-out land may be doing so because of inadequate resources for cultivation or because their holding-size is too small to ensure subsistence needs of the family.

as agricultural labour or they will migrate. However, since irrigation may also generate a greater demand for labour (by allowing more intensive cropping, for example), wage employment opportunities may expand and the shift of landless tenants to agricultural labour may not necessarily imply a loss in their welfare.

The adoption of HYV seeds and chemical fertilizers is likely to be more under conditions of assured water-supply consequent to irrigation, and therefore, its adoption and use would be more widespread among cultivating households with adequate resources. This factor also encourages a movement of leased-out land towards households which own land and/or other material resources. Thus the effect of technical change would appear to be to reduce tenancy and to shift the distribution of leased-out land in favour of households owning land and other resources. This tendency is further encouraged by mechanisation which reduces the landowner's dependence on hired labour, particularly during the peak season. Moreover, the larger holdings allow the cultivators to take advantage of the economies of scale in mechanisation.

The form of tenancy is also likely to change. First, as risks in production are reduced, the risk-spreading advantage of sharecropping may not be as important in the choice of tenancy contracts. Moreover, as the new technology makes a greater demand on entrepreneurship and managerial functions at least in the earlier stages, fixed-rent contracts would be preferred by the owner-tenants. For landowning households leasing-out land, a household's 'ability to cultivate' would become increasingly important in the choice of tenants. Tenancy contracts may increasingly be of short durations and renewable, thereby permitting the landowner to change tenants if necessary.

So far we have been assuming that while technological changes take place there are no major institutional changes and market imperfections continue to exist. But it is possible that imperfections, particularly those in the markets for credit and government-subsidised inputs like fertilizers and chemicals, may themselves diminish. As our models have shown, this will influence the nature and extent of tenancy. However, what our models do not show but what is nevertheless very important is that the timing of such interventions is also crucial. To illustrate, consider first the case when the extension of credit facilities becomes available and effective well after the new technology has been introduced. Then this may have limited importance as far as tenancy is concerned. Pure landowners, who had taken back land leased-out to landless tenants and instead leased it out to landed-tenants, may now find it profitable to cultivate, since they possess the means of doing so. They may thus take back land leased-out to owner-tenants, with a consequent decline in tenancy.

But suppose credit is made easily available even as the new technology is being introduced. Then the impact on tenancy of this packet of technological and institutional change may well be different from what we have sketched above. While landowning households (Type-c) leasing-out land to spread risks may, as before, resume land for self-cultivation with the spread of irrigation, pure land-owning households (Type-a) may not have any incentive to shift from landless tenants to landed tenants since the advantages of the new technology accrue to both types of households. To that extent the shift to landed-tenants may be less marked. In fact, the shift to self-cultivation itself would be less pronounced since tenants as well as landowners can avail of the new technology. The shift towards

fixed-rent tenancy would also be less evident since the landless and the relatively poorer tenants may be less willing to take the risks associated with entrepreneurship and decision-making involved in the new technology. However, to ensure that the landlord benefits from the new technology, he would encourage the use of new inputs and cost sharing will become more prevalent in share contracts. Moreover, while there may no longer be a preference between households owning land and those not owning land, the household's ability to cultivate would remain the prime consideration in choice of tenants. In any case, it is likely that landowners would participate more actively in production decisions on tenants' land.

Our study also throws up some considerations for land reform policies. The important point that emerges is that there is far too much diversity in tenancy (for example, in the terms and conditions, in the economic status of lessors and lessees etc.) and this makes any general prescription (e.g., land to the tiller) either meaningless or even counter-productive in very many regions and contexts. Moreover, as we have seen, tenancy is often inextricably linked to transactions in the labour and credit markets and land reform measures that do not involve these markets as well are not likely to have any long-term effects. This does not, of course, mean that we cannot say anything at all about policy. In our simple analysis of tenancy in the context of inter-related tenancy and credit transactions, we saw that policy intervention on behalf of the tenant was more effective if it aimed at the tenancy transaction rather than moneylending. More generally, however, before any tenancy reform is envisaged a detailed empirical study on tenancy in different institutional contexts would be of

primary importance. Such a study would bring out the reasons for leasing-in and leasing-out land as well as the various inter-relationships between those who lease-in and those who lease-out. Land reform policies would have to be formulated separately in each context.

Thus for example, in Punjab where a fair share of leased-in area is accounted for by big farmers, an improvement in the tenant's welfare at the expense of the landowner need not necessarily improve income distribution between the rich and the poor. (Particularly since most landowners leasing-out their land entirely are very small land-owners.) In fact, in such a context, tenancy reform by itself would be of limited importance as far as income-distribution is concerned. Rather than directly interfere in tenancy (by, say, fixing a ceiling on rent or conferring ownership rights on tenants, both of which may help the richer tenants at the expense of poorer land-owners) it would be more appropriate to ensure easy availability of credit to the small (and poorer) landowners and landless households. By making feasible cultivation of owned (or leased-in) land this would expand the range of alternatives available to these households, in case alternative employment is not satisfactory. Provision of adequate wages and expansion of employment opportunities, both in agriculture and outside agriculture, would be more meaningful policies for improving income distribution. As we had argued, it is not likely that tenancy, in practice, affects production adversely if tenants have adequate resources.

In contrast to Punjab, there are regions where the bulk of tenants belong to the landless and small landowning households with little means of cultivation. Here, traditional tenancy-reform policies have some relevance, particularly policies of rent control and security of tenure.

In this context we observed earlier that since the rental share in a share contract is often linked to the landlord's share of input costs, rent control in share contracts would require specifying an upper-bound on the rental share of the landlord, for different values of the cost share. Extension of credit to landless tenants on easy terms is of utmost importance. In fact, in its absence, as long as the landlord is the sole reliable supplier of credit to the tenant, much of tenancy reform measures are likely to be thwarted. Indeed, in such contexts, land-reform policies aimed at improving the tenant's lot at the expense of the landowner are likely to be resisted by the tenants themselves[2/].

Thus, for land reform policies to be effective, they must be a package which includes security of tenure, rent control and provision of credit on easy terms from reliable sources. Moreover, we must emphasise that most of these measures would have greater chances of success only if alternative wage employment opportunities are expanded and the bargaining strength of potential tenants is increased. In that sense, therefore, at least in the context of imperfect markets and interlocked transactions, our conclusion is that the interests of the landless agricultural labourers and tenants converge.

We conclude by mentioning some important areas of research. Our view is that a lot more attention needs to be devoted to empirical research in specific contexts. Regional studies on tenancy would be of importance both for theoretical work as well as in quantifying the various dimensions of

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2/ This has been strikingly revealed in the recent 'Operation Barga' initiated by the Left-Front Govt. in West Bengal. The movement aimed at recording the names of all sharecroppers, as a first step in providing them credit for cultivation. However, in some areas at least, the response of sharecroppers was very poor and the common fear was that by alienating the landowner they may lose a reliable source of credit in return for a dubious source, the Govt.

tenancy in different regions. In fact, an empirical study of a region (or a village) and a theoretical analysis based on that empirical study would be an ideal format for a study on tenancy. This has already been attempted successfully by Bell for the Kosi region in Bihar and by Bliss-Stern for the Palanpur village in Uttar Pradesh.

A survey on tenancy should cover households leasing-in land and also identify and include those households from whom land has been leased-in by the leasing-in households. Identification of these landlord tenant pairs would permit us to obtain a range of qualitative and quantitative information on tenancy such as : (i) The motivations for leasing-in and leasing-out land. (ii) The determinants of the terms of the tenancy contract. This can include a wide range of information such as (a) reasons for the landlord's/tenant's preference for the chosen form of tenancy. In a share contract, this would suggest the advantages of sharecropping over other forms, from the point of view of the lessor and lessee; (b) reasons why a 50:50 split is the most common sharing arrangement in a share contract; (c) reasons why only some input costs are shared and not others in a cost sharing arrangement. When markets are interlinked and the landlord supplies consumption/production loans to his tenant then information on the terms of the credit contract could also be elicited. For example, why does the landowner provide consumption loans to his tenant, particularly if the interest rate charged on such loans is low ? Are the terms of the credit contract related to the terms of the tenancy contract ? What prevents the tenant from borrowing from other sources ? (iii) Reasons governing the choice of a particular tenant and/or landowner. For example,

do landlords prefer households with large-sized families ? Is ownership of bullocks essential for leasing-in land ? Do tenants prefer small landowners ? Or do they prefer richer landowners who can provide loans to tenants ? (iv) The mode of decision-making on rented land. Who determines the cropping pattern on rented land ? Does the landlord have any say in the details of cultivation on rented land ? (For example, what crops to sow, how much of inputs to use and when, the timing and extent of other agricultural operations like irrigation etc., etc.) If he does, how is this sought to be enforced ? In cost sharing arrangements, if there is a disagreement between the landlord and the tenant cultivator regarding the quantum of input to be used, how is this resolved ?

In addition to the qualitative information that such a survey can provide, we should also obtain quantitative information on the cultivation practices on rented and owner-operated land. This information could be of use in evaluating the efficiency of tenancy arrangements. For this we would focus on only those households that lease-in as well as cultivate owned land. Information on cropping pattern as well as input-use pattern on leased-in and owner-operated plots of the same cultivator could then be canvassed.

We would expect to observe different kinds of forces operating in different regions and contexts and for this reason an attempt at arriving at one general theory of tenancy would be misguided. Rather, a number of analytical studies, each relevant in some institutional-cum-infrastructural context, would be more meaningful.

Appendix 1

In Chapter IV, section I we worked out the first order conditions for an interior maximum for the landlord and the tenant. We now verify the second order conditions for the landlord's and tenant's maximisation.

The tenant household's income is

$$y_t \equiv y^t(h, l_1, m_1) = (1-r)F(h, l_1 + \bar{l}, m_1) + \bar{w}(\bar{\bar{l}} - ah - l_1 - b_1 m_1)$$

Let

$$\frac{\partial}{\partial h}\left(\frac{\partial y^t}{\partial h}\right) = y^t_{11} = (1-r)F_{11}, \qquad \frac{\partial}{\partial l_1}\left(\frac{\partial y^t}{\partial h}\right) = y^t_{12} = (1-r)F_{12}$$

$$\frac{\partial}{\partial h}\left(\frac{\partial y^t}{\partial l_1}\right) = y^t_{21} = (1-r)F_{21}, \qquad \frac{\partial}{\partial l_1}\left(\frac{\partial y^t}{\partial l_1}\right) = y^t_{22} = (1-r)F_{22}$$

$$\frac{\partial}{\partial h}\left(\frac{\partial y^t}{\partial m_1}\right) = y^t_{31} = (1-r)F_{31}, \qquad \frac{\partial}{\partial l_1}\left(\frac{\partial y^t}{\partial m_1}\right) = y^t_{32} = (1-r)F_{32}$$

$$\frac{\partial}{\partial m_1}\left(\frac{\partial y^t}{\partial h}\right) = y^t_{13} = (1-r)F_{13}$$

$$\frac{\partial}{\partial m_1}\left(\frac{\partial y^t}{\partial l_1}\right) = y^t_{23} = (1-r)F_{23}$$

$$\frac{\partial}{\partial m_1}\left(\frac{\partial y^t}{\partial m_1}\right) = y^t_{33} = (1-r)F_{33}$$

The second order condition for the tenant's interior maximum requires that $((y^t_{ij}))_{i,j=1,2,3}$ be negative definite. By concavity of the production function F, we know that $((F_{ij}))_{i,j=1,2,3}$ is negative definite. Hence the negative definiteness of $((y^t_{ij}))$ follows.

The landlord household's income is

$$y_1 \equiv y^1(q, l_2, m_2) = rF(q, l_1 + \bar{l}, m_1) + G(1 - q, l_2, m_2) - \bar{w}(l_2 + a(1 - q)) + \bar{s}(\bar{L} - b_2 m_2)$$

Let

$$\frac{\partial}{\partial q}\left(\frac{\partial y^1}{\partial q}\right) = y^1_{11} = rF_{11} + G_{11}, \qquad \frac{\partial}{\partial l_2}\left(\frac{\partial y^1}{\partial q}\right) = y^1_{12} = -G_{12}$$

$$\frac{\partial}{\partial q}\left(\frac{\partial y^1}{\partial l_2}\right) = y^1_{21} = -G_{21}, \qquad \frac{\partial}{\partial l_2}\left(\frac{\partial y^1}{\partial l_2}\right) = y^1_{22} = G_{22}$$

$$\frac{\partial}{\partial q}\left(\frac{\partial y^1}{\partial m_2}\right) = y^1_{31} = -G_{31}, \qquad \frac{\partial}{\partial l_2}\left(\frac{\partial y^1}{\partial m_2}\right) = y^1_{32} = G_{32}$$

$$\frac{\partial}{\partial m_2}\left(\frac{\partial y^1}{\partial q}\right) = y^1_{13} = -G_{13}$$

$$\frac{\partial}{\partial m_2}\left(\frac{\partial y^1}{\partial l_2}\right) = y^1_{23} = G_{23}$$

$$\frac{\partial}{\partial m_2}\left(\frac{\partial y^1}{\partial m_2}\right) = y^1_{33} = G_{33}$$

The second order condition for the landlord household's interior maximum requires that $((y^1_{ij}))_{i,j=1,2,3}$ be negative definite. By concavity of F (and G, since F and G are identical), we know $((F_{ij}))_{i,j=1,2,3}$ and $((G_{ij}))_{i,j=1,2,3}$ are negative definite. It is easy to see that the negative definiteness of $((y^1_{ij}))$ follows from the negative definiteness of $((F_{ij}))$ and $((G_{ij}))$.

Appendix 2

In Chapter IV, section II we worked out the first order conditions for an interior maximum for the tenants' and landlords' problem. We now verify the second order conditions for an interior maximum for each type of household.

The landlord household's income

$$y_1 \equiv y^1(h_1) = r_1 \left[k\rho F^1 (h_1, l_1) + \rho G^1 (\bar{H}_1 - h_1, l_2) \right]$$

Since all production functions are identical and

F^1 $(= F^2 = G^1 = G^2)$ is concave, therefore

$$\frac{\partial}{\partial h_1} \left(\frac{\partial y^1}{\partial h_1} \right) = r_1 \left[k\rho F^1_{11} + \rho G^1_{11} \right] < 0$$

Hence the second order condition is satisfied.

The owner-tenant household's income

$$y_{ot} \equiv y^{t1} (q_1, l_1, h_2, 1)$$

$$= (1-r_1)k\rho F^1(q_1, l_1) + k\rho F^2 (\bar{H}_2 - h_2, 1) + r_2 \rho G^2 (h_2, l') - \bar{w} (l_1 + 1 + a(q_1 + \bar{H}_2 - h_2))$$

Let

$$\frac{\partial}{\partial q_1} \left(\frac{\partial y^{t1}}{\partial q_1} \right) = y^{t1}_{11} = (1-r_1)k\rho F^1_{11}, \qquad \frac{\partial}{\partial l_1} \left(\frac{\partial y^{t1}}{\partial q_1} \right) = y^{t1}_{12} = (1-r_1)k\rho F^1_{12}$$

$$\frac{\partial}{\partial q_1} \left(\frac{\partial y^{t1}}{\partial l_1} \right) = y^{t1}_{21} = (1-r_1)k\rho F^1_{21}, \qquad \frac{\partial}{\partial l_1} \left(\frac{\partial y^{t1}}{\partial l_1} \right) = y^{t1}_{22} = (1-r_1)k\rho F^1_{22}$$

$$\frac{\partial}{\partial q_1} \left(\frac{\partial y^{t1}}{\partial h_2} \right) = y^{t1}_{31} = 0, \qquad \frac{\partial}{\partial l_1} \left(\frac{\partial y^{t1}}{\partial h_2} \right) = y^{t1}_{32} = 0$$

$$\frac{\partial}{\partial q_1}\left(\frac{\partial y^{t1}}{\partial l}\right) = y^{t1}_{41} = 0, \qquad \frac{\partial}{\partial l_1}\left(\frac{\partial y^{t1}}{\partial l}\right) = y^{t1}_{42} = 0$$

$$\frac{\partial}{\partial h_2}\left(\frac{\partial y^{t1}}{\partial q_1}\right) = y^{t1}_{13} = 0, \qquad \frac{\partial}{\partial l}\left(\frac{\partial y^{t1}}{\partial q_1}\right) = y^{t1}_{14} = 0$$

$$\frac{\partial}{\partial h_2}\left(\frac{\partial y^{t1}}{\partial l_1}\right) = y^{t1}_{23} = 0, \qquad \frac{\partial}{\partial l}\left(\frac{\partial y^{t1}}{\partial l_1}\right) = y^{t1}_{24} = 0$$

$$\frac{\partial}{\partial h_2}\left(\frac{\partial y^{t1}}{\partial h_2}\right) = y^{t1}_{33} = r_2 \rho G^2_{11} + k\rho F^2_{11}, \qquad \frac{\partial}{\partial l}\left(\frac{\partial y^{t1}}{\partial h_2}\right) = y^{t1}_{34} = -k\rho F^2_{12}$$

$$\frac{\partial}{\partial h_2}\left(\frac{\partial y^{t1}}{\partial l}\right) = y^{t1}_{43} = -k\rho F^2_{21}, \qquad \frac{\partial}{\partial l}\left(\frac{\partial y^{t1}}{\partial l}\right) = y^{t1}_{44} = k\rho F^2_{22}$$

The second order condition for an interior maximum requires that $((y^{t1}_{ij}))_{i,j=1,2,3,4}$ be negative definite. Given that the production function is concave so that $((F^1_{ij}))$, $((F^2_{ij}))$, $((G^1_{ij}))$, and $((G^2_{ij}))$ are negative definite, it is easy to show that $((y^{t1}_{ij}))$ will be also negative definite.

The pure tenant household's income

$$y_{pt} \equiv y^{t2}(l_2, t_2, l')$$

$$= (1-r_1)\,\rho G^1(\bar{H}_1 - h_1, l_2) + (1 - r_2)\,\rho G^2(t_2, l')$$

$$+ \bar{w}\,\bar{p}\,(\bar{L} - l_2 - l' - at_2 - a(\bar{H}_1 - h_1))$$

Let

$$\frac{\partial}{\partial l_2}\left(\frac{\partial y^{t2}}{\partial l_2}\right) = y^{t2}_{11} = (1 - r_1)\,\rho G^1_{22}, \qquad \frac{\partial}{\partial t_2}\left(\frac{\partial y^{t2}}{\partial l_2}\right) = y^{t2}_{12} = 0$$

$$\frac{\partial}{\partial l_2}\left(\frac{\partial y^{t2}}{\partial t_2}\right) = y^{t2}_{21} = 0, \qquad \frac{\partial}{\partial t_2}\left(\frac{\partial y^{t2}}{\partial t_2}\right) = y^{t2}_{22} = (1-r_2)\,\rho G^2_{11}$$

$$\frac{\partial}{\partial l_2}\left(\frac{\partial y^{t2}}{\partial l'}\right) = y^{t2}_{31} = 0, \qquad \frac{\partial}{\partial t_2}\left(\frac{\partial y^{t2}}{\partial l'}\right) = y^{t2}_{32} = (1-r_2)\rho G^2_{21}$$

$$\frac{\partial}{\partial l'}\left(\frac{\partial y^{t2}}{\partial l_2}\right) = y^{t2}_{13} = 0$$

$$\frac{\partial}{\partial l'}\left(\frac{\partial y^{t2}}{\partial t_2}\right) = y^{t2}_{23} = (1 - r_2)\ \rho G^2_{12}$$

$$\frac{\partial}{\partial l'}\left(\frac{\partial y^{t2}}{\partial l'}\right) = y^{t2}_{33} = (1 - r_2)\ \rho G^2_{22}$$

The second order condition for an interior maximum requires that $((y^{t2}_{ij}))_{i,j = 1,2,3}$ be negative definite. Given that all production functions are identical and concave so that $((G^1_{ij}))$ and $((G^2_{ij}))$ are negative definite, the negative definiteness of $((y^{t2}_{ij}))$ immediately follows.

Appendix 3

In Chapter IV, Section II we worked out comparative static propositions assuming our system of equations had a solution. We now show that the equation system does have a solution.

The equilibrium set of equations describing our system, after having eliminated the variables t_2 and q_1 is given by :

$$r_1 \left[k\rho F_1^1 (h_1, l_1) - \rho G_1^1 (\bar{H}_1 - h_1, l_2) \right] = 0 \qquad \ldots (1')$$

$$(1-r_1)\, k\rho F_1^1(h_1, l_1) - \bar{w}a = 0 \qquad \ldots (2')$$

$$(1-r_1) k\rho F_2^1 (h_1, l_1) - \bar{w} = 0 \qquad \ldots (3')$$

$$\rho \left[-kF_1^2 (\bar{H}_2 - h_2, 1) + r_2 G_1^2 (h_2, l') \right] + \bar{w}a = 0 \qquad \ldots (4')$$

$$k\rho F_2^2 (\bar{H}_2 - h_2, 1) - \bar{w} = 0 \qquad \ldots (5')$$

$$(1 - r_1)\rho G_2^1 (\bar{H}_1 - h_1, l_2) - \bar{w}\bar{p} = 0 \qquad \ldots (6')$$

$$(1 - r_2)\rho G_1^2 (h_2, l') - \bar{w}\bar{p}a = 0 \qquad \ldots (7')$$

and $$(1 - r_2)\rho G_2^2 (h_2, l') - \bar{w}\bar{p} = 0 \qquad \ldots (8')$$

We want to show that given $0 < r_1 < 1$ and $0 < r_2 < 1$, this system of equations has at least one solution which satisfies our conditions that

$$0 < h_1 < \bar{H}_1 \qquad \text{and} \qquad 0 < h_2 < \bar{H}_2 .$$

For convenience, assume that $k = 1$ and $\rho = 1$. Assume that all production functions are identical and are of the Cobb-Douglas form exhibiting diminishing returns. Thus

$$F^1(h_1, l_1) = h_1^{\alpha}\ l_1^{\beta}\ , \qquad F^2(\bar{H}_2 - h_2, 1) = (\bar{H}_2 - h_2)^{\alpha}\ 1^{\beta}\ ,$$

$$G^1(\bar{H}_1 - h_1, l_2) = (\bar{H}_1 - h_1)^{\alpha}\ (l_2)^{\beta} \quad \text{and} \quad G^2(h_2, 1') = h_2^{\alpha}\ (1')^{\beta}\ ,$$

with $0 < \alpha < 1$, $0 < \beta < 1$ and $\alpha + \beta - 1 < 0$

Equations (1') to (8') can now be rewritten as :

$$\left(\frac{\bar{H}_1 - h_1}{h_1}\right)^{1-\alpha} = \left(\frac{l_2}{l_1}\right)^{\beta} \qquad \ldots (1)$$

$$(1-r_1)\ (\alpha)\ (h_1)^{\alpha-1}\ (l_1)^{\beta} = \bar{w}a \qquad \ldots (2)$$

$$(1-r_1)\ (\beta)\ (h_1)^{\alpha}\ (l_1)^{\beta-1} = \bar{w} \qquad \ldots (3)$$

$$-(\alpha)(\bar{H}_2-h_2)^{\alpha-1}\ (1)^{\beta} + r_2(\alpha)(h_2)^{\alpha-1}\ (1')^{\beta} + \bar{w}a = 0 \qquad \ldots (4)$$

$$(\beta)\ (\bar{H}_2 - h_2)^{\alpha}\ (1)^{\beta-1} = \bar{w} \qquad \ldots (5)$$

$$(1-r_1)\ (\beta)\ (\bar{H}_1 - h_1)^{\alpha}\ (l_2)^{\beta-1} = \bar{w}\ \bar{p} \qquad \ldots (6)$$

$$(1-r_2)\ (\alpha)\ (h_2)^{\alpha-1}\ (1')^{\beta} = \bar{w}\ \bar{p}\ a \qquad \ldots (7)$$

and

$$(1-r_2)\ (\beta)\ (h_2)^{\alpha}\ (1')^{\beta-1} = \bar{w}\ \bar{p} \qquad \ldots (8)$$

From (2) and (3),

$$\frac{l_1}{h_1} = \left(\frac{a\beta}{\alpha}\right) \qquad \ldots (9)$$

Substituting for l_1 from (9) into (1),

$$l_2 = \left[\frac{\bar{H}_1 - h_1}{h_1}\right]^{\frac{1-\alpha}{\beta}} \cdot \left(\frac{\rho\beta}{\alpha}\right) \cdot (h_1) \qquad \ldots (10)$$

From (6) and (3),

$$\left[\frac{\bar{H}_1 - h_1}{h_1}\right]^{\alpha} \left[\frac{l_1}{l_2}\right]^{1-\beta} = \bar{p} \qquad \ldots (11)$$

But from (1),

$$\left(\frac{l_1}{l_2}\right) = \left[\frac{h_1}{\bar{H}_1 - h_1}\right]^{\frac{1-\alpha}{\beta}} \qquad \ldots (12)$$

Substituting for $\left(\frac{l_1}{l_2}\right)$ from (12) into (11),

$$\left[\frac{\bar{H}_1 - h_1}{h_1}\right]^{\alpha} \left[\frac{h_1}{\bar{H}_1 - h_1}\right]^{\frac{(1-\alpha)(1-\beta)}{\beta}} = \bar{p}$$

or,

$$\left[\frac{h_1}{\bar{H}_1 - h_1}\right]^{\frac{1-\alpha-\beta}{\beta}} = \bar{p}$$

or,

$$\frac{h_1}{\bar{H}_1 - h_1} = \theta \qquad \ldots (13)$$

where

$$\theta = \left(\bar{p}\right)^{\frac{\beta}{1-\alpha-\beta}}$$

From (13),

$$h_1 = \left(\frac{\theta}{1+\theta}\right) \cdot (\bar{H}_1) \qquad \ldots (14)$$

Since $\theta > 0$, h_1 is positive and less than $\bar{H}_1$.

[For $\alpha = \frac{1}{2}$, $\beta = \frac{1}{4}$, and $\bar{p} = \frac{1}{2}$, $h_1 = \left(\frac{1}{3}\right) \cdot (\bar{H}_1)$]

From (9) and (10) respectively, we have

$$l_1 = \left(\frac{a\beta}{\alpha}\right) \cdot \left(\frac{\theta}{1+\theta}\right) (\bar{H}_1), \text{ and } l_2 = \left(\frac{a\beta}{\alpha}\right) \left(\frac{\theta}{1+\theta}\right) (\bar{H}_1) \left(\frac{1}{\theta}\right)^{\frac{1-\alpha}{\beta}} \quad \ldots(15)$$

Substituting for h_1 and l_1 in (2) we get

$$(1 - r_1) = \frac{(\bar{w}) \left(\frac{a}{\alpha}\right)^{1-\beta} \left(\frac{\theta}{1+\theta}\right)^{1-\alpha-\beta}}{\beta^{\beta}} (\bar{H}_1)^{1-\alpha-\beta} \quad \ldots (16)$$

From (7) and (8),

$$\left(\frac{l'}{h_2}\right) = \left(\frac{a\beta}{\alpha}\right) = \frac{l_1}{h_1} \quad \ldots (17)$$

From (8),

$$(1-r_2) = \frac{(\bar{w}\ \bar{p}) \cdot \left(\frac{a\beta}{\alpha}\right)^{1-\beta} (h_2)^{1-\beta}}{\beta\, (h_2)^{\alpha}}$$

$$= \frac{(\bar{w}\ \bar{p}) \cdot \left(\frac{a}{\alpha}\right)^{1-\beta} (h_2)^{1-\alpha-\beta}}{(\beta^{\beta})} \quad \ldots (18)$$

From (5),

$$l^{\beta} = \left(\frac{\beta}{\bar{w}}\right)^{\frac{\beta}{1-\beta}} (\bar{H}_2 - h_2)^{\frac{\alpha\beta}{1-\beta}} \quad \ldots (19)$$

Substituting for l, r_2 and l' in (4) and after simplifying, we get the equation

$$(\alpha).\left(\frac{a\beta}{\alpha}\right)^{\beta}.(h_2)^{\alpha+\beta-1} - (\alpha)\left(\frac{\beta}{\bar{w}}\right)^{\frac{\beta}{1-\beta}}(\bar{H}_2-h_2)^{\frac{\alpha+\beta-1}{1-\beta}} + \bar{w}a(1-\bar{p}) = 0 \quad \ldots (20)$$

Equation (20) can be solved for h_2.

Clearly $h_2 \neq \bar{H}_2$, for if this were so, equation (20) will not hold. Also, for r_2 between zero and unity, h_2 cannot be zero from equation (18). Therefore h_2 will be between zero and $\bar{H}_2$.

Solving for h_2 from (20) and substituting in (19), (18) and (17) we get the equilibrium values of l, r_2' and l' respectively.

Appendix 4

In our model of Chapter IV, Section II we were unable to study the shifting importance of different forms of tenancy arrangements, particularly sharecropping and fixed-rent. We now slightly modify our earlier model to introduce this feature.

Suppose the owner-tenant household can lease-in land from the landlord household either on a share contract or on a fixed-rent contract. We assume, however, that the owner-tenant does not lease-out land. The household employs only hired wage labour in cultivation of owned and leased-in land.

The pure tenant household also leases-in land from the landlord household but we assume it can only do so under a share contract. As before, it uses only family labour for cultivation of leased-in land and the household works for wage employment also.

Market imperfections prevent the pure tenant household from having access to new output-raising inputs. Moreover, the owner-tenant household has a greater number of options available to it compared to the pure tenant household :

(1) Unlike the pure tenant household, the owner-tenant household has the option to choose from fixed-rent and sharecropping contracts. The pure tenant household does not have this choice and can lease-in land only under a share contract.

(2) While the pure tenant household is assumed to accept whatever land is leased-out to it by the landlord household, the amount of land leased-out to the owner-tenant household reflects his demand for land.

Model description. The landlord household has $\bar{H}_1$ (without loss of generality, assume this to be unity) units of land. Of this, it leases-out $(q_1 + q_2)$ to the owner-tenant household, q_1 on a share contract and q_2 on a fixed-rent contract. His crop share is r and the rent per acre in the fixed-rent contract is R. The landlord household leases-out the remainder of his land, $1-q_1-q_2$, to the pure tenant household. The income of the landlord household is

$$y_1(q_1, q_2) = r\left[k(\theta)F(q_1, l_1) + G(1-q_1-q_2, l_3)\right] + Rq_2.$$

F and G are the output levels on land rented out for cropsharing tenancy to the owner-tenant household and the pure tenant household respectively. Rq_2 is the fixed-rent income from land leased-out to the owner-tenant household. θ is the amount of new input (e.g., fertilizers) applied by the owner-tenant per unit of land cultivated and $k(\theta)$ represents the output-raising impact of this input. l_1 and l_3 are respectively the amount of labour used on sharecropped land by the owner-tenant household and the pure tenant household.

The landlord household chooses q_1 and q_2 to maximise y_1. Assuming an interior maximum, the first order conditions are :

$$k(\theta)\, F_1(q_1, l_1) - G_1(1 - q_1 - q_2, l_3) = 0 \qquad \ldots (1)$$

$$-rG_1(1 - q_1 - q_2, l_3) + R = 0 \qquad \ldots (2)$$

Equations (1) and (2) can be solved for q_1 and q_2 in terms of r, R, l_1, l_3 and the exogenous parameter k.

The owner-tenant household has an initial endowment of land, say $\bar{H}_2$. It leases-in h_1 units of land under a share contract and h_2 units for a fixed-rent R per acre. We assume the owner-tenant household utilises the fixed-rented land to increase the size of the non-cropshared part of his operational holding. Thus he cultivates two plots of land — one of size h_1 and the other of size $\bar{H}_2+h_2$. The household utilises l_1 units of hired labour on the cropshared plot and another l_2 units on his other plot. Suppose it also uses θ kgms. of fertilizers per unit of area cultivated. The use of this fertilizer shifts the owner-tenant household's production function by a factor $k(\theta)$. If p_f is the price of fertilizers, the owner-tenant household's income is

$$y_{ot}(h_1, l_1, h_2, l_2) = (1-r)\, k(\theta)\, F(h_1, l_1) - \bar{w}l_1 - p_f \theta h_1 + k(\theta)\, J(\bar{H}_2+h_2, l_2) - \bar{w}l_2 - p_f\theta(\bar{H}_2+h_2) - Rh_2.$$

The owner-tenant household chooses h_1, l_1, h_2 and l_2 to maximise y_{ot}. Assuming an interior maximum, the first order conditions are :

$$(1-r)\, k(\theta)\, F_1(h_1, l_1) - p_f \cdot \theta = 0 \qquad \ldots (3)$$

$$(1-r)\, k(\theta)\, F_2(h_1, l_1) - \bar{w} = 0 \qquad \ldots (4)$$

$$k(\theta)\, J_1(\bar{H}_2 + h_2, l_2) - p_f \cdot \theta - R = 0 \qquad \ldots (5)$$

$$k(\theta)\, J_2(\bar{H}_2 + h_2, l_2) - \bar{w} = 0 \qquad \ldots (6)$$

Equations (3) to (6) can be solved for h_1, l_1, h_2 and l_2 in terms of r, R and the exogenous parameters k, θ, $\bar{H}_2$, p_f, and $\bar{w}$.

The pure tenant household has, say, $\bar{L}$ units of labour. It leases-in whatever land is leased-out to it by the landlord household (i.e., $1-q_1-q_2$). If it uses l_3 units of its family labour in cultivation of leased-in land, then $(\bar{L} - l_3)$ units of its labour is available for wage employment. If only a proportion $\bar{p}$ of total labour supplied can be employed in the wage labour market, then the income of the pure tenant household is

$$y_{pt}(l_3) = (1-r)\, G(1 - q_1 - q_2, l_3) + \bar{w}\bar{p}\,(\bar{L} - l_3)$$

The household chooses l_3 to maximise y_{pt}. Assuming an interior maximum, the first order condition is

$$(1-r)\, G_2(1 - q_1 - q_2, l_3) - \bar{w}\bar{p} = 0 \qquad \ldots (7)$$

Equation (7) can be solved for l_3 in terms of r, q_1, q_2 and the exogenous parameters $\bar{w}$ and $\bar{p}$.

In equilibrium, we must have as before :

$$h_1 = q_1 \qquad \ldots (8)$$

and

$$h_2 = q_2 \qquad \ldots (9)$$

Equations (1) to (9) are nine equations in as many unknowns. If a solution to this system of equations exists, we can prove the following comparative static propositions.

(I) With an increase in the likelihood of wage employment (i.e., with an increase in $\bar{p}$), (1) the distribution ofleased-out area shifts in favour of the owner-tenant households and (2) there is a shift in the pattern of tenancy, from cropsharing to fixed-rent.

(II) With a reduction in the inequality of access to new inputs (k decreases), (1) the distribution of leased-out land shifts in favour of the pure tenant households and (2) there is a shift in the pattern of tenancy from fixed-rent to sharecropping.

Appendix 5

In what follows we work out the solution to the model discussed in Section III of Chapter IV.

The tenant's consumption in periods 1 and 2, C_{t1} and C_{t2} respectively are :

$$C_{t1} = \bar{c}_t' + \bar{w}(1 - cy) + B = \bar{c}_t + B - \bar{cwy}$$

$$C_{t2} = (1 - r)y - (1 + i)B$$

where $\bar{c}_t'$ is his initial endowment and $\bar{c}_t \equiv \bar{c}_t' + \bar{w}$

His decision problem is to choose y and B so as to maximise his utility $U_t = \alpha_1 \log C_{t1} + \alpha_2 \log C_{t2}$, subject to the constraints :

$$C_{t1} > c_s \qquad \ldots (1)$$

$$C_{t2} > c_s \qquad \ldots (2)$$

$$B \geq 0 \qquad \ldots (3)$$

and

$$0 < y \leq \bar{y} \left(= \frac{1}{c}\right) \qquad \ldots (4)$$

The tenant treats r and i as given parameters.

For simplicity we assume $c_s = 0$. Constraint (3) rules out lending by the tenant and constraint (4) implies the tenant must produce some output on rented land.

From the inequalities (1) and (2) we obtain

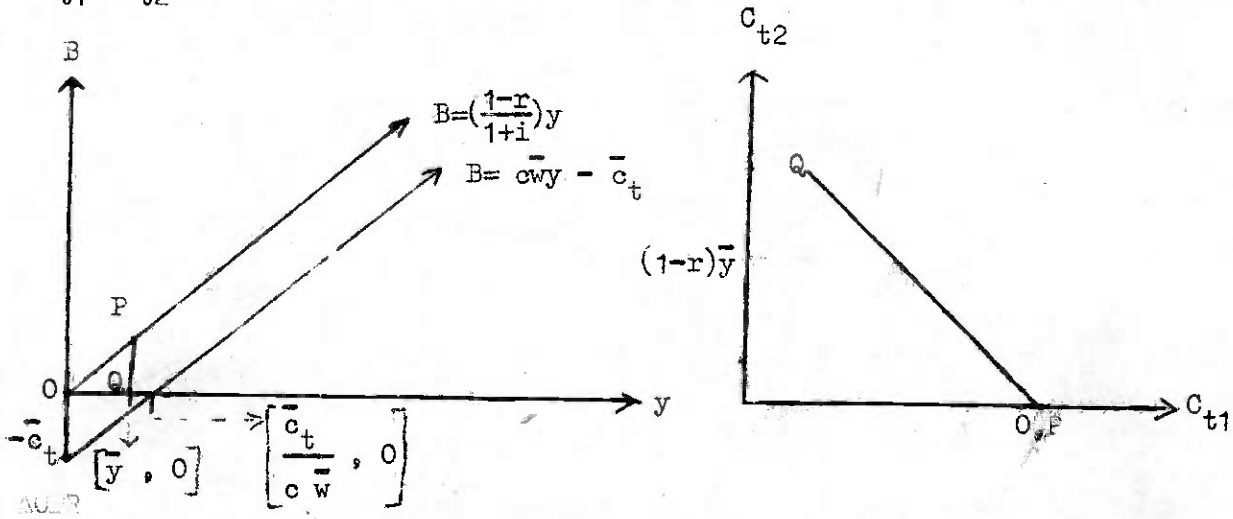
$$\bar{cwy} - \bar{c}_t < B \leq \left(\frac{1 - r}{1 + i}\right)y$$

We now sketch the feasible region for the tenant.

Case I. Suppose $(1 - r) = (1 + i)\bar{cw}$ and further assume that

$$\text{I.1} \qquad \bar{y} < \frac{\bar{c}_t}{\bar{cw}}$$

Then the feasible region for the tenant in the (y, B) and the corresponding (C_{t1}, C_{t2}) plane is sketched below.



ΔOPQ is the feasible region in the (y, B) plane. This becomes the line OQ (or PQ) in the (C_{t1}, C_{t2}) plane..

At $\{Q\}$, $\{ y, B \} = \{ 0, 0 \} \Rightarrow \{C_{t1}, C_{t2} \} = \{ \bar{c}_t, 0 \}$

At $\{P\}$, $\{ y, B \} = \{ \bar{y}, \bar{cwy} \} \Rightarrow \{ C_{t1}, C_{t2} \} = \{ \bar{c}_t, 0 \}$

At $\{Q\}$, $\{ y, B \} = \{ \bar{y}, 0 \} \Rightarrow \{ C_{t1}, C_{t2} \} = \{ \bar{c}_t - \bar{cwy}, (1-r)\bar{y} \}$.

Thus the optimal solution is either point $\{ Q \}$ or any point on PQ except point $\{ P \}$.

The optimal solution is { Q } if the slope of the Indifference curve at { Q }

$$= \frac{\alpha_1}{\alpha_2}\left(\frac{C_{t2}}{C_{t1}}\right) = \left(\frac{\alpha_1}{\alpha_2}\right) \cdot \left[\frac{(1-r)\bar{y}}{\bar{c}_t - c\bar{w}\bar{y}}\right] < \text{slope of } PQ = \frac{(1-r)\bar{y}}{c\bar{w}y} = (1+i)$$

or,

$$\text{if } \bar{y} < \left(\frac{\alpha_2}{\alpha_1+\alpha_2}\right)\left(\frac{\bar{c}_t}{c\bar{w}}\right) = \frac{k}{c\bar{w}}, \quad \text{where } k \equiv \left(\frac{\alpha_2}{\alpha_1+\alpha_2}\right)(\bar{c}_t).$$

Therefore,

$$\text{if } \bar{y} < \frac{k}{c\bar{w}}, \text{ then } \hat{y} = \bar{y}, \ \hat{B} = 0 \text{ is the optimal.}$$

If, on the other hand,

$$\bar{y} \geq \frac{k}{c\bar{w}}$$

thenthe solution is given by any ($\hat{y}$, $\hat{B}$) such that

$$\left(\frac{\alpha_1}{\alpha_2}\right)\left[\frac{(1-r)\hat{y} - (1+i)\hat{B}}{\bar{c}_t + \hat{B} - o\bar{w}\hat{y}}\right] = (1+i) \quad \text{or } \hat{B} = c\bar{w}\hat{y} - k, \ \hat{B} \geq 0, \ 0 < \hat{y} \leq \bar{y}$$

We will assume that if the tenant is indifferent between producing an output less than $\bar{y}$ and producing the maximum output $\bar{y}$, he will produce the maximum.

Then,

$$\text{if } \frac{\bar{c}_t}{c\bar{w}} > \bar{y} \geq \frac{k}{c\bar{w}}$$

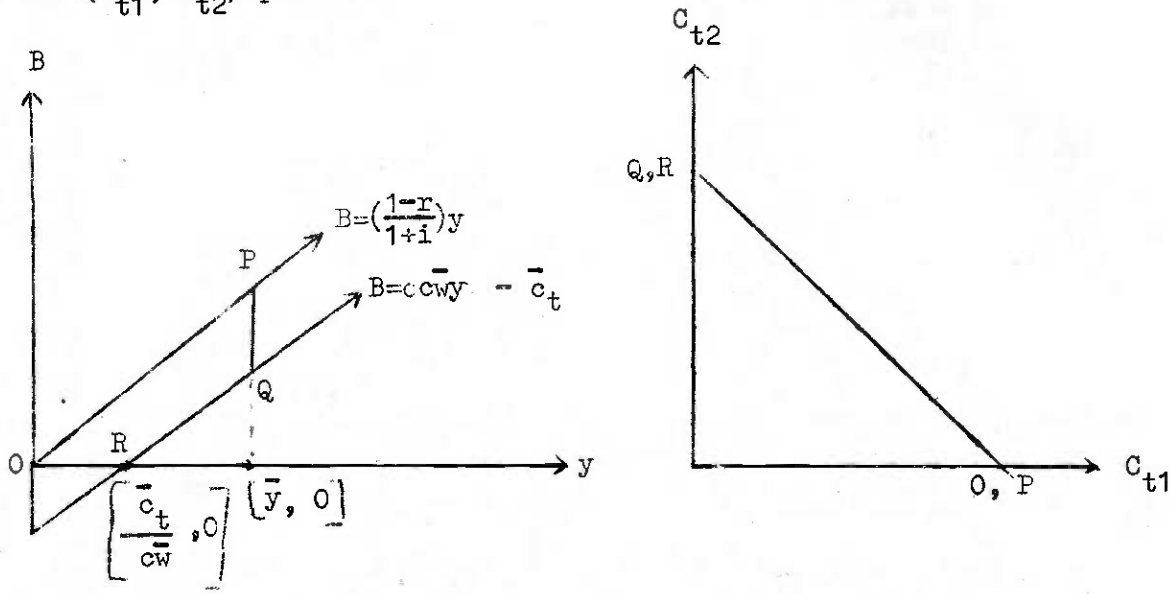
the optimal solution is

$$\hat{y} = \bar{y} \qquad \text{and} \qquad \hat{B} = c\bar{w}\bar{y} - k \geq 0.$$

Suppose $(1-r) = (1+i)c\bar{w}$ and further assume that

$$\text{I.2} \qquad \bar{y} \geq \frac{\bar{c}_t}{c\bar{w}}.$$

Then the feasible region is OPQR in the (y, B) plane and line OR (or PQ) in the (C_{t1}, C_{t2}) plane.



At $\{0\}, \{y, B\} = \{0, 0\} \Rightarrow \{C_{t1}, C_{t2}\} = \{\bar{c}_t, 0\}$

At $\{P\}, \{y, B\} = \{\bar{y}, (\frac{1-r}{1+i})\bar{y}\} \Rightarrow \{C_{t1}, C_{t2}\} = \{\bar{c}_t, 0\}$

At $\{Q\}, \{y, B\} = \{\bar{y}, c\bar{w}\bar{y} - \bar{c}_t\} \Rightarrow \{C_{t1}, C_{t2}\} = \{0, (1+i)\bar{c}_t\}$

At $\{R\}, \{y, B\} = \{\frac{\bar{c}_t}{c\bar{w}}, 0\} \Rightarrow \{C_{t1}, C_{t2}\} = \{0, (1+i)\bar{c}_t\}$

In this case the optimal solution is any point on PQ or any point on OR excluding {Q}, {R}, {O} and {P}.

At the optimal,

$$(\frac{\alpha_1}{\alpha_2}) \left[\frac{(1-r)\hat{y} - (1+i)\hat{B}}{\bar{c}_t + \hat{B} - c\bar{w}\hat{y}}\right] = (1+i)$$

or,

$$\hat{B} = c\bar{w}\hat{y} - k, \quad \hat{B} \geq 0, \quad 0 < \hat{y} \leq \bar{y}$$

Again, since the tenant is indifferent between producing $y(< \bar{y})$ and $y = \bar{y}$, we assume $\hat{y} = \bar{y}$. Thus when

$$\bar{y} > \frac{\bar{c}_t}{\bar{cw}}, \quad \hat{y} = \bar{y} \quad \text{and} \quad \hat{B} = \bar{cwy} - k \text{ is optimal.}$$

Summarising Case I, when

$$(1 - r) = (1 + i)\bar{cw}$$

and

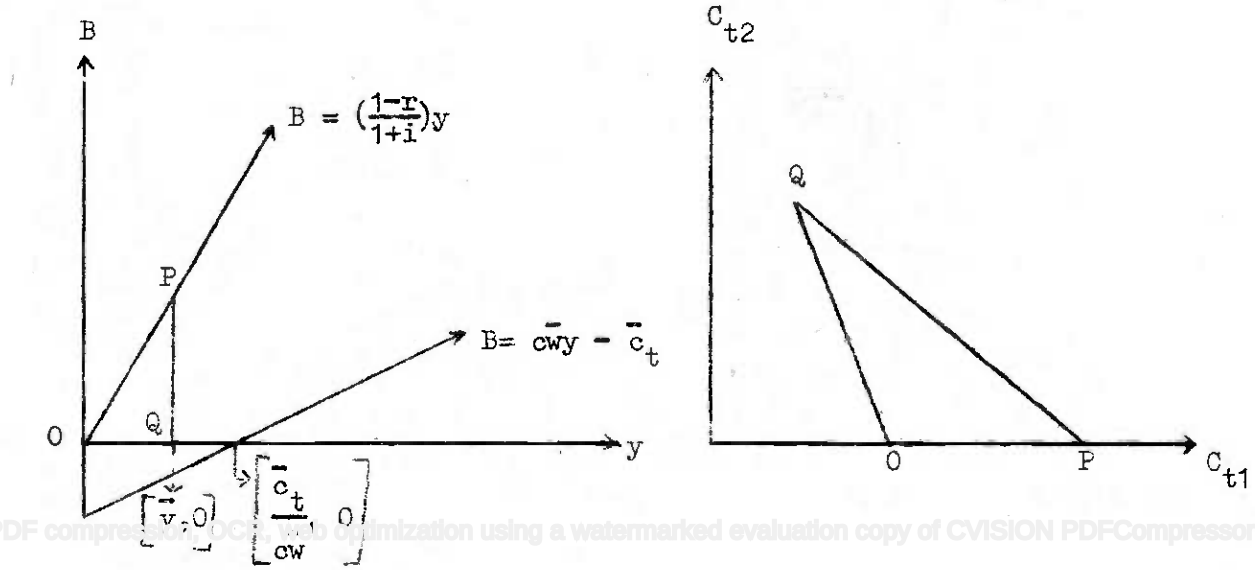
(1) $\bar{y} < \frac{k}{\bar{cw}}$ then $\hat{y} = \bar{y}$, $\hat{B} = 0$.

(2) $\bar{y} \geq \frac{k}{\bar{cw}}$ then $\hat{y} = \bar{y}$ and $\hat{B} = \bar{cwy} - k \geq 0$.

Case II. Suppose $(1 - r) > (1 + i)\bar{cw}$ and further assume

II.1 $\bar{y} < \frac{\bar{c}_t}{\bar{cw}}$

Then the feasible region is ΔOPQ in the (y, B) plane and ΔOQP in the (C_{t1}, C_{t2}) plane.



At $\{O\}, \{y, B\} = \{0, 0\} \Rightarrow \{C_{t1}, C_{t2}\} = \{\bar{c}_t, 0\}$

At $\{P\}, \{y, B\} = \{\bar{y}, (\frac{1-r}{1+i})\bar{y}\} \Rightarrow \{C_{t1}, C_{t2}\} = \{\bar{c}_t + \bar{y}(\frac{1-r}{1+i} - \bar{cw}), 0\}$.

At $\{Q\}, \{y, B\} = \{\bar{y}, 0\} \Rightarrow \{C_{t1}, C_{t2}\} = \{\bar{c}_t - \bar{cwy}, (1-r)\bar{y}\}$

The tenant's optimal solution is therefore any point on line PQ excluding {P}. The solution is at {Q} if the slope of the indifference curve at{Q}

$$= \left(\frac{\alpha_1}{\alpha_2}\right)\left[\frac{(1-r)\bar{y}}{\bar{c}_t - \bar{cwy}}\right] < \text{slope of PQ} = (1 + i).$$

That is,

$$\text{if } \bar{y} < \left[\frac{\alpha_2}{\alpha_1(\frac{1-r}{1+i}) + \alpha_2 \bar{cw}}\right] \cdot (\bar{c}_t) < \frac{k}{\bar{cw}}$$

then $\hat{y} = \bar{y}$ and $\hat{B} = 0$ is the optimal.

When $\bar{y} \geq \left[\frac{\alpha_2 (\bar{c}_t)}{\alpha_1(\frac{1-r}{1+i}) + \alpha_2 \bar{cw}}\right]$ then the solution is given by

$$\hat{y} = \bar{y} \text{ and } \left(\frac{\alpha_1}{\alpha_2}\right) \cdot \left[\frac{(1-r)\bar{y} - (1+i)\hat{B}}{\bar{c}_t + \hat{B} - \bar{cwy}}\right] = (1 + i)$$

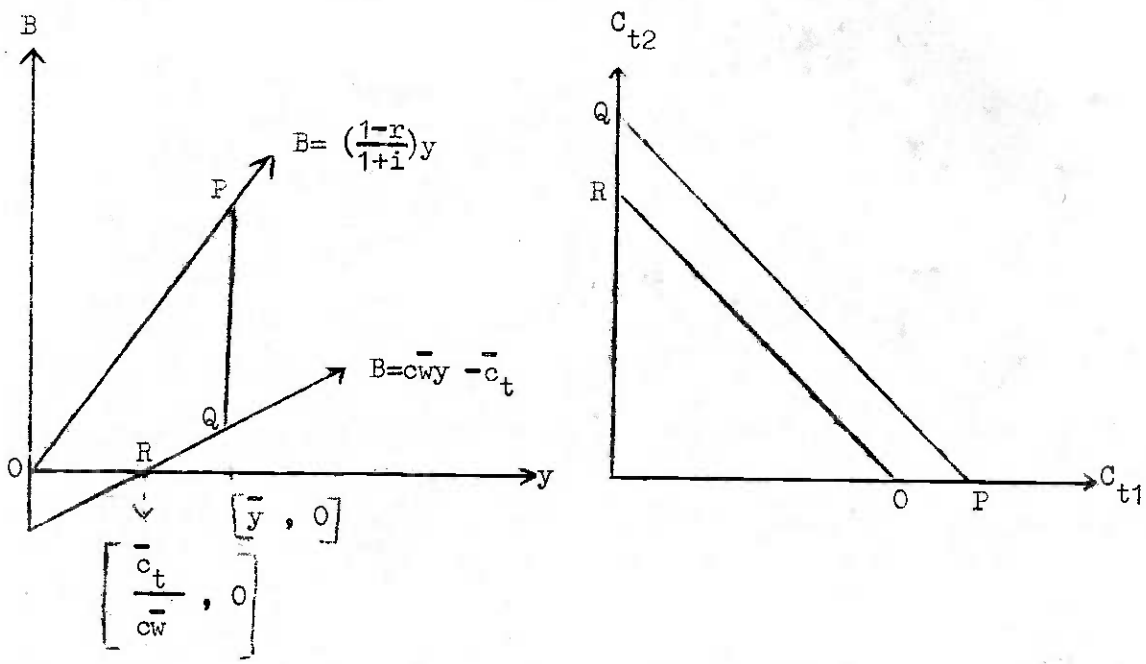
or

$$\hat{B} = \left(\frac{1}{\alpha_1 + \alpha_2}\right)\{\alpha_1(\frac{1-r}{1+i})\bar{y} - \alpha_2(\bar{c}_t - \bar{cwy})\}$$

Suppose $(1-r) > (1 + i)\bar{cw}$ and further assume that

II.2 $\quad \bar{y} \geq \frac{\bar{c}_t}{\bar{cw}}$.

Then the feasible region is PORQ in the (y, B) and (C_{t1}, C_{t2}) planes.



At $\{O\}$, $\{y, B\} = \{0, 0\} \implies \{C_{t1}, C_{t2}\} = \{\bar{c}_t, 0\}$

At $\{P\}$, $\{y, B\} = \{\bar{y}, (\frac{1-r}{1+i})\bar{y}\} \implies \{C_{t1}, C_{t2}\} = \{\bar{c}_t + \bar{y}(\frac{1-r}{1+i} - \bar{cw}), 0\}$

At $\{Q\}$, $\{y, B\} = \{\bar{y}, \bar{c}\bar{w}\bar{y} - \bar{c}_t\} \implies \{C_{t1}, C_{t2}\} =$

$$\{0, (1+i)\bar{c}_t + \bar{y}[(1-r) - (1+i)\bar{cw}]\}.$$

At $\{R\}$, $\{y, B\} = \{\bar{c}_{t/\bar{cw}}, 0\} \implies \{C_{t1}, C_{t2}\} = \{0, (\frac{1-r}{\bar{cw}})\bar{c}_t\}$

and since $\bar{y} > \frac{\bar{c}_t}{\bar{cw}}$, the y-coordinate of $\{Q\}$ exceeds the y-coordinate of $\{R\}$. The optimal choice for the tenant will lie on PQ excluding $\{P\}$ and $\{Q\}$. At the optimal, $\hat{y} = \bar{y}$ and the slope of the indifference curve

$$= \left(\frac{\alpha}{\alpha_2}\right) \left[\frac{(1-r)\bar{y} - (1+i)\hat{B}}{\bar{c}_t + \hat{B} - c\bar{w}\bar{y}}\right] = \text{slope of AB} =$$

$$\frac{(1+i)\bar{c}_t + \left[(1-r) - (1+i)c\bar{w}\right]}{(1+i)\bar{c}_t + \left[(1-r) - (1+i)c\bar{w}\right]} \quad X\ (1+i) = (1+i)$$

or

$$\hat{B} = \left[\frac{\alpha_1\left(\frac{1-r}{1+i}\right) + \alpha_2\,(c\bar{w})}{\alpha_1 + \alpha_2}\right](\bar{y}) - \left(\frac{\alpha_2}{\alpha_1 + \alpha_2}\right)\bar{c}_t$$

Summarising case II, when $(1-r) > (1+i)\,c\bar{w}$ and

(1) $$\bar{y} < \left[\frac{\alpha_2}{\alpha_1\left(\frac{1-r}{1+i}\right) + \alpha_2\, c\bar{w}}\right] \cdot (\bar{c}_t) < \frac{k}{c\bar{w}}$$

then

$$\hat{y} = \bar{y} \quad \text{and} \quad \hat{B} = 0.$$

(2) $$\bar{y} \geq \left[\frac{\alpha_2}{\alpha_1\left(\frac{1-r}{1+i}\right) + \alpha_2\, c\bar{w}}\right] \cdot (\bar{c}_t)$$

then

$$\hat{y} = \bar{y}$$

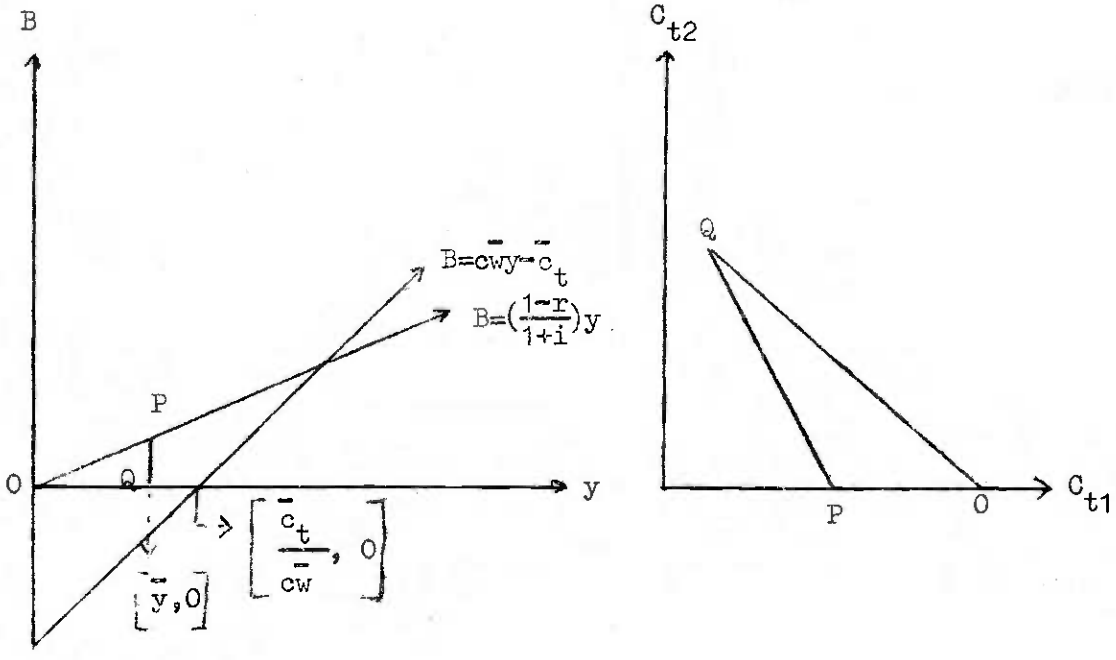
and

$$\hat{B} = \left[\frac{\alpha_1\left(\frac{1-r}{1+i}\right) + \alpha_2\, c\bar{w}}{(\alpha_1 + \alpha_2)}\right](\bar{y}) - \left(\frac{\alpha_2}{\alpha_1 + \alpha_2}\right)\bar{c}_t$$

Case III. Suppose $(1-r) < (1+i)\ \bar{cw}$ and assume

III.1 $$\bar{y} < \frac{\bar{c}_t}{\bar{cw}} .$$

Then the feasible region is ΔOPQ in the (y, B) plane and ΔPQO in the (C_{t1}, C_{t2}) plane.



At $\{O\}$, $\{y, B\} = \{0, 0\} \implies \{C_{t1}, C_{t2}\} = \{\bar{c}_t, 0\}$

At $\{P\}$, $\{y, B\} = \{\bar{y}, (\frac{1-r}{1+i})\bar{y}\} \implies \{C_{t1}, C_{t2}\} = \{\bar{c}_t - \bar{y}(\bar{cw} - \frac{1-r}{1+i}), 0\}$

At $\{Q\}$, $\{y, B\} = \{\bar{y}, 0\} \implies \{C_{t1}, C_{t2}\} = \{\bar{c}_t - c\,\bar{w}\,\bar{y}, (1-r)\bar{y}\}$.

The optimal solution is any point on OQ excluding $\{O\}$. The solution is at $\{Q\}$ if

$$(\frac{\alpha_1}{\alpha_2})\left[\frac{(1-r)\bar{y}}{\bar{c}_t - c\,\bar{w}\,\bar{y}}\right] < \frac{(1-r)\bar{y}}{c\,\bar{w}\,\bar{y}} \quad \text{or} \quad \bar{y} < \frac{k}{\bar{cw}} .$$

If $\bar{y} \leq \frac{k}{\bar{c}\bar{w}}$,

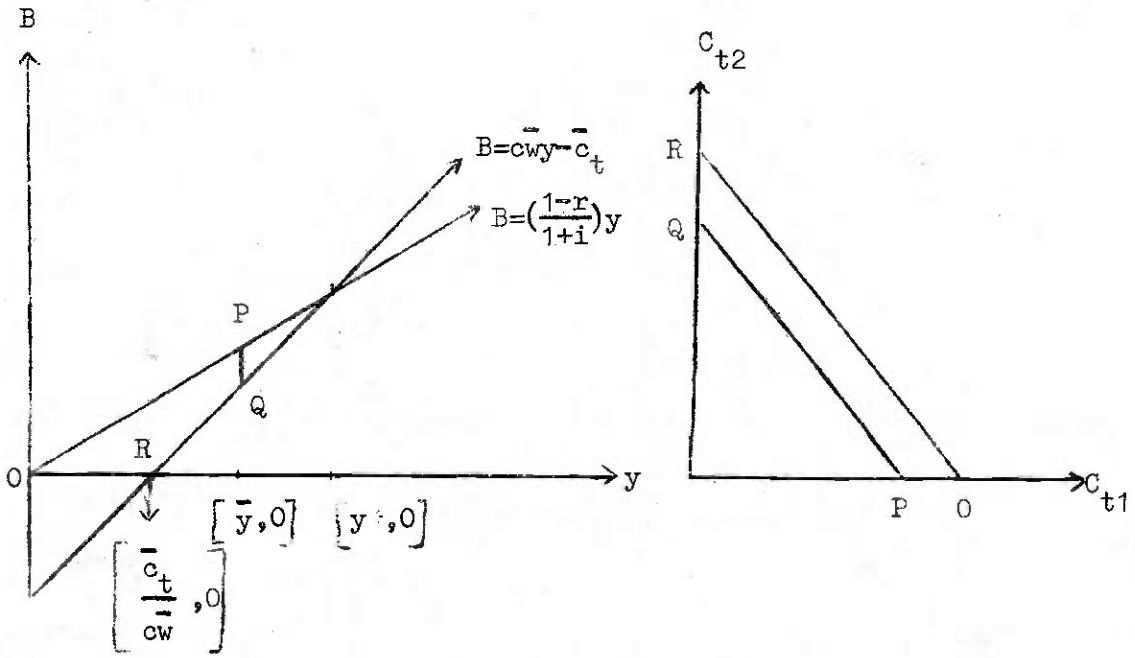
then

$$\hat{B} = 0 \text{ and } \left(\frac{\alpha_1}{\alpha_2}\right)\left[\frac{(1-r)\hat{y}}{\bar{c}_t - \bar{c}\bar{w}\hat{y}}\right] = \frac{(1-r)\hat{y}}{\bar{c}\bar{w}\hat{y}} \Rightarrow \hat{y} = \frac{k}{\bar{c}\bar{w}} < \bar{y}.$$

Suppose $(1-r) < (1+i)\,\bar{c}\bar{w}$ and further assume that

$$\text{III.2} \qquad \bar{y} > \frac{\bar{c}_t}{\bar{c}\bar{w}}.$$

Then the feasible region is OPQR in the (y, B) and (C_{t1}, C_{t2}) planes.



At {0}, {y, B} = {0, 0} $\Rightarrow$ $\{C_{t1}, C_{t2}\} = \{\bar{c}_t, 0\}$

At {P}, {y, B} = $\{\bar{y}, (\frac{1-r}{1+i})\bar{y}\}$ $\Rightarrow$ $\{C_{t1}, C_{t2}\} = \{\bar{c}_t - \bar{y}(\bar{c}\bar{w} - \frac{1-r}{1+i}), 0\}$

At $\{Q\}$, $\{y, B\} = \{ \bar{y}, c\bar{w}\bar{y} - \bar{c}_t \} \Longrightarrow \{C_{t1}, C_{t2}\} =$

$$\{0, (1+i)\bar{c}_t - \bar{y}\left[(1+i)c\bar{w} - (1-r)\right]\}$$

At $\{R\}$, $\{y, B\} = \{ \frac{\bar{c}_t}{c\bar{w}}, 0 \} \Longrightarrow \{C_{t1}, C_{t2}\} = \{ 0, (\frac{1-r}{c\bar{w}})\bar{c}_t \}$

Given $\bar{y} > \frac{\bar{c}_t}{c\bar{w}}$, the y-coordinate of $\{R\}$ exceeds the y-coordinate of $\{Q\}$.

The optimal solution will lie on OR excluding $\{O\}$ and $\{R\}$. At the optimal, $\hat{B} = 0$ and

$$(\frac{\alpha_1}{\alpha_2})\{\frac{(1-r)\bar{y}}{\bar{c}_t - c\bar{w}\bar{y}}\} = \frac{1-r}{c\bar{w}} \quad \text{or} \quad \hat{y} = \frac{k}{c\bar{w}}.$$

It is easily shown that this is true regardless of whether

$$\bar{y} > y^* \quad \text{or} \quad \bar{y} \leq y^*$$

Summarising case III, when $(1-r) < (1+i)\,c\bar{w}$ and

(1) $\bar{y} < \frac{k}{c\bar{w}}$ then $\hat{y} = \bar{y}$ and $\hat{B} = 0$.

(2) $\bar{y} \geq \frac{k}{c\bar{w}}$ then $\hat{y} = \frac{k}{c\bar{w}}$ and $\hat{B} = 0$.

Thus, depending on the initially given parameters (that is, depending on whether $\bar{y} \gtrless \frac{k}{c\bar{w}}$) and on the landlord's specification of i and r (which determines whether $(1-r) \gtrless (1+i)c\bar{w}$), the tenant's optimal choices are determined as above. Given the tenant's optimal borrowing and output levels, the landlord chooses the best i and r. We will show that the landlord will never choose an i and r for which $(1-r) > (1+i)c\bar{w}$. Thus his optimal choice will be confined to those i and r combinations for which either $(1-r) = (1+i)c\bar{w}$ or $(1-r) < (1+i)c\bar{w}$.

Consider the landlord's problem for each of the cases discussed above.

I.1 $(1-r) = (1+i)c\bar{w}$ and $\bar{y} < \frac{k}{c\bar{w}}$.

Since $\hat{B} = 0$ and $\hat{y} = \bar{y}$ we have

$$C_{l1} = \bar{c}_l$$

$$C_{l2} = r\bar{y} = \left[1 - (1+i)c\bar{w}\right]\bar{y}.$$

Clearly, the landlord's optimal choice is $\hat{i} = 0$, $\hat{r} = 1 - c\bar{w}$. At the optimal :

$$\hat{C}_{l1} = \bar{c}_l, \qquad \hat{C}_{t1} = \bar{c}_t - c\bar{w}\bar{y} > 0.$$

$$\hat{C}_{l2} = (1 - c\bar{w})\bar{y}, \qquad \hat{C}_{t2} = c\bar{w}\bar{y} > 0$$

II.1 $(1-r) > (1+i)c\bar{w}$ and $\bar{y} < \frac{k}{c\bar{w}}$. Then there are two possibilities.

(i) If $\bar{y} < \left[\frac{\alpha_2(\bar{c}_t)}{\alpha_1\left(\frac{1-r}{1+i}\right) + \alpha_2 c\bar{w}}\right] < \frac{k}{c\bar{w}}$,

then $\hat{y} = \bar{y}$ and $\hat{B} = 0$ so that

$$C_{l1} = \bar{c}_l$$

$$C_{l2} = r\bar{y}$$

Clearly, the landlord will seek to maximise r. However, this choice of r cannot exceed $(1 - c\bar{w})$ since for $\hat{r} \geq 1 - c\bar{w}$ the constraint $\hat{i} \geq 0$ will be violated. But for any $\hat{r} < 1 - c\bar{w}$ the landlord's utility will be higher in the region $(1 - r) = (1 + i)\,c\bar{w}$.

(ii) If $\left[\frac{\alpha_2(\bar{c}_t)}{\alpha_1(\frac{1-r}{1+i}) + \alpha_2 c\bar{w}}\right] < \bar{y} < \frac{k}{c\bar{w}}$, then $\hat{y} = \bar{y}$

and

$$\hat{B} = \left[\frac{\alpha_1(\frac{1-r}{1+i}) + \alpha_2 c\bar{w}}{\alpha_1 + \alpha_2}\right](\bar{y}) - (\frac{\alpha_2}{\alpha_1+\alpha_2})\bar{c}_t$$

$$c_{11} = \bar{c}_1 - (\frac{\alpha_2}{\alpha_1+\alpha_2})(c\bar{w}\bar{y} - \bar{c}_t) - (\frac{\alpha_1}{\alpha_1+\alpha_2})(\frac{1-r}{1+i})\bar{y}$$

$$c_{12} = (\frac{\alpha_2}{\alpha_1+\alpha_2})\bar{y}\left[r + (1+i)c\bar{w}\right] + (\frac{\alpha_1}{\alpha_1+\alpha_2})\bar{y} - k(1+i).$$

Again, we want to show that the landlord will never choose an i and r such that $(1-r) > (1+i)c\bar{w}$ in the region

$$\left[\frac{\alpha_2(\bar{c}_t)}{\alpha_1(\frac{1-r}{1+i}) + \alpha_2 c\bar{w}}\right] < \bar{y} < \frac{k}{c\bar{w}}$$

Rewriting c_{11}, $c_{11} = (\bar{c}_1 + k) - (\frac{\bar{y}}{\alpha_1+\alpha_2})\left[\alpha_2 c\bar{w} + \alpha_1(\frac{1-r}{1+i})\right]$

But

$$k - \{\frac{\alpha_2 c\bar{w} + \alpha_1(\frac{1-r}{1+i})}{\alpha_1+\alpha_2}\}(\bar{y}) = (\frac{1}{\alpha_1+\alpha_2})\{\alpha_2\bar{c}_t - \left[\alpha_2 c\bar{w} + \alpha_1(\frac{1-r}{1+i})\right]\bar{y}\} < 0$$

$\therefore \quad \hat{c}_{11} < \bar{c}_1.$

Moreover, $\hat{c}_{12} < \bar{y} - k(1 + \hat{i})$ and can in no case exceed $\bar{y} - k$. But $\bar{y} - k < \bar{y}(1 - c\bar{w})$, since $k - c\bar{w}\bar{y} > 0$.

Therefore, if $\bar{y} < \frac{k}{c\bar{w}}$ the landlord will never choose an i and r for which $(1-r) > (1+i)c\bar{w}$. He will always attain higher utility by being in the region $(1-r) = (1+i)c\bar{w}$.

Case III.1 $(1-r) < (1+i)\,\bar{cw}$ and $\bar{y} < \frac{k}{\bar{cw}}$

Then $\hat{y} = \bar{y}$ and $\hat{B} = 0$.

$$\hat{C}_{l1} = \bar{c}_l$$

$$\hat{C}_{l2} = r\bar{y}$$

In this case the landlord will again raise r to the maximum feasible value. If there is an exogenously specified upper bound $\bar{r}$ close to unity, the landlord will set $\hat{r} = \bar{r}$. If there is no upper bound (except $r < 1$), the landlord can set $\hat{r}$ as close to unity as he likes and the tenant's consumption in pd.2 is ground down to the minimum feasible. Assuming an upper bound $\bar{r}$ ($> 1 - \bar{cw}$), the optimal solution is $\hat{r} = \bar{r}$, $\hat{i}$ is any non-negative value and

$$\hat{C}_{l1} = \bar{c}_l\,, \qquad \hat{C}_{t1} = \bar{c}_t - c\,\bar{w}\,\bar{y}$$

$$\hat{C}_{l2} = \bar{r}\,\bar{y} > (1 - \bar{cw})\,\bar{y}\,, \qquad \hat{C}_{t2} = (1 - \bar{r})\,\bar{y}.$$

Comparing III.1 with I.1 we observe that the landlord's utility is higher in III.1 than in I.1. Thus when $\bar{y} < \frac{k}{\bar{cw}}$, the optimal solution is $\hat{r} = \bar{r}$, $\hat{i}$ is any non-negative value, $\hat{y} = \bar{y}$ and $\hat{B} = 0$. Correspondingly, $\hat{C}_{l1} = \bar{c}_l$, $\hat{C}_{l2} = \bar{r}\,\bar{y}$, $\hat{C}_{t1} = \bar{c}_t - c\,\bar{w}\,\bar{y}$ and $\hat{C}_{t2} = (1-\bar{r})\bar{y}$.

Now consider the landlord's optimisation when $\bar{y} \geq \frac{k}{\bar{cw}}$.

I.2 If $(1-r) = (1+i)\,\bar{cw}$, then $\hat{y} = \bar{y}$ and $\hat{B} = c\,\bar{w}\,\bar{y} - k \geq 0$.

$$C_{l1} = \bar{c}_l - (c\,\bar{w}\,\bar{y} - k)$$

$$C_{l2} = r\bar{y} + (1+i)(c\,\bar{w}\,\bar{y} - k) = \bar{y} - (1+i)k$$

Clearly, the landlord's optimal solution is $\hat{i} = 0$, $\hat{r} = 1 - c\bar{w}$ and

$$\hat{c}_{l1} = \bar{c}_l - (c\,\bar{w}\,\bar{y} - k), \qquad \hat{c}_{t1} = \bar{c}_t - k > 0$$

$$\hat{c}_{l2} = \bar{y} - k, \qquad \hat{c}_{t2} = k > 0$$

II.2 If $(1-r) > (1+i)c\bar{w}$, then $\hat{y} = \bar{y}$

and

$$\hat{B} = \left[\frac{\alpha_1\left(\frac{1-r}{1+i}\right) + \alpha_2 c\bar{w}}{\alpha_1 + \alpha_2}\right](\bar{y}) - k$$

$$c_{l1} = (\bar{c}_l + k) - \left[\frac{\alpha_1\left(\frac{1-r}{1+i}\right) + \alpha_2 c\bar{w}}{\alpha_1 + \alpha_2}\right](\bar{y})$$

$$c_{l2} = \left(\frac{\alpha_2}{\alpha_1+\alpha_2}\right)\left[r+(1+i)c\bar{w}\right]\bar{y} + \left(\frac{\alpha_1}{\alpha_1+\alpha_2}\right)\bar{y} - k(1+i)$$

We again show that the landlord will never choose an $\hat{i}$ and $\hat{r}$ such that

$$(1 - \hat{r}) > (1 + \hat{i})c\bar{w}$$

$$c_{l1} < (\bar{c}_l + k) - \left(\frac{1}{\alpha_1+\alpha_2}\right)(\alpha_1+\alpha_2)c\,\bar{w}\,\bar{y} = \bar{c}_l - (c\,\bar{w}\,\bar{y} - k)$$

and

$$c_{l2} < \left(\frac{\alpha_2}{\alpha_1+\alpha_2}\right)\bar{y} + \left(\frac{\alpha_1}{\alpha_1+\alpha_2}\right)\bar{y} - k(1+i) = \bar{y} - k(1+i)$$

which can never exceed $\bar{y} - k$.

Thus for any choice of i and r in the region $(1-r) > (1+i)c\bar{w}$, the landlord's utility is less than what he could achieve in the region $(1 - r) = (1 + i)c\bar{w}$.

III.2 If $(1-r) < (1+i)\bar{cw}$, then $\hat{y} = \frac{k}{\bar{cw}}$, $\hat{B} = 0$. Correspondingly,

$$C_{l1} = \bar{c}_l$$

$$C_{l2} = r\frac{k}{\bar{cw}}.$$

Again, the landlord sets r at the maximum feasible value. If there is an upper bound $\bar{r}$ (assumed to be larger than $1 - \bar{cw}$), then $\hat{r} = \bar{r}$ is optimal. If there is no upper bound, then the landlord can fix $\hat{r}$ as close to unity as he wishes. Thus when $(1-r) < (1+i)\bar{cw}$, the optimal solution is $\hat{r} = \bar{r}$, $\hat{i}$ is any non-negative value, $\hat{y} = \frac{k}{\bar{cw}}$, $\hat{B} = 0$ and

$$\hat{C}_{l1} = \bar{c}_l, \qquad \hat{C}_{t1} = \bar{c}_t - c\bar{w}\bar{y}$$

$$\hat{C}_{l2} = \bar{r}\frac{k}{\bar{cw}}, \qquad \hat{C}_{t2} = (1-\bar{r})\frac{k}{\bar{cw}} < k$$

Comparing III.2 and I.2 we see that

$$\text{if} \quad \bar{y} \geq \frac{k}{\bar{cw}},$$

there are two possible solutions :

(i) $\hat{r} = 1-\bar{cw}$, $\hat{i} = 0$, $\hat{y} = \bar{y}$, $\hat{B} = c\bar{w}\bar{y} - k \geq 0$.

$$\hat{C}_{l1} = \bar{c}_l - (c\bar{w}\bar{y} - k), \qquad \hat{C}_{t1} = \bar{c}_t - k.$$

$$\hat{C}_{l2} = (1 - \bar{cw})\bar{y} + (c\bar{w}\bar{y} - k) = \bar{y} - k, \quad \hat{C}_{t2} = k$$

and

(ii) $\hat{r} = \bar{r}$ $(\bar{r} > 1 - \bar{cw})$, $\hat{i}$ is any non-negative value,

$$\hat{y} = \frac{k}{\bar{cw}}, \quad \text{and} \quad \hat{B} = 0$$

$$\hat{C}_{l1} = \bar{c}_l, \qquad \hat{C}_{t1} = \bar{c}_t - k$$

$$\hat{C}_{l2} = \bar{r}\frac{k}{\bar{cw}}, \qquad \hat{C}_{t2} = (1 - \bar{r})\frac{k}{\bar{cw}} < k.$$

Without further assumptions on the landlord's utility function it is not clear which of the two solutions will be preferred by the landlord.

However, we can easily establish the following results :

(1) If $\bar{y} < \frac{k}{\bar{c}\bar{w}}$ i.e. , if $\bar{w} < k$, then interlinking is not preferred by the landlord. He so adjusts the terms of the tenancy and credit contracts that the tenant is induced not to borrow at all.

(2) When $\bar{y} \geq \frac{k}{\bar{c}\bar{w}}$ or $\bar{w} \geq k$ then there are two preferred alternatives depending on the landlord's utility function. Either the landlord does not prefer to have interlinked land and credit transactions (i.e., $\hat{B} = 0$ as in (i)) or he does prefer interlinking ($\hat{B} > 0$). But then, our equilibrium solution shows that the optimal interest rate on the loan in the interlinked transaction is zero. Thus interlinking, in our model, does not lead to 'exploitation' through usurious interest rates.

(3) It is also obvious that an appropriate restriction on the landlord's power to set r (say, by imposing a constraint that $r < 1 - \bar{c}\bar{w}$) will benefit the tenant. On the other hand, no upper bound restriction on i will be effective in improving the tenant's welfare.

(4) Suppose technical progress increases the productivity of labour so that c decreases to c'. Then the maximum output that is producible with one unit of labour increases from $\bar{y}$ ($= \frac{1}{c}$) to $\bar{\bar{y}}$ ($= \frac{1}{c'}$). We can show that this change will benefit the landlord.

Suppose $\bar{y} < \frac{k}{\bar{c}\bar{w}}$ or since $\bar{y} = \frac{1}{c}$, $\bar{w} < k$. Then it is clear from our solution corresponding to this case that $\hat{C}_{11}$ is unaffected by a fall in c while $\hat{C}_{12}$ increases. Hence the landlord's utility increases.

Suppose $\bar{y} \geq \frac{k}{\bar{c}\bar{w}}$ or $\bar{w} \geq k$. Then, as we showed, there are two possible solutions, (i) and (ii). Assume $\alpha_1 = \alpha_2 = \alpha$. Then the equilibrium is given by solution (i) if

$$(\bar{r}\,\frac{k}{\bar{c}\bar{w}}) < (\bar{y} - k) \quad \text{and} \quad \bar{c}_1 \geq \frac{(\bar{y} - k)(\bar{c}\bar{w}\bar{y} - k)}{\left[(\bar{y} - k) - \bar{r}\,\frac{k}{\bar{c}\bar{w}}\right]}$$

That is,

$$(\bar{r}\,\frac{k}{\bar{c}\bar{w}}) < (\frac{1}{\bar{c}} - k) \quad \text{and} \quad \bar{c}_1 \geq \frac{(\frac{1}{\bar{c}} - k)(\bar{w} - k)}{\left[(\frac{1}{\bar{c}} - k) - \bar{r}\,\frac{k}{\bar{c}\bar{w}}\right]}$$

The equilibrium is given by solution (ii) if <u>either</u>

(a) $(\bar{r}\,\frac{k}{\bar{c}\bar{w}}) \geq (\frac{1}{\bar{c}} - k)$

or

(b) $(\bar{r}\,\frac{k}{\bar{c}\bar{w}}) < (\frac{1}{\bar{c}} - k)$ and $\bar{c}_1 < \frac{(\frac{1}{\bar{c}} - k)(\bar{w} - k)}{\left[(\frac{1}{\bar{c}} - k) - \bar{r}\,\frac{k}{\bar{c}\bar{w}}\right]}$

Suppose $(\bar{r}\,\frac{k}{\bar{c}\bar{w}}) > (\frac{1}{\bar{c}} - k)$ before technical change and $(\bar{r}\,\frac{k}{\bar{c}'\bar{w}}) > (\frac{1}{\bar{c}'} - k)$ after technical change. Then clearly, after technical change the landlord's consumption in period two, $\hat{c}_{12} = \bar{r}\,\frac{k}{\bar{c}'\bar{w}} > \bar{r}\,\frac{k}{\bar{c}\bar{w}}$. Hence consumption in second period has increased while consumption in the first period remains unchanged at $\bar{c}_1$. Hence landlord gains.

Suppose, however, that after technical change

(b') $(\bar{r}\,\frac{k}{\bar{c}'\bar{w}}) < (\frac{1}{\bar{c}'} - k)$ and $\bar{c}_1 \geq \frac{(\frac{1}{\bar{c}'} - k)(\bar{w} - k)}{\left[(\frac{1}{\bar{c}'} - k) - \bar{r}\,\frac{k}{\bar{c}'\bar{w}}\right]}$

Then, in the after-technical change equilibrium,

$$\hat{C}_{11} = \bar{c}_1 - (\bar{w} - k) \quad \text{and} \quad \hat{C}_{12} = \frac{1}{c'} - k.$$

Before technical change,

$$\hat{C}_{11} = \bar{c}_1, \quad \hat{C}_{12} = \bar{r}\frac{k}{\bar{c}w}.$$

We will show that utility after technical change exceeds his utility before technical change. This requires

$$\left[\bar{c}_1 - (\bar{w} - k)\right]\left[\frac{1}{c'} - k\right] \geq (\bar{c}_1)\left(\bar{r}\frac{k}{\bar{c}w}\right)$$

or

$$\bar{c}_1 \geq \frac{(\bar{w} - k)\left(\frac{1}{c'} - k\right)}{\left[\left(\frac{1}{c'} - k\right) - \bar{r}\frac{k}{\bar{c}w}\right]}$$

But given our assumption (b') this is automatically satisfied. Likewise, it can be shown that if (i) is the equilibrium solution in both the pre- and post-technical change situations, any change which reduces c increases the landlord's utility. Hence technical change which improves productivity of labour always increases the landlord's utility.

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