(6)

AGENCY COSTS, AGRICULTURAL ORGANIZATION, AND DEVELOPMENT IN NEPAL

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY
IN ECONOMICS

DECEMBER 1984

by

Shankar P. Sharma

Dissertation Committee

James A. Roumasset, Chairman
Linda Martin
Marcellus S. Snow
Chauncey T.K. Ching
James Mak

We certify that we have read this dissertation and that, in our opinion, it is satisfactory in scope and quality as a dissertation for the degree of Doctor of Philosophy in Economics.

DISSERTATION COMMITTEE

James A. Roumasset
Chairman

Linda L. Martin

Marcellus A. Snow

ACKNOWLEDGEMENTS

I wish to acknowledge the Open Grants and the Resource Systems Institutes of the East-West Center for their support during the course of my graduate studies. I am also indebted to the Agricultural Development Council (ADC/NewYork, Bangkok) for providing me the research grant, and the Institute of Science. Tribhuvan University, for local sponsorship of my field study.

I would also like to express my appreciation for the assistance provided by Kesab Lamsal, Guru Datta Marahatta, Hari Kunwar, Rajendra Yadav, Ganesh Roy, and Jai Ram Shrestha during my field work.

The write-up of my dissertation was done at the East-West Center where I had the opportunity of receiving considerable help from many people. I am greatly indebted to Dr. James Roumasset, my dissertation committee chairman, for providing inspiration, encouragement, and advice at every stage of my study. His suggestions and directions were really valuable in producing this dissertation. Dr. Linda Martin took the trouble of reading and giving detailed comments on the manuscript, for which I am appreciative. Dr. Marcellus Snow pointed out several econometric problems and also took the responsibility of reading the final copy of this dissertation. I would like to acknowledge Dr. James Mak and Dr. Chauncey Ching for their valuable comments on my work. Also I had the opportunity for much interaction with different scholars including Professors. Robert Evenson and Brian Wright of Yale

University; ADC Research Associates in Nepal Dr. John Cool, and Dr. Michael Wallace; and ADC Regional Director in Bangkok, Mr. Gerard Rixhon.

Karen Kusumoki helped me in editing the manuscript. Ken Breazeale took the responsibility of organizing and editing the document. I thank both of them. I also wish to thank Arsenio Balisacan, Dr. Tood Johnson, Noor Tamrakar, and Shiva Sharma, who assisted me in providing various assistance and facilities.

Last but not the least, I would like to thank my parents for their love and care which were a continual source of inspiration for me through the course of this study, and indeed, throughout my life. I dedicate this dissertation to them.

ABSTRACT

In conventional principal agency theory, tenure choice was classified according to three modes of employment--wage, share, and rent. Labor shirking and risk sharing are taken as the factors by which contracts could be distinguished in principal agency theory. But if labor and risk were the only factors in determining agricultural contracts, then rent contracts would have been a predominant agricultural contract. However, rent contracts are somewhat uncommon, relative to the many other types of agricultural contracts. Another theory developed independently of principal agency theory is positive agency theory. Positive agency theory determines the equilibrium contract by considering a number of non-measureable institutional evidences and the model is vague.

The model used in this study is based on multiple shirking of inputs. In agriculture, factors of production are provided by different agents. Land is provided by the principal and labor is provided by tenants. As a consequence, a complete theory of agricultural contracts requires allowace for shirking of the inputs--land, capital, and management. Management therefore is considered the primary determinant of the contract. In our model, first the production is defined in terms of physical inputs, technology, and the contracting system under which the firm operates. Since each factor is motivated by self-interest, separate ownership of the factors of production produces a shirking problem in all forms of agricultural contracts. Second, the difference between the first-best

and the second-best solutions has been derived in the usual context of utility maximization and profit maximization, and is defined as agency cost. Agency cost in agricultural organization is defined as the monitoring and supervision costs plus the residual loss. Organizations which minimize the agency costs will evolve. Finally, it has been shown that the degree of specialization distinguish agricultural firms from one another.

Specialization in management depends on physical characteristics of land and the characteristics of cultivators. It was observed that the higher the value of land quality or non-farm income or wealth index or the lower the value of distance of the farm from the land owner's residence, the higher was the degree of specialization. The land quality index represents the proxy for homogeneity of land and the propensity to shirk. Since it was possible to rank contracts according to the degree of specialization, an ordinal multinomial probit model was used to test the model. Our results confirm that the characteristics of land, measured by the land quality index influences specialization and thus, the type of contracts chosen.

The theoretical model developed in this study is more general and complete in nature. The classification of contracts appears to be useful for explaining a number of systematic patterns concerning the choice of contracts. In traditional models of tenure choice (e.g. Stiglitz, 1974; Reid, 1976 etc.) the share contract was considered as an intermediate arrangement between the rent and wage contracts. However, in our model, the fixed rent contract and the sharecropping contract, where the sharecropper provides labor, management, and much

of the labor, are very close to each other and have a low degree of specialization. Sharecropping is closer to the rent contract than the wage contract. The estimated statistical distance between these contracts confirm the classification.

The other conclusion drawn was regarding economic arguments of a land reform program. A common argument for land reform program is that the owner-operator agricultural system is productive relative to a share tenure or even a fixed rent leasehold system of agriculture. Secondly, the landlords determine the contractual form, and whatever the landlords can get from the tenants in the form of fixed rent or sharecropping is a function of their market power. Finally, the inverse relation between farm size and productivity is taken as evidence of dualism in the agricultural sector. None of the above arguments were seen statistically significant in this study. These findings imply that detailed research work has to be carried out before formulating any kind of policy in the area of reallocation of resources.

Finally, it can be concluded that the policy reform should focus on other sources of poverty, rather than regulation of indigenous institutions. The basic sources of poverty are the scarce endowments of land and capital relative to high population pressure on a small and declining resource base, and low rates of return to labor due to low levels of technology. Thus, policies should be formulated to eliminate the growing poverty by investing in infrastructure (e.g. irrigation) and developing land-saving and labor-using technologies.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

Introduction

The continuing interest in the rural sector economy is understandable because a majority of the world's population still live and work in the rural agricultural sector. Due to this interest in recent years attempts have also been made to understand the role of institutions as well as their impact upon the behavior of individuals and families in rural areas.[1] As a result, economic theories seeking the determinants of different tenancy arrangements as well as welfare implications have flourished. Understanding of these theories is very crucial and has a direct effect upon the agricultural as well as the overall development of a country; different theories and models lead to different policy implications. The formulation and implementation of any agricultural policy will be successful only if we know to what extent the new policy is effective and how tenants will be able to take advantage of this new policy.

There are two schools of thought about agricultural contracts and tenancy arrangements. The first school, sometimes known as the "inefficiency" school,[2] considers tenancy in general and views

---

[1]Very good collections of recent articles on this area and the references are found in Binswanger and Rosenzweig (ed. 1984) and Singh (1984).

[2]The terms efficiency and inefficiency school are not used very widely in the literature. However, Bell(1976) used these terms to distinguish the two schools of thought. We will also use the terms very loosely.

sharecropping as an inefficient way of organizing scarce resources.[3] Some of the issues raised by this school include under-supply of agricultural inputs, mismanagement of land, high share of the output to the landlord. One of the other issues raised by the authors of the inefficiency school is that in tenancy arrangement the landlord has the power to extract the production surplus generated by technological progress. The "efficiency" school, views that contracts pull resources together, try to maximize profit, and are close to efficiency or of the "second-best" type.

Hence, it is very important to have an understanding of different tenancy arrangements and models as they directly affect the formulation of proper policies. For example, according to the "inefficiency" school, if tenancy is an economically inefficient way of organizing scarce resources, then the policy implication may be the redistribution of resources to achieve productive efficiency. Land-reform programs with the inclusion of ceilings in land and other measures of tenancy reforms are highly desirable. So, in general, policies should focus upon the reallocation of resources.

On the other hand, due to almost efficient resource allocation, the "efficiency" school says that the redistribution of land per se is not very important. So the rate of development is dependent upon

---

[3]The inefficiency school views that an income-maximizing tenant will allocate his labor input only up to the point where his share of marginal product is equated with the opportunity wage. The efficiency school argues that contracts substitute for markets and in the presence of information and enforcement costs and the solution will be second best. For general distinction of two schools see Jaynes (1984), Otsuka (1982), and Bell (1976).

labor-saving and labor-using technological progress, creation of off-farm employment opportunities, population control, infusion of capital, and addition and mobilization of resources.

Tenancy of some form has been in existence for a long period (Singh, 1984). Several attempts at tenancy reforms with the aim of minimizing agricultural contracts have been in different countries, but have not been very successful. This indicates that the contract performs some intrinsic function for the contracting parties and is also vital in the maintanence of economic equilibrium. A number of reasons have appeared in the literature justifying the existence of the tenancy system. The following section will examine the motivation of the landlord and tenant in entering into a tenancy contract. Another interesting issue is the coexistence of different contracts. We can find many different types of tenancy arrangements even in a small geographical area. The models that explain the coexistence of different contracts will be reviewed in Section 2. Section 3 will provide the objectives of the present study. Section 4, will briefly present the research approach of the study. The organization of the complete research study will also be presented in this section.

1.1 Role of Tenancy

In the process of optimizing the available resources in the economy, landlords and the laborers engage in different types ofcontracts. Generally, tenancy is a contractual arrangement between the landowner and the tenants where the landowner leases the land in return for a mutually agreed upon share or sum of the produce, and

the tenant has the right to cultivate the rented land and appropriate its output. In many instances, for a variety of reasons, small landowners also lease in land and are tenants. On the other hand, in a few circumstances, small landowners also lease out land for different reasons.

As a result, there are different farm contracts that are reflective of the above mentioned tenancy arrangements. These farm contracts are basically of three types.[4] One is fixed rent where the laborers or the tenants lease in the land at a fixed fee and the fixed fee is normally paid in kind. Another is share tenancy where the actual output is shared between the landlord and the tenant. The last is the farm managed by the owner himself and where the landlord hires labor at a fixed wage (and this is of course different from the owner operated case where the owner of the land cultivates his land with his own family labor).

At this point, it is important to note the basic difference between tenant cultivation and owner cultivation. In the former, the agreement relating to farm cultivation is reached between landowner and the tenants regarding the crops to be grown, type and level of inputs to be used, and other collateral services to be exchanged. On the other hand, owner managed cultivation is normally done with the help of hired laborers on a fixed wage basis. Thus, based upon different contractual agreements, production can be organized in many

---

[4]Although the contracts can be classified in more than three categories (Roumasset and Uy, 1983), only three most prevelant contracts are taken for the field study.

different ways, and dependent upon the economic environment, may result in the efficient form of tenancy contract.

One of the reasons given for tenancy is that different rural households have different factor endowments. A landless household can be better off by leasing land rather than looking for a uncertain wage employment.[5] Similarly, landlords can be better off by leasing rather than searching for the laborers especially during the peak season. Similar logic applies to capital endowments (e.g., draft animals, etc.). Thus, these different factor endowments and imperfect land, labor, and capital market are the fundamental reasons for tenancy.

Secondly, agricultural production requires a large number of decisions regarding seed, fertilizer, crop mix, irrigation, weeding, and harvesting. This results in the necessity for the allocation of different management skills, but at the same time, they are indivisible and a market does not exist for these skills. However, through the help of tenancies, different management and entrepreneurial skills could be obtained and utilized (Rao, 1971; Kotwal, 1981).

Thirdly, tenancy can be considered as a part of the labor contract in imperfect labor markets. The labor market is fragmented and imperfect, and the knowledge of skill levels are unavailable. Thus, given the imperfect labor market contracts act as

---

[5]The job searching cost for the laborers may be high and similarly, the enforcement cost, information cost and searching cost for laborers may be high. Thus, both of the parties may prefer the contract.

self-screening devices in the sense that given the alternatives, highly skilled laborers can select fixed rent and unskilled laborers can select wage contracts.

The fourth reason is that contracts could minimize the transaction costs.[6] Separate ownership of land and labor produces a labor-shirking (in quality and in quantity) problem in all forms of tenancy. Thus, the landowner faces the problem of monitoring, supervision, and enforcement costs. Tenants may have to spend some resources on future job-search. The existence of different contracts attempts to minimize these total transaction costs (Cheung, 1969; Roumasset, 1976; Datta and O'Hara, 1983).

There are a few other possible reasons,[7] for tenancy contracts. Indivisible inputs (like bullocks) and imperfect lease-markets may be one of the reasons of tenancy (Bliss and Stern, 1979). Since the market to rent these inputs is imperfect, tenancy can be viewed as an adjustment of indivisible inputs together with the presence of imperfect lease-markets. Similarly, share tenancy in particular, can be considered a credit system (Jaynes, 1980; Braverman and Srinivasan, 1982). Since capital and credit markets are imperfect, an assetless person can acquire access to capital and credit with the help of a tenancy contract. If a tenant does not have wealth or access to credit, landlords are forced to credit advances to tenants.

---

[6]First-best efficiency is just not possible in general (the main reason is market is incomplete). This results in the existence of transaction costs. For details see Jaynes (1980).

[7]Singh (1984) has given a most rewarding view of all the possible reasons.

Compared to a wage contract, tenants in a sharecropping system will put more effort in the production process because their reward depends upon the output.

The final reason for tenancy is the risk factor (Cheung, 1969; Stiglitz, 1974, 1979; Newbery, 1974, 1975). Largely because of weather and other factors, the agricultural sector has to face production uncertainty.

Different contracts can be considered as a mechanism for sharing and spreading risk. From the landlord's point of view, risk is lowest in fixed rent contracts and is highest in wage contracts. But from the tenant's point of view, risk is lowest in wage contracts and it is highest in fixed rent. However, in the share tenancy, risk is spread between the landlord and the tenant.[8]

Almost all of the above mentioned reasons conclude that, in the absence of perfect inputs market, tenancy is a means of optimizing resource allocation. However, the discussions did not deal with the coexistence of different types of tenancy. Since the model that is going to be developed in this study attempts to explain different types of tenure contract within a single model, it is very important to evaluate the different tenancy models that explains the coexistence of different tenure system.

---

[8]The explanation was first put forward by Cheung (1969). Further works in this area were done by Reid (1974), Stiglitz (1974), Newberry (1974) etc.

1.2 Coexistence of Tenancy

In the process of resource utilization in agriculture, we may see many kinds of agricultural contracts even within a small geographical area. The coexistence of these different contracts depends upon the economic environment of the area.[9] Many reasons have been cited in the literature regarding the coexistence of the different tenure systems. In the following section, models that explain the existence of the different tenure statuses in an area will be reviewed.

The classical economists, understood tenancy arrangements as an economically efficient way of organizing resources. Because of imperfect markets, and under the condition that it is difficult to monitor and supervise labor, the economists viewed sharecropping as an improvement over a wage contract because of its positive incentive effect. However, the classical economists also recognized that sharecropping provides the workers less incentive to work than fixed rent tenant or an owner-cultivator. In the literature, Marshall is cited most often for this kind of inefficiency argument, but Marshall himself did not hold the idea that sharecropping has disincentive effects on work efforts. In his footnote, he tried only to demonstrate what would happen if the tenant was left unsupervised to pursue his own interest only. Cheung (1969) elaborated upon this footnote, providing an in-depth explanation, and blaming Marshall for a narrow view on tenancy. Thus, we call the advocates of inefficient

---

[9]Kotwal (1981).

arguments as the naive-Marshallians (or the inefficiency school).[10] The basic idea of naive-Marshallians is that a profit maximizing tenant will allocate his labor input only up to the point where his share of marginal product is equated with the opportunity wage (for details see Appendix 1). The disincentive implies the under-supply of labor because of the fact that a sharecropper only gets a fraction of the total output. The inefficiency generated by this incentive effect is also called "Marshallian inefficiency."

However, the reasons for the widespread use of sharecropping despite its allocative inefficiency were not explained.[11] There was a failure to demonstrate how the choice among alternate types of contracts is actually made in different regions.

Subsequent models have tried to explain the coexistence of different contracts. One explanation has been in terms of risk and transaction costs (Cheung, 1969). Transaction costs here include negotiation costs, enforcement cost and supervision costs. This model can explain only two types of contracts--sharecropping and the rest (Kotwal, 1981). Also, it is not clear why wage contracts exist even if the landlord bears the costs as well as the risk.

The greater the uncertainty of production, the greater the scope of entrepreneurship. The greater the scope of entrepreneurship, the higher will be the proportion of fixed rent contracts (Rao, 1971). So more reliable crops like rice are produced under share contracts, whereas more uncertain crops like tobacco are grown mostly under

---

[10]For detailed discussions see Jaynes (1984).
[11]Datta and O'Hara (1983).

fixed rental contracts. Here, risk sharing is also the main concern behind the different contracts. But the model also contradicts theories that state risk sharing as the main rationale behind sharecropping.

There have also been similar versions of risk sharing as a rationale for share cropping (Hallagan, 1978; and Newbery and Stiglitz, 1979). The first tries to explain that the contracts are selected by the peasants according to their entreprenurial abilities. On the other hand, to have the contract exist, the landlords should also have complementary preferences to those of his tenants. If there are three types of peasants, there will also be three kinds of landlords with different preferences. Thus, the model will result in three different contracts. Similarly, the second argues that "individuals who believe they are very unproductive will choose the wage contract and those in between will choose the share contract". This self screening process may lead us to believe that we can have more than three contracts. Newbery and Stiglitz (1979) explained that economies of scale can make sharecropping attractive in the absence of incentive effects in the presence of risks on production. For example, because of indivisibilities and the absence of bullock rental markets, reliance on rented bullocks may be too risky. Indivisibilities may also arise in managerial skills.

Another theoretical model of tenancy choice considers land, labor, other modern inputs, and management capacity of the tenants as the factors of production (Bell and Zusman, 1980). Input share, output share, tenancy size, and fixed rental rate, etc., are

determined by the bargaining process between the landlord and the tenant. Thus enterpreneurship, as well as the heterogeneous distribution of the factor endowments are possible explanations for the coexistence of the different types of contracts. As a result, factor endowments of tenants and landlords determine tenancy contracts. In this model, it seems that labor and other input variables are the tenant's discretionary variables, resulting in the problem of shirking. Productive efficiency in the model is not achievable[12] in this instance. This model has been extended by Kotwal (1981). According to the extended model different types of contracts "stem from the heterogenous distribution of enterprenurial skills." Thus the entrepreneurial residual is claimed by the tenant in case of fixed rent contracts. This residual in the case of a wage contract is captured by the landlord and in share cropping, it is shared by both. In this model, entrepreneurial abilities and resources have been defined rigorously. But much work on the model has to be done and it has not been empirically tested.

Other studies have been conducted to explain the coexistence of different tenancy systems. Inequality of ownership patterns of various inputs of agricultural production also give rise to land tenure. The basis of distinguishing different contracts is transaction costs (Datta and O'Hara; 1982). This transaction cost arises to the landlord because of supervision and monitoring cost. This cost to the

---

[12]Binswanger and Rosenzweig (1984).

tenant is the job search cost as well as the bonding cost. Different contracts try to minimize the total transaction costs.

More recently, the overall problem of tenure choice has been explained by the principal agency model[13] (discussed in Section 2.1.2). In this model, an agent is hired by a principal to produce a product. Contractual arrangements are used to allocate optimum resources and outputs. There are a number of conditions under which we can analyze the model. It may be possible that either the agent's action is fully known, that no information is available to the principal or that some intermediate situation may happen. On the other hand, since an agent is hired to work for the principal, the model should deal with incentive problems. This problem may occur due to the fact that the agent would prefer to work less. The principal is concerned mainly with the outcome or the share of the payoff and the maintainance of his land. The objective of this model is to find the Pareto optimal contract in different contracts. In other words, the problem is to find how the optimal sharing arrangement of the payoff is dependent on the observed variables. In this theory, the role of imperfect information such as moral hazard is considered. However, a drawback of this model is that it only focuses upon shirking by the agent.

The principal can also take a number of actions. In the course of these actions, there is a possibility of shirking by the principal.[14] This is one of the criticisms of the principal agency

---

[13]For further details see Lewis (1980), Harris and Raviv (1978), and Holmstrom (1979).

theory. Due to this possibility, an extension of the principal agency theory is in order. In the new model, estimates of the principal's input and the agent's input is necessary. Hence, the principal and the agent take necessarry courses of action. Although the information may be incomplete, it can be used to improve a contract that initially is based on the actions of the agent alone. Additional information about the principal's action can be useful to improve the welfare of both the principal and the agent. Anotner criticism of principal agency theory is that the theory does not consider how the organizations function internally. Similarly, capital intensity, information costs, specialization, etc., and their interactions, which determine the agency cost, are not taken into consideration.[15] Thus, the present study makes use of the modified verson of positive agency theory (Jensen 1983). First, this study[16] will define a production function in terms of physical inputs, technology, and contracting system. Secondly, agency cost will be defined as the difference between the first-best and second-best and will be derived under the framework of utility maximization and profit maximization. The agency cost in agricultural organization is the monitoring and supervision costs and the residual loss. Thirdly, it will be shown how land quality is related to the agency cost and how it helps to determine the agricultural contracts. Finally, specialization in management is related to land quality, and thus, it

---

[14]This argument was first seen in Roumasset and Uy (1983).

[15]Disadvantages and general objectives of principal agency theory have been summarized by Jensen (1983).

[16]Details of the present approach are discussed in Chapter II.

will be shown that the residual claims due to management distinguish agricultural contracts from one another.

1.3 Purpose

Prior to 1950, it has been estimated that 60 percent of the cultivated land in Nepal was leased-in by farmers paying rent to the various categories of owners. The ratio of share cropping to total tenancy was 75 percent for the country as a whole. Rent contracts were more popular in upland[17] (less fertile land) compared to lowland (more fertile land) areas, with a ratio of more than 2:1. A land-reform program was introduced in Nepal in 1964, which tried to secure tenancy rights, regulate the land ceiling, and make certain regulations regarding the tenancy floor. In 1972, eight years after the land reform was introduced in the country, a sample survey conducted by the government of Nepal showed that 28.4 percent of the cultivators were still engaged in some form of tenancy. Tenancy presently accounts for 24 percent of the cultivated area. This percentage is normally underestimated. However, even with the given statistics tenancy is still a significant feature of the agrarian structure in Nepal.[18]

Therefore, the purpose of this study is to understand the reasons for the coexistence of different agricultural contracts in

---

[17]The country can be broadly divided into three parallel geographic regions extending from east to west--the terai (low land), the middle hills and the high mountains, covering respectively 23, 44, and 34 percent of the total area. The terai region is a narrow strip of plain with fertile soil and comprises a dense forest belt. The middle hills is mainly characterized by rugged terrain and poor soils.

[18]These statistics were extracted from Zaman (1973).

Nepal and why they differ. This is vital since the welfare of the people is directly linked to the different policies of the government. Thus to determine policy implications it is very important to define different models that have different policy implications. Differences will be analyzed in relation to the expanded theory mentioned above. The main objectives of this study are:

i) to determine how contracts differ and the reason for this difference; and

ii) to determine policy implications as a result of different contracting specifications.

1.4 Methodology

The framework employed to study the above questions rests on the assumption that in equilibrium, contracts minimize agency cost. Because the factors of production are owned by different parties, the separation of the factors produces a monitoring and supervision problem under all forms of tenancy. In the case of agriculture, a monitoring problem has a greater impact on production. The laborer or the worker tries to shirk his labor input. On the other hand, the land belongs to the landlord and is an input for production. Thus, there is a possibility of shirking of land. The shirking of land by the landlord implies that, ceteris paribus, the landlord cultivates the good quality land and leases-out the poorer quality land.

Assuming that the inputs of the principal and agent are unobservable, the equlibrium contract involves a trade-off between incentives to the agent and incentives to the principal. If all

inputs are observable, the profit maximizing situation will lead to first-best profits. However, under the unobservable inputs situation, we will have the "second-best profits." In this study, we will use the contracting models that minimize the agency cost defined by the difference between the first-best and second-best profits. The organization of the remainder of the study is as follows.

Theoretical models will be discussed in Chapter II. The discussion is organized in five sections. The first section explains the existing model of tenure choice in relation to the principal agency theory and positive agency theory. The present methodological approach will be presented in Section 2. In the third section, we will develop a theory of contracts based on specialization and multiple shirking. Overall contrast of the major existing model will also be discussed in this section. The last section will compare the efficiency and inefficiency schools by developing some major hypotheses.

Chapter III presents the basic analysis of the data according to region and tenancy choice. This chapter is divided into six sections. The first section will provide a description of different land ownership patterns in Nepal. The second section attempts to provide probable reasons of the incidence of tenancy. This section will be followed by the land reform program (Nepal, 1964). The fourth section will discuss the sampling techniques used in the study. The fifth section deals with some of the economic and demographic characterestics of the households according to the mode of agricultural organizations. This section is basic in the sense

that it reports on data for all tenancy statuses. The last section includes some econometric analysis. This section describes the relationship between productivity, farm size, and land quality. Also, the production function model for different tenancy statuses as well as the technology of production is analyzed according to tenancy status in this section.

Chapter IV is the core of this study. The first section presents different models of tenancy choice. The linear probability model, multinomial, and multiple probit analysis and their comparisions will described in detail. The second section compares the inputs and output level per hectare for the owner operated land and the leased in land (in share contract) cultivated by the same farmer. The last section provides some analysis on the sharing of the input and output between landlords and the tenants and its change over time. The Wilcoxon matched-pair test is used to test the hypothesis that the higher the percentage share of the cost sharing, the higher the share of the output. The hypothesis and its test used to draw conclusions will be reported in this section. Main inferences about our theory are drawn from this chapter.

Chapter IV also describes the econometric models and the statistical models used to analyze the data in connection with the theory developed in Chapter II. A regression analysis where the dependent variable is qualitative instead of continuous, has been described in Appendix 7. Use of the linear probability model for the qualitative endogeneous variable involves some problems. Alternatively, a probit model will be used for the analysis.

Comparision is also made between these two models. The model, estimation procedure, its properties, and testing procedures will also be given in this chapter.

Chapter V provides the summary and conclusions. This chapter briefly summarizes the results and inferences drawn in Chapters III and IV. Also, the policy implications of the findings are discussed in depth.

CHAPTER II

Theoretical Framework and Methodology

Different economic, social, and political activities are carried out by different types of organizations. Organizations also produce goods and services; they take different forms and also behave differently. A major challenge for social scientists is to explain why organizations take the forms they do and why they function in a particular way as they do. A large amount of research has been carried out by economists on the theory of organization.[1] Organizations have very complex structures and one of the problems is that the theory developed is either non-mathematical or generally non-empirically oriented. In recent years, agricultural organization theory has also developed very rapidly. The objective of this chapter is thus to develop a rigorous, empirically oriented theory of agricultural organizations and a theory of tenure choice.[2]

---

[1]Some of the important organization theories are developed and reviewed in Williamson (1964, 1975, 1979, 1981), Arrow (1964, 1974), Alchian (1950, 1969, 1981), Alchian and Demsetz (1972), Jensen and MecKling (1976, 1979), Harris and Raviv (1978), Fama (1980), Demsetz (1982), Fama (1980), Fama and Jensen (1983, 1983a), and Jensen (1983).

[2]Some of the important research studies on agricultural organizations and tenure choice are Cheung (1969), Rao (1971), Stiglitz (1974), Reid (1976), Roumasset (1978, 1979), Roumasset and Uy (1980, 1983), Newbery and Stiglitz (1979), Binswanger and Rosenzweig (1984), and Murrell (1983).

This chapter has three sections. The first section reviews the positive agency theory and the principal agency theory. The present methodological approach is presented in the second section, which develops a theory of contracts based on specialization and multiple shirking. Also in this section, tenure choice, for which there are diverse theories, will be explained by the theory developed in this section. In the last section attempts will be made to contrast the naive-Marshallian approach of contract choice with the efficiency or fundamentalist approach. This section should help to generate a few more hypotheses regarding productivity and distribution.

2.1 Agency Theories

2.1.1 Positive Agency Theory

Jensen and Meckling (1976) define an agency relationship in the organization as "a contract under which one or more persons (the principal[s]) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent". In the case where both the parties try to maximize their utilities, it is quite likely that the agent does not always work in the interest of the principal. This is a moral hazard problem in the agency relationship. The principle of agency relationship is also applicable to the theory of firm. In the classical theory of firm, an enterprenuer single-mindedly operates the firm to maximize profits. The development of "managerial" theories of the firm rejects the classical theory of the firm and views the firm as a set of contracts among factors of production,

with each factor motivated by its self-interest.[3] The principal can control this problem either by establishing appropriate incentives or by incurring monitoring costs designed to control the agent's adverse activities. In some cases the principal, again to quote Jensen and Meckling (1976, p.308), "will pay the agent to expend resources (bonding costs) to guarantee that he will not take certain actions which would harm the principal or to ensure that the principal will be compensated if he does take such actions." These costs will be positive, since the agent will not work in the best interest of the principal. In addition, agency cost includes the residual loss incurred because the cost of full enforcement of contracts exceeds the benefits.[4]

Thus, the agency cost is the sum of the monitoring expenditure by the principal, the bonding expenditures by the agent, and the residual, shirking cost.[5] The model does not have to have a principal and an agent to define agency cost. Cooperative efforts of two or more individuals may also have the same kind of agency costs. The definition of agency cost for the theory of firm, thus, is close

---

[3]Further details can be seen in Fama (1980).

[4]The idea of residual loss has been discussed both in Jensen and Meckling (1979) and in Roumasset and Uy (1983).

[5]Theoretically to minimize the enforcement cost one can use the wage revision process imposed by the managerial labor market, which amounts to full ex-post settling up by the manager for his past performance. This will help in settling up ex-post managerial incentive problems for the problems usually attributed to the separation of security ownership and control of the firm are resolved. Even in this dynamic process there exists a residual loss. However, in a one-period model, there can be no enforcement of contracts through a wage revision process imposed by the managerial labor market (Fama, 1980).

to the problem of shirking and monitoring of team production (Alchian and Demsetz 1972) and excess burden (Roumasset and Uy, 1981).

Separation of ownership of the factors of production in agriculture produces agency costs.[6] Agents of the agricultural contract are the landlords and the tenants. The agency cost in agriculture, thus, constitutes supervision and monitoring costs, and the residual shirking cost. Supervision and monitoring expenditure are incurred by the principal in order to minimize the shirking cost, which is the dollar equivalent of the reduction in welfare of the principals arising out of the divergence between the agent's decisions and the optimal decision of the principal. It can be assumed that in agriculture, the choice must be made between fixed rents, sharing, and wage contracts.[7] When land is leased out at a fixed rent the tenant may not use the land in a manner consistent with the landlord's preferences. The tenant will have little direct incentive to maintain the soil fertility, irrigation facilities, and other assets attached to land. In a wage contract, labor shirks in both quantitative and qualitative terms. However, share contracts have both problems but in lesser degree. Thus, the agency costs incurred in the types of contracts are different.

Assuming that the agents arrive at some kind of agreeable

---

[6]Separation of ownership of the factors of production has some benefits too. If there is no agency cost, the separation of the ownership of factors of production may produce the situation where the resource allocation may be pareto optimal.

[7]There can be more than three choices depending upon the different economic environment. More details will given in the following sections.

contract, the objective of the positive agency theory is to investigate the incentives faced by each of the contracting parties and the elements entering into the determination of the equilibrium contractual form characterizing the relationship between the agents. Industrial organization (Fama and Jensen, 1983; Fama, 1980) is an example of this kind of contractual form.

To investigate the incentive structure of different contracts, definitions and abstracting assumptions are extremly productive. The positive agency theory is also based on definitions and simple abstracting assumptions. It assumes that individuals in the organization try to maximize their own utility through co-operative behavior. These individuals have divergent interests and generate the agency cost. Welfare of at least one party will be increased with the reduction of the agency costs. The incentive structure faced by the agents and the variables entering into the determination of the equilibrium also determine the agency cost. And the organization, which is a nexus of contracts, tries to minimize this agency cost. Minimum agency cost theory can be justified either by profit maximization or evolution principle.[8]

How organizations survive is another question in organization theory. Organizations, like individual firms, face competition in the market to deliver the activities or products at the lowest price

---

[8]Agency cost can also be changed with the change in transaction cost structure. Trust (Arrow, 1969), F-connection (Ben-Porath, 1980), and reliability (Goldberg, 1979; Klein and Leffer, 1981) can change the economic structure of contract. But even in these cases, the minimum agency cost theory is applicable (see footnote 5).

while covering costs. Organizations which can provide the product demanded by the customers at the lowest price will survive.[9] Examples and use of this theory has been discussed more rigorously in Fama and Jensen (1983, 1983a).

Mathematical modeling of this kind of problem is complex. The positive theory of organization is based on the characterizations of the contracting relations, and much of the evidence on these propositions is qualitative and institutional in nature. Thus, the collection of data and its statistical analysis itself will be a complex task. This theory simply does not intend to get into regression analysis and other econometric analysis. It claims that the inferential theory has not been developed to analyze the qualitative institutional data.[10] Before any kind of mathematical model is utilized a great effort has to be expended to determine the dimensionality of the problem and to define the major variables of the concerned issue.

Thus, definitions and abstracting assumptions are helpful in developing organizational theory. These definitions and abstracting assumptions are thus used to develop propositions about important aspects of the environment and their relation to the features contributing to survival of the organizations. First, the model defines the agency cost. Second, it uses profit maximizing and

---

[9]The survival of the fittest tautology was argued by Alchian (1950) and Jensen (1983).

[10]Non-parametric statistics deal with the qualitative data, but this also has a number of problems. For details see Jensen (1983, p.332.).

cost-minimizing tautology to establish a theory which is consistent with those contracts. Finally the theoretical structure can be extended to derive additional non-obvious propositions.[11]

This model has basically two problems. Firstly, it assumes the individuals solve the normative problem of contracts and investigate the elements entering into the determination of the equilibrium form characterizing the relationship between agents. If successful, it can derive some more non-obvious hypotheses. If the data available is inconsistent with the predictions, the theory is revised. Thus, it involves a sequential build-up procedure of the theory. Although it is not unscientific, it is not rigorous. Secondly, it incorporates qualitative and institutional evidence in its theory, which cannot be measured very easily with mathematical verification, and may not be accurate.

2.1.2 Principal-Agency Theory

Another theory developed independently of positive agency theory is principal-agency theory. This theory focuses on the problem of formulating the contractual relationship between the principal and agent to provide appropriate incentives for the agent to make choices which will maximize the principal's welfare under uncertainty and imperfect monitoring situation. Contracts may be between the employer and employee, the owner and manager, the insurer and insured, and so on. The employer is called the principal and the

---

[11]Because of the nature of the problem, the methodology used by Roumasset (1978) in understanding the non-market resource allocation and other aspects of rural institutions was also of similar nature. This is discussed in section 2.3 in detail.

employee is called the agent. The contracts lead to a risk sharing arrangement. As a result, a moral hazard problem often occurs when an agent's actions cannot be observed directly. The problem of the principal-agency theory is in determining how the payoff function can be used to determine the optimal control contract. A simple mathematical model of this theory based on Holmstrom (1979) and Harris and Raviv (1978) is as follows:[12]

Let a be the agent's input, and θ be the state of nature, then the payoff x is given by

(2.1) $$x = x(a,\theta)$$ [13]

The problem is how this payoff should be shared optimally between the principal and the agent. Let s(x) denote the payment schedule to the agent, then x-s(x) = r(x) is the payment schedule to the principal. Pareto-optimal sharing rules are generated by the program

(2.2) $$\max_{a} V(x-s(x))$$

such that

(2.3) $$U(s(x),a) \geq \bar{U}$$

where V is the expected utility of the principal and U is the expected utility of the agent. The agent determines his effort by solving the expected utility function;

---

[12]Holmstrom's model is more general than those of Harris and Raviv (1978) and Lewis (1980) in the sense that any additional information about the agent's action, however imperfect, can be used to improve the welfare of both the principal and the agent.

[13]It differs from the payment schedule from Stiglitz (1974) in that the payment schedule in this case has a distribution function, whereas Stiglitz's payment schedule is of the form $\alpha + \beta x$ where and are constants.

(2.4) $$\max_{a} U_{\theta}(s(x),a)$$

Constraint (2.3) guareentees that the agent will have at least a minimum expected utility U (which the agent can obtain contracting with other principals in the market). a is chosen from the set of arguments that maximizes the objective function of agent.

If the principal could observe a, he could force the agent to work according to the contract and the solution would be obtained only through equations (2.2) and (2.3). This solution is refered to as the first-best. However, full observations in actions is either impossible or prohibitively costly. This constraint (2.4) will, thus, generate an alternative solution and is called a second-best solution.

A number of other propositions have been established through this model. One of the conclusions drawn is that principal-agency theory has a moral hazard problem and the optimal solution under moral hazard is not first-best. Thus, there would be gains to observing the agent's action. The principal would like to see the agent increase his effort in the second-best situation. By creating additional information systems, or by using other available information about the agent's action or the state of nature, contracts can generally be improved.

The same model can also be used in agricultural organization with certain modifications (Roumasset and Uy, 1983). In agriculture, separate ownership of land and labor produces a serious labor-shirking problem. If the landlord could observe the agent's action, there will not be any shirking cost and the solution will be

first-best. The worker will be paid his marginal product and this will be a wage contract. If the agent is risk neutral, then the first best solution can be obtained by paying the agent the residual above some fixed payment to the agent, not to shirk his input. This is a fixed rent contract.

When a and x are not observable, and if the agent is risk-averse, then the first-best solution is unachievable. Hence, the principal-agency theory can be described as the moral hazard theory of share tenancy. In order to preserve some incentive for the agent and to enhance efficiency in risk bearing, the residual has to be shared between the landlord and the tenant.

There are a number of shortcomings in this theory. First, the endogenous information about shirking has not been incorpotated into the continuous optimization model because of the additional complexity. Secondly, the utility functions employed in this theory cannot be measured by existing methods. Existing theory is capable of measuring only indirect utility functions (Roumasset and Uy, 1983). Thirdly, the modeling of additional effects of the contracting environment and the technology of monitoring and bonding (examples are capital intensity, information costs, degree of specialization etc.) in shaping the form of organization is not possible. Fourthly, the possibility of input shirking by the principal has not been taken into consideration. In agricultural organizations analysis, previous models assume that land is fixed and the only other input, labor, is provided by the tenant. Taking land as a fixed input may be inappropriate, because lands differ in

quality and can be depreciated (or mismanaged). Thus, giving the entire residual to the worker involves some inefficiency. Share contracting in agriculture may have been motivated by the tendency to minimize shirking of both labor and land. Lastly, because of the complexity of the problem, the principal-agency theory generally is non-empirically oriented (Jensen, 1983, p.334). In fact, it should be noted that the principal-agency model is a special case of positive agency theory. By virtue of simplicity, the latter is amenable to formal modeling.

2.2 Present Approach

The above review of agency theories concludes that one is faced with a number of problems in exploring organization theory through the use of existing models. First of all, in the usual theory of firm, the entrepreneur who enforces contracts perfectly with cost effectiveness maximizes profits. A new theory views the firm as a set of contracts among factors of production, with each factor motivated by self-interest. Thus, under the classical approach, information problems regarding how organizations are structured or how they function internally are not taken into consideration.

Secondly, characterizations of the contracting relations, and much of the best evidence on the forms of contracts, their provisions, and their analysis should be the objective of organization theory. Techniques for modeling these variables are almost non-existent.

Finally, the principal-agency theory models the structure of the preferences of the parties to the contracts, the nature of uncertainty, and the informational structure in the environment (Jensen, 1983). In this theory, other aspects of the contracting environment and the technology of monitoring and bonding on the form of contracts, have not been taken into consideration. Capital intensity, degree of specialization, information costs, capital and labor markets, and their interactions are some of the factors that determine the monitoring and supervision costs. In turn, these costs determine the contractual form.

There are a number of problems in getting the mathematical solution of the above mentioned problems. Econometricians try to identify the variables in the model, the functional form, and the distribution of errors. The explicit statements that are made about the theory are tested by a tangible set of data and derived from formal inference, subject to repeated testing. The model assumes that the inference is not unduly affected by the subjective opinions of the researcher.[14] Thus, the mathematical analysis is better dealt with objective, hard, and precise propositions.

In the process of modeling complex economic arguments (like those of institutional evidence), the model narrows down the richness of the information and arguments of the problem. It does not

---

[14]Even otherwise if one has unrealistic assumptions in the model, the model produces unrealistic predictions, but these predictions may be empirically correct (Samuelson, 1983).

recognize the economic knowledge that is inferred from actions.[15] Similarly, statistical analysis, which has to be done within the limits of a reasonable horizon, becomes ineffective.

Statistical inference itself, on the other hand, is an opinion based on the sampling distribution of a random variable and the prior (or the marginal) probability of the parameters. Thus, if one derives a better logical conclusion based on a set of facts, it may be superior to the objective inference (Leamer, 1983).

The application of non-parametric inferential theory may aid in dealing with institutional, qualitative data. One of the assumptions of non-parametric statistics is that the observations are independent and that the variable under study has underlying continuity (Siegal, 1956). This condition is seldom satisfied (Jensen, 1983).

In addition, a scientific survey and sampling technique of collecting institutional evidence has yet to be developed. Unscientific data collection used in conventional statistical inferential theory may lead to biased, inconsistent, and inefficient results. The likelihood of getting incorrect inference becomes higher. We have a limited knowledge of institutional arrangements and the institutional evidence consists of non-commensurable items. Thus, we have difficulty in including the relevant institutional content in abstract models.

---

[15]The idea is that the full information and knowledge, generally, is not utilized in the mathematical model (McClosky, 1983).

The institutional characteristics are subjective, soft, and vague. But they are very important aspects of analysis. A well defined theory on organizational form does not exist. Even if one cannot exemplify those ideas in abstract models, the observations collected on these institutions will be very helpful in deriving and identifying patterns, and finally to explain the patterns observed, using some principles. Thus, to deal with the behavioral and managerial theories of institutions and to make effective use of the scarce information, the Samuelson-Jensen methodological approach looks very promising for developing rational models.

Samuelson (1983) advocates inductive methodology, even in the non-institutional type of problems, because of five different reasons. First, he says facts can never be ignored and are very valuable. Economists have access to the data they study, while some other scientists like astronomers cannot have a relationship with the data they study. A methodology that uses synthesized propositions is more useful in comparision to the methodology that uses analytical a priorism. Second, the precision in probabilistic facts can at best be only partial and approximate. Third, experience confirms that by its nature, narrowed down abstract models, through the established opinion of the researchers, permits them to ignore or play down inconvenient departures of their theories from the observable real world. Fourth, it seems objectively to be the case that there does not accumulate a convergent body of econometric findings, convergent on a testable truth. And, finally to quote him, "...as you observe scientists and study the developments of disciplines when schools

evolve and paradigms are born and die, it is forced upon you that what ultimately shapes the verdicts of the scientist juries is an empirical reality out there".

Thus, according to Samuelson, the methodology for his papers was intended to characterize what descriptions the new literary and mathematical paradigms imply for the observable data. The paradigm's full set of entailed descriptions is what is of interest and forms the basis for a complete judgment on it. The general scientific, inductive methodology emphasized by Samuelson is, first, to organize the facts (observed data or arrangements) into a useful and meaningful pattern of integrated phenomena so that it constitutes a functional unit. Next, it has to be organized into patterns that are more cohesive than the data themselves and which can provide economical descriptions of the data that afford tolerably accurate extrapolations and interpolations.

Jensen (1983), on the basis of mathematical problems and other technical problems (discussed above in this section) in dealing with the institutional data, elaborated the importance of definition and simple abstracting assumptions to derive a research methodology of the organization theory. According to Jensen (1983), the methodology proceeds by observing a "subset of the observed contract structures to develop propositions about the important aspects of the environment and the monitoring and bonding technology--that is, to derive additional non-obvious positive propositions (and hypotheses), confronting these propositions with previously unknown or unused data provides a test of the theory." If the conclusion of the hypothesis

is inconsistent with our theory and the prediction developed in the begining, then the theory itself is revised and replaced by a new alternative theory. This process continues and is also a scientific process.

Similar methodology has been applied in the new institutional economics[16] (Roumasset, 1978, 1984; Roumasset and Uy 1983). In explaining the existence and evolution of institutions, the new institutional economics uses conventional tools such as cost, benefits, and equilibrium. They document the institutional arrangements and finally explain the observed patterns using different theoretical framework.

Thus our methodology, given below, depends on Samuelson's (1983) reasoning of inductive methodology, Jensen's generalized process of model building, and Roumasset and Uy's (1983) method of analysis.

In the process of analysis, first, the firm is viewed as a set of contracts and thus the production function is defined in terms of physical inputs, technology, and the contracting system under which the firm operates. Since each factor is motivated by self-interest, separate ownership of the factors of production produces a shirking problem in all forms of agricultural contracts. Secondly, the difference between the first-best and the second-best solutions will be derived under the framework of utility maximization and profit maximization, and is defined as the excess burden or the agency cost.

---

[16]Basically, new institutional economics deals with the non-market resource allocation and existence and evolution of institutions.

The agency cost in agricultural organization is the monitoring and supervision costs and the residual loss. Organizations in an attempt to maximize profit try to minimize agency cost. Because of the competition, organizations which can deliver the activities or products at lowest price while covering cost will survive. Thirdly, it will be shown that the residual claims due to specialization in management distinguish agricultural firms from one another and help explain the survival of organizational forms in specific activities. Finally, it has been seen from different studies (Roumasset, 1984; Datta and O'Hara, 1983; Roumasset and Uy, 1983; Ali, 1979; Rao, 1971) that land quality is related to the agency cost and how it helps to determine the agricultural contracts will be developed. Different economic conditions affect specialization in management, and additional hypotheses can be generated by extending the theoretical structure.

Similar methodologies were used by Roumasset and Uy (1983) to explain the agricultural organizations and the following section is based on their work. The present treatment differs from theirs in that the methodology developed here is more general in nature. Also, the impact of variables, other than land quality on tenure choice is examined rigorously under the same framework.

2.2.1 Production and Organization

Suppliers of the inputs (land, labor, capital, etc.) in agriculture implicitly or explicitly enter into a set of contracts which delineate the rights and obligations of the respective participants in the activities of the organization. Such contracts

also specify the disposition of rewards and costs arising in the organizational activities. A cost and reward structure may be a very important criterion for the incentives in agricultural production. Thus the maximum attainable production of a firm or output of an organization not only depends on the physical inputs, technology, and knowledge, but also on the contracting system within which the firm operates. As a result, the simplified production function in agriculture is given by,

$$(2.5) \qquad q = f_{\psi}(x,y,\theta)$$

where q is the total output; ψ is the form of organization; x is the agent's input (effort); y is the principal's input (land); and θ is the state of nature. The problem is how this payoff should be shared optimally between principal and the agent.

Let s(q) denote the payment schedule to the agent, then the remainder q-s(q)=r(q) will be the share to the principal. Then the agent chooses x (which is also a function of θ) to

$$(2.6) \qquad \max U_{\psi}(x,\hat{y})$$

where $\hat{y}$ is the agent's estimate of y.

The principal chooses the contract, ψ, and the input level, y to

$$(2.7) \qquad \max_{\psi} (\hat{x},y)$$

$$\text{subject to} \qquad U \geq \bar{U}$$

Here the principal and agent may or may not be risk neutral towards lifetime income. But the agent will be risk neutral towards

income changes of a particular enterprise to the extent that diversification, risk-sharing, and credit allow individuals to maintain stable rates of consumption in the face of fluctuating components of income (Roumasset and James, 1979; Kotwal, 1981).

Although there are risk sharing benefits from the contract, a first-best solution is generally unachievable. x, y, and θ are unobservable. x is a productive input with direct disutility for the agent, creating an inherent difference in objectives between the principal and the agent. In the same manner, y, a productive input from the principal, may have different shirking properties and the share of the residual to the principal (and the agent) depends on the scope of shirking of the corresponding inputs. The equilibrium contracts evolve with a trade-off between incentives to the agent and incentives to the principal.

First-best profit is defined as,

$$\Pi^* = (\psi^*, x^*, y^*) \tag{2.8}$$

where ψ^*, x^*, y^* are solution value of the model (equations 2.5-2.7).

Then the agency cost or the excess burden of an organization ψ is measured by

$$\Pi^* - \Pi_i^{**} \tag{2.9}$$

$$\Pi_i^{**} = \Pi(\psi_i, x_i^{**}, y_i^{**}) \tag{2.10}$$

where x_i^{**} and y_i^{**} are defined by equation (2.6) and (2.7) subject to the organizational form $\psi = \psi_i$ and given the probability density

function of $\hat{x}$ and $\hat{y}$.

The optimum contractual form (or the organization with minimum agency cost) ψ, which minimizes second-best profits and (equivalently) minimizes excess burden (or the agency cost),i.e.,

$$(2.11) \qquad \min_{i,\, i\in\Pi} (\Pi^{*} - \Pi_{i}^{**})$$

where Π is the alternative set of contracts.

In this case q can be viewed as a random variable with a distribution F(x,y,q) parameterized by the agent's and the principal's action (Mirrles, 1974; 1976; Holmstrom, 1979). For given x and y, F(x,y,q) represents the distribution function of q. The distribution of θ, uncertainty, and the variation in the organizational form is captured via the relationship (2.5). If F(x,y,q) is known, then the solution can be obtained mathematically for the system.

If the model does not contain ψ, then the solution will be simple and has been derived by Holmstrom (1981). But because of the qualitative and institutional nature of the problem, omission of ψ will limit the scope of the problem. This impose restrictions for the convenience of applying calculus.[17]

By using a discrete approach, one can simply conclude that the

---

[17]In a discontinuous distribution the random variable sometimes assumes exact (finite) set of values. For continuous random variables the occurance of any exact value of X may be ragarded as having zero probability. As a result in discontinuous case basic theorems of real analysis (which assume the random variable to be continuous) are not applicable.

dominant contract is the one with the higher maximum profit point, and equivalently the lower minimum agency cost, $\Pi^{*} - \Pi^{**}_{i}$. The difference between the first-best and second-best solutions in agricultural contracts arises for the following reasons (Williamson, 1975; Datta and O'Hara, 1983; Roumasset and Uy, 1983; Murrell, 1983).

2.2.2 Divergence from Ideal Maximization

As discussed in the above section, the shirking of inputs is a real problem under all forms of tenancy contract. In a wage contract, labor shirks in both quantitative and qualitative terms. As a result, a wage contract requires that the different tasks of agricultural production be monitored properly and this is costly in farming.

In a fixed rent contract, the complexity occurs in specification of the tasks for land maintenance. Thus, in this case, the tenant has little direct incentive for the maintenance of the land, including soil fertility, irrigation facilities, and other durable assets attached to land. As a result, contingency sequential contracts may be warranted, but they are costly and hazardous (Williamson 1975, 1979; Murrel, 1983).

In a share contract, both of the problems of both wage contracts and fixed rent contracts are present, but each in a lesser degree. Thus, it is seen that the agency cost may depend on economic as well as non-economic factors. This agency cost is different in different agricultural contracts and a simple analysis may not be applicable. For example, the above discussion concludes that the fixed rent contract has a high transaction cost. But if trust exists between the agents for non-economic reasons sequential contracts are not

hazardous (Ben-Porath, 1980). With the same reason, opportunism may not occur. Also if there exists an alternative contract without the problem of fixed rent, agents can avoid the problem. Similarly, if the principal has the estimate of the land quality and knows that it is poor then the output loss (or the cost) associated with fixed rent will be low. However, in good quality land, choice between the two types of contracts rests on a weighing of the incentive properties (rent contract) of one against the profitability of the other (wage contract). How land quality and specialization contribute in agency cost will be discussed in the following section.

2.2.3 Specialization and Tenure Choice

Agricultural production process are complicated and involve different activities including decision regarding initiation and implementation of resource allocation. The decisions are specialized tasks of management and are important to the survival of the organization.

First of all agricultural land usually has a higher production elasticity than other inputs. As a consequence proper management of land is very important in these activities. Secondly, production activities take place over space and time and involve many different forms of labor tasks. These activities are sensitive to the quality of effort. Quality of work performed cannot be ascertained easily after the work has been completed. For example, how well the fertilizers were mixed and how evenly the mixture was applied in the field is difficult to check by simply looking at the field. This process will complicate the monitoring job, and the control of labor

will be difficult. The problem becomes more serious for high yield variety technology (Kotwal, 1981). Thirdly, the production process involves decision making under uncertainty. Production uncertainties are caused by weather conditions, mismanagement, improper timing and cultivation methods, wrong combination of inputs etc. Also there may be uncertainty in inputs and output markets. Thus, an enterpreuneur must have ability to bear risk. Fourthly, the entrepreneur or the manager must be able to supervise production by the team members. Finally, if the markets for inputs and output are imperfect he must be able to secure quality inputs in right time at low prices. He must also be able to sell his products at an appropriate time for higher prices.

The criteria for effective management discussed above must also include additional skills. Supervision and monitoring will be more productive if it is carried out by a person who has technical knowledge (including access to scarce information) of the production process. Thus, as the optimum quantity of management per unit of land increase, then the profitability of employing skilled worker for different production tasks also increases. As a result, if the benefits associated with specialized management are high, incentives may best be maintained by compensating management with profits and supervised hired labor. The profitability of hiring workers may increase and the economies of scale of supervision costs enhance profitability (Roumasset and Smith, 1981).

Different contracts have different management structure. In a fixed rent contract, the tenant claims the residual for both labor

and management. The landowner's management input, for this contract, if any, is minimal and negligible. On the other hand, in the wage contract, the landlord provides the management and most of the capital; labor is hired from outside the farm. The landlord is the residual claimant in the wage contract for the capital and the management. In a sharecropping arrangement, the landlord and the tenant share in management and in the residual. Since share tenants often hire a large proportion of the labor, management sharing may be the key distinguishing feature of share tenancy (Reid, 1976; 1979; Roumasset, 1976; Roumasset and Uy, 1983).

As a consequence, one can conclude that in a fixed rent contract, most of the laborers are provided by the tenant himself, and there is little or no specialization. The residual is claimed by his own labor and his own management. In the other extreme, a wage contract, which is a case of highly specialized firms, labor (and sometimes even the management) is hired from outside the firm. Profitability of supervision and monitoring is high and the residual is claimed for the landlord's management. Share tenancy may be regarded as an inertmediate arrangement, and the management and residual is shared between the landlord and the tenant. Thus, the characterization of residual claims due to specialization in management distinguish agricultural contracts from one another and help to explain the survival of organizational forms in specific activities. The gains to specialization in management is more important in more productive land compared to low productive land and is discussed below.

2.2.4 Land Quality and Tenure Choice

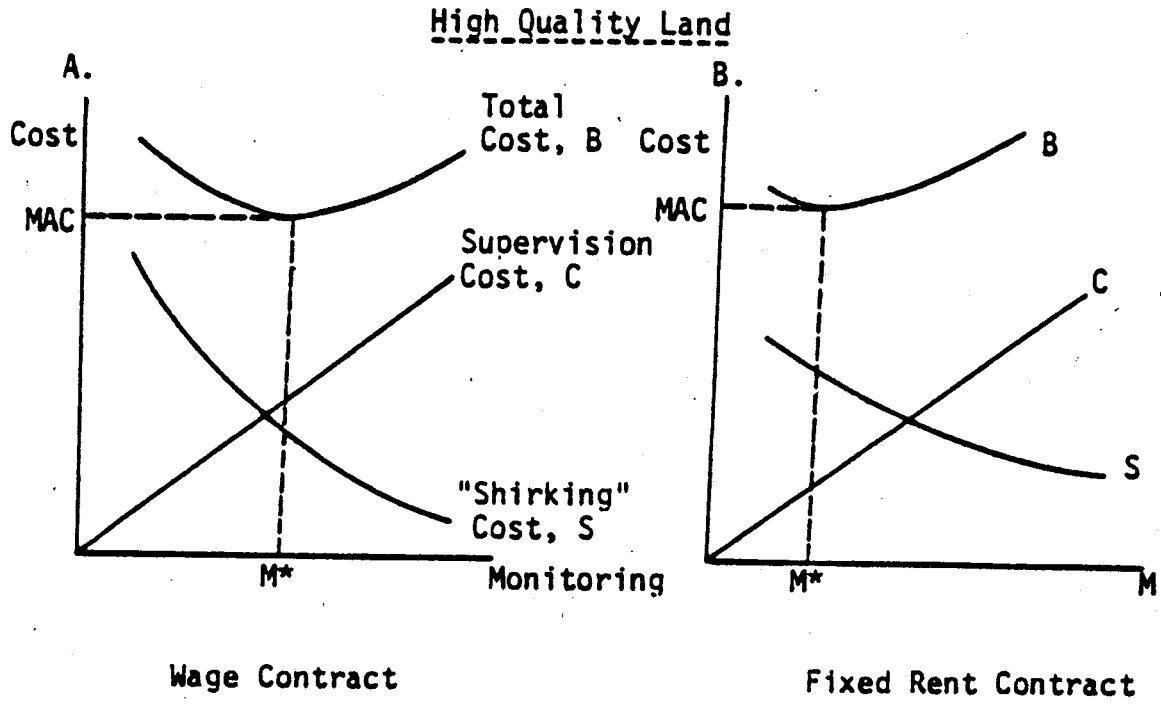
Above discussion conclude that specialization in management is a determinant of agricultural contracts. Specialization in management is more important in good quality land relative to low quality land. The main reason is that the profit loss associated with mismanagement in production activities is higher in good quality land compared to lower quality land. As a result, wage contract is more profitable in rich quality land and fixed rent contract is more profitable in relatively poorer quality land. This incidence has been observed in different countries by a number of researchers (Roumasset, 1979; Datta and O'Hara, 1983; Alston and Higgs, 1982). The argument is described in Fig. 2.1 (Roumasset and Uy, 1983).

Panels A and C represent the case of wage contracts and panels B and D represent the case of fixed rent contracts. Panels A and B represents the contracts on high quality land and panels C and D represent the same contracts on lower quality land. The horizontal axis measures the monitoring expenditure M, and the monitoring cost is represented by a 45-degree line. Shirking cost is the residual cost of the contract and is defined as the remainder of excess burden (or agency cost) after deducting monitoring costs, i.e.,

Agency cost A = monitoring cost+ shirking cost.

The shirking cost curves in B and D are drawn flatter than those in A and C. These flatter curves are due to the assumption each extra unit of monitoring reduces the shirking of x more than it reduces the shirking of y. The shirking cost curve is also drawn

Fig. 2.1 Choice of Contract by the Principal of Minimum Agency Cost



Source: Roumasset and Uy (1983)

higher in panel B than that in D due to the assumption that the profit maximizing ratio is higher on more productive land.

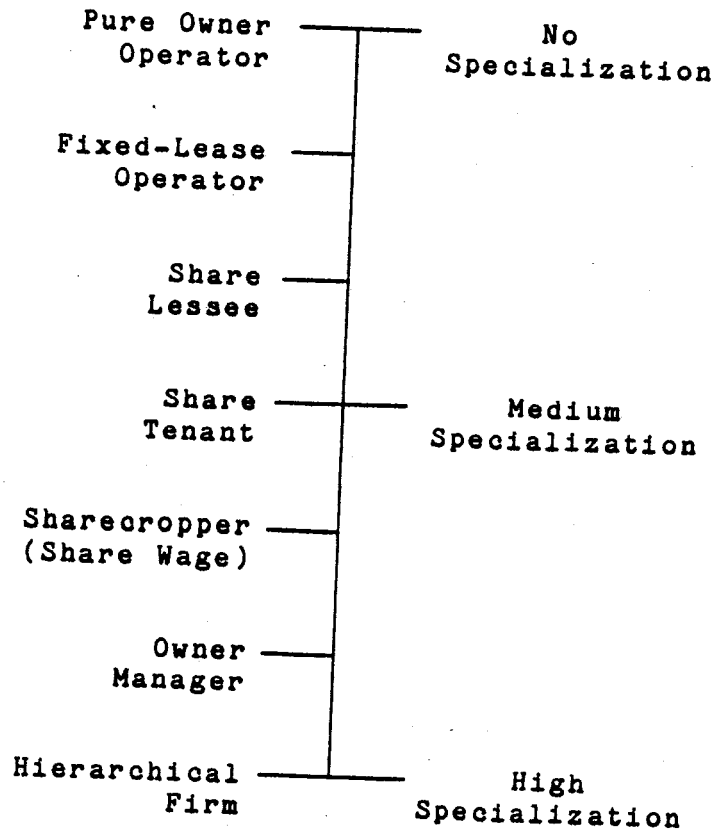
In each panel monitoring cost is optimal at the point M^* where the agency cost is at a minimum. The contract that minimizes agency cost is chosen. Although the figures represent the hypothetical situation, the figures show that wage contracts predominate on highly productive land, while fixed rent contracts predominate on land of lower productivity. Since agricultural inputs per hectare are higher on more productive land, we expect that the incidence of wage contracts relative to rent contracts will be higher as land productivity is higher. So the testable hypothesis is that, as the mismanagement problem is high in good quality land, such land will be put under wage contract rather than rent control.

These discussions about specialization in management, land quality and tenure choice lead to a classification of agricultural firms as illustrated in Fig. 2.2 (Roumasset and Uy, 1983). Different panels distinguish agricultural firms according to the extent of separation between labor and management. All other sorts of contracts can be accomodated according to this classification.[18] Also according to this classifiation, a share contract can be divided into different parts. In pure share tenancy, the landlord and the tenant share in inputs (including management and capital), and they also receive equal shares of the output.

---

[18]For details see Roumasset and Uy (1983).

Fig. 2.2. Classification of Agricultural Firms According to Degree of Specialization Between Labor and Management



Source: Roumasset and Uy (1983)

In some situations, the landlord provides almost all the non-labor inputs and the tenant receives a reduced share, commonly one-third (Roumasset and James, 1979; Alston and Higgs, 1982). In another case the tenant provides labor, management, and much of the capital. The landlord provides little more than the land itself, and accordingly, the landlord's share will be only one-third or one-fourth of the total output (Roumasset and James, 1979; Mullins et al., 1981). The first tenure system is called "sharecropping" and the second tenure system is called "share lease". Sharecropping lies between wage contracts and share tenancy, and "share lease" lies between fixed leases and pure share tenancy.

On the top of the spectrum is the owner-operator. The owner-operator provides all the inputs, namely, land, labor, and capital by himself. Thus, he is the sole residual claimant of labor and the management. The other extreme, is the hierarchical firm. In this form of organization, there is specialization in types of management. The owner of the firm provide most of the land, capital, and decision making, and he is also the sole residual claimant.

It is thus seen that the whole spectrum from owner operator to owner-manager (and hierarchical firm) can be classified according to the extent of specialization. The residual goes to labor or management. Thus, the primary criterion used for ranking contracts is the extent to which there is specialization between labor and management. Rent contracts primarily reward labor (capital and management coming from landlord and the role of management is

negligible) while wage contracts, to a large extent, reward capital and management.

Considerable flexibility may occur in the different organizational form in terms of specialization. For example in a owner-operated firm, any member of the household may specialize in management, and the rest of the members may contribute unskilled labor. Similarly, share tenancy has also been noted for flexibility (Roumasset and Uy, 1983).

In general, what we can conclude is that when there is a high importance of management in production then it is profitable to attract skilled managers and in order to provide incentive for investment in decision-making ability, it becomes efficient to reward management with the residual and to limit labor shirking by supervision.

If the potential losses from mismanagement are low, then the rent contract (or the share contract to a lesser degree), which gives incentive to workers, serves as a device to lower supervision costs. Thus, the prevalance of wage contracts is higher on good quality land and the prevalance of rent contracts is higher on poorer quality land. Land quality (and of course technology and economic conditions) affect specialization through production characteristics, and these characteristics in turn, influence the form of organization.

2.2.5 Economic Conditions and Specialization

The terms of the contracts may vary according to the change of economic environment. Some of the factors that affect the economic

environment are given below.

Biased technological change will change factor intensities. Labor saving technological change reduces the number of laborers and lowers the supervision requirements. Mechanization standardizes the tasks, and the quality of outcome is less influenced by the quality of laborers and their effort.

There are a number of other factors that may affect contractual choice. Other evidence seen in the surveyed area in Nepal is that the shorter (greater) the distance of the farm from the landlord's residence, the higher (lower) the probability that it will be under a wage contract. So it can be concluded that the farther the distance of the farm from the owner's residence is the lower the supervision and monitoring costs in leasing out the land.

The characteristics of the different cultivators are also expected to be different. These characteristics may also influence the agency costs. Depending on the location of the place, landlords may be engaged in non-farm activities. The opportunity cost of supervision and monitoring may be high for these landlords.[19] They will cultivate one or two parcels of land by themselves and lease-out other parcels to the tenant.

In a rural area, land holdings are the primary determinant of wealth. Because of population pressure, and imperfect land markets,

---

[19]On the other hand, if the opportunity of off-farm employment is limited and the landowners are not engaged in these activities, non-farm income of the tenants becomes higher. The reason is that the income of the tenants from agriculture is generally low and thus the tenants have to be engaged in non-farm income earning activities.

landowners generally have fragmented landholdings. Basically, because of land fragmentation, the landlord, in order to maximize profit may have to engage in different types of contracts including wage contract. The landlords normally have a big parcel of land and are rich. The leassees normally have low income and small plots of land. Thus, wealth of the agents may also affect the tenure choice. In the process of minimizing agency cost, if the contracts are ranked in the order of fixed rent, share contract, and wage contract, one can expect a negative effect of the distance variable, and a positive effect of land quality, non-farm income, and wealth to the order of the contract.

In summation, the separation of the ownership of the factors of production creates a shirking problem in all forms of agricultural contracts. A more general theory of economic organization (and tenure choice), thus, requires allowance for shirking of labor as well as other inputs -- land, capital, and management.

Shirking costs of different inputs will be different and depend on the economic environment. Agency costs or excess burden are defined as the sum of supervision costs and the residual shirking costs (and if there is bonding cost it will also be added to the total cost). Contracts evolve so as to minimize the agency cost.

In the process of minimizing agency cost specialization in management plays a key role. If the management input requirement is small, the returns to specialization in management may be low. The contract preferred in this case will be the one where much of the labor and management is provided by the same household and where the

residual (or large share of it) goes to the same household. The incentive basically goes to the labor. On the other hand, if specialization in management is warranted, because of high quality land or because of the nature of the crop, then the contract that gives the residual to the manager not the workers, will be preferred.

The theory developed in this chapter will be tested in Chapter IV using primary data from Nepal. But before testing the theory, the next section will compare the major implications drawn from this model and the "inefficiency" model.[20]

2.3 Naive-Marshallian Model and Efficiency Model

So far, the research model basically on the efficiency principle of contract choice (new institutional economics). At this point of time, prior to the development of any hypotheses, it will be useful to go back and compare the efficiency model with the naive-Marshallian model (or the efficiency model discussed in Section 1.2).

First of all, the efficiency school argues that contract choice is determined by the economic environment. Different models of contract choice are based on different incentive problems and are determined by economic environment. The only issue in this school is the extent to which they can be overcome. Other authors contend that contracts are largely determined exogeneously. Economic environment has less to say about any contractual choice.

---

[20]This "inefficiency" model is similar to that described by Bell (1976) and the "Marshallian School" mentioned in Braverman and Stiglitz (1984).

Secondly, according to the efficiency school, the extent to which the incentive problems are overcome is indicated by the presence or absence of different input and output intensities between different contracts. Thus, the inputs (including management) are also determined by the economic environment and conditions (Binswagner and Rosenzweig, 1984).[21] However, the inefficiency school is based on the premise that an income maximizing tenant will allocate his labor (and other) input(s) only up to the point where his share of marginal product is equated with the opportunity wage (Appendix 1). This implies that the inputs and output per unit of land on sharecropped holdings will be lower than those of owner operated holdings (Bell, 1976).

Thirdly, with the same reasoning described above, the efficiency school predicts that variations in land quality, physiological density, cost sharing crop type, technology, etc., determine the rental share of the landlord and the tenant (Roumasset, 1984; 1979). On the other hand, the inefficiency school does not give a clear picture of the effect of cost sharing on the rental share.

The hypothesis regarding the contract choice is tested and explained in Section 4.1, Section 4.2, and Section 4.3 deal with the question of productivity differential across contracts and the rental share respectively.

---

[21]Basically for an owner-tenant, if farm size and land quality are controlled the inputs and output per unit of land should be equal in sharecropped plots and owner operated plots.

CHAPTER III

Tenure System and Economic Characteristics

The theory discussed in the previous chapter suggests that production technique influences the form of agricultural organizations. Production technique in turn will be influenced by economic factors such as land quality, technology, labor (quality and quantity) and so on. Thus our objective in this chapter is to describe and analyze the general economic characteristics of different production techniques in Nepal. First, the land ownership types and the change in their conditions will be examined. Possible reasons of incidence of tenancy and the land reform program will also be discussed in sections 2 and 3 respectively. Methods of data collection and sampling technique will be discussed in section 4. Section 5 will present a short description of the survey area. Section 6 will review how different households have different factor endowments and thus will have different inputs, outputs, and incomes. Also, this section deals with the basic economic characteristics of the two study areas in Nepal as well as with the mode of agricultural organization of the households. The last section tries to explain the relationship between productivity, land quality, and farm size, and also examines the factor shares of different inputs of rice production.

3.1 Land Ownership Types in Nepal

In Nepal, traditionally,[1] all lands were regarded as the property of the state. Property rights of the state were relinquished and gradually transfered to individuals in different ways. The nature of property rights to the individuals were dependent basically upon two factors: the purpose of the relinquishment of its ownership rights by the state, and the character of the beneficiary. There were six different means individuals and institutions could acquire land and are called birta, kipat, jagir, rakam, and guthi. The remaining land not under those classifications of ownership was placed under government control and called raikar. The land area under different forms of land cultivated systems is documented in Table 3-1.

Table 3-1. Area Under Different Land Cultivation Systems (1952)

Form	Area ('000 ha.)	Percentage of Total Area
Raikar	963.5	50.0
Birta	700.0	36.3
Guthi	40.0	2.1
Kipat	77.0	4.0
Jagir, Rakam etc.	146.5	7.6
Total	1,927.0	100.0

Source: Zaman (1973).

[1]Because of the gradual transformation of the property rights, and the unavailability of the data, it is difficult to present the exact date for different reforms and changes.

Table 3-1 shows that more than 86 percent of the land was under the raikar and birta systems. The following section presents a brief description of each kind of land ownership in Nepal which will provide an in-depth understanding of the numbers and the land ownership systems mentioned in Table 3-1. The descriptions are based on studies by Regmi (1976,1978) and Zaman (1973).

Raikar Land

All the lands except birta, kipat, jagir, rakam, and guthi (discussed below) were under government control and classified as raikar land. Raikar land was, therefore, the land which the government retained its ownership and taxed the individuals who operate it. Traditionally, this kind of land was obtained by individuals in two ways. The people could reclaim and cultivate waste land and forest land. The cultivator was supposed to pay rent (tax) to the government. Secondly, even if individuals did not reclaim and cultivate land, rice land[2] in the village was distributed among the local people in that village according to family size. The lands were taken away from those who had plenty and alloted to those who had none. The basic idea of this program was to give an equal share of the land to all the families in a given area. The land obtained in this system could not be leased, inherited, or sold. Land ownership and receiving rent was not permitted in this system. Similarly, in terai people could reclaim and cultivate waste land and

---

[2]Rice land in Nepal is called khet and non-rice land is called pakho. Pakho land is unirrigated high land or hillside land in the hilly regions, including Kathmandu valley, on which only dry crops such as dry rice, maize, and millet can be grown.

forest land.[3] However, the redistribution of the cultivated land like the one discussed above was not observed in terai.

In the middle of ninteenth century, records of individual rights to land were compiled. At the same time, individual rights to land were allotted independently of the needs for subsistence. If the land was favorably located, highly fertile, or if the investment in land made it more productive, the landowner could lease the land to other people and collect the rent (or even he could sell it). In 1921, the right to sell and mortgage raikar landholdings was recognized by legislation. To end forgery and illicit practices, the transactions were be registered and attested by the government. The practice of redistribution of land became obsolete. After this land reform program, only waste land was distributed to the people who did not have enough rice lands.

Once this kind of transaction was legally allowed, the previous restriction that only allowed local residents to hold raikar lands became ineffective too. In the raikar land, the begining of abseentee landownership could be seen. But there was still one limitation on the development of full property rights to land. Even with all these new regulations, if the government wanted to acquire land for various reasons, it could acquire the land without any compensation. Under normal conditions if the landowner left the taxable land uncultivated (in otherwords if he did not let it be cultivated by others on lease) the government could take the land and

---

[3]Even Indians were invited and encouraged to cultivate forest land and settle in Nepal.

give it to others. But the incentive to implement this regulation was not beneficial to the government in the latter case, because the government did not lose tax revenues. After the political change in 1951, the provision to acquire raikar land without compensation for government requirements and public use was eliminated. Payment was required for land acquired. Thus, the full property rights to land were guaranteed only about twenty to twenty-five years ago.

Birta Land

Land grants in favor of priests, soldiers, teachers, members of the nobility, and the royal family were a tradition in Nepal. Such grants were part of the birta system. Basically, this system was a result of religious, political, and economic considerations.

Priests and teachers (mostly religious) were considered very respected people in the society. Land grants to these people were influenced by the religious spirit. Political considerations were other important aspects of this system. The main political intention used was to please the ruling class of people and to preserve their authority. Economic considerations were another important factor in forming a judgement about land. The major source of national revenue was agriculture, extension of cultivated areas increased government revenues. Ancestors of present rulers, as well as the prime ministers of the previous regime (1845-1951) made lavish birta grants.

According to the nature of the grant, benefeciaries of this grant were very few. This type of land was generally transferable. The birta landowners were very powerful. They had some judicial and

police power. They could use the unpaid labor services from the village they lived in, and the local inhabitants were under obligation to provide it. Birta owners not only enjoyed the privilege of exemption from the government land tax (there was some birta land that was not tax exempt) but were also entitled to appropriate agricultural rents, as well as the revenue from judicial fines, market duties, and customs. In case of war and emergencies, birta owners were obligated to pay taxed and bear some of the state's expenses. In the course of time, both the privileges and the obligations were controlled and regulated.

Birta land holders had private property rights to the land. Birta owners could hold, transfer, subdivide, and mortgage their land. Even if the government taxed birta land the level of taxation was low in comparision to other types of land (discussed below) which increased it's value. Government could not acquire birta land without compensation. So this group of people had a secure agricultural income.

There were two classes of birta land. The first was the instance in which birta owners were allowed by government regulation to collect the land tax (and the rent in raikar land where the state is the landowner). In this case, the landowner's income was approximately equivalent to the land tax on the raikar land. This was completely abolished in 1959 and compensation was given to the landowners depending upon total output of the land. In the other class of birta land, either the landowner appropriated rents (share or fixed lease) from tenants under mutual contract or they cultivate

their land by themselves. In this kind of land system, landowners could retain their land but the land was taxed as in the raikar land. Rights of transferability and inheritability applied to some of the birta, but most were granted to the recipients only during their lifetime. The birta system was terminated in 1959. However, the birta land of the later class were converted into taxable (raiker) land.

Kipat

This system has a historical origin. When the country was being unified by a King of western Nepal in late eighteenth century, the area ruled by these ethnic groups were incorporated in the country through the mutual agreement and not by war. Under this agreement, the chieftains or the rulers in the area were given full privilage to their land. Thus, under this system, the land was given to a certain ethnic group only. In general, this group did not have the privilege of owning birta land. One of the forms of this system is described as follows. A kipat owner derived his rights by virtue of his membership in the social unit. Hence, the title of the land is communal. A chief for example, may be the custodian of the land, but he is not its owner. The normal unit of land ownership was generally the extended family group and once the land was granted to such a group, it remained its property. In theory, land may be pledged and redeemed, but only in a manner such that it shall not be permanently lost.

Although the land was held on a communal basis, the cultivation was done on an individual basis, and if the tenant ceased to exercise

his or her right to own and cultivate the land, this vacant land was reallotted by the village headman to another member of the same community. Government did not have any role in this reallocation. The land cultivatied wasted or forest under the kipat system was not available for birta grants. Generally, there was no taxation in this system. However, these privileged ethnic groups invited people from other ethnic group in their community, and a substantial part of land was given to these people. The area under this system declined, and in 1886, government issued legislation prescribing that all kipat lands that had been or might be sold or otherwise transferred to non-members of the system would be converted into taxable land (raiker).

In 1968, this system was also eliminated. Kipat lands were treated as raikar land from then onwards.

Jagir Land

Revenues from lands in some places in the country were assigned as emoluments to government employees and functionaries. In the beginning of this section, we explained that the raikar lands were owned by government. The revenues to the government were the share of the output produced, and was assesed in kind. Because of the imperfect market in output and because of the eneormous problems in transportation, communication, and storage, revenue collection was very difficult. To lessen these kinds of problems, the government assigned lands to its employees as their emoluments and was called the jagir system. The rest of the land from which the government collected revenue was called jagera. Thus, the raikar land and this

system were not mutually exclusive. The sum of jagir and jagera lands constituted the total raikar land of the state.

In this system, the employees of the government office not only worked in the offices but also acted as tax collection agents on behalf of the government. The land assigned to the employee was only for the period he remained in the service of the government. The land was not private property. The form and level of rent payments by the cultivators to the employees were annually revised and were fixed by the government according to tax-assessment records. In 1951, this system was abolished formally by legislation and the land under this jagir system, was returned to government control again.

Rakam

For one group of the people who were assigned raikar lands (and also jagir and guthi lands, (see below), the households were required to provide unpaid labor on a compulsory basis to the government. So the peasants in this system, paid taxes to the government and also provided labor services. This system was called rakam and was limited particularly to the Kathmandu valley. The government tried to abolish this system in the early 1950s but was not completely successful. However, legislation in 1963 abolished this system completely, and the land tax system was established according to the raikar system.

Guthi

Guthi was a kind of charitable landownership system. In this system, the state or birta owners endowed lands for the establishment or maintenance of public enterprises like temples, schools,

hospitals, monastries, etc..

There were also different forms of the guthi system in Nepal. The rulers or the government did not interfere with social and religious activities in the country, but the land in this system was confiscated in cases involving violation of stipulated charitable and religious functions. Revenue did not go to the state, but to the charitable institutions. The amount of land covered by this system is substantial (2%) and the system continues presently.

Thus, it was seen that there were different types of landownership systems in Nepal. In an effort to achieve uniformity in the land tenure system, birta, rakam, jagir, and kipat land were converted into raikar in 1950s and 1960s. The only other system which still continues is the guthi system which is related to the religious activities.

3.2 Landownership System and Tenancy

Different landownership systems were reviewed in the last section. These different land ownership types may be one of the probable reasons for the emergence of the tenancy system in Nepal. First of all, by nature of the land ownership type, many beneficiaries of the land grant systems (as for example birta, jagir, rakam, etc.) normally had land areas larger than they could cultivate personally.[4] Secondly, before the middle of the ninteenth century, lands were taken away from those who had plenty and alloted to those who had none. The system became obsolete around the middle of the

---

[4]Exact statistics are not known, but evidence reported in Regmi (1976, 1978) supports our statement.

ninteenth century. Individual rights in raikar land were established. This provide an incentive to individuals to accumulate land. Another regulation in 1934 provided other opportunities to accumulate land. Under this regulation, any individual could offer to reclaim virgin, waste, or forest lands that were situated in a place distant from the their settled area. Laborers could be brought in from India also. This reclaimed land was inheritable and secured from arbitrary eviction. Similarly, in some places if an individual could reclaim waste land that could generate a revenue of at least Rs. 100[5]per year, they were given official status as well as the right to exact unpaid labor. Thus, both of these factors, individual rights in raikar land as well as the new regulation encouraged individuals to accumulate land.

Thirdly, although statistics are not available, the malaria problem in terai contributed to low population density until around the mid fifties of this century. Indians were allowed to come in and cultivate land in the terai and some of them were also appointed as the tax collection functionaires. Those functionaires were called jimidars.[6] The privilaged jimidars also accumulated land to a large extent. Thus the land grants by the government, incentive to cultivate forests and virgin lands to Indians in terai the evolution of property rights to land, and non-existence of manufacturing and

---

[5]The exchange rate for 1934 is not available. The exchange rate in 1971 was US $ 1 = Rs. 7.00.

[6]Jimidar is a term used to indicate a landlord whose rights "extended over lands occupied by a number of persons" (Regmi, 1976; p. 106).

industrial activities also encouraged people to accumulate land.

It is clear that a landowner who was able to accumulate an area larger than he could cultivate personally, had the option either to appoint tenants for this purpose or employ hired labor. In the presence of high searching cost and enforcement cost of hired labor, probably tenancy was the only alternative.

Although tenancy problems in Nepal are discussed in the literature (Regmi, 1976, 1978; Zaman, 1973), none of the studies have provided any statistics relating to the extent of tenancy in the country. The only available statistics, which give the percentage of total area cultivated by different form of tenants for 1961, are reported in Table 3-2.

Table 3-2. Total Cultivated Area and Percentage Cultivated by Tenants According to the Region (1961).

Region	Total Cultivated Area ('000 ha.)	Total Cultivated Area by Tenants ('000 ha.)	Percentage of Total Cultivated by Tenants
Hills	41.82	7.00	16.74
Terai	102.89	33.13	32.20
Total	144.71	40.13	27.73

Source: Zaman (1973).

Statistics in Table 3-2 indicate that tenancy accounted for about 28 percent of the total cultivated area. According to a government survey, these statistics fell to 24 percent in 1972 (Zaman, 1973). However, even with the given statistics, tenancy is still a significant feature of the agrarian structure in Nepal. Significant variations in the incidence of tenancy was also observed

between the regions.

3.3 Land Reform

Above discussions indicate that in 1951, a large percentage (exact figure is not known, but for 1961 see Table 3-2) of the total cultivated land was under tenancy. The new government formed in 1951 blamed the previous regime for encouraging social and economic differentiation in the agrarian community. There was a trend toward the concentration of landownership and toward absentee landownership. The new government also blamed the previous government for failing to protect the rights and interests of those who worked on the land. Thus, the new government, with the directive principles of social and economic justice and a higher standard of living for the people, introduced different land reform programs in the country. The most crucial land-reform program was introduced in 1964. One of the basic objectives of the land-reform program was to remodel agrarian relations and mobilize capital from agriculture. Ceilings were also imposed on both landownership and tenancy holdings aiming at 'equitable' distribution of cultivated land. Tenancy security and rent control, were other main objectives of the land reform

Table 3-3. Ceilings on Land Holdings in Different Regions According to Land Use Type.

Region	Agricultural Lands (ha.)	Residential Lands (ha.)	
		Urban Area	Rural Area
Hills	4.00	0.50	0.80
Kathmandu	2.50	0.25	0.40
Terai	16.93	0.67	2.03

Source: Regmi (1976).

Ceilings on land holdings according to the 1964 reform, are illustrated in Table 3-3. Land in excess was acquired by the government (with compensation). These acquired lands were supposed to be distributed. However, only about 3 percent of the total cultivated land was found to be in excess of the ceilings.

In terms of a tenant's security, the existing tenants in 1964 or those who had raised the main crop at least once were made permanent tenants on the agricultural land they cultivated. The eviction of tenants is possible if the tenant's action is against the effort of increasing productivity of the land or if they defaulted in the payment of rents or discontinued cultivation. However, to evict the tenant, the landowner must go to the court and get an order. If the landowner wants to cultivate the land himself, wants to use the land for residential purposes (within limits), or wants to sell the land, the landlord is supposed to pay twenty-five percent of the value of the land. If the tenant dies, the tenancy rights goes to either his son or husband or wife of the tenant through the selection of the landlord.

Rent has also been controlled in connection with these reforms. In the Kathmandu valley and in some of the terai districts, rent has been fixed according to land quality. For rest of the country, half of the total annual produce of the main crop is the share for the landlord.

Previous discussions summarized the macro aspect of land tenure system. The next objective of this study is to determine how contracts differ and the reason for this difference. Primary data

were collected for the purpose of analysis. Before the analysis is carried out, the following section presents the sampling technique of data collection.

3.4 Sampling Technique

Politically, the country is divided into 75 districts. Each district, depending upon its population size and area, is further subdivided into several village panchayats.[7] Generally, a village panchayat consists of more than one village. Since the incidence of tenancy is not distributed uniformly throughout the country, probability[8] sampling of any kind may be very costly. On the other hand, the objective is not to generalize the results. This study, thus, used a purposive sampling technique. In this method, units were selected in the sample according to how typical they are of the population according to the judgement of the researcher. It was not based on the principles of the theory of probability. As a result the estimation and control of sampling errors were out of question for this study.

First, to find the concentration of the incidence of tenancy, the record prepared by the ministry of agriculture (Nepal) was utilized. Two districts, one in the hills and one in the terai,[9] where the incidence of tenancy was relatively higher, were selected

---

[7]The village panchayat is the smallest political unit of the country.

[8]Sampling methods based on the laws of probability are called probability sampling.

[9]Terai and hills differ in a great deal in terms of economic and social characterestics. Comparision of the results from the two places will be interesting.

in the first stage of sampling. The districts selected were Kavre (eastern hills) and Rupandehi (western terai). In the second stage, using the same criterion, one village from each district was selected with the help of land registration records available in the district land reform office.

The villages selected in Kavre and Rupandehi were Subba Panchayat and Dhakdhai Panchayat respectively. With the help of village panchayat officials, a sampling frame[10] stratified according to pure tenants, owner tenants, owner manager and, owner operators was made. Although it is a judgement sampling, the final stage of the sampling was almost equivalent to stratified random sampling. Since the first stage and second stage sampling were not random, we cannot estimate the sampling error of the estimates. Because of cost and time constraints 54 households were selected in Subba Panchayat and 66 households were selected in Dhakdhai Panchayat. A large scale sample survey is also not required for this kind of study which uses an inductive methodology. The sampling unit of this study is a household. Primary data were collected using a household questionnaire for the analyses of the results.

Even though the structure of the economy in both of the sample areas is totally agrarian, differences exist between the two areas. Normally, in Nepal, if we say terai, we think that it is more productive and has good irrigation facilities, high wage rates, and

---

[10]The sampling frame provides the basis for the selection and identification of the units in the sample. The sampling frame used also included a few more adjoining villages of Subba and Dhakdhai Panchayats.

so on. If we think of the hills, generally it is poor, has underdeveloped irrigation facilities, and is less productive. But the areas selected for this study are basically opposite in nature.

3.5 Survey Area

Subba Panchayat

This village panchayat is located about 20 miles east of Kathmandu. The survey was actually done in and around Subba Panchayat. Part of this panchayat is connected to Banepa, the nearest town, by an unpaved road. The highway connecting Kathmandu and the Tibetian border passes through Banepa. Since this area is in the hills, most of the land is in the form of terraces. Some of the land is also in the foot hills and the river basin and is fertile. The source of income is basically through agriculture. Those who have less land, earn a living by working as wage laborers in the village or in the town, of Banepa. Seventeen percent of the total sample households regularly generate income by selling milk due to the presence of a milk collection depot of a dairy corporation and the availability of soft loans from the government to purchase water buffaloes.

Average annual income per capita was Rs. 1468.11 The income of large farmers and landlords are distinctly higher than those of other farmers. Rice farming is very important in terms of its share in total household income. Large farms or the landlords earned a large share of income from non-farm commercial activities. Near landless

---

[11]Exchange rate U.S. $ 1.00 = Rs. 10.40 (1981).

and small sharecroppers had a very low annual average per capita income (Rs. 750) compared to owner managers and the big landlords (Rs. 2031).

Population pressure in this area is high. For the panchayat, per capita operational land holdings is 0.33 ha. (and is 0.38 ha. for the whole district). Average rice and wheat production for this panchayat is 3.9 mt.ton/ha and 1.5 mt.ton/ha respectively (compared to 2.8 mt.ton/ha and 1.2 mt.ton/ha respectively for the whole district). Of all the agricultural production, rice comprised of 32.4 percent, wheat 18.9, percent and millet, potato and oilseed 10.7 percent. Besides rice and wheat, farmers in this area grow maize, soybeans, mustard seed, sugar cane, and so on.

Rice production in this panchayat is characterized by a high level of yield corresponding to the use of high yield varieties (HYVs) and the application of fertilizers. Productivity is very high in this area. But because of low per capita availability of land and the high dependency on agriculture of the people, income per capita is low.

Dhakdhai Panchayat

Dhakdhai Panchayat was the other survey area. This panchayat is located about 150 miles southwest of Kathmandu, and is close to the Indian border. This panchayat does not have any motorable road. Bullock-cart is used for transportation purposes. It is located about two miles east of the district headquarter Bhairahawa, which is also a major market for this village.

This panchayat is in the plains or terai area of the country. But the irrigation facilities have not yet been developed in this area. In comparision to the Subba Panchayat, population density is low. For the survey area per capita land holdings is 2.28 ha. (and is 2.4 ha. for the whole district). Although the families in this area cultivate five times more land than in Subba Panchayat, productivity is low due to low usages of fertilizer and high yield varieties. The average rice and wheat production for this panchayat is 1.2 mt.ton/ha and 1.3 mt.ton/ha respectively (compared to 1.75 mt.ton/ha and 2.0 mt.ton/ha respectively for the district). Also, in this panchayat, rice is the most important crop, and its share in the total income is high. Maize, millet, potato, sugarcane, oilseed, and other crops are also grown here, but their contribution to the household income is very low.

High income is associated with the size of the farm. Landlords and owner managers normally have large land areas compared to tenants. But unlike Subba Panchayat this group of people do not engage in many off-farm activities. Off-farm employment opportunities are very limited. The wage rate was about Rs 10.00 per person per day in 1981, but in the village, the wage is given in rice rather than cash.

Although land availability is high in this area per capita, the lack of technological development, productivity, inputs, outputs, and income are low compared to Subba Panchayat. Per capita income of the households surveyed was Rs 1051.

3.6 Outputs, Inputs and Incomes

Restoration of private property rights and the land reform program in the country were briefly discussed in the previous sections. Before proceeding to any further analysis of the different agricultural organizations, one must examine the resource base of this area. Thus, this section first examines the nature, magnitudes, distributions, and use of the primary factors of production, such as labor, land, and capital, in the survey areas. We will then look at outputs and incomes of the household. All these results are reported according to region and the type of agricultural organization.

Agricultural Labor

According to the 1971 census, the population of Subba Panchayat was about 4,000. A large proportion of the population directly or indirectly depend upon agriculture. Of the 54 sample households surveyed in this area, 8 households were engaged in business. Among these 8 households, 4 generated substantial amounts of income from business. All others were directly or indirectly dependent upon agriculture. But among the 66 households surveyed in the Dhakdhai area, none were engaged in economic activities other than agriculture. In both the areas, virtually no one was engaged in mining, hunting, or fishing.

Table 3-4 shows the distribution of a sample household population according to age structure, agricultural organization types, and region. If we consider the population of ages 10 to 59 as

economically active population[12], the percentage of this population in Subba Panchayat for the sample group was 63 percent, whereas it was 68 percent for Dhakdhai Panchayat. These percentage figures are comparable with the national figures for the census 1971. In 1971, in Nepal economically active percentages of the total population for the hills and terai were 64 and 67 respectively. The percentage of young dependents was high probably because of a high birth rate.

Even though the percentage of the economically active population is not very high, the probabilities of finding temporary off-farm[13] employment is 0.55 and 0.31 in Subba and Dhakdhai Panchayats respectively. Similarly, the probability that a person is not directly involved in productive work is 0.20 and 0.37 in Subba and Dhakdhai Panchayats respectively. Thus, a significant number of man years of labor available for productive employment is available in these regions.

Land: Its Distribution and Quality

Although land is a major source of wealth for the people, it alone does not guarantee an adequate income. Size, soil quality, access to markets, skills of the people, availability of irrigation, and the climate (sufficient and timely rainfall) determine the

---

[12]As the survey was done in the rural area, people aged ten and above were observed to be engaged in one or the other form of economic activities. This is consistent with the studies (Kutcher and Scandizzo, 1981; Hayami and Kikuchi, 1981).

[13]Probability of finding temporary off-farm employment is defined as the ratio of an average annual employment per family worker outside his own farm, in man-days, to the standard availability for employment of 300 man-days a year (Kutcher and Scandizzo 1981).

Table 3-4. Distribution of Sample Household Population According to Age Structure, Agricultural Organization Types and Region (percentages in parantheses)

	Subba Panchayat			Dhakdhai Panchayat		
Age Group Tenancy Status	0-10	10-59	>59	0-10	10-59	>59
Owner						
Tenant	44(25)	121(68)	12(7)	70(28)	172(69)	8(3)
Fixed						
Renter	21(33)	37(58)	6(9)	-	-	-
Share						
Tenant	12(23)	36(71)	3(6)	22(30)	46(63)	5(7)
Owner						
Manager	88(35)	149(59)	15(6)	25(31)	55(68)	1(1)
Total	165(30)	343(63)	36(7)	117(29)	273(68)	14(3)

Source: Survey data.
- Not applicable

productivity of the land. Before we examine the quality of land we first look at the farm sizes for different classes of farmers. Table 3-5 reveals that farm sizes vary dramatically among different types of tenancy and between the regions.

Owner tenants who lease a small piece of land either in fixed-rent or in sharecropping arrangements have an average operating size of 0.39 ha. in the Subba Panchayat and 1.95 ha. in Dhakdhai Panchayat. For the pure renter and pure sharecropper, this figure is 0.21 and 0.23 for Subba Panchayat. In Dhakdhai Panchayat, a pure sharecropper has an average holding of 0.71 ha. Owner -managers normally have big parcels of land under their ownership, but the area cultivated under their management is 0.51 ha. for Subba Panchayat and 4.64 ha. for Dhakdhai Panchayat. No significant potential exists for

Table 3-5. Plotwise Distribution of Operational Landholdings According to Tenancy Status

Region Tenancy Status	Average Landholdings n	Subba Panchayat	n	Dhakdhai Panchayat
Owner Tenant	22	0.39	36	1.95
Fixed Renter	19	0.21	-	-
Share Tenant	17	0.23	15	0.71
Owner Manager	16	0.51	15	4.64
Total	74	0.33	66	2.28

Source: Survey data.
- Not applicable

expanding the area under cultivation in the Subba Panchayat and the situation is almost identical in Dhakdhai Panchayat too. Generally speaking, Dhakdhai Panchayat was inhabited very recently and had high average landholdings. Also, if we compare the average landholdings among the different tenancy classes, owner managers had the highest average landholdings compared to rest of the classes. The reason is that this class was also the landlord class.

Size is only one dimension of productive land; its quality is equally important. In both Subba and Dhakdhai Panchayats, a sales market for land is either absent or involves very high transaction costs. Hence, it is hard to capture the variations in land quality through price. The other method is to use the government categorization for tax purposes. Also this categorization is not

unbiased, because of the fact that in some cases when people think that the government is likely to get the land for its use, they tend to register their land as high quality land. In this case if the government gets their land for its use, they get a good remuneration. Secondly, in the places where the probability of land acquisition by the government is low, people tend to register their land in a low category, because then they would have to pay a lower land tax. The land quality index (LQI) used in this study is expected revenue minus non-land production costs, both on a per hectare basis. Neglecting the impact of skill in this residual, the average LQI for different tenancy statuses is given in Table 3-6.

Although it is a crude method of measuring the land quality, Table 3-6 shows that in the Subba Panchayat the average LQI for an owner manager is high compared to the other tenancy group. In Dhakdhai Panchayat, however, we have only two other categories, and here also it is seen that owner manager have slightly better quality land.

Farmers were also asked to give a subjective estimate of the value of their land. Table 3-7 reports the indicated average land value per ha. with respect to farm size class and region.

Within the region price variation is due to land quality, but the variation may also be partly due to the unreliability of subjective valuations. Price of land also depends on the location of the place and the physiological density.[14] The physiological density according

---

[14]Physiological density is defined as the population per unit of cultivated area.

Table 3-6. Tenancy Status and Average Land Quality Index by Region

Region / Tenancy Status	Subba Panchayat n	Subba Panchayat LQI	Dhakdhai Panchayat n	Dhakdhai Panchayat LQI
Owner Operator	22	33.20	36	37.6
Fixed Renter	21	26.78	-	-
Share Cropper	15	32.14	15	32.67
Owner Manager	15	48.36	15	42.52

Source: Survey data.
-Not applicable

Table 3-7. Tenancy Status and Land Value per Hectare by Region

Region / Tenancy Status	n	Land Value ('000 Rs.) Subba Panchayat	n	Dhakdhai Panchayat
Owner Tenant	22	105.0	36	16.0
Fixed Renter	19	103.0	-	-
Share Tenant	17	126.0	15	16.0
Owner Manager	16	179.0	15	20.0
Total	74	125.0	66	16.9

Source: Survey data.
-Not applicable

to the 1971 census for Subba Panchayat, was 12 persons per ha. and 4.8 persons per ha. for Dhakdhai Panchayat. Average landholdings in Dhakdhai Panchayat is high. The low price of land in Dhakdhai Panchayat is not due to its a relatively low quality in comparision to Subba Panchayat but because of low physiological density.

As a result two important conclusions can be drawn. The first is that the operating size of the owner managed category is higher

compared to the average operating size of the rest of the classes. The average operating plot size between owner operator and fixed renter (and also share lease) within the region is not statistically different. Secondly, owner managers operate on good quality land compared to rest of the classes. Although there exists a difference in LQI between fixed renter and share leaser, the difference is not much and the LQI difference between the owner operator class and the leased class is negligible. The difference in land quality among the different tenancy class will have an important implication in our analysis later on.

Capital

In Subba Panchayat, agriculture can be considered as a semi-market oriented sector. On the other hand, in Dhakdhai Panchayat, agriculture is a subsistence sector. In both places, however, use of modern agriculture equipment is limited. Everyone in Subba Panchayat rents and uses machines for threshing purposes. Four landlords in Dhakdhai have tractors and use them for land preparation, as well as for transporting goods. These equipment are a little easier to value than those embodied in land.

Average number of animals per households in Dhakdhai Panchayat is given in Table 3-8 according to tenancy status. Although structures and equipment for agricultural use are also very important capital for the farm, these items have not been reported here, because of two problems. The first is that it is hard to distinguish what portion of the structure is for agricultural use and what portion is for residential purposes, since the space is shared for both purposes in

most of the cases. The second reason is that these people did not have more equipment than the required minimum. The investment incentive is low because of low returns to capital.

In Subba Panchayat land preparation is done manually with a digging instrument called kodali (hoe). People do not keep bulls in their houses. In the season of land preperation all the people in the village are busy in their work. In this area exchanged labor is very common except in the case of big landlords. Big landlords use hired laborers to a great extent.

Table 3-8. Average Number of Agricultural Animals (only for ploughing) in Dhakdhai Panchayat According to Tenancy Status

Tenancy status	n	Average number of animals per household
Owner Tenant	22	2.0
Share Cropper	8	1.6
Fixed Renter	8	1.0
Owner Manager	16	2.0

Source: Survey data.

Only limited capital use was seen in both the places. Generally, it can be said that the farmers in all the classes did not have more equipment than the required minimum.[15]

Agricultural Products

Many types of short-cycle crops are cultivated in the sample area. Rice and wheat are the major crops grown in these areas. Rice

[15]Required minimum was not measured with any standard theoretical tools. It was observed that almost none of the household were involved in equipment renting activities. Equipment and tools in most of the were traditional.

is the principal diet in both of the places. In Subba Panchayat, wheat is grown basically in almost all the areas where the rice is grown. Water is available through springs and small streams under rain-fed conditions. In Dhakdhai Panchayat land plots are scattered in many places. Irrigation facilities are very poor, so most of the farmers in this panchayat cultivate only a single crop. In our sample, in Dhakdhai Panchayat rice is grown on 150.5 ha. in total, but wheat and other crops were grown only on 64.7 percentage of the rice cultivated area. Table 3-9 illustrates the percentage of wheat cultivated area for given rice cultivated area, according to different tenancy statuses.

Table 3-9. Wheat Cultivation as a Percentage of Rice Cultivated Area

Region	Subba Panchayat			Dhakdhai Panchayat		
Tenancy Status	n	Rice cultivated Area (ha.)	Wheat Cul. as a % of Rice Cul. Area	n	Rice Cultivated Area (ha.)	Wheat Cul. as a % of Rice Cul. Area
Owner Tenant	22	8.6	95.5	36	70.2	22.2
Fixed Renter	8	4.0	100.0	-	-	-
Share Cropper	8	3.9	98.1	15	10.7	4.7
Owner Manager	16	8.2	90.0	15	69.6	40.4
Total	54	24.7	95.0	66	150.5	29.4

Source: Survey data.
-Not applicable

Virtually every farm has a kitchen garden where vegetables are grown mostly for home consumption. Maize, millet, potato, mustard seed, etc., are some other crops grown in Subba Panchayat.

In Dhakdhai Panchayat, only about 42 percent of the total rice cultivated area was utilized for a second crop. Wheat cultivation accounted for 29 percent of the total rice cultivated land. Higher utilization was not possible for two reasons. The first reason is that on average one hectare of land is scattered in 16 different places. This is due to population pressure and land fragmantation through intergenerational transfer. Also due to the imperfect land market people can not buy or sell land whenever they desire. The second problem is that the land is dry, and irrigation facilities are limited. Even if people manage to get water to some places, its level will be low, and has to be lifted manually, which is a difficult task. Labor is also limited since owner tenants and pure tenants depend on family labor for agriculture. Use of hired labor is constrained by poverty, and the rate of return is very low because of stagnant technology.

In the hills of Nepal agricultural land is divided into two parts in terms of irrigation. Khet fields are irrigated or rainfed land, whereas bari are upland dry fields. Rice and wheat are grown on khet. Most of the other crops are grown in bari. Rice was the main crop grown in both places. The second most important crop was wheat, and the percentage of land used in wheat cultivation is increasing.

Livestock

In both areas, people raise stock of some type for the purpose of getting milk, butter, meat, manure, and power. Although specialization is not observed in stock raising, a milk collection depot in Subba Panchayat has provided much incentive to farmers to

raise water buffaloes. About 90 percent in Subba Panchayat and 75 percent of the total sampleed houses in Dhakdhai Panchayat have at least some cows and water buffaloes.

Bullocks are exclusively used for ploughing in Dhakdhai Panchayat. Almost all of the houses raise bullocks for this purpose. In Subba Panchayat, land preparation is done manually with the help of kodali and thus bullocks are not raised. Table 3-10 gives the number of livestock according to type and tenancy status.

Table 3-10. Average Number of Cattle per Households According to Types and Tenancy Status

Region	Subba Panchayat		Dhakdhai Panchayat	
Tenancy Status	Bulls/Buffalo	Cow/Buffalo	Bulls/Buffalo	Cow/Buffalo
Owner Tenant	-	3.0	2.0	2.3
Fixed Renter	-	2.0	1.0	1.0
Share Cropper	-	3.0	-	-
Owner Manager	-	2.4	2.0	3.0

Source: Survey data.
-Not applicable

Every household has goats and chickens which are raised for food. Dung from cows, waterbuffalos, and bullocks are important for fuel and manure. Calculation of the nutrient content of the different types of manure used is not possible. However, about 220 kilos of farm yard manure per hectare were used in both the places.

Agricultural Output

Per capita gross output from crops in Subba and Dhakdhai panchayats for the given tenancy category is illustrated in Table 3-11

Table 3-11. Per Capita Gross Output of Crops and Meat and Dairy Products (in Rs.) According to Tenancy Status in Subba Panchayat

Products Tenancy Status	n	Agriculture	Meat and Dairy	Total
Owner Tenant	22	663	132	795
Fixed Renter	8	363	227	590
Share Cropper	8	453	411	864
Owner Manager	16	850	154	1004
Total	54	643	194	837

Source: Survey data.

Table 3-12. Per Capita Gross Output of Crops and Meat and Dairy Products (in Rs.) According to Tenancy Status in Dhakdhai Panchayat

Products Tenancy Status	n	Agriculture	Meat and Dairy	Total
Owner Tenant	36	609	140	749
Fixed Renter	-	-	-	-
Share Cropper	15	89	105	194
Owner Manager	15	2648	207	2855
Total	66	954	147	1101

Source: Survey data.
-Not applicable

and 3-12. The tables also provide an estimation of meat and dairy production per capita in the area.

Per capita gross output is high in Subba Panchayat even if the land holding size is small here. Most of the dairy products in the classes other than owner manager class are sold in the market in Subba Panchayat. Almost all meat and dairy products of the owner manager classes are consumed in their homes. In the owner tenant class, about 20 percent of the total meat and dairy products are consumed at home. This figure is about 5 to 10 percent of the pure renter classes. In Dhakdhai Panchayat, all the products are used mostly for household consumption purposes. Access to market was limited in this area. In general, agricultural products clearly dominate the agricultural incomes in all classes in both places.

As far as the gross output of principal crop is concerned, it has been reported in Table 3-13. In both sample areas, rice is the predominant crop. Productivity of both rice and wheat was higher in Subba Panchayat compared to Dhakdhai Panchayat. Higher inputs per unit of land (discussed below in Table 3-15) may be the primary reason for this higher productivity in Subba Panchayat.

These productivity statistics provide a first insight into the stagnation and low productivity of Dhakdhai Panchayat agriculture. In this panchayat because of relatively low physiological density and technological stagnation, use of hired labor was low in owner manager class. As a result owner manager class is not very different from the owner tenant class in terms of productivity. In both areas all the crops are mostly subsistence. These crops are either for consumption

Table 3-13. Plotwise Average per Hectare Yields of Principal Crops (1981) by Tenancy Status and Region

Region / Tenancy Status	Subba Panchayat n	Rice (kg)	Wheat (kg)	Dhakdhai Panchayat n	Rice (kg)	Wheat (kg)
Owner Tenant	22	3771	1310	36	1194	1689
Fixed Renter	17	3863	1634	-	-	-
Share Cropper	19	3747	1317	15	924	555
Owner Manager	16	4321	1930	15	1327	1119
Total	74	3905 (2704)	1520 (1910)	66	1162 (2020)	1302 (1120)

Note: The numbers in the parentheses represent the regional average figures.
Source: Survey data.
-Not applicable

purposes or for the local markets.

Inputs and Costs

Measurement of production costs is very complicated. Most of the input costs are of the non-market variety. Many inputs are just the byproducts of different farm activities (seed and manure are produced on the farm, and so on). Exchanged labor and hired labor are paid in kind and with foodstuffs and so on. Bullocks in the terai are used for ploughing purposes, as well as for pulling the bullock-cart. In this kind of situation it is difficult to quantify all kinds of production inputs. Table 3-14 illustrates the composition of purchased agricultural inputs per hectare by region and by tenancy status.

The expenditures on insecticides and pesticides are extremely low. The calculation of labor expenditure is done for the hired labor only. In the Subba Panchayat, use of hired labor is greater although

Table 3-14. Agricultural Purchased Inputs According to Tenancy Status and Region

Region / Tenancy Status	Subba Panchayat		Dhakdhai Panchayat	
	Wage labor(Rs.)	Purchased inputs (Rs.) (fertilizer)	Wage labor(Rs.)	Purchased inputs (Rs.) (fertilizer)
Owner Tenant	1080	1581	434	135
Fixed Renter	1077	815	-	-
Share Tenant	1089	845	25	9
Owner Manager	2305	1251	848	338

-Not applicable
Source: Survey data.

average landholding was lower. Hired labor input per hectare in Subba Panchayat was high. Corresponding figures were very low in Dhakdhai Panchayat.

Similarly, average fertilizer input in Dhakdhai Panchayat is extremely low compared to the Subba Panchayat. Demand of chemical fertilizer depends on the land area under irrigation, use of high yield varieties and fertilizer-to-price ratio. In Dhakdhai Panchayat the land area under irrigation is small. Similarly, the use of high yield varieties is low in this panchayat. This may be the reason of low fertilizer use in Dhakdhai Panchayat.

Agricultural Incomes

The distribution of income is a major concern in the national economy. The majority of the people in rural areas are poor. People were engaged in agricultural as well as non-agricultural income earning activities in both of the surveyed areas. In Subba Panchayat, the rich (especially landlords) were engaged in different commercial activities because of market access. But in Dhakdhai Panchayat, these

kinds of activities were extremely limited for the landlords due to limited market facilities. Poor people in this area were involved in wage earning activities in and around their village. Agricultural incomes as well as non-agricultural incomes were calculated for the people in both regions according to tenancy status again and these are reported in Table 3-15 below.

Income is measured as the gross value of crop and livestock production plus receipts from land rentals less expenditures for purchased inputs and hired labor. For sharecroppers (or renters), income is the value of their share of the product plus other food stuff produced on the plot and consumed or sold by the sharecropper's

Table 3-15. Household Average Farm and Non-farm Incomes by Type of Agent and Region (Rs.)

Region	Subba Panchayat			Dhakdhai Panchayat		
Tenancy Status	Farm ('000)	Non-farm ('000)	Per capita	Farm ('000)	Non-farm ('000)	Per capita
Owner Tenant	5.3	3.0	988	4.2	2.1	875
Fixed Renter	2.9	2.2	750	-	-	-
Share Tenant	2.9	2.5	1059	0.7	2.8	361
Owner Manager	13.6	18.9	2031	14.3	1.0	2887
Total			1468			1051

Source: Survey data.
-Not applicable

(renter's) family less the cost of inputs purchased by the sharecropper (renter). Non-farm income is also reported in Table 3-15. Non-farm income is mostly from wage income, services and business. In Dhakdhai Panchayat, landownership appears to be the

single most important factor in assuring an adequate income. In Subba Panchayat, however, the landlords were also engaged in non-farm earning activities. But even then income is highly correlated with land holding size.

Non-agricultural income for the owner manager class in Subba Panchayat is basically from business. For other classes in this area non-farm income comes from wage labor. In Dhakdhai Panchayat, the non-agricultural income is basically from wage earnings. Landlords are not engaged in other non-farm activities; their sole income is from land.

Thus, income is associated with land holdings. Non-farm income was higher for landlords in Subba Panchayat, as opposed to the pure tenants in Dhakdhai Panchayat. Per capita total income was substantially higher for landlord classes in both the places.

3.7 Farm Types and Factor Shares of Rice Output

Previous sections reported the general background of the survey area as well as the different economic characteristics of the different tenancy statuses. The issues discussed were the resource base (land, labor, and capital) of the area, inputs, agricultural products, other outputs, employment, and agricultural and non-agricultural incomes for different types of agricultural organizations.

High population pressure in a low resource base seems to be the major problem in these villages. Although there was seen some technological progress in Subba village, it seems to have been offset by population growth. However, in Dhakdhai Panchayat, per capita land

cultivated was high, although it was technologically, a stagnant village. Off-farm income opportunities were limited and income of the tenant class was low. The income gap between tenants and landlords was high. The situation resulted in poverty and a skewed income distribution.

In this section, the production pattern of rice will be examined in greater detail. A Cobb-Douglas production function will be used to examine the contribution of land quality relative to farm-size in rice production. The same type of production function will also be used to find out the factor shares of rice output.

Farm Size, Land Quality, and Productivity

One of the widely observed phenomenon in developing countries is the inverse relation between farm size and output per hectare (Sen 1964, Roumasset 1976, Kutcher and Scandizzo 1981, Hayami and Kikuchi 1981, Deolalikar 1981, etc.). According to Sen (1964), the shadow wage of family labor is low (in a labor surplus economy) and the market wage is high in a labor surplus economy. In general, small farmers use a greater proportion of family laborers and the large farms use a greater proportion of hired laborers. Thus, small family farms will be farmed more intensively, resulting in an inverse relation between farm size and output per unit of land. Another explanation for the same phenomenon is given by Roumasset (1976). The explanation of the inverse relationship between farm size and yield per hectare is the inverse relationship between farm size and land quality. It could be that small farms have good quality land, and they produce higher per hectare yields given the same intensity of

cultivation. Also better quality lands tend to be farmed more intensively, especially with regard to labor inputs. But both schools support the inverse relationship between farm size and output per hectare.

Another obvious expectation about productivity is that the yields per hectare increase with land quality. This land quality, of course, may be the natural quality of land or it may be because of a higher level of agricultural technology. Land quality was captured in the analysis through our definition of a land quality index (LQI).

To examine the relationship between yield per hectare, land quality, and farm size, we use the following Cobb-Douglas model was used

$$(3.1) \quad Q = CA^{\beta_1}L^{\beta_2}$$

Log-linear transformation of this production function with an error term gives

$$(3.2) \quad \log Q = \log C + \beta_1 \log A + \beta_2 \log L + \varepsilon$$

where,

Q = Gross rice output per ha. (kg)

A = Farm size (gross rice cropped area in ha.)

L = Land quality index

β_1 = Output elasticity of farm size

β_2 = Output elasticity of land quality index

The equation will be estimated by the method of ordinary least squares for all the agricultural organization types and according to the region. The estimated parameters are given in Table 3-16 and Table 3-17.

The results reported in Table 3-16 for Subba Panchayat shows that LQI has a positive significant effect on the output per hectare (except for the pure tenant case). On the other hand, farm size generally does not have a significant effect on the gross output per hectare. Here also the exception is the pure tenant class. The output elasticity of farm size is significant in this class. Similar results for Dhakdhai Panchayat are shown in Table 3-17. In Dhakdhai Panchayat, LQI is significant in all cases including pure tenant. The results also indicate that at least for this sample, farm size, even though it was inversely related with the output per hectare, is not statistically significant in most of the cases.

The main objective of the regressions were to examine the relationship between yield per hetare, land quality, and farm size. In this section a crude relationship between the land quality index and the output per hectare was established. This land quality index is dependent upon so many other variables for example, the soil fertility, fertilizer, capital, farm size, etc.. Thus, to see the factor shares of rice output with respect to effective farm size,

Table 3-16. Relation Between Gross Output per Hectare, Farm Size and Land Quality Index for Subba Panchayat (log linear relations)

coefficients / Farm Type	n	constant	Elasticities LQI	Farm Size	R^2
Owner Tenant	22	7.32*	0.298*	0.075	0.58
		(36.15)*	(5.11)*	(0.99)	
Pure Tenant	16	7.36*	0.074	-0.453*	0.35
		(11.27)*	(0.37)	(-2.40)	
Owner Manager	16	5.56*	0.776*	0.604	0.96
		(31.01)	(16.67)	(0.267)	
Total	54	7.05*	0.361*	-0.024	0.42
		(32.50)	(6.04)	(-0.61)	

* significant at 1% level
t-statistics in parentheses
Source: Survey data.

Table 3-17. Relation Between Gross Output per Hectare, Farm Size and Land Quality Index for Dhakdhai Panchayat (log-linear relations)

Coefficiets / Farm Type	n	constant	Elasticities LQI	Farm Size	R^2
Owner Tenant	36	6.72*	0.114*	-0.021	0.20
		(53.89)*	(2.78)*	(-0.281)	
Pure Tenant	15	5.70*	0.363*	-0.179*	0.68
		(23.08)*	(4.59)*	(-2.54)	
Owner Manager	15	6.00*	0.331*	-0.197	0.65
		(23.13)	(4.42)	(-0.62)	
Total	66	6.48*	0.179*	-0.004	0.31
		(58.21)	(5.13)	(-0.135)	

* Significant at 1% level.
t-statistics in parentheses.
Source: Survey data.

labor, fertilizer, livestock, the Cobb-Douglas model was used for both subsamples;

$$(3.3) \quad \log Y_i = \alpha_0 + \sum_{j=1}^{n} \alpha_i \ln x_{ij} + u_i$$

where,

Y_i = total rice output for the ith farm (kg)

X_{i1} = total value of farm land ('000 Rs.)

X_{i2} = labor in man-days

X_{i3} = quantity of fertilizer used (kg)

X_{i4} = value of livestock (Rs.)

u_i = error term

Although the quantity of insecticides used, value of credit received, and value of structures and permanent land improvements are also important factors of production, these variables because of negligible use, were not taken into consideration in the production function for both of the sample area. Table 3-18, shows the effect of price (effective farm size), labor, fertilizer, and livestock on output in Subba Panchayat.[16] The coefficient of scale and R^2 has also been reported according to the type of the type of farm. Similar result for Dhakdhai Panchayat has been reported in Table 3-19.

The quantity of inputs used depend upon their shadow prices. As for example supply curve for family labor for the household that

---

[16]Here the intention is to see the factor shares of different inputs in rice production. Thus for simplicity of interpretation we use Cobb-Douglas production function.

Table 3-18 Cobb-Douglas Production Functions by Type of Farm for Subba Panchayat (log-linear relations, t-values in the paranthesis)

Variable / Type of Farm	Constant	Elasticities: Price+	Labor	Fertilizer	Livestock	Coefficient of Scale	R^2
Owner/Tenant	3.93*	0.42*	0.16	0.18	0.09	0.85**	0.89*
	(8.28)	(3.86)	(0.61)	(1.21)	(1.72)		
Tenant(pure)	4.57*	0.34	0.49	-0.02	0.07	0.95**	0.37*
	(4.66)	(0.33)	(1.58)	(-0.15)	(0.52)		
Owner Manager	2.56*	0.26	0.35	0.42**	0.16	1.18**	0.90*
	(3.86)	(1.10)	(1.26)	(1.98)	(1.04)		
Total	3.25*	0.18*	0.82*	-0.06	0.02	0.96**	0.82*
	(9.92)	(2.91)	6.93	(-0.80)	(0.42)		

* significant at 1% level of significance

** significant at 5% level of significance

\+ price is the total value of farm land and reveals the effective farm size

Source: Survey data

Table 3-19 Cobb-Douglas Production Functions by Type of Farm for Dhakdhai Panchayat (log-linear relations, t-values in the paranthesis)

Variable		Elasticities					
Type of Farm	Constant	Price+	Labor	Fertilizer	Livestock	Coefficient of Scale	R^2
Owner/Tenant	3.10*	0.21**	0.85*	---a	-0.03	0.99*	0.88*
	(8.86)	(1.90)	(9.92)		(-0.59)		
Tenant(pure)	5.70*	0.63**	0.13	---a	0.17	0.94*	0.85*
	(23.08)	(2.21)	(0.45)		(1.21)		
Owner Manager	4.01*	0.68*	0.30	0.04	0.10	1.12*	0.97*
	(7.78)	(2.65)	(1.02)	(0.51)	(0.51)		
Total	2.93*	0.16*	0.79*	---a	0.05	1.01*	0.92*
	(14.74)	(2.72)	(11.67)		(1.02)		

a. only few observations

* significant at 1% level of significance

** significant at 5% level of significance

+ price is the total value of farm land and reveals the effective farm size

Source: Survey data

hire-out labor lie well below that of wage labor (Roumasset, 1976). Similarly, different cultivators have differential access to capital and credit (Bliss and Stern, 1980; James and Roumasset, 1984). In Dhakdhai Panchayat the contribution of land in the production is higher compared to other factors. The higher contribution of land is attributed to low population density in this panchayat. Use of fertilizer was low due to the small proportion of irrigated land in this panchayat. However, the contribution of labor and fertilizer in the production is higher relative to land in Subba Panchayat. The reason for this difference is due to the higher population density and the higher proportion of irrigated land in Subba Panchayat.

R^2 turns out to be quite satisfactory in all the cases. The explanatory variables account for 82 to 90 percent of the variations (and this variation is 37 percent in one case) in logarithms of the gross value of crop output.

The same production function was used to find out the percentage contribution of each factor of production in the output for Dhakdhai Panhayat. The results have been reported in Table 3-19.

As in the Subba Panchayat, the coefficient of scale is statistically significant and reveals constant returns to scale. Thus, all types of farms taken into consideration were working close to allocative efficiency. Table 3-14 shows that use of fertilizer was very low in Dhakdhai Panchayat. Also, most of the farms were not using fertilizer at all. Thus, the only variables affecting production were effective farm size and labor. The factor share of

labor is high for this sample. The results were as expected in this kind of situation.

The R^2 is high in all cases--the explanatory variables account for 85 to 97 percent variations in logarithms of the gross value of rice output.

Uncertainty of future prices and yields, lack of resources, existence of several capital limitations, and imperfect factor markets are some of the reasons for noise in the production function, and acheivement of allocative efficiency is not expected.

Conclusions drawn in this last section are threefold. First, it can be seen that statistically all the modes of agricultural organizations were reveal constant returns to scale. Secondly, land and labor were observed to be
the most important factors of production. Thirdly, the factor share of different inputs varied among different agricultural organization types. At this point in time, it is not known if the different factor share observed among different agricultural organization types is a result of different tenancy choice or due to different production functions. This will be discussed in the following chapter.

Thus, the findings of this chapter can be summarized as follows. During earlier periods, people could obtain land in two ways. They could reclaim and cultivate any form of land or could get land under the land grant system. Although property rights were not fully guarenteed before 1951, they were established long before 1951 in the first type of land. After 1951, the land grant system was abolished

and full property rights were established.

The land grant system of the government and the emergence of property rights which provided an incentive to accumulate land were reviewed, and probable reasons for different tenancy systems were also discussed.

A major land reform program was launched in the country and land ceiling, rent control, and tenancy security were introduced in some or the other form. But the land reform program of 1964 was not very successful (Zaman, 1973).

Basically three types of tenure systems (fixed rent, sharecropping, and wage contract) exist in Nepal. Outputs, inputs, incomes, productivity, farm size, land quality, and other relevant aspects of production were discussed according to the tenancy types for both sample areas.

Average family size was relatively high as well as the percentage of dependents. The probability that a person was not directly involved in productive work was very high. The operating plot size of all the classes was low, but higher in Dhakdhai Panchayat compared to Subba Panchayat. The operating size of the owner managed category was higher compared to the average operating size of the rest of the classes. Another implication is that owner managers operate on good quality land compared to the rest of the classes. The difference in LQI between owner operator class and leased class was negligible.

Capital input was very negligible in both places. Use of fertilizer was more common in Subba Panchayat than in Dhakdhai

Panchayat.

Higher productivity in Subba Panchayat was observed. This higher productivity was attributed to the relatively easily available water and the use of fertilizers and HYVs. Because of higher physiological density and higher transaction cost of off-farm employment, the shadow price of labor will be below the wage rate for the household that hire-out labor. Due to the same reason cultivation was more intensified in Subba village Panchayat as opposed to Dhakdhai Panchayat. Low productivity, relatively larger average landholdings, and low level of agricultural support were some of the characteristics of Dhakdhai Panchayat. Intensification was constrained by higher shadow price of capital and stagnate technology.

Income was highly related to size of land holdings. Per capita total income was substantially higher for landlord classes in both of the places. The log-linear relation model to determine the impact of farm size and LQI on productivity indicated that in general, farm size does not have a significant effect on output, but the effect of LQI was highly significant and positive.

Effective farm size and labor were seen to be the two dominant inputs for rice production. Factor shares of the two input variables were high in rice production. In all cases, statistical tests on coefficient of scale reveal that there are constant returns to scale. As expected, we could not rank the efficiency of different contractual arrangements. At least, in terms of returns to scale, all contracts behave in a efficient manner.

If all the contracts are close to efficiency the next question is why we observe different contracts even in a small geographical area. In the next chapter we will therefore address the question of the differences in contracts.

CHAPTER IV

Estimation and Hypothesis Testing

In the last chapter we described the four most important characteristics of our study. First, the land ownership systems, incidence of tenancy, and the land reform program (1964) in Nepal were reviewed. Probable reasons for the emergence of the tenancy system were also discussed. Secondly, in Dhakdhai Panchayat agricultural inputs per unit of land were very low, per-household cultivated land was relatively high, and productivity was low. In Subba Panchayat, agricultural inputs per unit of land were high (use of fertilizer was high and water availability was relatively less uncertain). Average landholdings were low, but productivity was high. Thirdly, we found that in both places owner managers operate on good quality land compared to the other classes. Effective farm size and labor were the two dominant factors affecting production in the sampled area. Lastly, we applied Cobb-Douglas production functions to agricultural organizational types and the region. The percentage contributions of different factors of production were different for different agricultural organization types. But we do not know whether this is due to different tenure choice or to different resource allocations that may be endogenous to the tenure choices. It was also found that all agricultural organization types revel constant returns to scale.

The next question that is going to be discussed in this chapter is, why should we observe different contracts even in a small geographical area. What are the determinants of these contracts? These questions will be our primary concern in this chapter.

The model of our analysis was developed in Chapter II and states that contracts evolve so as to minimize agency costs. The hypothesis generated was that higher the land quality, the higher will be the degree of specialization. Specialization is also influenced by other economic variables like non-farm income, wealth index, etc. Based on the observed pattern of these variables a cohesive theoretical framework of tenure choice and specialization was formulated in Chapter II. These patterns will be further tested with multiple and multinomial probit models taking agricultural organization type as the dependent variable and the land quality index, distance of the farm from the owner's residence, non-farm income, and the wealth index as the independent variables.

Although there is a difference among fixed rent, share tenancy, and wage contracts, we do not expect much difference between fixed rent and share tenancy. The reason is that for a given technology, it is not so difficult to identify the optimum level of the tenant's input and the corresponding output level. In contrast, the cost of conversion of sharecropper to wage laborers would likely be substantial. The cost of supervising laborers in agricultural activities is usually very high, because most work in these activities is not standardized and requires personal judgments (Hayami and Kikuchi 1981). Thus the next issue examined will be the

'distance'[1] between the two pairs of contracts.

After investigating these issues, another question regarding the level of the inputs and output across different agricultural contracts will be addressed. Although the efficiency theory predicts that all contracts are efficient, we do not expect a similar input and output pattern across contracts. The review of the "inefficiency" and "efficiency" schools in section 2.4 indicates that the "inefficiency" school supports the contention that inputs and output per unit of sharecropped holdings will be lower than those owner operated holdings of the same fertility. The "efficiency" school contends that different contracts combine various agricultural inputs in various ways. The quantity of inputs used depend upon their shadow prices and the transaction costs.

Other questions that will be discussed in the last section include the effects of output and inputs on the contractual rent in the leased land and the other variables that influence the contractual rent.

Thus, in short the organization of this chapter will be as follows. First, the multinomial and multiple probit equations to estimate the model of tenure choice will be presented. The details of the probit model including testing of hypothesis will also be described in the first and second sections. The third section will

---

[1]By 'distance' we mean the statistical distance between two sets of vectors. The distance may be Hoteling distance (Anderson, 1958), or Mahalonobis distance (Saxena and Surendran, 1967). But in our study we will examine this distance by calculating the statistical distance between two populations and also by comparing the standarized regression coefficients.

compare the input and output level per hectare for the owner operated land and the leased land (in share contract) cultivated by the same farmer. The final section will present some analysis of the sharing of the inputs and output between landlords and the tenants and its change.

Before defining the explanatory variables and the endogenous variables, the nature of the models that are used in analyzing the data will be discussed. Test of goodness of fit and methods to test the coefficients of the model are also mentioned in the following section.

4.1 Econometric Models

Binary Choice Models

Suppose that a landlord has two choices. He may want to cultivate his land by himself with hired labor or he may want to lease it out to tenants. The choice of the contract may depend on several independent variables. Given the contracts and the information about the contracts, our objective is to build a model that in turn can predict the landlord's behavior. Given the set of explanatory variables this model will be able to estimate the probability that the landlord will make certain choices.

Statistically, for the measure of given attribute X, the probability that an individual drawn at random from the population will choose y can be denoted by the conditional probability P(y/X,S), where S is the set of individuals. Thus in our problem given the choice set, and the attributes X, P(y/X,S) represents the conditional probability that a landlord S will select the alternative y. This

kind of binary choice problem can be explained in terms of linear probability model.

Linear Probability Model

In the linear probability model let y denote the qualitative random variable that is 1 if the event occurs, and 0 otherwise and let x be a column vector with p explanatory variables. Thus, the regression equation for the jth observation is,

$$(5.1) \qquad y_j = \beta_1 x_{1j} + \beta_2 x_{2j} + \ldots + \beta_p x_{pj} + u_j$$

$$= \sum_{i=1}^{p} \beta_i x_{ij} + u_j$$

$$(5.2) \text{ or } \quad y_j = \beta' x_j + u_j; \text{ where } \quad x_j = (x_{1j}, x_{2j}, \ldots, x_{pj})$$

$$\beta' = (\beta_1, \beta_2, \ldots \beta_p)$$

$$E(u_j) = 0 \quad j$$

$$E(u_j u_k) = 0 \quad j=k$$

and $y_j = 0$ if the event occurs

$= 1$ if the event does not occur

The purpose of this model is to determine the probability that an individual with a given set of attributes will make one choice rather than the alternative.

Suppose that higher the value of $\beta' x_j$ greater the probability that y will be one, i.e., the relationship between $\beta' x_j$ and y_j is positive. This has been represented in Figure 4.2. Although the linear probability model can approximate the true function for the middle value of $\beta' x_j$ the approximation is poor for very large and very small values of $\beta' x_j$.

There are a number of problems in using linear probability model when the dependent variable is dichotomous. The problems vary from estimation to testing of hypothesis. Some of the problems are described in Appendix 4.

Probit Model

Because of the difficulties associated with the standard linear regression, alternative models are required. Probit and logit are the alternative models that can be used to analyze such binary data.

Our basic problem in the linear probability model is that the predictions may lie outside the unit interval (0,1). If it is possible to transform the attributes x, which may range in value over the entire line, to the values in the range (0,1), through some probability distribution, one can have a solution. The transformation should maintain monotonicity. This requirement calls for the use of cumulative distribution functions in the model. Mapping is done from the range (0,1) to the range $(-\infty,+\infty)$ through the cumulative distribution functions.

We know that the probability density function of X is

(5.3) $\quad p_j = Pr[X < x] = F(x)$

Now if we have the linear model of the form (5.2) then we can transform the model in the probability distribution function form as,

(5.4) $\quad p_j = F(\beta' x_j)$

Therefore, given the attribute x

$$(5.5) \qquad \Pr[\text{the event occurs}] = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\beta' x_j} e^{-t^2/2} dt$$

Here F is the cumulative distribution function of the standard normal distribution.

If we denote $\beta' x_j = z_j$ and then under the above assumption of standard normal variate,

Pr [event occurs] if $z_j \leq z_j^*$

Pr [event does not occur] if $z_j > z_j^*$

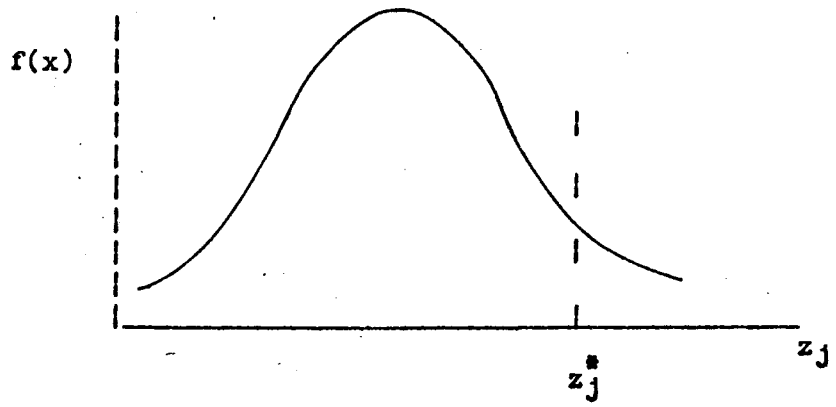


Fig. 4.1. Probability Density Function and Critical Regions for Different Events

The area under different probabilities has been illustrated in Figure 4.1. So these probabilities are the cumulative probabilities of z_j. The transformed value of z_j will be in the range (0,1), because the range of cumulative probabilities also lie in the interval (0,1).

If we take the example of tenure choice then p_j is the conditional probability that, given attribute index z_j, a farmer will be a share contractor. Once we know the value of z_j (or fix the value of z_j), then p_j is the probability that the standard normal variate will be less than or equal to z_j.

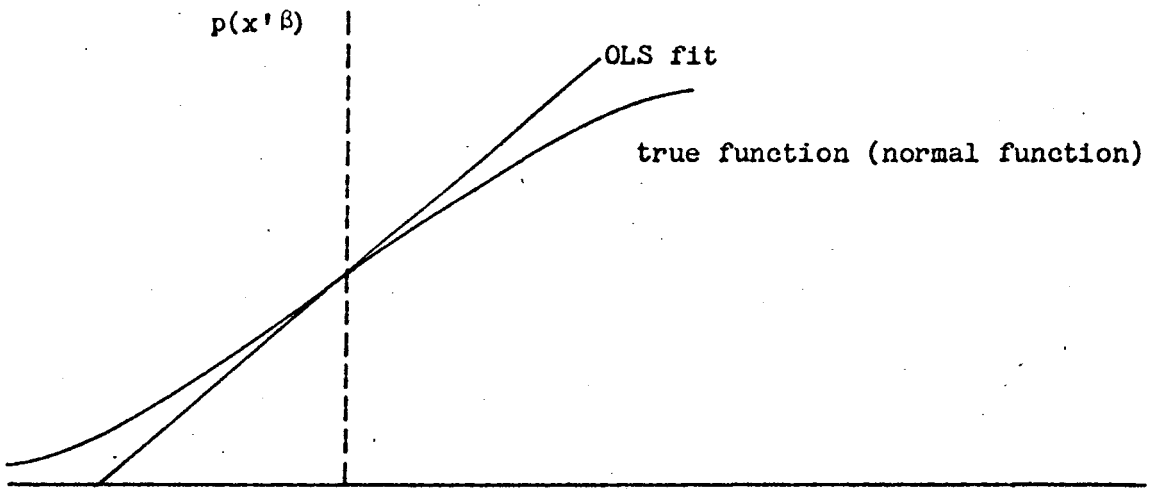


Figure 4.2. One of the Illustrations of OLS and Probit Function

Figure 4.2 gives the graph for the probit function as well as for the linear probability function. Least square estimation will have positive errors for small x_is. The predicted values are non-linear in fact and are being approximated by linear predictions.

Probit and logit models can be estimated by using maximum likelihood estimation procedure (Appendix 4). Maximum likelihood estimation provides consistent and asymptotically efficient estimation.

Testing of Hypothesis

Classical statistical tests to the estimated parameters are based on the normality assumption of the errors. Error terms are not normal (see Appendix 4), when the dependent variable is dichotomous. Another reason for not using the t-test is that the small sample properties of the variance covariance matrix are not known.

Since maximum likelihood estimation is consistent and asymptotically efficient, all parameter estimators are asymptotically normal. Thus, we can make use of the standard normal distribution to test the hypothesis regarding the coefficients. This test is analogous to the t-test. However the likelihood ratio test can be used to test the significance of all or a subset of coefficients in the logit or probit model in a small sample size. This has also been discussed in Appendix 7.

Test of Goodness of Fit

Another important aspect of the model is to measure the test of goodness of fit. R^2 is one of the statistics to measure the goodness of fit of a model. $\hat{R}^2$ in probit analysis is similar to that of the simple regression model and measures the portion of the variation in the dependent variable explained by the probit model. The coefficient of variation in the probit model is defined as

$$(5.6) \quad \hat{R}^2 = \frac{(\hat{y}_i - \hat{\bar{y}})^2}{n + (\hat{y}_i - \hat{\bar{y}})^2}$$

where n is the sample size.

This $\hat{R}^2$ is analogous to R^2 defined in OLS, which is of the form

$$(5.7) \quad R^2 = \frac{(y_i - \hat{y}_i)^2}{(y_i - \bar{y})^2}$$

In the probit model we can neither find the deviations of the dependent variable y about its mean, nor we can observe the residuals about the regression plane. Thus, R^2 in the probit model is estimated by $\hat{R}^2$ whose distribution is unknown. So inferences cannot be drawn about $\hat{R}^2$ until we know the sampling distribution of $\hat{R}^2$.

An alternative measure of the goodness of fit is the percentage of the total observation predicted correctly. So far as the prediction problem is considered the choice function $P_i(\theta, X_i)$ that could predict perfectly the choice of each observation in the data set, i.e.,

(5.8) $$P(\theta, X_i) \simeq 1 \qquad i = 1, 2, 3, \ldots\ldots, p$$

is also analogous to the multiple regression model. In other words all the observations lie on the regression plane. In the previous sections, different aspects of OLS and probit model were discussed. OLS and probit model differ in estimation procedure, in testing coefficients, in the test of goodness of fit, and interpretation. However, the possibility of comparing two models exists and can be compared by calculating the standardized coefficients for the models and is given below.

OLS vs Probit Model

In the regression model,

(5.9) $$y_j = \beta' x_j + u_j$$

$$\text{and } \frac{\partial y_j}{\partial x_j} = \beta_j$$

Thus, represents the amount of change in the observed value of the dependent variable for a unit change in the observed value of the dependent variable for a unit change in the independent variable. The coefficients would of course, change if we were to rescale the dependent variable (2, 4, 6, for example). In the probit model,

(5.10) $$p_j = F(z_j) = F(\beta_1 x_1 + \ldots + \beta_j x_j + \ldots + \beta_p x_p)$$

Therefore,

$$(5.11)\quad \frac{\partial p_j}{\partial x_j} = \frac{\partial p_j}{\partial z_j} \cdot \frac{\partial z_j}{\partial x_j} = f(z_j)\ \beta_j \qquad \text{[because } F'(z) = f(z) \text{ and } z_j = \beta_1 x_1 + \ldots + \beta_p x_p\text{]}$$

Thus the coefficient in the probit model represents the amount of change in the dependent variable on its underlying scale with a unit change in the independent variable. Change in the underlying scale is nothing but it is the change in the probability of being in a higher response category for a unit change in the independent variable. So this value is independent of the original categorization of the dependent variable. This relationship is true, because of the fact that in probit analysis, the standard error around the hypothesized regression line is set to unity and thus the coefficients bear no relation to the categorization of the dependent variable.

Thus, the coefficients in the two models cannot be compared directly. However, if we calculate the standardized coefficients namely,

$$(5.12)\quad \beta_i^* = \beta_i \frac{\sigma_{x_i}}{\sigma_y}$$

where,

σ_{x_i} = standard deviation of x_i

σ_y = standard deviation of y

then these coefficients are comparable across the models. The coefficient β_i^* now represents the number of standard deviations of

change in the dependent variable for one unit change of the standard deviation in the independent variable x_i.

In OLS, σ_y is the standard deviation of the observed value of y_is, but in the probit model this is the standard deviation of y on its underlying scale. Thus the standardized coefficients can be used across the models to compare the strengths of different variables. These were the characterestics of the binary choice models. If one has a multiple choice problem, then the binary choice model can be generalized and results can be interpreted in a similar manner. This generalized model will be used in the subsequent sections for the analysis.

Multinomial Probit and Logit

Tenure choice, which is the dependent variable in our analysis, is discrete and qualitative in nature. Hence the ordinary regression analysis is not applicable. The linear probability model[2] is the easiest one of all the models for this kind of situation but involves certain disadvantages. In this situation, where the dependent variable is categorical, one can use probit and logit models.[3] However, if the dependent variable takes more than two values, an extended binary logit and probit model (McFadden, 1974; Theil, 1969) can be used. Extended models assume categorical rather than ordinal data. These models start with the axiom which states that "the

---

[2]In the linear probability specification the dependent variable is considered as a dummy variable and the model can be viewed as the general extension of the linear regression model with dummy variables.

[3]The probit model makes use of normal distribution and the logit model makes use of the logistic distribution.

relative odds of one alternative being chosen over a second should be independent of the presence or absence of unchosen third alternatives" (McFadden, 1974, p. 109). As a result the ranking of the categories of the dependent variable does not make any difference in the analysis.[4] Thus, in these models of multiple choice, the data generates the category. For a given set of objects of choice, a sample is drawn from a sequence of independent trials, recording attributes of each individual, the set of alternatives available to him, and his actual choice.

The binary choice model can be generalized, and more detail analysis can be done, if there is a known ordering to the categories associated with the exogeneous variable. The model was developed by McKelvey and Zavoina (1975) and is called the ordinal multinomial probit model. In the regression equation (5.2) Y takes qualitative values. The model does not satisy assumptions of a linear model. The ordinal multinomial probit model assumes that Y takes discrete values due to incomplete data on the dependent variable. Thus, a distinction is made between the observed dependent variable Y and the dependent varibale of theoretical interest Z in the ordinal multinomial model. For example, suppose that a landlord faces three choices. He may want to cultivate his land by himself by wage contract or he may want to lease it out to tenants for either a share of the output or a fixed rent. In order to study the behavior of the

---

[4]Some of the examples of this type of problem can be found in McFadden (1974), Pindyck and Rubinfeld (1982), and Schmidt and Strauss (1975).

landlord, the model assumes that there is an underlying index Z_j (Z_j is the value taken by the random variable Z) for the jth landowner which measures the extent to which each tenure choice is dependent on diffferent economic environment. Further, assume that the actual observed dependent variable is $Y_j = 2$ if wage contract, 1 sharecropping, and 0 if fixed rent. Then the cutoff points z^* and z^{**} are adopted to define the relationship between observed dependent variable Y and the dependent variable of theoretical interest Z.

Z is assumed to be in the interval level and would satisfy a linear model

(5.13) $\quad Z_j = \Sigma\beta_i x_{ij} + \varepsilon_j \qquad \varepsilon \sim N(0, \sigma^2)$

Here the error term is assumed to be distributed normally with mean 0 and variance .

Z_j in (5.13) is continious and can be translated to the observed dependent variable with a certain rule. In the example of the landlord and the tenant, Z_j, the dependent variable of theoretical interest, can be translated to the observed dependent variable Y, using z^* and z^{**} as follows.

An individual will choose

(5.14) fixed rent contract $(Y_j = 0)$ if $Z_j \leq z^*$

(5.15) share contract $(Y_j = 1)$ if $z^* < Z_j < z^{**}$

(5.16) wage contract $(Y_j = 2)$ if $Z_j \leq z^{**}$

So the ordinal multinomial probit model is divided into three parts and the cutoff points are z^* and z^{**}.

Expression (5.15) can be written as,

$Y_j = 1$ if $\quad z^* \leq \beta_i x_{ij} + \varepsilon_i \leq z^{**}$ (using equation 5.13)

Since $\varepsilon \sim N(0, \sigma^2)$, the expression can be written in terms of probability as,

$$(5.17)\quad Pr(Y_j = 1) = F[(z^{**} - \Sigma\beta_i x_{ij})/\sigma\,] - F[(z^{*} - \Sigma\beta_i x_{ij})/\sigma\,]$$

where $F(z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z} e^{-t^2/2}\, dt$

and represents the probability distribution function of standard normal variate. Since any linear transformation of the scale of Y as well as of the parameters z^* and z^{**} does not change the probability distribution function in (5.17) and (5.17) can be written as

$$Pr(Y_j = 1) = F(z^{**} - \Sigma\beta_i x_{ij}) - F(z^{*} - \Sigma\beta_i x_{ij})$$

The problem is to estimate the parameters $\beta_1, \beta_2, \ldots, \beta_k$ using the likelihood function,

$$L = L(Z/\beta_1, \beta_2, \ldots, \beta_k).$$

A nonlinear maximum likelihood estimation method is used to estimate the coefficients. The method of maximum likelihood estimation calls for choosing values of parameters that will maximize the likelihood function. In other words, parameters maximize the likelihood of observing the sample that was in fact observed. Estimates of z^* and z^{**} are build up in the system.

Since maximum likelihood estimators are consistent and asymptotically efficient, all parameters estimators are asymptotically normal. This model is used to find the effect of

different independent economic variables on tenure choice. In the following section different explanatory variables will be defined and the model is used to test different hypotheses.

4.2 Tenure Choice: Econometric Estimation and Tests

In this section an ordinal multinomial probit equation will be used to estimate the model of tenancy choice. Ordinary least square estimation results are reported, and the performance of these predicting models is also discussed.

Many efforts to estimate different binary and multiple choice probit and logit models have been made by different researchers.[5] The most recent computer programming White (1978) provides the maximum likelihood estimation software for the ordinal multinomial probit model. This model, uses different economic variables to describe the individual's tenancy choices among three mutually exclusive alternatives.

Endogenous Variable

Different tenure contracts can be classified according to the extent to which factors of production--land, labor, capital and management--are provided by different economic agents. Although different types of tenancy have been classified according to specialization, the most prevalent are fixed rent, owner operated, share leased, sharecropping, and owner managed contracts. In the

---

[5]Schmidt and Strauss (1975) have used the multiple logit model to predict the occupational attainment of individuals. They used five occupations as a dependent variable but the whole set of observations was grouped. An OLS approximation was used after getting the appropriate probabilities.

Subba Panchayat area, there are basically three types of contracts: fixed rent, share leased and owner managed. However, only sharecropping and owner managed contracts were observed in the Dhakdhai area. Tenancy status is taken as a qualitative dependent variable in our model. In the case of Subba Panchayat, this qualitative variable takes three values, whereas in the case of Dhakdhai Panchayat, it takes only two.

Explanatory Variables

The explanatory variables for the model have been carefully selected. Four different exogeneous variables, described below, seem to be appropriate for the model.

The first and the most important exogeneous variable is the land quality index. Its importance in the determination of tenancy status already been discussed in Chapter II. Land quality is taken as a proxy for homogeniety of land and shirking of labor. Thus, it can be said that for a given supervision level, the profit loss associated with high quality land is higher compared to that for relatively poor quality land. So according to the principle of minimizing agency cost, good quality land is cultivated under owner management. Relatively poor quality land will be cultivated under 'fixed lease' and the medium quality will be operated under 'share tenancy'.

The second important explanatory variable for the tenure choice is the distance from the owner's residence. It has already been mentioned above that because of population pressure and low alternative employment opportunities in other economic sectors, land fragmentation through intergenerational transfer has become a serious

problem. On the other hand, land acquisition by the landlords is accomplished through different means. One of the important reasons for the fragmented holdings is that there are only a few landlords in any given village. The land market is imperfect. Most other people do not have much savings and if somebody wants to sell his land for any reason the land has to be bought by these landlords. This type of land accumulation system also accelerates the problems of monitoring and enforcement. So it is not unusual that, ceteris paribus, the landlords try to be involved only in the nearest available farm and it will then become owner managed. Share tenancy requires a certain amount of supervision and inspection by the landlord and hence, compared to lease contract, the share tenanted farm should be closer to the landlord's residence. Since the supervision and monitoring cost is lowest for leased tenancy, more remote places are found in this category.

The other important explanatory variable is that in Subba Panchayat most of the landlords were engaged in off-farm activities.[6] Non-farm activities[7] depend fundamentally on location. The Subba Panchayat, where the study was done, was on the route to many districts of the eastern part of the country. So the landlords in

---

[6]However, in Dhakdhai Panchayat landlords were not engaged in non-farm activities, at all. In this Panchayat the tenants were engaged in off-farm wage earning activities, because of low income. So the effect of non-farm income in Dhakdhai Panchayat is expected to be negative.

[7]The non-farm activities (and income) may be endogenous to the equation system and can create a simultaneous equation bias. But most of the landlords in this panchayat are not absentee landlords. Thus, in general, off-farm activities can be considered largely exogenous.

this area had been engaged in business for quite a long time. Others in the hills and in the terai, who engage in other businesses and services either have little time to work in the fields or the opportunity cost of supervision and monitoring is high. So instead of cultivating all the available land, landlords cultivate one or two parcels and lease out other parcels to the tenants. We thus, expect a positive relation between non-farm income and the ranking of our tenure choice.

Another important explanatory variable is the wealth index (or the total landholdings) of the landlord. It was seen in the previous chapters that a large percentage of land was distributed to religious leaders, soldiers, bureaucrats and so on. Some of these landowners are absentee landlords too. Typically, the size of landholdings of a member of this class are quite substantial compared to that of other classes. However, due to population pressure and imperfect land markets the landowners generally have fragmented landholdings. Basically because of land fragmentation, the landlord in order to maximize profit, try to pull resources and engage in different types of contracts including wage contracts. It also was observed that lessees normally have low incomes and small plots. Fixed renters were seen to be the poorest amongst them.

Results for Subba Panchayat

Hypothesis 1

Once the dependent and explanatory variables are specified, the next problem is the estimation of the model. Model specification was done in sections 4.1 and 4.2. The main hypothesis was that the

higher the land quality, the higher will be the degree of specialization. The testable hypothesis is that the inherent land quality is a significant determinant of organizational form. In other words, if the contracts are ranked in ascending order according to fixed rent, sharecropping, and wage contract, then the higher the value of LQI, the higher the probability of the contract choice being in a higher numbered group. In order to test this hypothesis, the multinomial probit model was used with the tenancy status as a dependent variable and land quality index as an independent variable. Results for Subba Panchayat are reported in Table 4-1.

Table 4-1. Multinomial Probit Model with Tenancy Status as a Dependent Variable and LQI as an Explanatory Variable (Subba Panchayat)

Dependent Variable	Explanatory Variable	Coefficients	z-ratio
Tenancy Status = 0 if fixed renter = 1 if share tenant =2 if owner manager	LQI	0.0581	4.08*
	Constant	-1.6500	-3.28*
$\hat{R}^2$ = 0.47	% Predicted correctly = 54		χ^2 = 21.81

* significant at 1% level of significance.
Source: Survey data.

The Chi-square test here enables us to test the hypothesis that the multiplicative coefficient for LQI is zero. We reject this hypothesis at a 1% level of significance. Fifty-four percent of the dependent variables are predicted correctly by this model. The estimated R^2 indicates that 47% of variation in the dependent

variable is explained by the independent variable in this model. The result is consistent with the hypothesis and concludes that the inherent land quality is a significant determinant of organizational form.

The ranking of the dependent variable was justified in sections 2.2.3 and 2.2.4 in Chapter II. The ranking of the dependent variable does make a difference in the coefficients. However, by the nature of the model if we reverse the ranking order we get exactly the same coefficient with a reverse sign and same $\hat{R}^2$ (Theil 1969). But if we select the rank in a random order for the same problem we get different results and the results may be insignificant too. In this kind of random order we may not get the causal relationship between the dependent variable and the exogenous variables.

Table 4-2. Multinomial Probit Model with Tenure Choice as a Dependent Variable with Different Explanatory Variables (Subba Panchayat)

Dependent variable	Explanatory Variables	Coefficients	Standardized Coefficients	z-ratio
= 0 if fixed renter	LQI	0.041	0.189	2.72*
= 1 if share tenant	Distance	-0.741	-0.101	-1.69**
= 2 if owner manager	Non-Farm Income	0.009	0.314	2.29*
	Wealth Index	0.018	0.704	2.30*

$\hat{R}^2$= 0.93 χ^2= 60.39* % predicted correctly= 78

* significant at 5% level
** significant at 10% level
Source: Survey data.

Sub-hypothesis 2:

A good deal of variance in the model is still unexplained. Although LQI might be the primary determinant of the organizational type, the agency costs of the agricultural contract may also be affected by distance of the farm from the owner's residence, non-farm income, and wealth index. We have, above, specified these variables in the context of tenure choice. It was observed that the lower the distance of the farm from the land owner's residence, the higher the non-farm income, or the wealth index of the cultivator, the higher will be the degree of specialization. Thus, our second testable sub-hypothesis is that if the contracts are ranked in ascending order according to fixed rent, sharecropping, and wage contract, then the higher the value of LQI, or non-farm income or wealth index or the lower the value of distance variable, the higher the probability of the contract choice being in a higher numbered group.

A multinomial probit model will be used to explain the possible tenure choice with the above explanatory variables. A positive impact of all the explanatory variables on the dependent variable except the distance variable is expected. The distance variable is expected to influence the tenure choice negatively. The results of the regression equation are given in Table 4-2.

A test was carried out for the null hypothesis that all the multiplicative coefficients vanish simultaneously. Also, others were carried out test the hypothesis that the individual coefficients vanish. But as in our case the dependent variable is not continuous (and does not have normally distributed disturbance terms), with the

t-test being inappropriate even in ordinary least-square estimation. Since we do not know the small-sample properties of the variance covariance matrix of the estimates,[8] the reported asymptotic t-ratio will be unable to test the coefficients. But one of the advantages of the maximum likelihood estimation is that the estimators are consistent and asymptotically efficient. Also, the estimators are normal for large samples. Thus we can make use of the z-test, analogous to the t-test for small samples. The z-test is reported in Table 4-2. All the coefficients are significant in the model. The estimated value of the coefficient of is determination is $R^2 = 0.93$. The Chi-square value, to test that all the multipicative coefficients are zero, is 60.39 and is highly significant.[9]

The ordinary least square estimation is presented in Table 4-3. Here also, the coefficients are significant at the 5% level of significance. R^2 is 0.65 and the F-value for testing the hypothesis that all the multiplicative coefficients will vanish is 22.52 and is highly significant at the 1% level.

Because of different specifications, direct comparison of estimated coefficients is not possible, even for a given set of explanatory variables. So far, as the responsiveness of the probability of different tenure choices to small changes in each of the explanatory variables is concerned, the change is nothing but the coefficients of each variable in the least square estimation. In the

---

[8]For details see Silberman and Duran (1976).

[9]As discussed in section 4.1 the Chi-square test can be used to test the significance of a subset of coefficients for small samples in the probit model.

Table 4-3. OLS Model with Tenure Choice as a Dependent Variable with Different Explanatory Variables (Subba Panchayat)

Dependent Variable	Explanatory Variables	Coefficient	Standarized Coefficient	t-ratio
Tenancy Status	LQI	0.019	0.365	3.87*
= 0 if fixed rent	Distance	-0.480	-0.271	-2.74*
= 1 if share tenancy	Non-farm Income	0.002	0.324	3.31*
= 2 if owner manager	Wealth Index	0.123	0.200	2.01*
	R^2 = 0.65		F = 22.52*	

* Significant at 5% level.
Source: Survey data.

probit model it is different and the corresponding probabilities are

$$\text{Prob(tenancy status)} = \frac{\partial P_j}{\partial x_j} = f(z_i)\beta_j$$

where f is the density function of standard normal variate.

Given the order of tenant choice, Tables 4-2 and 4-3 illustrate that the LQI has a positive significant influence on the probability of tenancy ladder for both of the models. Distance of the farm from the owner's house is also seen to be a negative significant factor on the probability of tenure choice.

Finally, non-farm income and wealth exerted a positive influence on the probability of tenure choice in both of the estimations. The results conform to hypothesis 2 described above. The strength of the model can be determined by calculating and comparing the standarized coefficients for the OLS model as well as for the probit model and is given by the relationship

$$(5.18)\quad \beta_i^* = \beta_i \frac{\sigma_{xi}}{\sigma_y}$$

where β_i is the original regression coefficient, σ_y is the standard deviation for the dependent variable, and σ_{x_i} is the standard deviation of x_i. These standardized coefficients measure the number of standard deviations of change in the dependent variable for one unit change in the standard deviation of the independent variable.

If we compare the standardized coefficients between the OLS estimate and the probit model, OLS regression analysis reveals that land quality index and non-farm income are the most important variables for tenancy choice, and that the wealth index has a very weak influence on the dependent variable. In contrast, probit analysis finds that the wealth index and non-farm income are responsible for a larger portion of the variance than the LQI and the distance variables.

$\hat{R}^2$, the measure of goodness of fit, explains a good deal of variance in probit model compared to the ordinary least square specification. The higher $\hat{R}^2$ in the probit model is not unusual because a perfect fit to a probit model would translate into a poorer fit of a linear regression model under these conditions. Thus, the prediction capability for the probit model seems to be preferable compared to the least square specification. The percentage of the correctly predicted tenure choice is 78, which is very high.

Sub-hypothesis 3

An additional advantage of our model over other efficiency models (e.g. principal-agency, positive-agency, or Stiglitz's (1974)

models) is that the statistical distance between the contracts can be estimated in the model. Moreover, after we rank different agricultural contracts in order of fixed rent, share tenancy, and wage contract, it is also possible to estimate a scale or set of scores associated with the available choices (Pindyck and Rubinfeld, 1982, p. 302.)

The classification of contracts in our model reveals that, statistically the difference between rent contract and share contract should be insignificant. There are basically two reasons for this hypothesis. First of all for a given technology, it is not so difficult to identify the optimum level of a tenant's input and the corresponding output level. As a result, the reduction of agency cost from a share to a fixed rent contract would not be large but the cost of shifting the sharecropper to wage laborers will be high. This implies that the reduction of the agency cost from wage contract to rent contract is higher than the reduction of the agency cost from wage contract to share contract and that the reduction of transaction cost from share contract to rent contract is rather low. Secondly, in Subba Panchayat, a sharecropper provides labor, management, and much of the capital. In the classification of the agricultural contracts (section 2.2.4), the fixed rent contract and the sharecropping contract where the sharecropper provides labor, management, and much of the labor, are very close to each other and lie on the lower bound of the spectrum. Thus, statistically, the fixed rent contract and the sharecropping contract should be close to each other.

In the following section, first, the statistical distance between different pairs of contracts will be estimated. Then the effect of the different variables in the choice of one contract relative to another will be examined by using OLS method.

Distance Between Contracts

If $X_1 \sim N(\mu_1, \Omega)$ and $X_2 \sim N(\mu_2, \Omega)$, then the distance between the two populations D^2 is given by (Saxena and Surendran, 1967),

$$D^2 = (X_1-X_2)'(S/n_1+n_2-2)^{-1}(X_1-X_2)$$

where X_1, X_2, and S are the unbiased estimate of μ_1, μ_2, and Ω. n_1 and n_2 represent the sample sizes for the two populations. The distance is called Mahalonobis D^2. Under null hypothesis ($\mu_1=\mu_2$),

$$\frac{n_1 n_2}{n_1+n_2} \cdot \frac{n_1+n_2-p-1}{(n_1+n_2-2)p} D^2 \sim F_{p,\ n_1+n_2-p-1}$$

D^2 for different pairs of contracts has been given in Table 4-4.

Table 4-4. Statistical Distances Between Different Pairs of Contracts (Subba Panchayat).

Contracts Pair	D^2	F
Rent, Share	0.2464	1.11
Share, Wage	1.4739	4.01*
Rent, Wage	2.3419	6.37**

* Significant at 5%
** Significant at 1%

Table 4-4 revels that the distance between rent contract and share contract is not significant. However, the analysis shows that the distance between wage contract and rent contract is significant and higher than the distance between wage contract and share

contract.

Further to examine the effect of different variables on the relative preference of one contract to another, a third sub-hypothesis is tested. The hypothesis is that the effect of LQI, 'distance' of the farm, non-farm income, and wealth index on the relative preference of wage contract to rent contract will be stronger than the effect of the same on the relative preference of share contract to rent contract.

Using the same explanatory variables as described in Table 4-3, the multinomial probit analysis was done for different pairs, but we had some problems in the estimation. If the sample size is small then convergence may often not occur. Occasionally, an apparent convergence may occur, but it will give peculiar values for the affected coefficients.[10]

---

[10]"Nonconvergence is caused in every such case by the following circumstances: Consider a binary explanatory variable and suppose that every time it takes on a particular value, say one, the dependent event occurs. The dependent event may occur when the explanatory variable is not one, but that it always occurs for the particular sample when the explanatory variable is one must adversely affect the possibility of estimating the coefficient of that variable in the probability function. This is because the sample data tell us that the probability of the dependent event must be one when the particular explanatory variable takes on the value one. Note that the probability need not, and generally will not, be one for the population as a whole, so the difficulty described is likely to occur only for small or otherwise peculiar samples. If the data tell us the probability must be one for the explanatory variable to equal one, the estimated coefficient must be $+\infty$. Such a coefficient results in a failure to converge of our gradient procedure for maximizing the likelihood function or, occasionally, an apparent convergence but with a very large number of iterations and peculiar values for the affected coefficients and the constant terms." (Nerlove and Press, 1973)

A solution can be obtained by partitioning the sample into several groups by the offending explanatory variable and to estimate the probability function conditional on the value of the offending variable for the subsample. But if the total sample size is small, we cannot follow this procedure due to the problem of nonconvergence.

We face this problem in the case of Subba Panchayat, when we attempted to fit the multinomial probit model for fixed renter, sharecropper, and the wage contractor taken in pairs. When we take them in pairs the sample size becomes small, and thus we have the problem of apparent convergence and we get unusual values for the estimates and the test.

To test the hypothesis consider three regression equations with p explanatory variables as follows;

$y_1 = X_1 \beta_1 + \mu_1$ where $y_1 = 0$ if fixed rent
1 if wage contract

$y_2 = X_2 \beta_2 + \mu_2$ $y_2 = 0$ if fixed rent
1 if share contract

$y_3 = X_3 \beta_3 + \mu_3$ $y_3 = 0$ if share contract
1 if wage contract

Statistically the hypothesis to be tested is

H0: $\beta_1 = \beta_3$

vs. H1: $\beta_1 \gg \beta_3$

(More general form of null hypothesis is H0: $\beta_1 = \beta_2 = \beta_3$
vs. H1: $\beta_1 > \beta_2 > \beta_3$)

But the statistics to test this hypothesis is not known. However, we can test

$$H01: \beta_1 = 0 \qquad H02: \beta_2 = 0 \qquad H03: \beta_3 = 0$$

$$vs.HA1: \beta_1 \neq 0 \qquad vs.HA2: \beta_2 \neq 0 \qquad vs.HA3: \beta_3 \neq 0$$

The results for model (1) and (3) are given in Table 4.5 and 4.6. We rejected the hypotheses H01 and H03, but failed to reject H02. Since $\beta_2 = 0$, and $\beta_1 \neq 0$, $\beta_3 \neq 0$, we can conclude that $\beta_1 > \beta_2$ and $\beta_3 > \beta_2$. The test statistic to test $\beta_1 > \beta_3$ is not known. But in general individual coefficients in Table 4.5 for LQI and distance variable is higher than the coefficients in Table 4.6.

Table 4-5. Results of OLS for Fixed Renter and Owner Manager (Subba Panchayat)

Dependent Variable	Explanatory Variables	Coefficients	Standardized coefficient	t-ratio
= 0 if fixed renter = 1 if owner manager	LQI	0.0110	0.380	3.93*
	Distance	-0.3200	-0.308	-2.93*
	Non-farm Income	0.0013	0.339	3.49*
	Wealth Index	0.0006	0.201	2.07**
	$R^2 = 0.76$	F = 26.9*	n = 39	

* Significant at 1% level
** Significant at 5% level
Source: Survey data.

The coefficients not only follow the ladder of tenancy in order of fixed rent, share tenancy and owner manager, but also indicate that the reduction in agency cost of a shift from a share contract to a leasehold contract is not large (in the OLS model the coefficients

Table 4-6. Results of OLS for Share Tenant and Owner Manager (Subba Panchayat)

Dependent Variable	Explanatory Variables	Coefficients	Standardized Coefficient	t-ratio
= 0 if Share Tenant = 1 if Owner Manager	LQI	0.0100	0.339	2.96*
	Distance	-0.3960	-0.314	-2.65*
	Non-farm Income	0.0015	0.407	3.38*
	Wealth Index	0.0007	0.240	2.04**
	R^2 = 0.69	F = 15.37*	n = 35	

* Significant at 1% level.
** Significant at 5% level.
Source: Survey data.

are insignificant and are not reported here). However, although the reduction of the agency cost from wage contract to share contract is large, the reduction of the agency cost from wage contract to lease contract is higher. Significant coefficients of regression equations (Tables 4-5 and 4-6) support the hypothesis.[11] The results further justify the classification of contracts provided by our model.

Results for Dhakdhai Panchayat

The OLS model for Dhakdhai Panchayat with all the explanatory variables of tenure choice is given in Table 4-7. In this case, the dependent variable is binary and takes only two values, either wage contract or share contract.

[11]Insignificant regression coefficients for the equation where the dependent variable is fixed rent and sharecropping and the results of Tables 4-5 and 4-6 accept the hypothesis. Detailed statistical analysis was not done for this purpose. There is considerable scope for further research on this issue.

Table 4-7. Results of OLS Model for Share Tenants and Owner Manager (Dhakdhai Panchayat)

Dependent Variable	Explanatory Variables	Coefficients	Standardized Coefficient	t-ratio
= 0 if share tenant = 1 if owner manager	LQI	0.0030	0.283	2.19*
	Distance	-0.0017	-0.960	0.81
	Non-farm Income	-0.0020	-0.276	-2.30*
	Wealth Index	0.0006	0.355	2.65*
	R^2 = 0.44	F = 8.40*		

* significant at 5% level.
Source: Survey data.

In Dhakdhai Panchayat, LQI and Distance seem to have very weak effects on tenancy. This result is not very unusual. As explained in Chapter III, the villages in terai are relatively new. Indians were encouraged to come and cultivate the land in this area almost freely. Some of them cultivated big parcels of land. Moreover, a large percentage of the land was given as land grants to people in various walk of life. So the whole tenancy structure is not like that of the Subba Panchayat. However, our hypothesis is still maintained to a certain extent.

Also, in Dhakdhai Panchayat we had a problem with the probit model. In this case, variables like distance of the farm from its owner's residence and the wealth index played the roles of offending explanatory variables for the convergence of maximum likelihood

estimation in the probit model. Hence, the model has been given only with two explanatory variables, namely LQI and non-farm income for the probit model.

Except for the distance variable, all other coefficients are significant at the 5% level of significance. Tables 4-8 and 4-9 are the OLS and probit estimation after we take out the two offending (in the sense of apparent convergence) explanatory variables namely distance and 'wealth index' are excluded. Standardized coefficients have also been reported in the tables.

Table 4-8. OLS Model with Tenancy Status as a Dependent Variable with Different Explanatory Variables (Dhakdhai Panchayat)

Dependent Variable	Explanatory Variables	Coefficients	Standardized Coefficients	t-ratio
= 0 if Share tenant = 1 if Owner manager	LQI	0.0098	0.410	3.21*
	Non-farm income	-0.0069	-0.356	-2.79*
	R^2= 0.32,	F= 9.9*,	n=47	

* significant at 1% level.
Source: Survey data.

The difference here compared to Subba Panchayat is that the sign of non-farm income is negative. The only source of income for the big landlords is farm income. The involvement of these people in any form of non-farm activities is almost negligible. However, the tenants, who did not have enough income from the land, were engaged in non-farm wage earning activities.

Table 4-9. Multiple Probit Model with Tenancy Status as a Dependent Variable with Different Explanatory Variables (Dhakdhai Panchayat)

Dependent Variable	Explainatory Variables	Coefficients	Standardized Coefficients	Asymptotic t-ratio
= 0 if Share tenant = 1 if Owner manager	LQI	0.042	0.484	2.65*
	Non-farm income	-0.060	-0.849	-2.50*

$\hat{R}^2$= 0.74, χ^2 = 21.25*, % predicted correctly= 84.

* significant at 1% level
Source: Survey data.

So in Dhakdhai Panchayat the impact of non-farm income is seen to be negative. R^2 is 0.44 for the OLS method. The F-test to test that all the multiplicative coefficients are zero is 8.4 and is significant at the 1% level of significance. Sub-hypothesis 3 is not feasible in Dhakdhai Panchayat, since the panchayat had only two types of agricultural contracts.

Thus, we see that in both places, LQI, distance of the farm from the owner's residence, non-farm income of the owner of the land, and the wealth index all have significant effects on tenure choice, which is compatible with our hypothesis developed in Chapter II.

Thus, in this section, we were able to rank different agricultural contracts. The determinants of contract choice are land quality, distance of the farm from owner's residence, non-farm income, and wealth index. The inference drawn from the test is that the higher the value of LQI, or non-farm income or wealth index or the lower the value of distance variable the higher will be the degree of

specialization. The conclusion is that the contracts evolve so as to minimize agency cost and supports the model developed in Chapter II.

4.3 Inputs and Output in the Sharecropped land and Owner-Operated Land.

In the previous section we found that different agricultural contracts are dependent upon different economic environments. All the agricultural contracts were close to efficiency. If this is the case, what can we predict about inputs and outputs per unit of land across different contracts? The issue of inputs and output across different contracts will be discussed in this section.

Hypothesis 4:

If we take the example of labor inputs, the efficiency school predicts that the private shadow wage for households that hire-in labor is higher than market wage and is lower for households that hire-out labor. Better quality farms will be smaller than the poorer quality land. Also, equlibrium labor intensity is higher for better quality land.

The theory of specialization and minimizing agency cost does not support the idea that the inputs and output per unit of land are equal in the owner managed class and leased (especially sharecropped) land. The reason is that different agricultural organizations have different land quality and use labor and capital inputs differently. The labor and capital inputs depend upon the land quality and the shadow price of inputs. But if we control land quality and farm size the inputs and output levels per unit of land on owned and leased plots that are cultivated by the same farmer will not be different. This is the

hypothesis that is to be tested in this section. Hotelling T^2 will be used for the test (see Appendix 4 for the description of T^2).

A number of empirical studies have been done regarding the input and output level of owner operated farm and sharecropped farms in this context. Vyas (1970), Rao(1971), Chakravarty and Rudra (1973), and Dwivedi and Rudra (1973), in general, found no difference in the input-output patterns of owner operated farms and tenant operated farms. On the other hand, Bell (1976) and Chattopadhyay (1979) have shown that the intensity and yields are higher on owned land.[12] Sharma (1983) on the basis of a survey done in Nepal conoludes that sharecropping is the second-best solution.

Left-out variables and errors in measurement are the major econometric problems in these analysis. Even if owner-operators, pure tenants and owner tenants are from the same locality, the nature of land quality, size of operational holdings and access to irrigation, etc., may be different for different farmers. Similarly, labor preferences, modern inputs, attitude toward risk aversion, and managerial abilities may also be different for different farmers.

Measures of a number of inputs, outputs, and environmental and behavioral variables are required to test different hypotheses regarding alternative theories of tenancy. However, one way to control the variations described above is to compare the difference between inputs and output per hectare on owned land and leased land operated by the same farmer. As explained in section 3.6 and

---

[12]These references are discussed in Singh (1984).

according to Table 3-6, there is not much difference in the average quality of land between the owner operated plots and leased plots for the owner tenant class.

The easiest way to compare the inputs and output is by using the Hotelling T^2. This statistic is typically used to test whether the two mean vetors are equal. Let the vector of average inputs and outpu denoted by x. Define

$$x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$$

where x_1 = seed inputs/ha. (average)

x_2 = fertilizer inputs/ha. (average)

x_3 = labor inputs/ha. (average)

x_4 = output/ha. (average)

Again let x^t and x^r denote the inputs and output vectors for the leased plots and the owner operated plots for the same group of owner-cum tenant, then our hypothesis is to test

$$(x^t - x^r) = 0$$

$$\text{vs } (x^t - x^r) \neq 0$$

The test statistic is

$$T^2 = \frac{n_1 n_2 (n_1 + n_2 - 2)}{n_1 + n_2} (x_0^1 - x_t^1)^1 w^{-1} (x_0^1 - x_t^1) \tag{5.19}$$

(5.20) where, $w = S_1 + S_2$

$$(5.21) \qquad S_1 = \begin{bmatrix} \Sigma x_{1i}^2 & \Sigma x_{1i}x_{2i} & \Sigma x_{1i}x_{3i} \\ & \Sigma x_{2i}^2 & \Sigma x_{2i}x_{3i} \\ & & \Sigma x_{3i}^2 \end{bmatrix}$$

Thus under H_0: $\dfrac{T^2}{n_1 + n_2 - 2} \cdot \dfrac{n_1 + n_2 - p - 1}{p} \sim F_{p, n_1+n_2-p-1}$

$$x^t = \begin{bmatrix} 484.4 \\ 206.9 \\ 304.3 \\ 3696.5 \end{bmatrix} \quad ; \quad x^r = \begin{bmatrix} 490.7 \\ 242.3 \\ 318.3 \\ 3683.8 \end{bmatrix}$$

$n_1 = n_2 = 22$; $p = 4$

$$\frac{T^2}{n_1 + n_2 - 2} \cdot \frac{n_1 + n_2 - p - 1}{p} \cdot \frac{0.00469}{42} \cdot \frac{39}{4} = 0.001$$

This statistics is less than 5.72 (= $F_{4,39}$) and hence is insignificant at the 1% level of significance. It conforms that statistically there is no difference in the average inputs and output of rice for owner operated plot and sharecropped plots for the same farmer in Subba Panchayat.

Similarly, under the same hypothesis for Dhakdhai Panchayat,

$$\frac{T^2}{n_1 + n_2 - 2} \cdot \frac{n_1 + n_2 - p - 1}{p} \cdot \frac{0.003378}{70} \cdot \frac{66}{5} = 0.00064$$

$F_{4,66}$ is 5.69 and hence similar results follow in Dhakdhai Panchayat.

Due to the reasons of different land quality and farm size (and other reason stated earlier in this section), we expect the inputs and output to be different in the owner managed and sharecropped plots by different farmers. Even for the same farmer, if there exists a difference in land quality between his own land and leased land, then we do not expect this kind of results.

For a given quality of land (with controlled farm size), vertical hierarchies (the use of authority, as for example the direct commands), poverty, cost sharing, and other form of incentives might be jointly responsible for reducing the differential in the inputs and the output between leased plots and owned plots.

Following this conclusion about the average inputs and output per unit of land for rice for owner operated plots and sharecropped plots for the same farmer, the hypothesis regarding the inputs will be tested. The hypothesis is that the labor requirements according to different tasks do not vary significantly among the sharecropping plots and owner operated plots operated by the same farmer.

Let x^1 be the vector of average labor inputs (in man-days) for different tasks then x^1 is defined as

$$x^1 = \begin{bmatrix} x_1^1 \\ x_1^2 \\ x_1^3 \\ x_1^4 \\ x_1^5 \end{bmatrix}$$

where, x_1^1 = Average labor inputs for land preparation

x_1^2 = Average labor inputs for plantation

x_1^3 = Average labor inputs for weeding

x_1^4 = Average labor inputs for harvesting

x_1^5 = Average labor inputs for threshing

x_0^1 = Vector of average labor inputs for rice in the owner's own land

x_b^1 = Vector of average labor inputs for rice in the sharecroped land for the same farmer

Then,

$$x_0^1 = \begin{bmatrix} 36.36 \\ 82.86 \\ 53.95 \\ 66.59 \end{bmatrix} \quad \text{and} \quad x_b^1 = \begin{bmatrix} 38.27 \\ 87.73 \\ 58.73 \\ 68.86 \end{bmatrix}$$

In Subba Panchayat, we did not consider the labor inputs for threshing in our vector, because of the use of machine threshing.

As defined above,

$$H_0 : (x_0^1 - s_t^1) = 0$$

$$\text{vs } H_1 : (x_0^1 - s_t^1) \neq 0$$

In our case $n_1 = n_2 = 22$ the number of observation in each group.

Under H_0:

$$\frac{T^2}{n_1 + n_2 - 2} \cdot \frac{n_1 + n_2 - p - 1}{p} \sim F_{p,\ n_1+n_2-p-1}; \text{ where } p = 4$$

Thus,

$$\frac{T^2}{n_1 + n_2 - 2} \cdot \frac{n_1 + n_2 - p - 1}{p} \cdot \frac{0.0008397}{42} \cdot \frac{39}{4} = 0.00019$$

This value is less than 5.76 ($= F_{4,25}$) and therefore not significant. So there is no reason to reject the null hypothesis. This finding supports the fact that statistically, there is no difference in the average per hectar labor inputs used between owned land and leased land operated by the same person.

Similar analysis done for Dhakdhai Panchayat gives,

$$y_0^1 = \begin{bmatrix} 21.14 \\ 35.78 \\ 38.53 \\ 22.81 \\ 13.03 \end{bmatrix}; \qquad y_t^1 = \begin{bmatrix} 21.86 \\ 41.33 \\ 17.64 \\ 22.89 \\ 12.33 \end{bmatrix}$$

$$\frac{T^2}{n_1 + n_2 - 2} \cdot \frac{n_1 + n_2 - p - 1}{p} \quad \frac{0.00473}{70} \cdot \frac{66}{5} = 0.00089$$

Here, $n_1 = n_2 = 36$; $p = 5$.

Again this value is less than 4.43 ($= F_{5,66}$) and is also insignificant and implies the same results as above.

Thus, this corollary hypothesis conforms that the labor utilization per unit of land for different tasks for the owner operator plot and the sharecropped plot were identical.

4.4 Contractual Rent

The precceding two sections of this chapter were concerned with the production aspect of different tenancy systems. The distributional aspect of output among different agents of the contract is another important issue of the agricultural contracts. This section, thus, examines the factors affecting landowner's share and an attempt will be made to explain the variation of the landlord's rent with respect to technology, cost sharing, and land reform legislation.

Factors Affecting Contractual Rent

a. Land Quality

The competitive theory of share contracts developed by Cheung (1969), Roumasset and James (1979), and Roumasset (1984) explains the positive association between land quality and the percentage share of the output received by the landowner. In Nepal, especially in the hills, there are many cases in which the better quality land in the village fetches a rent amounting to two-thirds of the crop (Regmi, 1978; p.14).

b. Population Density

Other evidence has been able to established a proposition that the landowner's share is related to the physiological density. Cross -section studies (Bangaladesh Rice Research Institute, 1977; Greertz 1965) as well as time series analysis (Ali, 1979; Lewis, 1971) support the proposition about the population density and the contractual rent. A higher physiological density will lead to a higher intensity per unit of land. And the higher output with respect to higher labor intensity per unit of land results in higher land owner's share (Roumasset, 1984). In Nepal, physiological density is also seen to be a major determinant of the rent. The landlord's rent varies from on third in Kailali Kanchanpur, which is the most sparsely populated area, to two-thirds in Mahottari districts, which is one of the most densely populated areas (Regmi, 1978; p.14). Competition among the tenants seems to be a great contributing factor to the variations of the output share for the landlord.

c. Cost Sharing and Technological Change

Cost sharing is another determinant of land owner's share. Heady (1947) and Johnson (1950) proposed that if input costs are shared at the same rate as output, the sharecropping arrangement can be made efficient.[13] On the other hand technological change also affects the landowner's share (Roumasset and James, 1979). For an illustration, consider a Cobb-Douglas production function

---

[13]For the review of theoretical explanations see Otsuka (1982).

(constrained to yield constant returns to scale).

(5.22) $$Q = H^{\alpha}L^{\beta}F^{1-\alpha-\beta}$$

where, Q = total output

H = land input

L = labor inputs

F = chemical fertilizer

Use of more and more fertilizer implies that the percentage share of fertilizer in the total output increases. If the fertilizer input cost were borne by the tenants, its output share should also go to the tenant.

d. Land Reform Program

In the Nepalese context there is another force that may be responsible for reducing the landlord's rent. The land reform program of 1964 intended to reduce contract rent in order to prevent exploitation of the tenant, if it existed. How great the reduction should have been is a different question. However, according to this land reform program the landowner cannot charge more than 50 percent (or the prevailing rate, whichever is lower) of the main annual crop, from the tenant. It certainly might have affected landlord's rent.

In Dhakdhai Panchayat, input costs were shared at the same rate as output before 1964. The system still continues. Since production is totally dependent on rainfall, production uncertainty is very high. Because of the irrigation problem, use of fertilizer in this area is limited. In this Panchayat, it was observed that tenants preferred sharecropping to fixed rent, probably because of low productivity and uncertainty in production.

In Subba Panchayat, however, contractual rent was affected by all the factors described above. It is difficult to separate the effect of all these independent variables. In this panchayat, probably the cost sharing and the technological aspect of the contractual rent were more important than the other factors. Share of inputs as well as output was 50/50 before the introduction of HYVs and chemical fertilizers in this panchayat. After this land-saving technological change, the total cost of the inputs were borne by the tenants. The use of more fertilizer implies that the percentage share of fertilizer in the total output increases. Thus the tenant's share of output is expected to increase after this technological change. On the other hand the higher output with respect to higher labor intensity (because of higher physiological density) per unit of land results in higher landowner's share. If the landlord's share in 1981 is lower than that in 1964, then it can be concluded that the effect of technological change and cost-sharing on landlord's share is higher than the effect of change in physiological density. In Subba Panchayat, households were asked about the inputs and output share between landlords and tenants in 1964 and 1981. To test the direction of the change in the rent and to make a judgment of "greater than" between any pair of two performances, the Wilcoxon Test statistics was used. In this test, the null hypothesis will be that the rent charged to the tenants in 1964 and 1981 do not differ. Our alternative hypothesis is that the rental charge to the tenants in 1981 is greater than that in 1964.

In the Wilcoxon matched pair rank test, we first determined the the difference between the rents for each pair of observations. If the d's are of the same size, we assigned tied cases the same rank. The rank assigned is the average of the ranks that would have been assigned if the d's had differed slightly. If there are three pairs that yield d's of +1, -1, -1, then each pair will have a rank of (1+2+3)/3 and the next d will get rank 4.

Let T be the smaller sum of like-signed ranks and N be the number of pairs in the observations. Then, z is normally distributed with zero mean and unit variance. Then under null hypothesis, for a large sample, the test statistic is,

$$(5.23) \quad z = \frac{T - \frac{N(N+1)}{4}}{\frac{N(N+1)(2N+1)}{24}} \quad [\sim N(0,1)]$$

In our case,

$T = 47.5$, $N = 23$ and $z = 2.72$

Tabulated value for N=23 is 69 for a 1% level of significance. Hence according to the rule, we reject the null hypothesis and statistically confirm that the tenant's share in 1981 is significantly greater than in 1964.

We thus conclude that a tenant's share of produce was more in 1981 than in 1964. There are basically two reasons for this conclusion. First, the HYVs and chemical fertilizer were introduced in 1964 and their costs in production were borne fully by the tenants. Secondly, the land reform law introduced in 1964 prohibited

landlords to collect more than 50 percent of the produce.

Summary

The issues analyzed in this chapter were threefold. The first issue was how the different contracts differ and why they differ. Agricultural contracts were classified according to the degree of specialization. Land quality was taken as a proxy for homogeniety of land and the propensity of shirking. The main hypothesis tested was that the higher the land quality, the higher will be the degree of specialization. Since the agricultural organizations were classified according to the degree of specialization, the first testable hypothesis was that inherent land quality is a significant determinant of organizational form. An ordinal multiple probit model was used to test this hypothesis, and the hypothesis was accepted at a very high confidence level.[14]

It was observed that besides land quality, agency cost and specialization was affected by different other explanatory variables. Inclusion of relevant variables increase the power of the test. Hence, the variables LQI, distance of the farm from the owner's residence, non-farm income, and a wealth index were regressed on tenancy choice. Contracts were ranked according to fixed rent, sharecropping, and wage contract in ascending order of magnitude. The higher the value of LQI, non-farm income, or wealth index, the higher was the probability that the contract choice would be in the

---

[14]Time series data for this kind of study is not available. However prior to 1950, it has been estimated that rent contract was more popular in less fertile land (hills) compared to more fertile land (terai) with a ratio of more than 2:1 (Zaman, 1973).

higher numbered group. As expected, the distance variable had a negative influence on the contract choice. Both the OLS model as well as the multiple probit model yielded the same results.

Once this kind of relationship between tenure choice and the explanatory variables explained above were established, our third sub-hypothesis was regarding the 'distance' between two pairs of contracts. It was explained that the reduction of agency cost of shift from a share to a fixed rent contract would not be large but that the cost will be high in converting the sharecropper to wage laborers. The distance between different pairs of contracts was estimated by using Mahalonobis D^2. Evidence confirms that the distance between fixed rent and sharecropping is insignificant, whereas the distance between wage contract and fixed rent (or sharecropping) is significant. To examine the effect of different variables on the relative preference of one contract to another contract OLS model was used. The sub-hypothesis tested was that the effet of LQI, distance of the farm from the landowner's residence, non-farm income, and the wealth index on the relative preference of wage contract will be stronger than the effect of the same on the relative preference of share contract to rent contract. There was no reason to reject the hypothesis. The results strongly support our classification of contracts.

In Dhakdhai Panchayat only two alternatives in agricultural contracts were available: sharecropping and wage contract. For the same explanatory variables, the OLS results were significant. There was no reason to reject Hypothesis 1 and sub-hypothesis 2. In this

case too, there was an apparent convergence problem in the probit model, and thus, we regressed the dependent variable only on LQI and non-farm income as the explanatory variables. The results were not different. We accepted the hypothesis.

After ranking different agricultural contracts in terms of land quality and other variables related to agency cost, our next hypothesis was that for a given land quality and farm size, the inputs and output per hectare of land on sharecropped plots will be same as that of owner operated holdings for the same farmer. Another corrollary hypothesis tested was that the labor utilization per unit of land for different tasks were same. Using Hotelling T^2 both of these hypotheses were accepted.

The third issue discussed in this chapter was the contractual rent of the tenants and the landlords. In 1964, on an average the landlord's share was about sixty-four percent. HYVs and chemical fertilizers were introduced in Subba panchayat in 1964. The full cost of the chemical fertilizer was borne by the tenants. In the same year, a land reform program was also introduced in the country that prohibited landlords from collecting more than fifty percent of the main crop in the land. Both of the forces act together and we expected the landlord's share to decrease by some percentage. The Wilcoxon test was carried out to test the hypothesis that tenant's share of produce was more in 1981 than in 1964. There was no reason to reject this hypothesis.

The analysis concludes that the degree of specialization in management distinguish agricultural contracts from one another and

help to explain the survival of organizational forms in specific activities. But, on the other hand production techniques are influenced by land quality, technology, and economic conditions. As a result the role of specialization in management will be higher in good quality land compared to lower quality land. The reason is that the production loss associated in production activities is higher in good quality land compared to relatively poor quality land. Similarly, it was observed that higher the value of non-farm income or wealth index or the lower the value of distance variable, the higher will be the degree of specialization. Empirical analyses carried out in this chapter confirm this incidence and supports the model that contracts evolve so as to minimize agency cost.

Chapter V

Summary and Conclusions

In recent years, attempts have been made to understand the role of institutions as well as the behavior of individuals and families in rural areas. Among them the theory of tenure choice has become an interesting area of study. As a result, a number of models have been developed which have led to different policy implications. The most recent approach is the modelling of these kinds of agricultural contracts using principal-agency theory and positive agency theory. Both of the theories have not adequately explained the economic organization of agriculture. Our attempt was to extend agency theory and to explore and examine the determinants of different tenancy arrangements as well as their welfare implications. Results, conclusions, and policy implications are summarized in the following section.

5.1 Summary

In Nepal, tenancy is a significant feature of the agrarian structure. A sample survey conducted by the government of Nepal shows that 28.4 percent of the cultivators were engaged in some form of tenancy (fixed rent and sharecropping) in 1972. Tenancy accounted for 24 percent of the total cultivated area in the country. For the purpose of this study, two village panchayats (Subba and Dhakdhai Panchayats from hills and terai, respectively) were selected by using

the purposive sampling technique. Fifty-four households in Subba Panchayat and 66 in Dhakdhai Panchayat were selected randomly using a sampling frame of the households in the village. A questionnaire sample survey was done in these villages for the purpose of data collection and empirical investigation.

In this study we attempted to relate different economic variables with the contract choice. The contract choice is the endogenous variable and qualitative in nature for the study. Since logit and probit models are more useful in modelling the qualitative endogenous variable, probit models were used extensively and the results were derived accordingly in the analysis. Major findings of this study were as follows.

In the earlier periods, people accumulated land in two ways. Firstly, people could get land under the land grant systems of the government. Recipients of birta land, which was one of the major land grant systems, were royal families, members of the nobility, soldiers, and priests. Most of these people lived in the cities, and these absentee landlords did not have any farming skills and also could not develop entreprenurial opportunities. This land grant system was abolished after 1951. Secondly, people could reclaim and cultivate certain kind of waste and virgin land. Even though property rights were not fully guaranteed, it was established long before 1951 in this type of reclaimed land. Emergence of full property rights also gave people incentive to accumulate land. In an agrarian economy, land was the major source of wealth and economic status for the people.

Thus, some individuals had enough land (either through government grant or through the incentive to accumulate land), but did not have enough labor, skills, and other neccesary inputs. These factors resulted in the separate ownership of the factors of production and probably became the primary reason for different tenancy systems.

Basically three types of tenure systems--fixed rent, sharecropping and wage contract--were observed in the survey area. In Subba Panchayat, all the three forms of contract were in existence, whereas in Dhakdhai Panchayat, there were only two kinds of contracts, sharecropping and wage contract.

Agricultural inputs, outputs and incomes were analyzed according to different agricultural organization types and region. According to our survey, the average household family size was about 10 and 6 in Subba Panchayat and Dhakdhai Panchayat, respectively. Average family size was relatively higher in Subba Panchayat than in Dhakdhai Panchayat. Due to high population growth rates the dependency ratio were also high.

In general, the operating plot size of all the classes was low, but higher in Dhakdhai Panchayat (2.3 ha.) compared to Subba Panchayat (0.33 ha.). Operating size of the owner managed category was higher compared to the average operating size of the remaining classes. Also the owner-manager class was operating on relatively good quality land and tenants were working on relatively poorer quality land.

Different contracts combine various agricultural inputs in various ways. The quantity of inputs used depend upon their shadow price. As for example supply curve for family labor for the household that hire-out labor lie well below that of wage labor. Similarly, different cultivators have differential access to capital and credit and face different shadow prices. Because of higher physiological density and higher transaction cost of off-farm employment, the shadow price of labor was below the wage rate in Subba Panchayat. As a result, cultivation was more intensified in Subba Panchayat. Intensification was constrained by higher shadow price of capital and stagnate technology in Dhakdhai Panchayat. Due to a lower physiological density effective farm size was the major factor of production in this panchayat. The average rice productivity was 3.91 and 1.16 metric ton per hectare in Subba Panchayat and Dhakdhai Panchayats respectively.

There was a high correlation between income and landholdings. Per capita total income was substantially higher for the owner manager class in both places. In Subba Panchayat, landlords were also engaged in non-farm, income earning activities. This was an important commercial center and on the trade route for many of the eastern districts. Thus, these landlords took advantage of this trade route. However, in Dhakdhai Panchayat, the sole income for the landlords was through farm activities. In the case of other tenants, the probability of getting work outside his/her farm was 0.55 and 0.31 in Subba and Dhakdhai Panchayat, respectively.

The log-linear model that was utilized to determine the impact of farm size on output was not significant in our sample. Another Cobb-Douglas production function was fitted with the objective of observing the factor shares of each factor of production in output. In Subba Panchayat, fertilizer contributed somewhat to production because of its easy availability. But in general, in both places, the dominant factors of production were seen to be the effective farm size and the labor. As expected, for most of the classes in Dhakdhai Panchayat, effective farm size was the major factor of production, whereas in Subba Panchayat, labor seemed to be the important factor of production. Shares of labor were 82% and 79% in the production of rice for Subba and Dhakdhai Panchayats, respectively. In both places, the coefficient of scale was seen to be statistically significant and revealed constant returns to scale. Constant returns to scale implies that for one percent increase in all resources, input responded with one percent increase in the output.

The second part of our analysis dealt with the three different issues of the contracts. First, an effort was made to explain why we observe that different contracts existed even in a small geographical area. Agricultural contracts were classified according to the degree of specialization. According to this classification in a fixed contract, most of the laborers are provided by the tenant himself and there is little or no specialization. The residual is claimed by his own labor and his own management. In the other extreme, a wage contract, which is a case of highly specialized firms, labor (and sometimes even the management) is hired from outside the firm.

Profitability of supervision and monitoring is high and the residual is claimed for the landlord's management. Share tenancy may be regarded as an intermediate arrangement, and the management and residual is shared between the landlord and the tenant. Thus, the characterization of residual claims due to specialization in management distinguish agricultural contracts from one another and help to explain the survival of organizational forms in specific activities.

On the other hand production techniques are influenced by land quality, technology, and economic conditions. The production loss associated in production activities is higher in good quality land and compared to lower quality land. As a result, wage contract is more profitable in rich quality land and fixed rent contract is more profitable in relatively poorer quality land. This incidence has been observed in different countries by a number of researchers (Roumasset, 1979; Alston and Higgs, 1982; Datta and O'Hara, 1983). The discussion generate the hypothesis that the higher the land quality, the higher will be the degree of specialization.

For testing purpose land quality is measured as the difference between expected revenue and non-land production costs, both on a per hectare basis. Land quality can be considered as the proxy for all location-specific factors which affect profitability. Different agricultural contracts can be ranked with respect to the degree of specialization. For this purpose fixed rent, sharecropping, and wage contract were ranked in ascending order with the degree of specialization. Thus, the testable hypothesis is that the inherent

land quality index is a determinant of contract choice. We had highly significant results. A criteria was developed identifying the correlation between land quality and contract choice for application to the ordinal multinomial probit model. Land quality in fact was a significant variable is selecting the agricultural contract. $\hat{R}^2$ was 0.47.

A good deal of variance was still unexplained in the first model. Inclusion of other relevant variables increase the power of the model. It was observed that the degree of specialization is affected not only by the location-specific factors but is also affected by other physical characteristics of land and economic characterestics of the cultivator. It was observed that the lower the distance of the farm from the land owner's residence or the higher the non-farm income or the wealth index of the cultivator, the higher will be the degree of specialization. Thus, the second testable sub-hypothesis is that if the contracts are ranked in ascending order according to fixed rent, sharecropping, and wage contract, then the higher the value of LQI, or non-farm income or wealth index or the lower the value of distance variable, the higher the probability of the contract choice being in a higher numbered group. All of the explanatory variables with the exception of the distance variable exerted positive significant effects on tenancy choice. As expected, distance had a significant negative impact on the dependent variable. The result implies that the responsiveness of LQI, non-farm income, and wealth index, to the tenancy status is significant and indicates that higher values of these explanatory

variables make it more likely to be in the higher numbered group. Similarly, the lower the distance of the farm from the owner's residence, the higher will be the probability that it will be in the higher numbered group. The estimated value of the coefficient of determination was high in all the cases.

Since the specification of probit and OLS models is different, standardized coefficients were used to compare the OLS and probit model. Even for the standarized coefficients, the results were similar to those explained above. $\hat{R}^2$ for the probit model was higher than the R^2 for the OLS model, and it was concluded that the probit model gave a better fit than the OLS model.

Although there is a difference between fixed rent, share tenancy, and wage contract, not much difference between fixed rent and share tenancy is exepected. The reason is that for a given technology, it is not so difficult to identify the optimum level of a tenant's input and the corresponding output level. As a result the reduction of agency cost from a share to a fixed rent contract would not be large but the cost of shirking the sharecropper to wage laborers wil be high. The distance between different pairs of contracts was estimated by using Mahalonobis D^2. Evidence confirms that the distance between fixed rent and sharecropping is insignificant, whereas the distance between wage contract and fixed rent (or sharecropping) is significant. To examine the effect of different variables on the relative preference of one contract to another contract OLS model was used. Thus, the third sub-hypothesis was that the effect of LQI, distance of the farm from the land

owner's residence, non-farm income, and the wealth index on the relative preference of wage contract to rent contract will be stronger than the effect of the same on the relative preference of share contract to rent contract.

We had the problem of apparent convergence in the probit model. The problem resulted in inflated on $\hat{R}^2$ and unusual coefficients for the explanatory variables. Thus, we used the OLS model to test this third hypothesis and the test failed to reject this hypothesis.

In Dhakdhai Panchayat, we had only two kinds of agricultural contract systems, sharecropping and wage contract. With the same explanatory variables, OLS estimation gave similar results as above. In this case too, we had an apparent convergence problem. Thus, only LQI and non-farm income were used as the explanatory variables in the final model. Both OLS and probit specification gave significant results.

Thus, the conclusion drawn was that land quality was an inherent determinant of tenure choice. Significant results imply that we cannot rank agricultural contracts in terms of efficiency, but that they can be ranked in terms of specialization.

Once we rank agricultural contracts in terms of land quality and other variables related to the specialization and, what does the model predict on the controversial issue of inputs and output per unit of land in owner-operated land and sharecropped land? The shadow wage for households that hire-in labor is higher than market wage and lower for households that hire-out labor. Thus, we expect different inputs of labor across the contracts. Also, land quality

and the farm size may result in different inputs and output per unit of land. But if land quality and farm size are controlled, use of family labor and hired labor are also controlled to certain extent. In this case we can expect the inputs and output per unit of land to be same.

The fourth hypothesis was that for a given quality of land and for the controlled farm size, the inputs and output per hectare of land on sharecropped plots will be same as those of owner-operated holdings for the same farmer. The Hotelling T^2 was used to test the hypothesis for both Subba and Dhakdhai Panchayats. Statistically, we failed to reject the hypothesis. Another sub-hypothesis tested was that the labor utilization per unit of land for different tasks would be the same for owner operated plots and sharecropped plots for the same farmer. T^2 test statistic was able to accept the hypothesis.

After establishing these results, another question posed was regarding the contract rent of the landlord (and the tenant). Variations in the landowner's share were observed between and within geographical areas of the country. Both the theory and empirical work suggest that land quality, physiological density, and cost sharing were the determinants of the contractual rent. In Subba Panchayat before the introduction of HYVs and chemical fertilizer, the landlord's share averaged to 65%. At that time, the factors of production were only land and labor (and bullock in Dhakdhai Panchayat) and there was less need of cost sharing. In 1964, introduction of the land reform program prohibited landlords from collecting more than fifty percent of the main crop in the land. In

the same year, HYVs and chemical fertilizer were introduced in the area. With this modern technology, productivity was increased at least by twenty percent. These input costs in general and fertilizer costs in particular were borne by the tenants. Thus, the increased contribution of new technology were of course captured by the tenants and not by the landlords in this particular case. Most of the landlords in Subba Panchayat were engaged in non-farm activities. These landlords did not shared cost in the production. The cost sharing pattern together with the land reform program led to decreased share for the landlord. Thus, the fifth hypothesis was to test whether the percentage rent to the tenants in 1981 was greater than that in 1964. The Wilcoxon-matched pair rank test was used to test this hypothesis. The test confirmed that the contractual share to the tenants in 1981 increased significantly.

5.2 Conclusions and Policy Implications

a. Tenure choice in the principal agency theory was classified according to the three modes of employment--wage, share, and rent. Labor-shirking and risk sharing are taken as the factors by which contracts could be distinguished in the principal agency theory. If labor and risk were the only factors in determining agricultural contracts then the rent contracts would have been a predominant agricultural contract. However, many other types of agricultural contracts can be observed even in a small geographical area.

The model used in this study is based on multiple shirking of inputs. In agriculture, factors of productions are provided by different agents. Land is provided by the principal. Labor is

provided by the tenants. As a consequence, a complete theory of agricultural contracts requires allowance for shirking of the inputs--land, capital, and management. Management therefore is considered the primary determinant of the contract in the model.

The role of management is very important in production activities. Agricultural production activities involve not only the problem of coordination of different economic agents, but also the proper management of inputs, output, and monitoring of different specialized tasks. As a result, profitability in management (and hence the specialization in management) increases relative to other inputs. Different agricultural contracts have different degrees of specialization in management. In a fixed rent contract, most of the labor is provided by the tenant himself, and there is little or no specialization. The residual, claimed by the tenant, is compensaion for nis own labor and management. At the other extreme, a wage contract, which can be characterized as a highly specialized firm, labor (and sometimes even management) is hired from outside the firm. Profitability of supervision and monitoring are high, and the residual is claimed for the landlord's management. Share tenancy may be regarded as an intermediate arrangement; both the management and the residual are shared between the landlord and the tenant.

Specialization in management is more important for good quality land than for poorer quality land. Land quality can be taken as a proxy for homogeniety of land and the propensity to shirk. Thus the profit loss associated with mismanagement in production activities is higher in good quality land compared to poorer quality land. As a

result, wage contracts are more profitable on good quality land and fixed rent contracts are more profitable on relatively lower quality land. In the same manner, medium quality land can be associated with sharecropping. This pattern was observed in the Philippines (Roumasset, 1984) and in India (Datta and O'Hara, 1983).

The hypothesis was further tested in Nepal with the dependent variable being the contract choice and land quality index as an explanatory variable. Since it was possible to rank contracts according to the degree of specialization, an ordinal multinomial probit estimation procedure was used to test the model. The ranking of the contract choice was in the ascending order of fixed rent, share cropping, and wage contract according to the degree of specialization. It was observed that the higher the land quality index,[1] the higher the probability of the contract choice being in the higher numbered group. In other words, in terms of our analysis, if the contract chosen is fixed rent (sharecropping) and on an average if the LQI is increased by one unit, then the probability that the share contract (wage contract) instead of the fixed rent contract being chosen will increase by 0.052 for Subba Panchayat. This probability was 0.042 for Dhakdhai Panchayat with both the probabilities significant at the 1% level of significance.

The theoretical model developed in this study is thus more general and complete in nature. Contracts are classified according

---

[1]All the values of the land quality index were mapped in the interval (0,100). Average land quality indexes were 27, 32, and 48 for fixed renter, sharecropper, and owner manager classes, respectively.

to the degree of specialization. The classification appears to be useful for explaining a number of systematic pattern concerning the choice of contracts. Our results confirm that the characteristics of land measured by the land quality index influences specialization. The model that contracts evolve so as to minimize agency costs is justified.

b. Specialization in management also depends on other physical characteristics of land, and the characteristics of the cultivators. It was observed that the higher the value of LQI, or non-farm income or wealth index, or the lower the value of 'distance' variable, the higher was the degree of specialization. The contracts were ranked according to fixed rent, sharecropping, and wage contract in ascending order, and it was observed that the higher the value of LQI, or non-farm income, or wealth index,or the lower the value of the 'distance' variable, the higher the probability of the contract choice being in a higher numbered group. In other words, if the contract chosen is fixed rent (sharecropping) and if on an average, the LQI is increased by one unit, then under the given conditions the share contract (wage contract) will be chosen instead of the fixed rent contract (share contract). This probability will increase by 0.041, -0.0741, 0.009 and 0.018 with respect to LQI, the 'distance' of the farm from the landlord's residence, non-farm income, and the wealth index, respectively, in Subba Panchayat. The coefficients were significant at a 1% level of significance in both cases. $\hat{R}^2$, the estimated variation in the dependent variable explained by the independent variables, was 0.93. Similar results were observed in

Dhakdhai Panchayat. The result further supports our classification of the contracts and also implies that agricultural contracts are determined by the physical and economic environment.

c. In traditional models of tenure choice (e.g. Stiglitz, 1974; Reid, 1976 etc.) the share contract was considered as an intermediate arrangement between the rent and wage contracts. However, in our model, the fixed rent contract and the sharecropping contract, where the sharecropper provides labor, management, and much of the labor, are very close to each other and have a low degree of specialization. Sharecropping is closer to the rent contract than the wage contract. Estimation of statistical distance will be helpful in further testing the classification.

It was explained in Chapter IV that the reduction in agency cost of a shift from a share contract to a leasehold contract is not expected to be large. However, the reduction of the agency cost from a wage contract to a lease contract is expected to be higher. There are basically two reasons for this difference in the agency cost. First, due to a kind of stable technology it is not very hard for the people living in the same area to identify the corresponding inputs and output level. Landlords also can detect tenant shirking by simply inspecting the share rents delivered over a period of time. Second, in the classification of agricultural firms, the fixed rent contract and the sharecropping contract where the sharecropper provides labor, management, and much of the labor, are very close to each other and lie on the lower bound of the spectrum.

Statistical distance (Mahalonobis D^2) between the contracts enables us to test the hypothesis. D^2 share and lease, wage and share, and wage and lease contracts were 0.25, 1.47, and 2.34, respectively. The last two distance figures were statistically significant. D^2 between lease contract and share contracts was not significant. The result further supports the classification of contracts in our model.

d. Another conclusion is that agricultural contracts are determined by the economic environment. The result for our sample is so strong that the significant effects of other idiosyncratic factors in contract choice are minimal.

Authors loosely classified as belonging to the "inefficiency" school argue that contracts are determined by custom (Bell, 1976), and that whatever the landlords can get from the tenants in the form of fixed rent or sharecropping is a function of their monopsony power. A test to examine this hypothesis can be arrived by regressing LQI, a 'distance' variable, non-farm income. a wealth index, and a variable that accounts for monopsony power of the landlord on the contract choice. The difference in R^2 between the two models provides the contribution of monopsony power, if any, in tenure choice. The efficiency model derived in this study serves as counterfactual for a test on any particular source of inefficiency. $\hat{R}^2$ for the model is 0.93. Thus, the contribution of a landlord's monopsony power in tenure choice is expected to be insignificant. Given a good fit for this sample and the lack of any apparant relation between the tenure choice and economic environment, we do

not expect such pursuits to be fruitful. However, it cannot be generalized without further investigation.

e. A general conclusion can be made regarding government policy distortion in existing resource allocation. It was observed that in agriculture, different models of contract choice are based on different incentive problems and are largely determined by the economic and physical environment. The incentive structures of different contracts are determined by the residual due to specialization in management and the model developed is an efficiency model. Our observations are consistent with the proposition that the forms of agricultural contracts may vary, but that they are efficient in terms of resource allocation. The organizations as they exist can thus be considered as substitutes for price mechanisms for efficient resource allocation. In many instances, government, intervenes and tries to regulate different institutions on the basis that these institutions allocate resources inefficiently. Examples are land market distortion, tenancy reform, etc. It appears that policy distortions cannot be justified by the inefficiency of indigenous institutions in terms of inefficient resource allocation.

The effect of distortions in the factor markets may have two consequences. First, distortions make the allocation of factors among sectors inefficient, and thus production will be below the maximum attainable. Consequently, a country's welfare will suffer because the product transformation curve will be inferior compared to the one obtained without distortion. Thus, depending upon the situation, the benefits to the country by relaxing the distortions

based on inefficiency may be high. Secondly, policy reform should focus on other sources of poverty. The basic causes of poverty are the scarce endowments of land and capital relative to high population pressure on small and declining resource base and low rates of return to labor due to low levels of technology. Thus, the policies should be formulated to eliminate for the growing poverty by investing in irrigation systems and developing land-saving and labor-using technologies.

f. One other implication of this study can be drawn about a land reform program. The main arguments of a land reform program can be classified under three headings in economic terms. The first basis is derived from the theory of the firm and argues "the productive superiority of an owner-operator agricultural system relative to a share tenure or even a fixed rent leasehold system of agriculture" (Ruttan, 1969). According to this concept in sharecropping, an income-maximizing tenant will allocate his labor inputs only up to the point where his share of marginal product is equated with the opportunity wage. In a fixed rent contract, the tenant will have little incentive for the maintainance of land, including soil fertility, irrigation facilities, and other durable assets attached to land. These arguments favor owner-operated agricultural production. The present study was able to test this reasoning of a land reform program. In terms of the argument that the sharecropper will allocate lower inputs compared to the owner operator, the Hotelling T^2 was used to test the hypothesis that the inputs and output levels per unit of land on owned and leased plots that are

cultivated by the same farmer will not be different. The value of the test statistics for Subba and Dhakdhai Panchayats were 0.001 and 0.00064 respectively. There was no reason to reject this hypothesis. It was argued in section 4.2 that different agricultural organizations have different land quality and use labor and capital inputs differently. Inputs depend on the farm size, land quality, and the shadow price of inputs. But if land quality and farm size are controlled, the inputs and output levels for owned and sharecropped plots should not be different.

The second economic argument for land reform program pertains to the market and monopoly power of the landlord. According to this argument, landlords determine the contractual form, and whatever the landlords can get from the tenants in the form of fixed rent or sharecropping is a function of their market power (Braverman and Stiglitz, 1982; Koo, 1982). In terms of the present analysis, first of all, it was seen that contractual choice is dependent upon different economic environments. In addition, recently it has been observed that the structure of contracts are designed so as to maximize the expected profits of the landlord, given the level of expected utility of workers. It has also been shown that there is no fundamental difference in the structure of the analysis of contracts between a competitive market and a market with single landowner (Braverman and Stiglitz, 1982). Secondly, it was also observed that the prospects for significant effects of exploitation are dim. Finally, a Wilcoxon matched pair rank test was used and it was seen that a tenant's share of produce was more in 1981 than in 1964. There

were two reasons for this outcome. First, chemical fertilizer was introduced in 1964 and its cost in production was borne fully by the tenants. Secondly, the land reform law introduced in 1964 prohibited landlords from collecting more than 50 percent of the produce. But it was not possible to separate the effect of these two factors from the rent received by the landlord from the tenant. However, evidence indicates that a landlord's rent in Nepal depends on population density, cost sharing, technology, and so on (Regmi, 1978).

The third economic argument in favor of a land reform program is the inverse relation between farm size and productivity. A few other studies (e.g., Roumasset, 1976) in different countries confirm that these small farms are of good quality land. As a result, the inverse relationship between farm size and yield per hectare is due to the inverse relationship between farm size and land quality. In commercial farms, farm size and productivity were observed to have a positive correlation. However, in Subba and Dhakdhai Panchayats the relationships were not significant. Thus, the conclusion can be drawn that the results do not seem compatible with the economic arguments favoring land reform. Several other studies (Barnum and Squire, 1979; Cheung, 1969) also support this conclusion theoretically and empirically. As a result the land reform program aimed at distributing land to the tillers may not be production efficient. Instead, competitiveness in the land market may be destroyed. In Dhakdhai Panchayat, it was observed that a substantial amount of land was uncultivated by landlords because of high agency costs (supervision and monitoring) in wage contract cultivation and

the problems associated with the land reform program in other forms of contracts. Similarly, a ceiling on official landholding may prevent the normal replacement of inefficient cultivators by efficient uses. Consequently, one should be cautious in implementing these programs from the efficiency point of view.[2]

g. Finally, it can be said that the analysis is also compatible with the general analysis of the village economy. Because of more or less inelastic land supply in the country, innovations and labor using technological change, if it occurs, may increase the input intensity in agricultural production. Agricultural organizations may change in accordance with the demand for hired labor and specialization. Demand for labor increases with investment in irrigation and other labor-using technological development. This change in technology increases not only the demand of labor, but also implies increasing returns to labor relative to land. This implies that the demand curve for labor will have greater elasticity and the wage of the workers as well as the rent of the tenant will increase significantly. In contrast, if population growth remains high, demand for food and its price increase. Higher physiological density, in the absense of technological development, also implies decreasing returns to labor relative to land. Decreasing returns to labor, in turn, lead to the situation of a declining wage rate as well as the tenant's rent. A declining wage rate warrants policy

---

[2]The possibility of inefficient production does not mean the land reform program of the country is not desirable. A vast scope for additional research on agricultural organizations still exists. Detailed inferences can be drawn only after further research.

efforts to reverse the trend of decreasing returns to labor relative to land.

5.3 Directions for Further Research

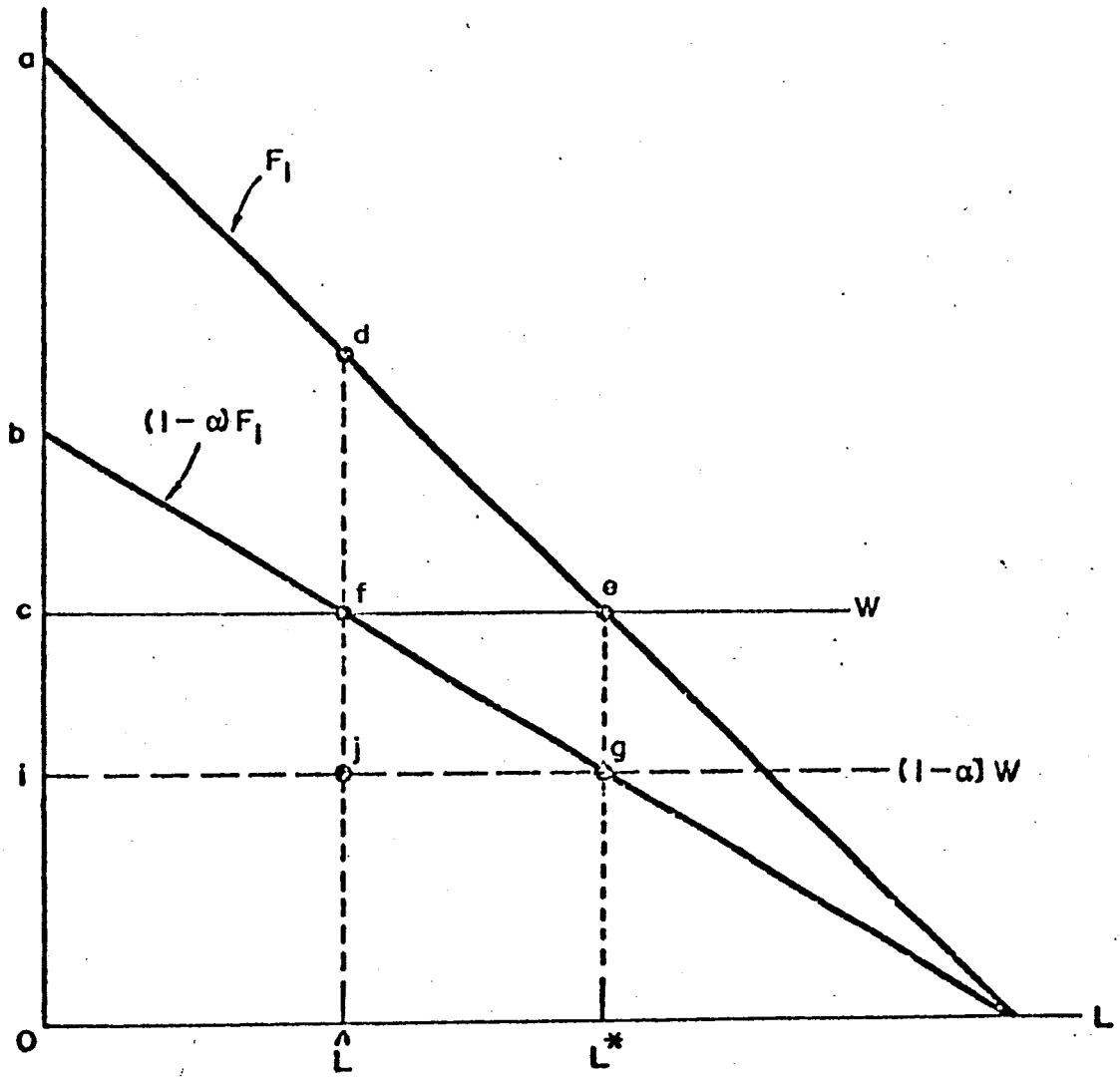
One of the major problems facing researchers is to develop a methodology of organizational behavior. Since institutional data are subjective and non-commensurable, it is difficult to use conventional tools of mathematics and statistics to develop a theory. As a consequence, one has to realize the implications of descriptions and new literary and mathematical paradigms in relation to the observable data. The development of any methodology may lead to possible modification. Using the inductive methodology, the theory developed in this present study was the theory of agricultural contractual choice restricted by management incentives. The rules of contracts change with the economic environment. Some of the factors that affect economic environment are technology, factor intensities, alternative employment opportunities, population, etc. Depending on the different economic envoronment, the theory can be modified accordingly. Even without modifications of the theory, further research may be desirable for the policy implication purposes. Because of cost and time constraints, 54 households were selected in Subba Panchayat and 66 households were selected in Dhakdhai Panchayat using a judgment sampling procedure. For a generalization of the results, a large scale probability sampling will be very useful. Taking into consideration the political and physiographic division of the country described in section 4.4, a multistage stratified sampling would be useful for this kind of study. Districts

(stratified with respect to physical conditions) can be selected in the first stage. Villages and households can be selected in the second and third stage respectively. Inferences drawn from this kind of large scale sampling will be more general and can be used for policy making purposes.

Another attempt can be made to confirm the theory using time series data. The present study is totally based on cross section data. Time series data were not available for the analysis. A survey technique can be developed to collect time series data that are relevant to our study. The analysis will be helpful not only in testing the theory, but also in understanding the dynamism of contracts. This can be beneficial in the formulation of a new agricultural policy.

APPENDIX 1

Figure A 1. Sharecropping and Under-supply of Input



APPENDIX 2

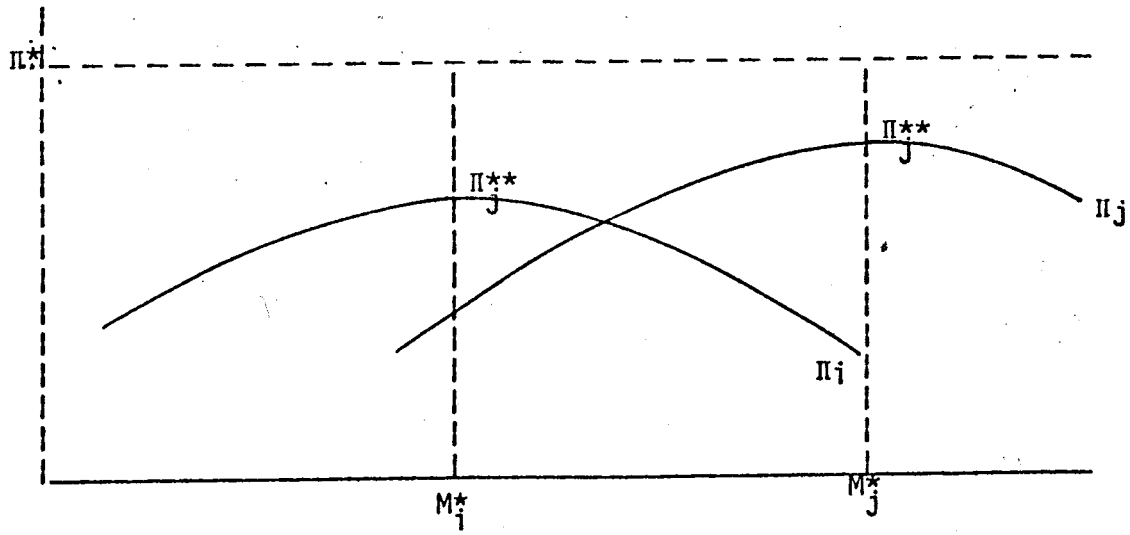
Table A-1. Total Area of Agricultural Holdings in Nepal and Share Thereof Cultivated by Tenants, 1961

Region	Total Area in Agricultural Holdings ('000 muris)		Area Cultivated by Tenants		Percentage of Total Area	
	Irrigated (Rice) Land	Unirrigated Land	Irrigated (Rice) Land	Unirrigated Land	Irrigated (Rice) Land	Unirrigated Land
Eastern midlands and Himalayan regions	3,836	11,292	1,627	1,967	42.41	17.41
Eastern inner Tarai	1,843	2,094	615	223	33.36	10.64
Eastern Tarai	46,509	15,105	16,186	3,040	34.81	20.12
Kathmandu Valley	1,417	865	591	201	41.70	23.23
Central inner Tarai	1,788	2,602	413	269	23.09	10.33
Western midlands and Himalayan regions	3,500	12,374	675	815	19.28	6.58
Western inner Tarai	3,006	1,765	1,340	672	44.57	38.01
Western Tarai	9,981	4,077	4,590	1,267	45.98	31.07
Western Tarai, far-western midlands and Himalayan regions	1,948	6,688	431	691	23.33	10.33
Far-western Tarai	10,447	3,718	3,554	1,064	33.82	28.61
Total	84,174	60,580	30,022	10,209	35.01	16.85
Grand total	144,754		40,231		27.79	

Source: Regmi (1978).

APPENDIX 3

Figure A 2. Choice of Contracts According to Second-Best Profits



Source: Roumasset and Uy (1983).

APPENDIX 4

Multivariate Statistical Tests and Regression Analysis

(a) Hotelling T^2

Hotelling T^2 is the test statistic to test the equality of two mean vectors. Let x and y be two pxl vectors, then the null hypothesis is:

$$H_0: \quad (\underset{\sim}{x} - \underset{\sim}{y}) = 0$$

$$\text{vs.} \quad (\underset{\sim}{x} - \underset{\sim}{y}) \neq 0$$

The test statistic is

$$T^2 = \frac{n_1 n_2 (n_1 + n_2 - 2)}{n_1 + n_2} (x - y)' w^{-1} (x - y)$$

where $w = S_1 + S_2$

$$\text{and } S_1 = \begin{bmatrix} \Sigma x_{1i}^2 & \Sigma x_{1i}x_{2i} & \Sigma x_{1i}x_{3i} \\ & \Sigma x_{2i}^2 & \Sigma x_{2i}x_{3i} \\ & & \Sigma x_{3i}^2 \end{bmatrix}$$

$$\text{Thus under } H_0: \quad \frac{T2}{n_1 + n_2 - 2} \cdot \frac{n_1 + n_2 - p - 1}{p} \sim F_{p, n_1+n_2-p-1}$$

[n_1 and n_2 are the number of observations for the variable xs and ys; p = number of elements in the vector.]

Source: Anderson (1958).

(b) Testing Constant Returns to Scale in Multiple Regression

Let the regression equation be:

$$y = \sum_{i=1}^{R} \beta_i x_i + u_i$$

$$E(u_i) = 0$$

$$E(u_i u_j) = 0 \quad \text{if } i \neq j$$

$$= \sigma^2 \quad \text{if } i = j$$

Suppose the hypothesis to be tested is:

$$H_0 : \sum_{i=1}^{R} \beta_i = 1$$

$$H_A : \sum_{i=1}^{R} \beta_i \neq 1$$

Define,

$$S = \Sigma e^2 = (Y - \sum_{i=1}^{R} \hat{\beta}_i x_i)^2$$

$$S_R = \Sigma e_R^2 = (Y - \sum_{i=1}^{R} \hat{\beta}_{iR} x_i)^2 \qquad \text{s.t.}, \sum_{i=1}^{R} \beta_{iR} = 1$$

Thus, under H_0:

$$F = \frac{(S_R - S)/p}{S/(n-R-1)} \sim F_{p,n-R-1}$$

where p = number of restrictions = 1

k = number of parameters in the model

(c) Problems Associated with the Linear Probability Model

(i) Non-normality of error terms:

From the regression model $y_j = \beta' x_j + u_j$, we have

$u_j = y_j - \beta' x_j$

If $y_j = 0$, $u_j = -\beta' x_j$ (1)

$y_j = 1$, $u_j = 1 - \beta' x_j$ (2)

Thus the error term takes only two values and cannot be assumed to be normal. In the ordinary least-square method, we assume that the error term is normal with mean 0 and variance ^{2} and thus can use different statistical tests to the estimated parameters. Thus, we cannot use the classical statistical tests.

(ii) Prediction problem:

Let $Pr(y_j = 1) = Pr(u_j = 1 - \beta' x_j) = p_j$

and $Pr[y_j = 0] = Pr(u_j = -\beta' x_j) = 1 - p_j$ [using (1) and (2)]

Thus, $E(u_j) = 0 \Rightarrow p_j(1 - \beta' x_j) + (1 - p_j)(-\beta' x_j) = 0$

or $p_j = \beta' x_j$

The value of p_j is not restricted and thus there is no guarantee that $\beta' x_j$ will lie in the unit interval. So the predicted value of y_j may lie outside the interval (0,1).

(iii) Hetereoscadisticity:

We observe

$$v(u_j) = E[u_j^2 - (Eu_j)^2] = E(^2_j)$$

$$= (1 - \beta' x_j)^2 p_j + (-\beta' x_j)^2 (1-p_j)$$

$$= p_j(1 - p_j) = \sigma_j^2 \qquad (3)$$

In the linear regression model, we have $E(u_j^2) = \sigma^2$ constant. But in this model $E(u_j^2) = \sigma_j^2$ and thus, is hetereoscadistic. The variances for the observations, for which p_j is close to 0 or close to 1, will be low, whereas the variances for the observations close to 0.5 will be high. The coefficients of regression analysis are not biased or inconsistent, but the estimate will not have the minimum variance (Intriligator, 1978). Thus the estimates will be inefficient and the prediction will not be precise.

So basically we have three problems in using the linear probability model. For the case where the predicted value of y_j may not lie in the interval (0,1), we can solve it in two different ways. If we make the approximation or drop the observations that generate the value predicted outside the range (0,1), then again we will have the problem of inefficiency. If we estimate the parameters of the equation subject to the constraint that $0 < \hat{y}_j < 1$, i.e., the constraint that the predicted values forced to lie between (0,1), the prediction may be biased.

The problem of hetereoscadisticity can be corrected as in the OLS estimation method by using the appropriate weights. But if we use a weighted regression equation, we have to face another problem. The predicted value of y_j may not lie in the interval (0,1).

The problems in the linear probability model call for alternative models for this kind of situations. Since the serious problem of the model is that the prediction lies outside the range (0,1), if we could

map the probability range (1,0) to $(-\infty, +\infty)$, then we may not have this problem.

Basically there are two models, probit and logit, that can be used to transform the probability range. Because of the availability of the software computer program for probit models, probit models have been used for the analysis.

(b) Maximum-Likelihood Estimation[1]

Let $f(x,\theta)$ denote the density function of the random variable x where θ is the parameter. Consider a random sample $x_1, x_2, \ldots x_n$ from a distribution having pdf $f(x;\theta)$. Then the function, $L(\theta; x_1, x_2, .x_n)$ is called the likelihood function and is equal to the joint probability density function of $x_1, x_2, \ldots, x_n$, i.e.:

$$L(\theta; x_1, x_2, x_n) = f(x_1;\theta) \ldots f(x_n;\theta) \quad (4)$$

So the problem is to find the estimate of θ which, when replaced by it, the likelihood function L is a maximum. This is called a maximum likelihood estimator. The estimator is given by $\hat{\theta} = \hat{\theta}(x_1 \ldots x_n)$ in the sense that it depends on the observational values rather than being a fixed number. This estimate of θ would provide the largest probability of this particular sample.

Maximum likelihood estimators can usually be obtained by differentiating $L(\theta; x_1, x_2, x_n)$ or $\log L(\theta; x_1, x_2, x_n)$ with respect

---

[1]A maximum-likelihood estimation procedure which can be applied to the model described above does exist. The maximum-likelihood allows for each individual observation within the sample to have a distinct probability associated with it.

to θ and setting the derivative equal to zero and usually is an absolute maximum.

Suppose there are only two choices and the total number of observations is n. y_j can take either of the two values 1 or 0. Let us assume that 1 is chosen n_1 times and 0 is chosen n_2 times, such that $n_1 + n_2 = n$. Under the assumption of independent observations, the likelihood function to be maximized is

$$L = \text{Prob}(y_1 \ldots y_n) = \text{Prob}(y_1) \ldots \text{Prob}(y_n)$$

Let P_i = probability of selecting 1, then $1-p_i$ is the probability of selecting 0. Since 1 is chosen n_1 times, then,

$$\begin{aligned} L &= \text{Prob}(y_1) \ldots \text{Prob}(y_n) \\ &= p_1 p_2 \cdots p_{n_1} (1 - p_{n_1+1}) \ldots (1 - p_{n_2}) \\ &= \prod_{j=1}^{n_1} p_j \prod_{j=n_1+1}^{n_2} (1 - p_j) \end{aligned} \tag{5}$$

Since $y_j = 1$ for the first n_1 observations and 0 for the last n_2 observations, then expression (5) can be written as

$$L = \prod_{j=1}^{n_1} p_j^{y_j} (1 - p_j)^{1-y_j} \tag{6}$$

Maximizing L is equivalent to maximizing logL because logL is a monotonic function of L. Hence from (5)

$$\log L = \sum_{j=1}^{n_1} \log p_j + \sum_{j=n_1+1}^{n} \log(1 - p_j)$$

In case of probit model,

$$p_j = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\beta' x_j} e^{-t^2/2} dt$$

$$1 - p_j = \frac{1}{\sqrt{2\pi}} \int_{\beta' x_j}^{\infty} e^{-t^2/2} dt$$

$$\frac{\partial \log L}{\partial \beta}_{\beta = \hat{\beta}} = 0 \qquad (7)$$

gives the estimate of , which is very complicated and is not discussed here. Instead we have a computer package for it and it can be used to get the estimates (White, 1978). The parameters estimated here are consistent and asymptotically efficient (Intriligator, 1978).

(c) Testing Hypothesis

Classical statistical tests to the estimated parameters are based on the normality of the errors. In (a) above it was explained that the error terms are not normal when the dependent variable is dichotomous. Another reason for not using the t-test is that the small sample properties of the variance covariance matrix are not known.

Since maximum likelihood estimation is consistent and asymptotically efficient, all parameter estimators are asymptotically normal. Thus we can make use of the standard normal distribution to test the hypothesis regarding the coefficients. This test is analogous to the t-test. However, the likelihood ratio test can be used to test the significance of all or a subset of coefficients in the logit or probit model. The likelihood ratio is defined as:

$$= \frac{\max L(\theta)_{H_0}}{\max L(\theta)_{H_0+H_1}} = \frac{L_0}{L_{max}} \qquad (8)$$

where $\max L(\theta)$ is the maximum likelihood function under the null hypothesis H_0 and $\max L(\theta)$ is the unrestricted likelihood function.

Under H_0,

$$-2\log\lambda = -2(\log L_0 - \log L_{max})$$

is distributed as a Chi-square distribution with p degrees of freedom, where p is the number of coefficients in the equations (constant is not included).

The decision rule is:

reject H_0 if $-2\log\lambda > \chi^2_{p,}$ at 100 % level of significance;

accept otherwise.

Thus to test the H_0: $\beta_1 = \beta_2 = \ldots = \beta_p = 0$, the likelihood ratio is

$$0 = \frac{L_0}{L_{max}}$$

L_0 = likelihood function L when all parameters are set to zero (other than the constant)

L_{max} = likelihood function L with all the parameters

Here $-2\ln\lambda_0$ is a Chi-square with p degrees of freedom. To test the null hypothesis $\beta_1 = 0$

$$\lambda = \frac{\text{Likelihood function L when } \beta_1 \text{ is left out}}{\text{Likelihood function L with all } \beta s}$$

and the Chi-square with one degrees of freedom.

(d) Test of Goodness of Fit

R^2 is one of the statistics to measure the goodness of fit of the model. $\hat{R}^2$ in probit analysis is similar to that of the simple regression model and measures the portion of the variation in the dependent variable explained by the probit model. This coefficient is defined as

$$\hat{R}^2 = 1 - \frac{E_{SS}}{T_{SS}} = \frac{R_{SS}}{T_{SS}}$$

where, E_{SS} = error sum of squares
R_{SS} = regression sum of squares
T_{SS} = total sum of squares

Let $T_{SS} = \hat{S}_T^2$, $R_{SS} = \hat{S}_R^2$ and $E_{SS} = \hat{S}_E^2$. Then,

$$\hat{S}_T^2 = \hat{S}_R^2 + \hat{S}_E^2 \tag{9}$$

Since $\hat{S}_E^2 = \text{plim } \Sigma e_i^2$

$$= n\sigma^2 \tag{10}$$

[Because,

$$R_{SS} = \Sigma e_i^2$$

and $\text{plim } S_n^2 = \sigma^2$

$$\text{plim } \frac{\Sigma e_i^2}{n} = \sigma^2$$

$$\text{plim } \Sigma e_i^2 = n\sigma^2 \ ]$$

$$\hat{S}_E^2 = \Sigma(\hat{y}_i - \hat{\bar{y}})^2 \tag{11}$$

In the probit model the dependent variable is normalized so that the variance around the regression line σ^2 is unity. Thus,

$$\hat{S}_R^2 = n$$

$$\hat{S}_T^2 = n + \Sigma(\hat{y}_i - \hat{\bar{y}})^2 \qquad \text{using (9) - (11)}$$

Therefore,

$$\hat{R}^2 = \frac{\hat{S}_E^2}{\hat{S}_R^2 + \hat{S}_E^2} = \frac{\Sigma (\hat{y}_i - \hat{\bar{y}})^2}{n + \Sigma(\hat{y}_i - \hat{\bar{y}})^2}$$

The R^2 value calculated in OLS is

$$\hat{R}^2 = \frac{\Sigma (y_i - \hat{y}_i)^2}{\Sigma (y_i - \bar{y})^2}$$

REFERENCES

Alchian, Armen A. (1969) "Corporate Management and Property Rights," Economic Policy and the Regulation of Corporate Securities in Henry Manne et. al., American Enterprise Institute; 337-360.

---------- (1950) "Uncertainty, Evolution and Economic Theory," Journal of Political Economy 58(3); 211-221.

Alchian, Armen A. and Harold Demsetz (1972) "Production, Information Costs, and Economic Organization," The American Economic Review 62(5); 777-795.

Ali, M. (1979) Share Tenancy in Bangaladesh, M.S. thesis, University of the Philippines, Diliman.

Alston, L. J. and R. Higgs (1982) "Contract Mix in Southern Agriculture since the Civil War; Facts, Hypotheses, and Texts," Journal of Economic History (June); 327-353.

Anderson, T.W. (1958) Multivariate Statistical Analysis; John Wiley New-York.

Arrow, K. J. (1974) The Limits of Organization: Norton and Company, Inc..

---------- (1969) "The Organization of Economic Activity: Issues Pertinent to the Choice of Market Versus Non-Market Allocation," The Analysis and Evaluation of Public Expenditures: The PPB System, Wasington, D.c.: Joint Economic committee; 46-64.

--------- (1964) "Control in Large Organizations," Management Science 10(April): 397-408.

Bardhan, P. K., and T. S. Srinivasan (1971) "Cropsharing Tenancy in Agriculture: A Theoretical and Empirical Analysis," The American Economic Review 61(march): 48-64.

Barnum, H.N. and Lyn Squire (1979) A Model of an Agricultural Household, World Bank Staff Occasional Papers # 27, World Bank, The Johns Hopkins University Press. Baltimore and London.

Bell, Clive (1980) "Alternative Theories of Sharecropping: Some Tests Using Evidence from Northeast India," Journal of Development Studies 13(4): 317-346.

Bell, C. and P. Zusman (1980). "On the Interrelationship of Credit and Tenancy Contracts," World Bank, Development Research Center, March. mimeo.

Ben-Porath, Y. (1982) Economics and the Family -- Match or Mismatch: Journal of Economic Literature 20(1)

--------- (1980) "The Organization of Exchange," Population and Development Review 6(1).

Binswanger, H.P. and M.R. Rosenzweig (1984) Contractual Arrangements Employment and Wages in Rural Labor Markets: A critical Review" in Contractual Arrangements, Employment and Wages in Rural Asia, Eds. H.P. Binswanger and M.R. Rosenzweig, New Haven: Yale University Press.

Bliss, C.J. and N. Stern, (1981) Studies in the Economy of a North Indian Village. Oxford University Press, New Delhi.

Braverman, A. and J.E. Stiglitz (1983) "Cost Sharing Arrangements Under Sharecropping: Moral Hazard, Incentive Flexibility and Risk." A World Bank Mimeo.

------- (1982). "Sharecropping and the Interlinking of Agrarian Markets," American Economic Review. 72(4): 695-715.

Chakravarty, A. and A. Rudra (1973) "Economic Effects of Tenancy: Some Negetive Results," Economic and Political Weekly, 8(28): 1239-1246.

Cheung, S.N. (1969) The Theory of Share Tenancy, Chicago: University of Chicago Press.

Datta, S. K. and D. J. O'Hara (1983) "Choice of Agricultural Contracts in the Presence of Transaction Costs," Mimeo

Demsetz, Harold (1982) "Barriers to Entry." American Economic Review 72(1): 47-57.

Fama, E.F. (1980) "Agency Problems and the Theory of the Firm." Journal of Political Economy 88(2): 288-307.

Fama, E. F. and Michael Jenesen (1983) "Agency Problems and Residual Claims," Journal of Law and Economics 26(June) 327-349.

---------- (1983a) "Separation of Ownership and Control," Journal of Law and Economics 26(June): 301-325.

Finney, D. J. (1964) Probit Analysis, 2nd ed., Cambridge: Cambridge University Press.

Goldberg, V.P. (1979) "The Law and Economics of Vertical Restrictions: A relational Perspective," Texas Law Review December: 91-129.

Geertz, C. (1970) Agricultural Involution: The Process of Ecological Change in Indonesia, Berkley and Los Angeles: University of California Press.

Hallagan, W. (1978) "Self-Selection by Contractual Choice and The Theory of Sharecropping," The Bell Journal of Economics 9(2): 344-354.

Harris, M. and A. Raviv (1978) "Some Results on Incentive Contracts with Applications to Education and Employment, Health Insurance, and Law Enforcement," The American Economic Review 68: 20-30.

Hayami, Y. and M. Kikuchi (1981) Asian Village Economy at the Crossroads: University of Tokyo Press, Tokyo.

Heady, E.O. (1947) "Economics of Farm Leasing Systems," Journal of Farm Economics 29: 659-678.

Holmstrom, B. (1979) "Moral Hazard and Observability," Bell Journal of Economics 10(1): 74-91.

James, William E., and James Roumasset (1984) "Migration snd the Evolution of Tenure Contracts in Newly Settled Regions," Journal of Development Economics, January: 147-162.

Jaynes, G. D. (1984) "Economic Theory and Land Reform" in Contractual Arrangements Employment and Wages in Rural Labor Markets in Asia (ed. Binswagner and Rosenzweig), Yale University Press, New Haven.

--------- (1982) "Production and Distribution in Agrarian Economies," Oxford University Papers 34(2).

Jensen, Michael C. (1983) "Organization Theory and Methodology," The Accounting Review 58(2): 319-339.

----- and William H. Meckling (1979) "Rights and Production Functions: An Application to Labor-Managed Firms and Codetermination," Journal of Business 52(4): 469-506.

--------- (1976) "Theory of Firm: Managerial Behavior, Agency Costs and Ownership Structure," Journal of Financial Economics 3(Oct.): 305-360.

Johnson, D.G. (1950) "Resource Allocation Under Share Contracts" Journal of Political Economy (58): 111-123.

Koo, Anthony (1982) Land Market Distortion and Tenure Reform, Iowa State University, Iowa.

Kotwal, A. (1981) "Choice of Contracts and Technological Change in Indian Agriculture," University of British Columbia, Department of Economics Discussion Paper 81-32.

Klein, B. and K. Leffler (1981) "The Role of Market Forces in Assuring Contractual Performance," Journal of Political Economy 9(89): 615-641.

Kutcher, G.P. and P.L. Scandizzo (1981) The Agricultural Economy of North East Brazil. The John Hopkins University Press, Baltimore.

Leamer, Edward E. (1983) "Let's Take the Con out of Econometrics," The American Economic Review 73(1): 31-43.

Lewis, T. (1980) "Bonuses and Penalties in Incentive Contracting," The Bell Journal of Economics 7(1): 292-301.

Lucas, R.E.B., (1979) "Sharing, Monitoring and Incentives: Marshallian Misallocation Reassessed', Journal of Political Economy, 87(June): 501-521.

Marshall, Alfred (1956) Principles of Economics (1890); London: Macmillan.

McCloskey, D.N., (1983) The Rhetoric of Economics," Journal of Economic Literature 21(2).

McKelvey, R. D. and W. Zavoina (1975) "A Statistical Model for the Analysis of Ordinal Level Development Variables," Journal of Mathematical Sociology 4: 103-120.

Mill, J.S. (1857) Principles of Political Economy, 4th edition, John W. Parker, London.

Mirrlees, J. (1976) "The Optimal Structure of Incentives and Authority within an Organization," The Bell Journal of Economis 7(1): 105-131.

Mullins. T, W.R. Grant, and R.D. Krenz (1981) "Rice Production Practices and Costs in Major U.S. Rice Areas, 1979," Agricultural Experiment Station, University of Arkansas, Fayetteville, in cooperation with Economics and Statistics Service, United States Department of Agriculture.

Murrell, Peter (1983) "The Economics of Sharing: A Transactions Cost Analysis of Contractual Choice in Farming," The Bell Journal of Economics 14(Fall): 283-293.

McFadden, D. (1974) "Analysis of Qualitative Choice Behavior," in Frontiers of Econometrics, P. Zaremba, ed. New York: Academic Press.

Nerlove, M. and S. J. Press (1973) Univariate and Multivariate Log-linear and Logistic Models, Rand Corporation, R-1306-EDA/NIH, Santa Monica, California.

Newbery, D. M. G. (1977) "Risk Sharing, Sharecropping and Uncertain Labor Market," Review of Economic Studies 64(Oct.): 585-594.

------- (1975) "The Choice of Rental Contract in Peasant Agricultural," in Agriculture in Development Theory. Ed. L. G. Reynods. New Haven: Yale University Press: 109-37.

------- (1974) "Cropsharing Tenancy in Agriculture: Comment," American Economic Review 64(Dec.): 1060-66.

------- and Stiglitz (1979) "Shareropping, Risk Sharing and the Importance of Imperfect Information," in Roumasset et. al. (eds.), Risk, Uncertainty and Agricultural Development, College Laguna, Philippines: Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA); New York, New York: Agricultural Development Council.

Pindyk, R. S. and D. L. Rubinfeld (1982) Eonometric Models and Econometric Forecasts, McGraw-Hill, New York.

Otsuka, K. (1982) "Economics of Share Tenancy: A Critical Survey" mimeo, Faculty of Economics, Tokyo University Press.

Rao, C. H. H. (1971) "Uncertainty Entrepreneurship and Sharecropping in India," Journal of Political Economy 79: 578-595.

Regmi, M. C. (1978) Land Tenure and Taxation in Nepal; Ratna Pustak Bhandar, Kathmandu, Nepal.

------- (1978a) Thatched Huts and Stucco Palaces: Peasants and Landlords in 19th Century Nepal. Vikas Publishing House, New Delhi.

------- (1976) Landownership in Nepal, University of California Press, California.

Reid, J.D. (1979) in Roumasset et al. (eds.), Risk, Uncertainty and Agricultural Development, College, Laguna, Philippines: SEARCA; New York, New York: A/D/C.

-------- (1976) "Sharecropping and Tenancy in American History," in Roumasset et. al. (eds.), Risk, Uncertainty and Agricultural Development, College, Laguna, Phillippines: SEARCA; New York, New York: A/D/C

------ (1976a) "Sharecropping and Agricultural Uncertainty" Economic Development and Cultural Change: 24(3): 549-576.

------ (1973) "Sharecropping as an Understandable Market Response: The Post-Bellum South," Journal of Eonomic History 33(March): 106-130.

Roumasset, J.A. (1984) "Explaining Patterns of Agricultural Contracts: Abaca, Coconut and Corn in the Philippines," in Binswanger et al. (eds.), Contractual Arrangements, Employment Wages in Rural Asia, New Haven, Connecticut: Yale University Press.

------ (1979). "Sharecropping Production Externalities and The Theory of Contracts," American Journal of Agricultural Economics, 61(4): 640-647.

------ (1978) "The New Institutional Economics and Agricultural Organization," Philippine Economic Journal 17(3): 331-348.

------ (1976) Rice and Risk: Decision-Making among Low-Inome Farmers in Theory and Practice, Amsterdam: North-Holland Publishing Co.

------ and Marilou Uy (1981) "Piece Rates, Time Rates, and Teams" Journal of Economic Behavior and Organization 1: 343-360.

------ and W. James (1979) "Explaining Variations in Share Contracts: Land Quality, Population Pressure and Technological Change," Australian Journal of Agricultural Economics, 23(2): 116-127.

------ and J. Smith (1981) Population, "Technological Change and Evolution of Labor Markets". Population and Development Review: 7(3): 401-420.

------ and Marilou Uy (1983) "Specialization and Incentives in Agricultural Contracts," mimeo.

Ruttan, V.W. (1969) "Equity and Productivity Issues in Modern Agrarian Reform Legislation". In Economic Problems of Agriculture Developed Societies, Ugo Papi and C.S. Nunn, eds., New York: St. Martin's Press; London: Macmillan.

Samuelson, P. (1983) "My Life Philoshopy," The American Economist 27(2): 5-12.

Saxena, H. C. and Surendran, P. U. (1967) Statistical Inference S. Chand and Co., New Delhi.

Sen, A. K. (1970) "Peasants and Dualism withor without Surplus Labor", Journal of Political Economy 76(October).

Sharma, Shankar (1976) "Testing Constant Returns to Scale in Cobb-Douglas Production Function" Nepali Mathematical Sciences Report, 27-30: Tribhuvan University, Nepal.

Sharma, Shiva (1982) "Landowner's Output Share and Factor Payment to Land: A case of Nepalese Sharecroppers". Nepal Institute of of Development Studies, Nepal. Mimeo.

Shmidt, P. and R. P. Strauss (1975) "The Prediction of Occupation Using Multiple Logit Models," International Economic Review 16(2): 471-486.

Siegal, S. (1956) Non-Parametric Statistics, Mc-Graw Hill, NewYork.

Singh, I.J. (Forthcoming) Small Farmers and the Landless The World Bank.

Silberman, J.I., and Durden, G.C. (1976) "Determining Legislative Preferences on the Minimum Wage: An Economic Approach". Journal of Political Economy 84(April): 317-329.

Smith, Adam (1937) The Wealth of Nations (1776), New York, Modern Library,: 361-372.

Snow, M. (1977) "Ratification Votes of State Legislatures on the Proposed Equal Rights Amendment" University of Hawaii, mimeo.

Stiglitz, J. E. (1974) "Incentives and Risk Sharing in Sharecropping," Review of Economic Studies 41(2): 219-255.

Theil, H. (1971) Principles of Econometrics, New York; Wiley.

----- (1969) "A Multinomial Extension of the Linear Logit Model," International Economic Review 10(3): 251-259.

White, K.J. (1978) "A General Computer Program for Econometric Methods -- SHAZAM". Econometrica 47(1): 239-240.

Williamson, Oliver E. (1981) "The Modern Corporation: Origins, Evolution, Attributes," Journal of Economic Litrature (Dec.): 1537-1538.

----- (1979) "Transaction Cost Economics: The Governance of Contractual Relations," Journal of Law and Eonomics 22(2):

Williamson, Oliver E. (1975) Markets and Hierarchies: Analysis and Antitrust Implications, Free Press.

----- (1964) The Economics of Discretionary Behavior: Managerial Objectives in a Theorf of the Firm, Prentice-Hall.

Zaman, A. (1973) Evaluation of Land Reform Program in Nepal, His Majesty's Government of Nepal.