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RURAL POVERTY AND THE ROLE OF NONFARM SECTOR IN ECONOMIC DEVELOPMENT: THE INDIAN EXPERIENCE

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ABSTRACT

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This dissertation examines certain issues of rural economic backwardness and the nonfarm sector relevant to many developing countries within the context of the Indian rural sector. The study focuses on the causes of the persistence of rural poverty and suggests the expansion of the modern nonfarm sector as a strategy to stimulate development in rural areas. The thesis consists of an overview paper which underlines the contributions made in this study in the context of the work already carried out in the field. Three independent papers follow this.

The first paper applies Sen's (1981) entitlement approach to look into the persistence of poverty and the presence of multiple groups with different productive resources within the rural economy. It builds on the existing literature relating to the causes of rural poverty by seeking to establish a relationship between the rural households and the anti-poverty policies through the ownership bundles of the households. A theoretical framework is presented within which the collective response of the households that determines the success or the failure of a policy can be examined.

The second paper examines expansion of the nonfarm sector as a strategy to strengthen the consumption bundles of resource poor rural households using a theoretical framework. The model here is based on the regional characteristics of eastern parts of the state of Uttar Pradesh in India. The work extends the increasing awareness of the potential role of the nonfarm sector in the development process. This is done by focusing on the expansion of the modern nonfarm sector and linkages running from it to the rural economy.

The third paper explores the income enhancing potential of nonfarm sector by empirically appraising a nonfarm employment project of Social Forestry in the region under study using a simulation model. The model simulates the inter-dependencies in the local economy and evaluates the income profile of both types households, those that directly participated in the project and the others that did not, over a period of ten years.

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PAPER - O
AN OVERVIEW OF POVERTY AND NONFARM SECTOR IN THE CONTEXT OF THE RURAL SECTOR IN INDIA

O.1 Introduction

This dissertation examines economic backwardness and the nonfarm sector in the context of the Indian rural sector with special emphasis on the eastern region of the state of Uttar Pradesh. The study focuses on the causes of the persistence of rural poverty and suggests the expansion of the modern nonfarm sector as a strategy to stimulate development in rural areas.

The present paper underlines the contributions made in this study as shown in Figure O.1, in the context of the work already carried out in the field. This is done by first presenting a definitional framework and background literature on rural poverty, which is adopted throughout the study. The existing literature on the issues examined in Papers - I, II and III respectively are reviewed next. Paper - I applies Sen's (1981) entitlement approach to look into the persistence of poverty in the presence of multiple groups with different productive resources within the rural economy. It is shown that weak ownership bundles perpetuate economic backwardness in the rural sector. Paper - II examines expansion of the nonfarm sector as a strategy to strengthen the consumption bundles of resource poor rural households using a theoretical framework. Improvement in the consumption bundles of such households is possible through strengthening of the respective ownership bundles. The model here is based on the regional characteristics of eastern parts of the state of Uttar Pradesh. In Paper-III system dynamics simulation is applied to establish the income enhancing potential of nonfarm sector and empirically appraise a nonfarm employment project of Social Forestry in the region under study.

The most important contribution of this dissertation is that it presents a perspective on the persistence of rural poverty that brings into focus the role of the entitlement status of household units in highlighting the causes of poverty and its persistence. This aspect, though very useful in determining the response of households to poverty alleviating policies, has not been explored in the current literature. While the works of Ladejinsky (1969), Sen (1981), Mukhopadhyay (1985) and Bhalla (1989,1993) mention the weak resources of households in agriculturally backward regions, these fall short of providing any framework to explain the causality between poor resource

Figure O.1

The Position Of This Dissertation In The Literature

Literature shows extensive work on factors that cause rural poverty and strategies that can improve it. Existing literature on some of the factors causing rural poverty in India:
Agricultural Performance & Rural Poverty: Narain (1957,1965,1980), Ahluwalia, (1978,1985), Bhalla (1989, 1990).
Urban Bias &Rural Poverty: Lipton (1977)
Trickle Down Policy &Rural Poverty: Bardhan (1974), ILO (1977), Poverty Reduction Handbook,The World Bank (1993)
Inappropriate Investment & Rural Poverty: Kakvani & Subbarao (1990).
Studies that examine the persistence of poverty and the response of the rural households units to the development incentives are scarce. The relationship between the aspects mentioned above and response of the household units has also not been explored in the literature.

Paper I: Causes of rural poverty examined in the context of ownership bundles using Sen's Entitlement Theory (1981).

Literature on the application of Sen's (1981) entitlement theory which he used to show that famines could occur even when there is no food shortage.
Dreze & Sen (1989), de Waal (1990), Osmani (1991), Teubal (1992): In the further understanding of famines.
Ravallion (1990):World food problems & undernutrion.
Gaay Fortman (1990) & Gore (1993): Examining distribution of benefits and costs within a society.

Response of rural households to development incentives depends on the respective ownership bundles. Poor ownership bundles shown to be perpetuating rural poverty and dual sectors within the rural economy.

Paper II: Examines the role of nonfarm sector in improving the consumption bundles of resource poor rural households. For such households improvement in consumption bundles reflect stronger ownership bundles.

The current literature reflects the increasing awareness of the potential role of nonfarm sector in the development process: Mellor (1976), Chuta & Leidholm (1978), Papola (1987), Bhalla (1990), Ranis &Stewart (1987,1993), Quibria (1994).

A theoretical framework is presented that enables the examination of the strength and direction of the linkages that arise due to the expansion of the modern rural nonfarm sector.

The focus of the existing studies on nonfarm sector is seen to be on linkages emanating from agriculture to the nonfarm sector. The few studies: Ranis & Stewart (1993), Grabowski (1995) and Reddy & Chakravarty (1999), while mentioning the importance of linkages running from the nonfarm sector to other sectors, do not provide ways to measure the effects of expanding the nonfarm sector.
Hymer &Resnick (1969) and Bautista (1971) although provide a framework which can measure the effects of changes in the economy, these examine the position of nonfarm sector in the rural economy using different sets of assumptions.

Expansion of the modern nonfarm sector shown to have the potential to improve consumption bundles of the consumption constrained households in the rural economy.

Paper III: Evaluation of the nonfarm employment project of social forestry for its potential to improve the ownership bundles of the participating households using a system dynamics model.

Literature on the application of system dynamics to development studies:
Various facets of developing economies examined based on economic dualism: Saeed (1980,1987)
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Experimental evaluation of nonfarm employment and rural sector: Tiwari(1989).
Empirical evaluation of development policies not found in the existing works.

Expansion of modern rural nonfarm sector shown to be an effective development strategy through its potential to strengthen the ownership bundles of the participating households.

base of households and agricultural backwardness amidst the current level of anti-poverty incentives offered by the government.

The present study acknowledges the presence of poor resource base of households and explains the persistence of rural poverty within the context of the entitlement framework. It further examines expansion of the modern nonfarm sector as a strategy to strengthen the resource base of the poor households.

Although there is an increasing awareness of the potential role of the nonfarm sector in the development process as seen in the works of Mellor (1976), Chuta & Leidholm (1979), Papola (1987), Bhalla (1990), Ranis and Stewart (1993), Quibria (1994), and Reddy & Chakravarty (1999), the present study is the first to show theoretically and empirically that rural nonfarm sector and linkages from it to the rest of the economy (rural and urban) can be an effective development strategy. It is also distinct from other studies on the subject by offering a growth strategy that is evaluated by combining both comparative static and simulation techniques for its potential to reduce economic backwardness.

The policy implication arising from this work is the emphasis that needs to be given to the strengthening of the ownership bundles of resource poor households in a development strategy. While reducing economic backwardness the strategy will also expand the consumer base in the densely populated rural sector by enhancing the purchasing power of the participating households. This in turn may stimulate manufacturing activity and encourage trade with the urban sector.

O.2 Definitional Framework of Important Concepts Used in the Study

In the literature the vast subject of development economics is shown to comprise the study of changes in human economic circumstances and the different ways of influencing these over time. Pioneers of development economics namely Rosenstein-Rodan (1943), Nurkse (1953), Lewis (1954), Leibenstein (1957), Hirschman (1958), Rostow (1960), Myrdal (1968), Streeten (1972), and Chenery et al (1974) view economic development as a growth process that requires the systematic reallocation of factors of production from a low-productivity, traditional technology, decreasing returns, mostly primary sector to a high productivity modern industrial sector.

The above mentioned economists according to Adelman and Morris (1997) assumed that the resource allocation process is hampered by rigidities, which are both technological and institutional in nature. This view is further supported by Chenery

and Srinivasan (1989), Kannappan (1995) and Thirlwall (1999), who point to investment lumpiness, inadequate infrastructure and incomplete and missing markets in obstructing the smooth transfer of resources.

Such inadequacies in the market mechanism have been the basis to justify market intervention in developing countries. In the late 1940s and 1950s it was suggested that this intervention should occur through a dominant role of the government to initiate and sustain the process of economic development (Leftwich,1995, Kurer,1996). However, as Krueger (1992,1993) points out, by the end of 1970s the poor performance of the governments of most developing countries in improving the economic circumstances of the population masses raised many questions regarding their role. The term 'government failure' began to be used widely. Lipton (1977), Lal (1984) and Oyen (1992) amongst others support the need for intervention but argue that policies adopted by governments have proved inappropriate and inadequate in tackling market deficiencies and have often introduced additional distortions.

The present study points to the persistence of distortions in the market in the region under study to justify the need for intervention through appropriate policies. The definition of poverty used in the present study is discussed in the next sub-section.

0.2.1 Poverty: Meaning and Measurement

In the context of developing countries the focus of economic development is seen to be towards reducing and alleviating poverty (WDR,1990). A policy definition of poverty derived from the well known US report 'Poverty Amid Plenty' (1969) is: 'a socially and economically unacceptable condition of living in a particular society'. The expression 'particular society' adopted in the above definition focuses on the difference between the poverty in downtown New York, Sub-Saharan Africa, slums of Calcutta and the rural parts of the Gangetic Plains in India as pointed out by Townsend (1979) and later by Sen (1981) and Oyen (1992).

The acknowledgement of the above noted differences in poverty gave rise to the concepts of relative and absolute poverty. Relative poverty: a concept more applicable in developed countries, according to Ravallion (1992) is said to exist in a given society when one or more persons do not attain a level of material well-being deemed to constitute a reasonable minimum by the standards of that society. Absolute poverty on the other hand is defined in the World Development Report (1990), as the inability to attain a minimal standard of living based on the cost of minimum adequate caloric intake of 2250 calories per person per day along with clothing and shelter.

The presence of poverty is generally measured by the poverty line that indicates a standard of living, which must be reached if a person is not to be deemed poor. Much of the literature and policy discussion in developing countries is concentrated on absolute poverty measured by an absolute poverty line (Ravallion,1992). The most widely accepted absolute poverty line is one dollar (US) a day per capita (the lower poverty line) and $ 2 a day per capita (the upper poverty line), recommended by the World Bank (in 1993, World Bank,1999). The poverty line adopted by the Indian Planning Commission refers to the level of consumption expenditure incurred to fulfil food requirements of 2250 calories per person per day- estimated at Rs 2220 per capita per annum in 1991 at current prices (this translates to approximately $123, US, at the 1991 exchange rate).

In recent years, ways of measuring how much poverty exists: poverty profiles, have been put forward, after establishing its presence through poverty line. Poverty profile measures indicate the severity and depth of poverty in a given population. These measures are increasingly becoming important for decision makers in making policy and investment choices between population sets in an economically backward region or between two poor regions. The severity of poverty between populations sets or regions can be compared through poverty profiles and the appropriate decision can be made based upon this measure instead of just considering the poverty line measure (Fields, 1994, Ravallion and Bidani,1994).

The present study has adopted the poverty line or the poverty headcount to examine the economic stagnation in the rural sector of India. The work here provides theoretical frameworks within which persistence of poverty and enhancement of the ownership bundles through the expansion of nonfarm sector can be explained and evaluated. Other measures of poverty would become relevant when deciding to implement the suggested strategy of nonfarm sector to reduce economic backwardness in a population set. The poverty population set in terms of the highest severity of poverty in the region (poverty comparison) can be selected through poverty profiles.

The above discussions provide a definitional framework of poverty in the context of developing countries. The concepts defined here are used in this dissertation. An insight into the current literature on poverty related issues in the rural sector of India is provided in the next section.

O.3 Rural Poverty in India

This dissertation focuses on rural poverty in India. The literature on rural poverty in India shows that while the effort of the Indian government towards reducing rural poverty has been very important (Quibria,1994, Chelliah and Sudarshan,1999,), it is lacking in emphasis on the households' response to development initiatives and in improving the rural skill base. Since it is the collective interaction of households' entitlement functions with the intervention variables that determine the success or the failure of the policy, the understanding of the households' response pattern is important.

The present study addresses this critical issue by extending the existing literature on causes of rural poverty through focusing on the relation between the ownership bundles of rural households and poverty and its persistence. This is done by examining rural poverty in India within the context of the entitlement framework and the ownership bundles of the rural households. It is shown here that ownership bundles of households determine the households' response to development incentives and policies. Poverty persists because households with poor ownership bundles are unable to avail themselves of the benefits of development incentives. The findings of the study suggest strengthening of the ownership bundles is necessary for the households to respond effectively to development policies. Expansion of the modern rural nonfarm sector is evaluated in the study in terms of the impact on the ownership bundles of the rural households in the region. The regional characteristics of the eastern districts of the state of Uttar Padesh provide the empirical setting for the study.

This section reviews the existing literature on rural poverty in India. The important contributions and useful insights into rural poverty reviewed here, are extended in the present work by examining these within the entitlement framework.

In the 1991 census the rural population in India accounted for 75 percent of the country's 846 million people, as against 83 percent of the country's 360 million people in 1951. 35 percent of the rural population lives below the official Indian poverty line. Of the 350 million people living in absolute poverty in India, over three-quarters (250 million) belong to the rural sector (1992, World Development Report,1994).

The agricultural sector continues to be the largest employer in rural India, which employed over 72 percent of the working population in 1951 as against over 66

percent in 1991 (Census Of India,1991). The percentage share of the agricultural sector in the country's GDP in 1991 was 27.7 which had fallen to 24.6 percent by the year 1996 (Economic Information Year Book, 1996).

Against the background described above, much has been written about issues and policies that have influenced rural poverty in India in the last five decades. The existing literature on rural poverty in the context of the issues examined in the present work as shown in Figure O.1, can be grouped into the following categories discussed in the subsequent sub-sections below:

- Agricultural performance and rural poverty,
- Urban bias and rural poverty,
- Landlessness and rural poverty, and
- Development initiatives by the government and rural poverty.

O.3.1 Agricultural Performance and Rural Poverty

Dharam Narain's work beginning in the late '50s through '60s and the '70s focused on the substantial role of agricultural performance and prices of the goods consumed by the poor in determining poverty (Narain,1957, 1965, Narain and Roy,1980). On a similar theme, the works of Ahluwalia (1978), Mellor and Desai (1985) and Bhalla (1989,1990,1993) show an inverse relationship between rural poverty and agricultural performance. It is also indicated that independent of agricultural performance, unanticipated increases in consumer prices aggravate rural poverty.

These studies have made a significant contribution in the understanding that while agriculture has an important role in determining rural poverty, consumer prices can also substantially affect poverty amidst the rural communities in India. While these findings offer useful insight for policy makers, the root cause for positive change in the agricultural performance in one region and its slow or insignificant progress in another, has not been explored. Furthermore, although the studies have established an important relationship between the rural poverty levels and the economic forces at play, no explanation is offered regarding the variables that affect the outcome of the above interaction in different regions.

Gaiha's (1991,1996) assessment of some of the poverty alleviation programmes in rural India points to noticeable improvements in agricultural performance that did not herald changes in the poverty levels of the majority, e.g. with the advent of the green revolution technology in the late 1960s. A related finding has also been put forward in the World Development Report (1990), regarding the existence of a large hard core of

poverty which is likely to persist even after a massive redistribution of land in rural India between 1950 through 1970. As a result of the land distribution policy of the Indian Government the proportion of owner cultivators increased from 40 to 75 percent of cultivators while the proportion of tenant cultivators reduced from 60 to 25 percent in the above period (Quibria,1994).

Gaiha did not provide an explanation for his very important finding and later (1992) acknowledged the gap in the understanding of persistence of rural poverty in India. He briefly suggested the understanding of the poverty related issues in the context of the entitlement framework but did not carry out any detailed analysis to put forward definitive conclusions.

O.3.2 Urban Bias and Rural Poverty

Lipton's (1977) celebrated work on urban bias and its relation with rural poverty provided a distinct theory that explained the weak impact of growth on mass poverty in the Third World. The framework has since been applied often to examine the various components of development policy in different regions as can be seen in the works of Gillis et al (1996) and Thirlwall (1999).

While Lipton's work provides a definitive explanation for urban bias in the development policies, it does not take into account the interplay of variables that contribute to the recipients' (rural households') response to such policies. Lipton's view of the persistence of rural poverty within the urban bias framework offers a widely accepted theory on the disproportionate benefits to the urban sector from the public allocation of resources in most developing countries. The explanation can be further strengthened by examining it in terms of the entitlement framework which would focus on the stronger exchange entitlement of the urban population that helps to attract the resources. In contrast the weak exchange entitlement of the rural population is unable to influence the allocation policies.

O.3.3 Landlessness and Rural Poverty

The ILO (1977) study on rural poverty and landlessness in South and South East Asia indicated that sustained growth in a country can be accompanied by continuing poverty of certain groups of people (the landless households) and the benefits of over-all growth do not always trickle down to those most in need. These findings appear to have changed very little in the following two decades as reported in the Poverty Reduction Handbook of World Bank (1993). Both studies present useful insight into

the shortcomings of the rural development policy adopted in India. However, these findings do not go far enough to uncover the reasons that have led to the benefits of the development policy not reaching those most in need.

O.3.4 Development Initiatives by the Government and Rural Poverty

Alleviation of rural poverty has been one of the primary objectives of planned development in India since her independence 53 years ago. A formal strategy of development with its thrust on industrialisation, was incorporated in the planning process during the Second Five Year Plan (The Planning Commission, 1956-61). Ever since, the policies and programmes have been designed and redesigned to meet the objectives. The problem of rural poverty was given a sharper focus during the Sixth Five Year Plan (The Planning Commission, 1980-85) with the introduction of special employment programmes, area development schemes and land reforms.

The Indian government's strategy for helping the economically disadvantaged in the rural sector in recent years comprised a combination of overall growth and direct anti-poverty interventions. The growth component (trickle down policy) involved investment in the agricultural sector through the introduction of Green revolution agricultural technology and high yield variety seeds (HYV) together with extensive land reform measures. The overall initiative is seen to be lacking in appropriate investment in manufacturing and rural industry as noted by Kakwani and Subbarao (1990).

There has been much debate regarding the beneficiaries of the above policies where Saith (1981) and Bardhan (1982,1985) indicate a rise in the number of poor amidst rising real net value added per capita in agriculture. Ahluwalia (1978) on the other hand has indicated that trickle down mechanisms operated in rural India. Srinivasan (1985) has questioned Ahluwalia's conclusions on the grounds of the weak evidence available at the all India level.

Since 1980 the government has launched numerous direct anti-poverty interventions of which some of the important ones are: Integrated Rural Development Programme (IRDP), National Rural Employment Programme (NREP) and Rural Landless Employment Guarantee Programme (RLEGP). The major criticism of IRDP has been its inability to raise the incomes of the poorest households i.e. the ultra poor or those with very low initial income levels and poor assets (Rao and Rangaswamy,1988) and its insufficient linkages with the growth process (Tendulkar,1992). The overall assessment of the NREP and RLEGP is similar where although the schemes created

450 million person days of employment, the benefits could not be accessed by the most deprived because of leakages and inefficiency in implementation as pointed by Guhan(1980). Gaiha (1996) has noted some successes of the programmes in the state of Maharashtra. Narayana et al (1988) in a nationwide investigation of such rural works programme (RWPs) found that the RWPs can be instrumental in eliminating hunger at modest cost if planned and executed appropriately. A drawback of RWPs is that although these create demand for unskilled labour, they are unable to enhance the skill base of labour in the long term.

In conclusion it can be said that the government's efforts in reducing rural poverty, which became a part of its planning process with its Second Five Year Plan (The Planning Commission, 1956-1961) have been mainly through land resources and rural works programmes. Although the strategy has had mixed success and the incidence of poverty remains the highest in the agricultural labour households as noted by Dev (1988) and Quibria (1994), there is evidence of both absolute and relative (though slow) gains to the rural poor with higher farm productivity as indicated by Datt and Ravallion (1992, 1998) and through the RWPs (Gaiha,1996).

The review of the existing literature on rural poverty in India carried out in the early part of this section shows extensive work on factors that aggravate poverty or strategies that can improve it. The literature also shows that the studies that examine the persistence of poverty and the response of the rural households to development incentives are scarce as pointed out in Figure O.1. Rural development has been part of the Government of India's planning process since its inception in the mid 1950s. However, while schemes and policies aimed at reducing poverty remain high in its agenda, changes in the incidence of poverty are noted to be slow. A shortcoming of such policies has been their inability to improve the skill base of rural labour in the long term as noted by Quibria (1994) and Narayana et al (1988).

O.4 Review of Existing Literature on Poverty and Dualism in the Rural Sector of Developing Countries: The Indian Experience, Paper - I

Paper - I examines the persistence of poverty and the presence of multiple groups with different productive resources within the rural economy in India. A theoretical model, based on Sen's entitlement approach (1981) is deployed to examine and explain these issues.

The work in Paper - I has attempted to provide a link between the existing theories of rural poverty and the ownership bundles of individual households as indicated in

Figure O.1. While the works of Ahluwalia (1978), Mellor and Desai (1985), Bhalla (1989,1990,1993) Lipton (1977) and Kakwani and Subbarao (1990) amongst others have provided valuable insight into different aspects of development policies and rural poverty, the emphasis on the response of the household units that collectively make the rural population and determine the success or failure of the policy is either absent or weak. In Paper - I an attempt is made to address this issue by examining the relationship between ownership bundles of households and their response to incentives and subsidies that comprise a key component of poverty reduction schemes. Variables that influence the response of households to the different incentives and subsidies offered within the poverty reduction schemes are examined in the context of the entitlement framework to explain the persistence of rural poverty. The paper also presents a perspective of the rural economy not reflected in the current literature by focusing on the presence of dual sectors *within* it .

A review of the existing literature on issues examined in Paper I is presented in the following two sub-sections. In the first sub-section the existing literature on the entitlement approach is reviewed. The second sub-section reviews the work on dual sector models and examines its applicability *within* the rural sector in India.

O.4.1 The Exchange Entitlement Approach

Sen (1981) in his work on the entitlement approach and famines has argued that in a market economy, a person can exchange what the person owns for another collection of commodities. The exchange can either be done through trading, through production, or through a combination of the two. The set of all the alternative bundles of commodities that can be acquired in exchange for what the person owns is the person's exchange entitlement. This relationship defines the economic possibilities that would be open to the person corresponding to each ownership situation. Sen used this framework to explain starvation and famines and to show that a person will be exposed to starvation if the person's exchange entitlement set does not contain any feasible bundle including enough food to sustain life. Sen further extended his work to search for causes of entitlement failures that explain famines, including those in Bengal, Ethiopia and Bangladesh. He put forward the theory that famines could occur even when there is no food shortage.

Paper - I builds on the versatility of Sen's entitlement approach to examine poverty and to explain issues related to the persistence of poverty in the rural sector of India. While Sen's approach has been applied to examine many issues, its application to explain the persistence of poverty has not been attempted in the literature. The present

paper examines persistence of rural poverty within the entitlement framework. The current literature as examined in section O.3 shows extensive work on poverty but scarce research on issues related to the persistence of poverty as pointed by Gaiha (1992). The present study has therefore contributed to the literature by explaining the persistence of poverty amidst increasing levels of anti-poverty government policies.

The analysis here focuses on a set of variables that relate the ownership bundles of households to the causes of economic backwardness in the rural economy given in other studies (Figure O.1, section O.2.2). The paper offers an explanation of the link between the ownership bundles, the poverty status of households and economic stagnation, an important issue, which has not been explored in the current literature.

Since its publication Sen's approach has attracted much attention and extension beyond its original context in the explanation of famines. The most important contributions of this approach are:

(1) In providing a framework which called for more research in the understanding of famines. In this context de Waal (1990) and Osmani (1991) have exchanged views over the value of Sen's approach for examining famines in Africa. de Waal's main criticism is the close involvement of Sen's framework with the Bengal famine, which poses some restrictions in explaining situations other than those of the Bengal famine. Examples of restrictions are: the prominence of assetless wage labourers in Bengal and its relative absence in Africa, the neglect of the roles of violence and associated social disruption in initiating and aggravating famines in Sen's original work and the little attention given to diseases and epidemic during famines.

Osmani while admitting that the entitlement theory does not explain the role of violence and the associated disruption in famines, defends Sen's approach by arguing that all famines involve at some stage a failure of food entitlements. Dreze and Sen (1989) have further examined this view where a collapse of food entitlements is shown to be the initiating failure in which epidemics themselves originate. Here the authors have extended the entitlement approach to cover hunger in general and to identify and assess policy options for ensuring that people have entitlements. On a similar theme, Teubal (1992) has related entitlement theory to food systems and regimes of accumulation in Argentina.

(2) In providing a unique way of examining distribution of benefits and costs within a society, such that the concept can be connected and applied to a wide spectrum of issues, topics and purposes with appropriate modifications in the original function.

This is seen in the works of Gaay Fortman (1990) and Gore (1993) who have moved beyond Sen's original terms. Fortman has put forward an institutional approach to the acquirement problem starting with entitlement theory. Gore on the other hand has related Sen's approach to other lines of work, such as negotiation and interpretation of the meanings of legal rights, administrative allocation of public sector benefits, conventions /negotiations within households and peasant communities. Gore probed several areas of Sen's framework while concentrating on Sen's definition of entitlement. Rein and Peattie (1983) first pointed out the absence of any sharp line of demarcation in Sen's framework, which according to them made the terminology often confusing.

While the value of Sen's entitlement approach remains undisputed, some limitations make its application difficult. The precise definition of entitlement sets is only possible, as admitted by Sen himself (Sen,1981), in conditions of perfect market-clearing equilibrium. In the absence of such conditions in most developing countries, entitlement definitions have some degree of inherent ambiguity. This may pose problems in empirical studies where precise entitlement sets are needed to examine shifts in the entitlement components. Furthermore, since Sen included different types of influences - economic, social and political in determining the exchange entitlements in the real economy, the process becomes very complex and highly dependent on the institutional structure of the economy. Sen's entitlement approach though not the perfect tool for empirical applications, has introduced an important theoretical framework that can provide useful insight into the understanding of ownership bundles and the corresponding economic status of households in the society.

In summary, Paper - I extends the literature on the causes of poverty and provides an explanation for the persistence of poverty amidst increasing levels of anti-poverty schemes, within the entitlement framework. The current literature on rural poverty is examined within the context of the entitlement framework and the ownership bundles of the rural household. It is shown that ownership bundles of households influence the households' response to development incentive packages. Poverty persists because households with poor ownership bundles are unable to have access to the benefits of the development incentives.

O.4.2 Dual Sector Models

In the development literature there has been a long tradition of conceptualising developing economies in terms of dual sector models. Such models generally focus on

different organisational and institutional behaviour between traditional agricultural and modern industrial sectors. In Paper - I the dual sector concept is examined in the context of the rural sector in India.

The classical wage theory, which assumes relatively, fixed real wages with unlimited supply of labour forms the basis of most dual economy models. The origin of such models can be traced to Ricardo (1817) who introduced the concepts of diminishing returns and labour surplus. Much of present-day literature on the subject is derived from the work of Lewis (1954) though earlier writings of Furnivall (1939) and Boeke (1942,1953) also contributed in shaping the present dual sector concept. In his work on India, Furnivall introduced the idea of economic plurality where two or more elements/ social orders live side by side without mingling, under one political unit. Present day dualism is a special case in the above framework. Boeke's work centred on examining economic dualism within a country.

The work on the analysis of the economic consequences of dualism was initiated in the 1940s through 1950s drawing attention to the emergence of a new social class: the profit earning entrepreneurs who reinvest their gains and savings to facilitate rapid growth in the capitalist sector. The best known models that emerged from this proposition were those of Lewis (1954) and Fei & Ranis (1964). The Lewis model is known as 'economic development with unlimited supplies of labour' where labour comes from the agricultural sector. The basic assumption in the model is that the marginal productivity of labour in the agricultural sector is so low that workers can be transferred to industrial occupations without a fall in the output of food.

The model has been challenged from many perspectives beginning with the near or zero marginal productivity of labour in subsistence agriculture assumption (Hansen,1966, Desai & Mazumdar,1970) to the capitalists' reinvestment of profits resulting in more jobs (Chakravarty,1977, Basu,1984). It is argued that if the investment involves labour-saving technology then the marginal product of labour would change asymmetrically such that the output rises without an increase in employment or wages. This has been validated through empirical testing of the model in Egypt (Mabro,1967) and Taiwan (Ho,1972) where the emphasis was on capital - intensive investment with less than predicted tendency to raise employment. While Hogendorn (1992), has questioned the surplus labour theory in the context of seasonality another issue gaining recognition is the incompatibility of the rural surplus labour in terms of the skills and literacy necessary for industrialisation (Chelliah and Sudarshan,1999).

The Fei-Ranis (1964) model (FR) for a dual economy demonstrates that by transferring surplus labour from the agricultural to the industrial sector, an economy can become fully commercialised. At the outset the model assumes a Lewis-type economy characterised by the presence of surplus labour. The FR model points out that Lewis did not pay much attention to the role of agriculture in promoting industrial and economic growth. The model also argues that a labour transfer from agriculture to industry should be preceded by a rise in agricultural productivity.

The main criticism of the FR model is that like the Lewis model it assumes near or zero marginal productivity of agricultural labour in the initial phase of development. The model has neglected the role of money and prices and the investment functions have not been specified (Ghatak and Ingersent,1984). It is also argued that no distinction has been made between wage-based labour and family-based labour.

In summary, the dual sector models captured the rural-urban divide in developing countries to formulate a path for economic progress. Although the growth process predicted in the dual sector models has been shown not to reflect reality, the principles guiding the models are noted to exist in other sectors of the economy. This can be illustrated especially by the principle of investment in one sector to achieve overall economic growth or the trickle down policy. The emphasis on industrialisation and investment in agricultural technology in the development plans in India was based on the rationale of the dual sector models (Ghosh,1995).

In recent years it has been seen that increasing farm productivity and modernisation in agriculture is accompanied by limited reductions in the poverty levels of the rural population in India. In Paper - I this situation within the rural sector is examined in the context of the dual economy framework with an objective of focusing on the shortcomings of the policy in the rural sector. It is shown here that there exist four groups with different productive resources - A^T, the traditional agricultural households, Z^T, the households employed in the traditional nonfarm activities, A^M, the modern agricultural households and Z^M, the households employed in the modern nonfarm activities. These groups may be categorised into two distinct sectors: the resource poor sector comprising Z^T and A^T (with characteristics similar to Lewis's traditional sector) and the capitalist sector comprising Z^M and A^M (which can be identified with Lewis's modern sector) *within* the rural economy.

The different exchange entitlements and ownership bundles of rural households encourage the continued existence of these sectors, which impedes economic progress of the resource poor households. This perspective of the rural sector may be useful in

appropriate resource allocation and policy formulation processes that aim to reduce poverty. Policy implication of this work would be to focus on strategies that enhance the resource base of the economically backward households (A^T & Z^T). This is a shift from the 'trickle-down' strategies derived from the dual economy models.

O.5 Review of Existing Literature on the Role of Nonfarm Sector in the Consumption Bundles of Rural Households, Paper - II

Paper - II examines the hypothesis that the modern nonfarm sector can alter the consumption bundles of resource poor households. These changes reflect improvement in the ownership bundles of such consumption constrained households. This hypothesis arises from the analysis in Paper I where Sen's (1981) entitlement approach is deployed to show that poor ownership bundles perpetuate poverty and its persistence in the rural sector as pointed out in Figure O.1.

The rural nonfarm sector is defined here as the range of economic activities, other than farming, that take place in rural areas of developing countries. The possible effects of expanding the rural nonfarm sector on the consumption bundles of the participating resource poor rural households are analysed in the context of a theoretical model. For such consumption constrained households positive changes in the consumption bundles are likely through improvement in the respective ownership bundles.

The literature review in this paper is divided into two sub-sections. The first sub-section reviews studies comprising models for nonfarm sector analysis with similar methodology to that used in Paper - II. Theoretical perspectives and studies of some of the implemented projects in the nonfarm sector of developing countries are reviewed in the second sub-section.

O.5.1 Selected Models 0f the Nonfarm Sector

The four goods model in Paper - II builds on the contributions made by Hymer and Resnick (1969), Bautista (1971) and Ranis & Stewart (1993) regarding the role of Z goods (nonfarm sector output) in the development of the rural economy. However, unlike the previous models the model in Paper - II focuses on the changes in the rural economy resulting from enhanced production of nonfarm sector goods. The methodology adopted here addresses the issue of evaluating the effect of change on a range of key variables involved, absent in the Ranis and Stewart (1993) model, by

providing a definitive treatment of the strength and direction of such effects (Figure O.1). The framework presented in the paper demonstrates the response pattern of the rural households to changes in the price of the modern nonfarm sector output. The focus on evaluating the response of the households to changes in the nonfarm sector, although an important factor in a development strategy is seen to be missing in the literature as indicated in Figure O.1.

In the past many researchers and policy makers have viewed the rural economy of developing countries as being synonymous with agriculture (Anderson & Leiserson,1980, Adams,1994, Grabowski,1995). According to this view rural households receive the bulk of their income from agricultural output. In recent years this view has begun to change. There is now a growing recognition that the rural nonfarm sector could also play a vital role in the economies of the rural households in developing countries as indicated in Figure O.1. This change is largely due to the contributions made by the work of Leidholm & Chuta (1976) in Africa, Anderson and Leiserson's (1978) study on rural enterprise and nonfarm employment and the results of rural budget surveys conducted by Braun et al (1991) in a number of developing countries. These studies show the increasing role of nonfarm activities in the economic growth of the rural sector.

Hymer and Resnick (H-R,1969) predicted a decline of such activities with agricultural development through a model of an agrarian economy with nonfarm activities. Although the H-R model recognised the existence of nonfarm activities as an integral component of the agrarian sector in developing countries, it did not include the nonfarm activities in the development process.

Using a comparative static methodology, the H-R model of the agrarian economy first derives the exchange equation between food and manufactured goods. It then analyses the effect of change in the given rate of exchange between food and manufactured goods, technological factors and prices. Here the model consists of three goods: F, the agricultural output, Z, the output from nonfarm activities and M the urban/imported manufactured goods. The F goods are produced, consumed and traded, the Z goods are (inferior) produced, consumed but not traded and the M goods are consumed but not produced locally. The model explored some of the factors behind the agrarian economy's elasticity of substitution in production and consumption. The results stress the importance of the urban manufacturing sector accompanied by increased specialisation and cash crop production in the agricultural sector in the process of development. The H-R model predicts a decline of the Z sector as the terms of trade between the agricultural output and the manufactured goods improve.

The H-R assumption of the Z goods being inferior has been challenged in subsequent work (Bautista,1971, Ranis & Stewart,1993). It is argued that the pessimistic conclusions of the H-R model depend on a restrictive set of assumptions, which may not apply in the developing countries of today.

Resnick (1970) subsequently applied the H-R framework to examine the decline of the Z goods sector during the economic transformation of three south-east Asian countries (Burma, Philippines and Thailand) during the colonial period. The study concludes that although an agricultural surplus was generated as resources were diverted from Z goods production to the cash crop production, it rarely made the farmers who cultivated the soil better off than prior to the changes. The process did not contribute to development of the region.

Bautista (1971) using the basic H-R framework has investigated the dynamic implications of Z goods productions in a small agrarian economy open to trade. This is done by incorporating agricultural capital and assuming Z goods to be substitutable for industrial consumption goods. The model is distinct in capturing the role of two other parameters - the saving rate and the population growth rate. It is shown that by increasing Z goods production it is possible for a peasant household to choose between consumption and investment. The use of a dynamic model made possible an analytical distinction between the short-run and long-run effects of a change in the terms of trade on the endogenous variables of the model. The model concludes that in contrast with the generally pessimistic prognosis of previous agrarian models, the agrarian economy does not necessarily fall into a low level equilibrium in the long run.

Ranis & Stewart (1993) introduced some departures and relaxed some assumptions in the H-R framework to explore the implications for rural development and the economy generally. Unlike the H-R model, here the Z sector activities range from household production on a small scale to small factories using appropriate and modern technology producing high quality products. The Z sector is divided into traditional household processes and products: the Zt sector and one with modern processes and products: the Zm sector. Another distinct feature in this framework is the recognition of the agricultural sector as being composed of two subsectors: the agricultural cash crop export sector (Ae) and a domestically oriented food producing agricultural sector (Ad). The theoretical perspective of Ranis & Stewart framework indicates that a dynamic food producing sector along with the modern Z goods (Zm) sector can lead to a scenario very different from the H-R framework. It is suggested

that policy changes affecting the rural economy may be required to facilitate the process of development. The implications of the model are relevant to the developing countries of South Asia as well as Sub-Saharan countries at different levels of development.

Although the Ranis and Stewart framework has incorporated the nonfarm sector in the development process, the graphical methodology selected falls short of demonstrating the actual effect of changes in the variables involved. This may dilute the importance of nonfarm sector and weaken the perception of its potential in the development process where one of the ways of measuring the effectiveness of a strategy may be by assessing the extent and direction of the impact it has on the economy.

The four goods model in the present paper builds on the contributions made by Bautista (1971) and Ranis & Stewart (1993) regarding the role of Z goods (nonfarm sector output) in the development of the rural economy. This is done by examining the possible effects of expanding the modern rural nonfarm sector on the consumption bundles of the participating resource poor rural households in the context of a theoretical model. Since for such consumption constrained households, changes in the consumption bundles are likely to reflect the ownership bundle status of households, the findings of the model indicate the role of the modern nonfarm sector in changing the ownership bundles of the resource poor rural households.

The methodology adopted here is similar to the H-R (1969) and Bautista (1971) models. However, unlike the previous models, the model in Paper - II focuses on the changes in the rural economy resulting from enhanced production of nonfarm sector goods. The methodology adopted here attempts to overcome the limitations of the graphical approach noted above and addresses the issue of evaluating the effect of change on the other variables involved, absent in the Ranis and Stewart (1993) model by providing a definitive treatment of the strength and direction of such effects (Figure O.1). The framework presented in the paper demonstrates the response pattern of the rural households to changes in the price of the modern nonfarm sector output. The focus on evaluating the response of the households to changes in the nonfarm sector, although an important factor in a development strategy is seen to be missing in the literature.

The study shows that in a densely populated low income agrarian rural economy, the improved and lucrative modern nonfarm sector offers new opportunities. This may have useful policy implications in regions where the labour absorption capacity of the agricultural sector is seen to be declining. The study suggests that emergence of the

modern nonfarm sector in such regions can improve the local economy through better consumption bundles higher rural-urban trade.

O.5.2 Theoretical Perspective and Some Case Studies of the Nonfarm Sector

Paper - II extends the existing theoretical perspective on the nonfarm sector by building on the emerging role of the rural nonfarm sector in the development process. A theoretical framework is presented in the paper which enables the evaluation of the strength and direction of the linkages arising from expanding the modern rural nonfarm sector. Here the potential of nonfarm sector to improve the consumption bundles of the participating resource poor households and encourage trade with the urban sector is examined. For such households positive changes in the consumption bundles are likely through improvement in the ownership bundles as shown in Paper I. By presenting a theoretical framework within which to assess the impact of these, Paper - II has shown the positive influence of the nonfarm sector in the rural economy.

The focus of previous research on the theoretical and empirical studies of the nonfarm sector, has been to examine the linkages emanating from agriculture to the nonfarm sector i.e. growth in nonfarm activities resulting from investment in agricultural technology and increasing the agricultural output, as shown in Figure O.1. By focusing on linkages arising from nonfarm sector (growth in nonfarm sector in response to consumption and trade of goods other than agriculture) to the rural economy, the paper has provided insight into important aspects of the nonfarm sector not found in the literature.

Rural nonfarm sector has been used to describe a wide range of all economic and service activities, other than farming that take place in rural areas (Anderson & Leiserson,1978). Such activities have been shown (Anderson & Leiserson,1980) to exist on or between the boundaries of the rural-urban and agricultural-nonagricultural categories. This classification involves a degree of arbitrariness in imposing a single dividing line on what is in fact a continuous spectrum of situations.

The analysis of the linkages between agriculture and the rest of the economy can be dated back to Quesnay in 18th century France as pointed by Harriss (1987), and later in the mid 20th century in the debate on balanced and unbalanced growth for development. This is found in the works of Rosenstein-Rodan (1943) and Nurkse (1953) who were proponents of balanced growth, where they argue that for a country to achieve sustained growth it must simultaneously develop a wide range of

industries. Hirschman (1958), an advocate of unbalanced growth introduced the concept of linkages: backward and forward, such that the pattern of linkages between different industries can be taken into account in deciding a development strategy. It was Mellor (1976) who for the first time examined the role of linkages in the context of the nonfarm sector and the rural economy to benefit economically backward rural households. Mellor's work on the Indian rural sector initiated much of the subsequent research on growth linkages: backward and forward, where the former indicated the demand from the agricultural sector for the nonfarm sector goods and the latter resulted from the supply of agricultural products to the nonfarm sector units.

Several studies have since been carried out to examine the agrarian economy in the context of growth linkages. Hazell & Roell (1983) indicate that evidence from Malaysia and northern Nigeria shows that households with large agricultural output provide incentive for the growth of nonfarm sector processing units.

Harriss (1987) subjected the growth linkages to empirical validation in an agricultural region of South India. The study points to the prominence of forward production linkages over backward linkages in the region. It also indicates that increased production of certain crops (paddy & groundnut) was accompanied by a growth in activities, which were both backward linkages (requiring nonfarm inputs) and forward linkages (providing raw material for rice and oil processing units) in the region.

It is the growth linkages that make the nonfarm sector an important tool in the development process. Grabowski (1995) proposed a three sector model for development where the third sector represents nonfarm production (as defined earlier in the section) by rural dwellers. Within this context the usual conclusions drawn from dualistic models concerning surplus labour are shown to be misleading. The reason for this arises from the allocation of labour between agricultural and rural based nonagricultural activities such that the marginal products in these activities are equally positive and equivalent to labour's opportunity costs in Grabowski's model. On a similar note Ray (1993) argues that small commodity production in the rural areas can facilitate sustainable and equitable development.

In the context of some South and South East Asian countries Mukhopadhyay (1985) has focused on the bifurcation of the nonfarm sector based on the production technology, linkage patterns and surplus generation rather than on aggregated product lines. The two identified sub-sectors comprise:
(1) enterprises with the objective of surplus generation using primarily hired labour and modern/appropriate technology (Z^M) and

(2) activities which are often seasonal and mostly run with the help of unpaid family labour (Z^T). Such units cater to the local market. However, with limited income opportunities, the Z^T units continue to provide employment to family members in the resource poor households as means of subsistence rather than as commercial ventures. In keeping with the labour residual philosophy these respond more to the supply side of the labour market than to the demand for the output. It is argued (Vaidyanathan, 1994), that rural workers who cannot get adequate work in agriculture spill over into rural nonfarm activities (Z^T) at low productivity and wages.

The categorisation of nonfarm sector into the two sub-sectors noted above has been adopted by Ranis & Stewart (1993, and the present study) as the modern Z^M and traditional Z^T nonfarm sectors.

It is noted by Papola (1987), Mukhopadhya (1985), Dev (1990), Chandrasekhar (1993) and Adams (1994) among others, that in the absence of alternative income generating avenues, the traditional nonfarm sector or Z^T continues to provide means of subsistence living in many rural areas of developing regions. While Mukhopadhya, Papola and Dev support the residual sector hypothesis through analysis of the employment and output pattern of the nonfarm sector, Chandrashekhar's conclusions are based on his examination of the Green Revolution and causes for occupational diversification in certain regions of India. Adam's analysis of nonfarm income in rural Pakistan reveals that while nonfarm unskilled labour income has an equalising effect on distribution, nonfarm income from services (government) has a disequalising effect. Adam attributes this to higher entry costs involved in nonfarm government employment, especially in the form of education, which makes this source more accessible to the richer households.

The relevance of the nonfarm sector as an integral component of the development process is increasingly being recognised, as seen amongst others in the works of Leidholm & Chuta (1976), Anderson & Leiserson (1980), Braun et al (1991), Adams (1994) and Grabowski (1995). This has led to interest in researching its various facets to assist the poverty reduction strategies for developing countries. However, the existing literature on the theoretical and empirical studies of the nonfarm sector, some of which have been reviewed above, shows that the focus of the research has been to examine the linkages emanating from agriculture to the nonfarm sector as shown in Figure O.1.

The literature shows that the relationship between linkages that may arise from the nonfarm sector to the agricultural sector/the rural economy and possible development

strategies have not been analysed with the same depth. The few studies that mention this aspect are those of Ranis and Stewart (1987), Grabowski (1995) and Reddy and Chakravarty (1999). While Ranis and Stewart provided a useful framework within which three types of linkages operate between the nonfarm sector and the rural economy and Reddy & Chakravarty's empirical work shows the positive effects of nonfarm income on rural household income, these studies do not go far enough to appraise the linkages that may arise as a result of expanding the rural nonfarm sector.

Paper - II addresses the above issue in two steps. First it builds on the emerging role of the rural nonfarm sector in the development process. Second, it provides a theoretical framework that enables the evaluation of the strength and direction of the linkages arising from expanding the modern rural nonfarm sector. Here the potential of nonfarm sector to strengthen the consumption bundles of the participating households within the rural area and encouraging trade with the urban sector is examined. By focusing on linkages arising from nonfarm sector to the rural economy and presenting a framework within which to assess the impact, the paper has shown the positive influence of the nonfarm sector in the rural economy. More specifically, this has been carried out in Paper II by demonstrating that a change in the price of the modern nonfarm goods Z^M causes improvement in the consumption bundles of the resource poor households reflecting positive changes in the respective consumption contrained ownership bundles.

O.6 Review of Existing Literature on System Dynamics Simulation and its Application to Development Studies, Paper - III

The concepts of a multiple sector economy (discussed in section O.4.2. and Paper - I) together with the expansion of the nonfarm sector (discussed in Paper - II) are combined in this paper to develop a growth model for a segmented economy. The model is then used to simulate the income flows in the rural sector of east Uttar Pradesh using system dynamics methodology. The objective of this simulation is to establish the potential of the nonfarm sector, through employment, to enhance the ownership bundles of the low income households as shown in Figure O.1. Here a representation of the chosen system (the rural sector of east Uttar Pradesh in this study) capable of reproducing the existing system behaviour is made. Such system dynamics simulations permit the examination of the effect of all the interacting variables of the selected system simultaneously.

The present study has deployed the system dynamics simulation for evaluating the development strategy of rural nonfarm employment: the Social Forestry project

implemented in the region under study in 1979. This step addresses the issue of substantiating the findings of a simulation by evaluation of a real situation, which is seen to be missing in the studies reviewed in the following section. The evaluation of the nonfarm strategy of Social Forestry through the simulatiuon process while assessing its effectiveness to enhance household income brings into focus the limitations of such projects and the effect of these on the rural economy.

The review here is divided into two sub-sections. The first sub-section reviews literature on the system dynamics methodology. This is followed by a review of the application of the methodology in development studies in the second sub-section.

O.6.1 The System Dynamics Methodology

Forrester's work through the 1960s and the following decade (1961,1968,1971,1983) at Massachusetts Institute of Technology introduced the conceptual framework and methodology which initially termed as Industrial Dynamics, has come to be known as System Dynamics. According to Forrester, social, economic and industrial systems are growing ever more complex. The complexity of these systems lies in the symptoms of urban decay, defaults on debt, terrorism and social and environmental degradation. In this methodology he has focused on ways for better understanding of the physical and social systems and to show how policies often produce the opposite of the desired results.

Coyle (1977) widened the application of System Dynamics through his emphasis on socio-economic areas. Coyle defined System Dynamics as the branch of control theory that deals with socioe-conomic systems, and the branch of management science, which deals with problems of controllability. Wolstenholme (1982, 1987, 1990) further contributed to the multidisciplinary application of System Dynamics by setting a broader framework that included operations research and the descriptive treatment of social and economic systems.

The system dynamics technique may be useful in the social sciences as it permits the analyst to examine the consequences of a policy over a period, prior to its implementation. This step helps in the identification of variables that do not bring about significant changes in the early stages, but may have undesirable or positive influences on the system in the long run. Appropriate measures can then be taken to account for the interaction of variables in their entirety on the system under study and thus reduce the probability of a course of action deviating from its expected path.

A major constraint to any study of socio-economic systems in most developing countries is the absence of reliable and consistent empirical data. System dynamics methodology offers a technique to overcome this problem to some extent. The subjective data regarding the relationship between certain variables and the limited empirical data available on these can be used in a graphical function. The resulting behaviour (a new variable) is then incorporated in the model and its influence on the whole system can then be studied.

Although system dynamics can be a useful tool of analysis especially in the context of developing countries, a word of caution has to be mentioned regarding the simulation results and the absence of any measures to check the robustness of the individual relationships that make up the model. Since the focus of the methodology is on examining the shape of change over time to redesign policy, simulations of socio-economic systems should be examined for the trends that are produced rather than the actual figures. Variables causing a particular trend can then be studied as a separate system and an appropriate policy can be formulated.

In summary, the procedure to observe and identify problematic behaviour of a system over time and to create a valid diagrammatic representation/model of the system, capable of reproducing the existing system behaviour along with design of improved system behaviour has grown over four decades. During its rudimentary stages the applications were largely industrial (Forrester,1961). Later the application areas broadened (Forrester, 1968, 1971 and Meadows et al 1972). During the 1970s and 1980s the scale of individual studies has been reduced, but the scope of application of the method has become extremely wide, covering most traditional academic disciplines of study, with a strong emphasis on socio-economic areas.

O.6.2 System Dynamics Application to Development Studies

Saeed (1980,1987) was amongst the first researchers to have applied this methodology to examine the various facets of the economy in the context of developing countries. Saeed's original model draws on neoclassical theory to construct a basic structure for growth and market clearing. The model is then modified by relaxing its simplifying assumptions about aggregations of sub-economies, savings and investment and wage determination. The model assumes the concept of economic dualism first recognised by Boeke (1953) and further developed by Lewis (1954), Sen (1966) and Bardhan (1973) which represents the coexistence of multiple sub-economies in developing countries.

Later Saeed (1988,1994) modified his original model and used it for experimental evaluation of past and exploratory development polices. In a more recent study, Saeed and Prankprakma, (1997) further relaxed the assumption of absence of technological growth used in previous models. The system dynamics model of a dual economy then attempts to identify operational ways for integrating technological growth into the development plans. The model incorporates the behavioural responses of the formal and self-employed to competition and innovation. This model is then deployed as an experimental apparatus to search for appropriate technological development policies to facilitate economic growth and change income distribution.

Saeed's contribution in introducing the system dynamics methodology to examine growth policies in the context of developing countries is noteworthy. His work has provided useful insight into the evolution of technological growth in developing countries using the system dynamics model. However, the framework in his findings remains hypothetical which may dilute the importance of the implications. For example, while the examination of different technological policies as a tool for economic growth has important implications for policy makers, it remains the conclusion of a hypothetical situation. The findings may be made more meaningful by substantiating these through evaluation of a real situation in a region exhibiting high technological growth in a developing country.

Sharma (1985) examined the planning and policy design process using a system dynamics model in the Indian context while Tiwari's (1989) work focused on viewing economic backwardness in urban and rural sectors as components of the same system.

The present study is distinct through its application of the system dynamics simulation for evaluation of a real world situation through assessing the development strategy of rural nonfarm employment. This step addresses the issue of substantiating the findings of a simulation showing a hypothetical configuration of variables by evaluation of a real situation, which was seen to be missing in the studies reviewed above. The experimental component in this work builds on earlier work (Tiwari,1989) to show how varying levels of rural nonfarm employment affect the incomes of the poorest households. The empirical evaluation, while assessing the effectiveness of nonfarm employment to enhance household income brings into focus the limitations of such projects and the effect of these on the rural economy.

O.7 Overview

An attempt is made in this dissertation to study causes of the persistence of rural poverty in the Indian context and examine ways of overcoming some of these through expansion of the modern nonfarm sector. Figure O.1 shows the contribution of the present work and its place in the literature. The current thinking on the issues examined in each of the three papers and the respective findings showing the value added to extend the literature is indicated in this figure.

The first essay examines the relationship between the ownership bundles of rural households and poverty. It builds on the existing literature on the causes of rural poverty by establishing a relationship between the rural households and the anti-poverty policies through the ownership bundles of the households. This important perspective, found to be lacking in the current literature, presents a framework within which the collective response of the households that determines the success or the failure of a policy can be examined. It is shown here that weak ownership bundles perpetuate economic backwardness in the rural sector. This has been carried out in Paper - I within the entitlement framework which is noted for its usefulness in theoretical applications. The relationship established here between ownership bundles, poverty and its persistence may be extended beyond the theoretical layout and examined empirically. This may further the understanding of the causes of poverty and its persistence for policy makers in future.

The second essay examines expansion of nonfarm sector as a strategy to improve the consumption bundles of the resource poor rural households using a theoretical framework. The work here extends the increasing awareness of the potential role of the nonfarm sector in the development process. This is done by focusing on the expansion of the modern nonfarm sector and linkages running from it to the rural economy. The literature shows that while the examined issue is an important component of the nonfarm strategy, not many detailed studies have been carried out to explore it. The paper has contributed to the literature in the field by presenting a framework within which a definitive treatment of the strength and direction of effects caused from linkages arising as a result of expanding the rural nonfarm sector can be made. The work here may be extended by incorporating labour input and examining the effect of expanding the modern nonfarm sector on the wages in other rural sectors. The model may also be made dynamic to capture the changing economic reality.

In the third essay system dynamics simulation is applied to establish the income enhancing potential of the nonfarm sector and empirically appraise a nonfarm

employment project of Social Forestry in the region under study. By supplementing the experimental findings with evaluation of a real world situation of nonfarm emolyment through the Social Forestry project, the study has shown a way that can make the findings of a system dynamics model more effective and acceptable to policy makers. To an economist, the application of the system dynamics simulation while assessing the effectiveness of nonfarm employment to enhance household income brings into focus the limitations of such projects and the effect of these on the rural economy.

The application of system dynamics in economic analysis remains scarce mainly due to the absence of ways of cross checking the relationship between variables being examined. However, it can be a useful tool of analysis especially in the context of developing countries, where often there is an absence of reliable and consistent empirical data. The system dynamics methodology offers a technique to use the limited empirical and subjective data on the relevant variables in the analysis. While access to consistent data remains low, system dynamics methodology may be employed to examine critical issues in the complex economic configurations in developing countries.

In conclusion, it can be said that while much remains to be done in the understanding of the poverty related issues, the present study has contributed to the existing literature on rural poverty by bringing into focus the relationship between the ownership bundles of households, the development incentives and the persistence of poverty. The research on this important aspect remains scarce. The study has further made the involvement of nonfarm sector in the development process more acceptable by providing a framework within which the effectiveness of expanding the nonfarm sector on the rural economy can be evaluated.

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PAPER - I

POVERTY AND DUALISM IN THE RURAL SECTOR OF DEVELOPING COUNTRIES: THE INDIAN EXPERIENCE

1.1 Introduction and Objective of the Paper

This paper is the first of a three part study of rural poverty and nonfarm sector in India. The framework and its implications described here form the basis for the hypotheses examined in subsequent papers. It also provides a background for the study by analysing poverty and economic segregation within the rural sector.

The objective of this paper is to examine the existing economic backwardness in rural India in the context of household units, based on evidence drawn from the Census of India (1981,1991) and the work undertaken on its causes reflected in the literature. While important contributions have been made regarding rural poverty and its causes as seen in the works of Narain (1965), Lipton (1977), Ahluwalia (1978), Bardhan (1984), Rao and Rangaswamy (1988), Kakwani & Subbarao (1990) and Bhalla (1993), little attention has been given to analysing households' response to changes in economic variables such as introduction of appropriate technology in rural manufacturing or improvements in agricultural technology. Since it is the collective response of households that determines the success or the failure of a policy, the issue is examined in this paper and the response pattern related to the work carried out on the causes of rural poverty in the literature.

The study presents a theoretical framework within which rural poverty and its persistence are examined in the context of the households' response to incentives. The findings show the shortcomings of the present development strategies to achieve greater economic welfare of the rural population in India. The model in the study suggests ways of overcoming some of these obstacles.

The exchange entitlement approach introduced by Sen (1981) originally to explain famines and starvation has been extensively used by economists to further analyse

famines (de Waal, 1990 & Osmani, 1991), food entitlements and epidemics (Dreze & Sen, 1989) and food systems (Teubal, 1992). Gaay Fortman (1990) and Gore (1993) have moved beyond Sen's original terms where Fortman has examined an institutional approach to the acquirement problem starting with entitlement theory. Gore has extended Sen's definition of entitlement to examine legal rights and other public sector benefits. (For details see the Overview Paper - O). In contrast to the studies mentioned above, the present study applies the exchange entitlement approach to explain the persistence of poverty and the presence of groups with different productive resources within the rural sector.

The entitlement framework is used in this paper to explain why economic progress has not reached the poorest households in rural India. The process of development in the Indian rural sector is further examined by considering the economic and the development policy characteristics prevalent in the sector. The study examines the rural economy to indicate the presence of groups with different productive resources that fit in the dual sector framework within it. The dual sector perspective adopted in this paper is distinct from the rural versus urban sectors, as proposed in many conventional dual economy models (Lewis,1954, Fei-Ranis,1964). Here, the rural economy itself exhibits dual sector characteristics.

This paper indicates that poor resource base is one of the causes of rural poverty. Consequently an important policy implication of this study on development projects for rural India is a shift in the emphasis towards enhancing the productive capabilities (resource base) of the economically deprived individual households. The relationship between the resource base of households and the benefit package offered in the existing policy is shown to be such that households with stronger resource base have easier access to the incentive bundles as compared to the economically backward households.

1.1.1 Organisation of the Paper

The study is organised in six sections.

In section 1.2 the exchange entitlement approach is described. The exchange entitlement mapping concept is then modified to explain the persistence of poverty in the rural sector in India in section 1.2.1.

Section 1.3 examines the rural labour market in India in terms of the factors that contribute to changing a person's exchange entitlement and ownership bundle in the rural sector. The purpose of this exercise is to assess the relationship between the ownership bundles of rural households and the existing rural market structure.

Section 1.4 seeks to examine the presence of distinct groups with different productive resources in terms of the exchange entitlement of rural households within the rural economy. The purpose of this analysis is to investigate whether any similarities can be drawn between groups with different ownership bundles within the rural sector in India and the dual economy models of Lewis (1954) and Fei and Ranis (1964). The findings are then evaluated to study the impact of such groups on the development process in rural India.

The resulting exchange entitlement of individual households and the economic prospects open to them in the rural market are investigated in section 1.5. The production and trade possibilities open to a household are incorporated in the exchange entitlement equation in this step.

Conclusions of the study are discussed in section 1.6.

1.2 The Exchange Entitlement Approach

A number of economists throughout the '70s, '80s and early '90s focused on the issue of rural poverty, the vicious circle of poverty and the low success of the 'trickle down effect' with reference to rural India (Lipton,1977, Chambers,1983, Bardhan, 1984,1985, Rao,1985, Mellor,1985, Bhalla,1989, Kakwani & Subbarao, 1990, Vaidyanathan,1992). The spectrum of theories put forward ranges from the presence of urban bias in development policy, the inappropriateness of development models and flaws in the implementation process of the incentive packages. Indirectly all

views point to the insignificant change in the earnings of the poorest rural households. The present study aims to elaborate this issue in order to understand its causes and explain the persistence of poverty amongst rural households in India.

In his study on 'Poverty and Famines' Sen (1981) used the ownership bundle and the exchange entitlement approach to examine famines and households that are likely to be caught in famines. In this section the ownership bundle and the exchange entitlement mapping concept has been modified to explain the persistence of poverty and the presence of groups with different productive resources within the rural sector. The analysis seeks to focus on the reasons for the very small change in the living standards of the poorest households in the rural sector that has been achieved by past development policy.

The exchange entitlement approach emphasises the understanding of the structure of the ownership or entitlement systems within which poverty is analysed. In an economy with private ownership and exchange in the form of trade and production, the entitlement of a person depends on the person's endowment (the ownership bundle) and the exchange entitlement mapping. The exchange entitlement mapping function Ei of person i transforms an endowment vector of commodities x into a set of alternative availability of vectors of commodities Ei(x). This is illustrated by considering a peasant in the rural sector. The endowment of the peasant consists of the peasant's land, labour power and a few other resources (e.g. cattle, tools). Beginning with the initial endowment, the peasant can acquire a number of different commodity bundles, some of which are listed below:

-produce food for own consumption (Production-based entitlement),

-sell labour power and get wages with which a package of consumables including food, can be acquired (Own-labour entitlement),

-sell the agricultural produce to buy other commodities and food (Trade-based entitlement)

The set of all such available commodity packages in a given economic situation is the exchange entitlement of the peasant's endowment. The exchange entitlement

mapping, then specifies the exchange entitlement set of alternative commodities, respectively for each endowment bundle. Mathematically this is expressed as follows: x is taken as the vector of commodities (including 'labour power') that is owned by a rural household, and p the n-vector of prices faced by the household. Given the household's ownership vector x, it follows that the household's exchange entitlement set E(x) is the set of vectors any one of which can be acquired by exchanging x.

(i) $E(x)= \{y|y \in X \ \& \ py \leq px\}$.

where X is the set of all non-negative vectors of all commodities (food, non-food consumables, services i.e. health, education, communication, transportation).

The exchange entitlement mapping (E-mapping) depends on the legal, political, economic and social characteristics of the society and the person's/household's position in it*. Production is an important aspect of this approach, thereby making production opportunities and trade possibilities of resources and products crucial in the analysis of E-mapping.

1.2.1 Poverty and the Exchange Entitlement

In this section, the concept of exchange entitlement outlined in section 1.2 is applied to explain the relation between poverty and ownership systems. Poverty in this study is considered to be the deprivation of the economic means to fulfil the basic needs package. In this study, the official Indian poverty line of Rs 2220 per capita, per annum (which translates to US $123 per capita per annum at 1991 exchange rate) based on the nutritional calorie requirement is assumed to meet the basic needs package. The World Bank poverty line of one US dollar a day ** (per capita) is used in section 1. 4. 2 to define the different economic groups within the rural sector.

In a rural market economy, a person can exchange what the person owns for another set of goods through trading and/or production. The different package of commodities that can be acquired in exchange for what the person owns is the 'exchange entitlement' of what the person owns. The 'exchange entitlement mapping' (E-

* Legal and political aspects of the society are excluded from this study.

** In 1993 purchasing power parity dollars. This is the lower poverty line while the upper is $2 per day.

mapping) defines the economic possibilities that would be open to a person corresponding to each ownership situation. Hence, given the E-mappings it is possible to identify those ownership bundles that cause poverty i.e. ownership bundles that are insufficient to acquire the basic needs package.

If the exchange entitlement of a rural household is given by (i) in section 1.2 i.e.
$\mathbf{E(x)= \{y|y \in X \ \& \ py \leq px\}}$
and the set of commodity vectors that satisfy the 'basic needs' requirement is given by $B \subseteq X$, then a person is deemed to be living in poverty, when $E(x) \cap B = \varnothing$. The 'poverty set' P of ownership vectors consists of those vectors x in X such that the exchange entitlement set E(x) contains no vector satisfying the basic needs requirement. i.e.
(ii) $\mathbf{P = \{x|x \in X \ \& \ E(x) \cap B = \varnothing\}}$.

The person or a group of persons will therefore be pushed into the poverty group or continue to live in poverty as long as their endowment vector remains unchanged and the exchange entitlement satisfies equation (ii).

Given a person's ownership bundle, Sen (1981) notes that the factors that can change the person's exchange entitlement are:
-Employment profile i.e. employability, its duration and wage rate.
-The money value of the person's non-labour assets.
-The value of return on the person's output.
-The cost of purchasing resources.
-The social and economic benefits the person can get and the taxes that must be paid.

The configuration of the above factors and the resulting effect on the exchange entitlement is influenced by the economic, social and political structure of a specific region. The next section examines the rural labour market in India in terms of the factors (listed above) that bear the potential to change a person's exchange entitlement and its effect on the ownership bundle. The analysis is carried out to examine the relationship that emerges in the subsequent sections between poverty and the existing structure of the labour market.

1.3 Exchange Entitlement and the Rural Labour Market

Much has been written about the rural labour market in India regarding its pattern of employment generation and wages (Bhalla,1987,1993), distribution of landholdings (Bardhan,1978, Sharma,1994, Besley,1997, Besley & Burgess,2000) and productivity (Datt and Ravallion, 1998). Detailed studies by Bardhan (1984), Rudra (1981), and Rajaraman (1984) show that the rural labour market in India is highly segmented, with wage rates differing even for labour involved in narrowly defined agricultural operations within the same geographical area. Characterised by its high dependence on agriculture for employment (66.9 percent of the total working population and 85 percent of the rural working population was employed in agriculture in 1991, Census of India,1991), other employment opportunities remain limited in the rural labour market in India.

This section examines the rural labour market in terms of the factors that contribute in changing a person's exchange entitlement E(x) and ownership bundle in the rural sector. The purpose of this exercise is to assess the relationship between the ownership bundles of rural households and the existing rural market structure. The examination here is expected to show how changes in the rural market structure brought in mostly through government policies, have affected the ownership bundles of the rural households in the last three decades. The steps involved in carrying out this investigation are described below.

In section 1.2.1 it was noted that some of the factors that may influence a person's exchange entitlement are the: employment profile in terms of employability, its duration and wage rate, the money value of the person's non-labour assets, the value of return on the person's output, the cost of purchasing resources and the social and economic benefits the person can get. Data on each of these variables in the rural market are examined to find how changes in them have affected the entitlement of rural households. The employment profile of rural households is studied through changes in the literacy levels and the corresponding changes in the demand for rural educated labour and its wages. Changes in the ownership bundles of rural households resulting from changes in the non-labour assets are examined through distribution of

Figure 1.1

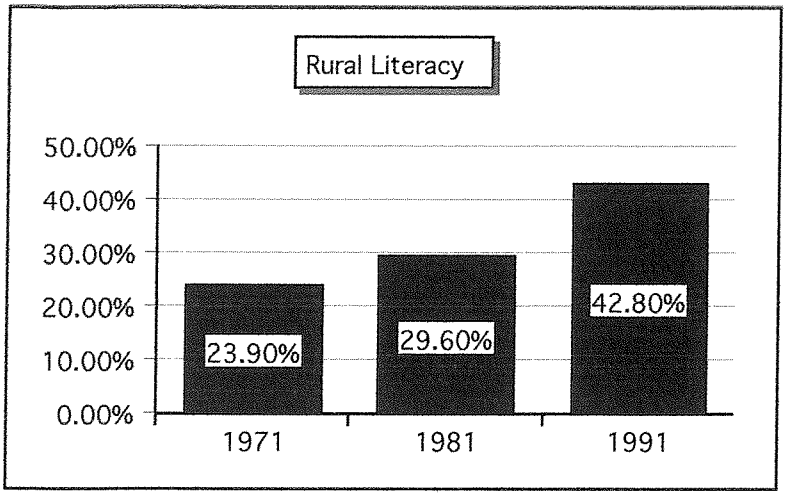


Figure 1.1a

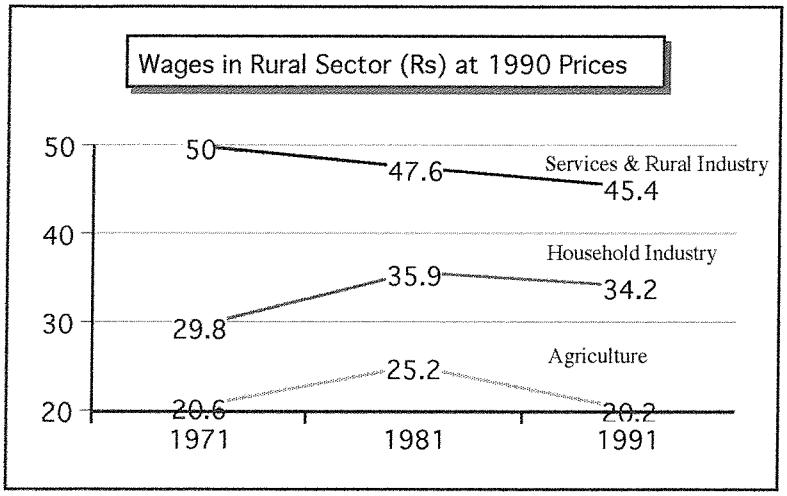


Figure 1.1b

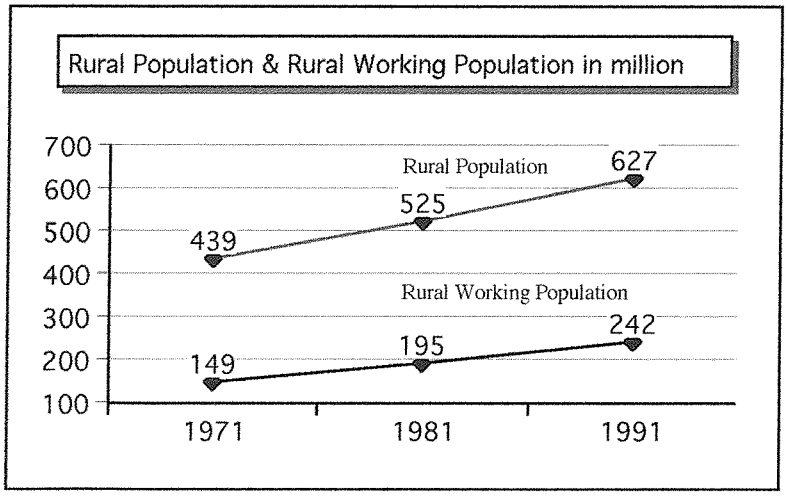


Figure 1.1c

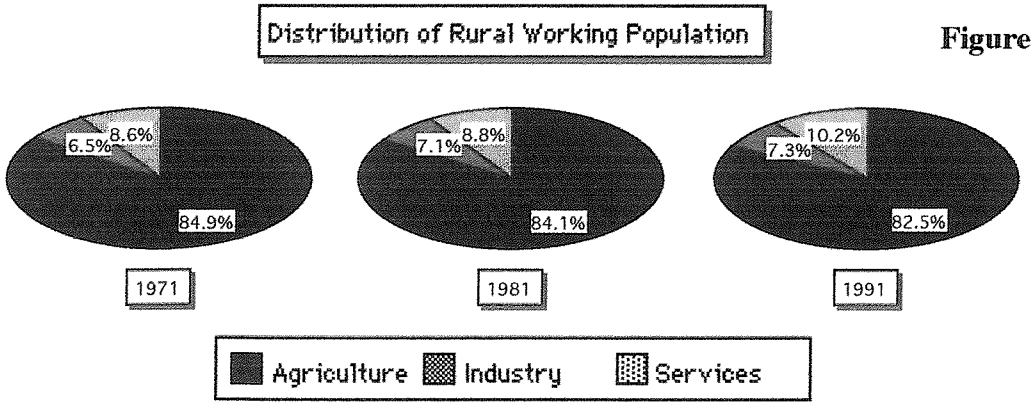


Figure 1.1d

Source: Census of India, 1971,1981,1991

land and other assets such as livestock and agricultural machinery. The government's pricing policy on food together with the inflation rates in the rural consumer prices are considered to examine the effect of these on return on output and the cost of purchasing resources by the poor households. The economic and social benefits that can alter the ownership bundles of the rural households are assessed by examining the government programmes initiated to channel the development incentives. The objective of this analysis is to focus on how changes in the rural market structure have affected the exchange entitlements of the rural households.

1.3.1 Employment Profile

This section examines the employment profile in terms of the literacy levels, the employment possibilities and the wages offered by the different sectors within the rural economy. Literacy is an important component of the endowment of an individual since it can influence the employability and hence the exchange entitlement of the individual. Positive changes in the literacy levels are expected to improve the exchange entitlement of a person through better paid skilled jobs in industry, services and agriculture. The following section examines the data on the literacy levels and changes in the employment possibilities of the rural population in India.

Changes in the rural literacy levels for the years 1971, 1981 and 1991 together with the distribution of workers in different sectors and the wage rates in the corresponding years in the rural market are shown in Figures 1.1(a, b, c and d). The figure shows that although only 42.8 percent of the rural population was estimated to be literate in the 1991 census, this is a significant increase in the literacy rates over the 1981 (29.6 %) and 1971 (23.9%) census. Data on the distribution of working population in the rural industrial and service sectors in the same period (1971-1991) shows that the employment possibilities in these sectors have grown very slowly: employing 6.6 and 8.7 percent of the working population in the rural industry and services respectively in 1971 which increased to 7.3 and 10.2 percent in 1991. Assuming the importance of literacy in both industry and services, changes in the literacy levels and the employment possibilities in these sectors show that there is mismatch between the increase in the supply of rural literate labour and the demand for their services.

Growth in both the rural industry and the service sectors has been slow such that demand for the services of the educated labour remains low in the rural sector. While the demand for educated skilled labour in agriculture increased during the last decade, it has been limited to the small proportion of the large farms (Bhalla,1993). This reflects the presence of distortions: mostly institutional in terms of investment lumpiness in rural industry together with lack of enterprise and untapped markets for such products. These distortions are a likely cause for the less than efficient allocation of educated labour in the rural sector. This has resulted in changes in the rural literacy levels not being accompanied by market forces that stimulate the demand for their services in the rural sector.

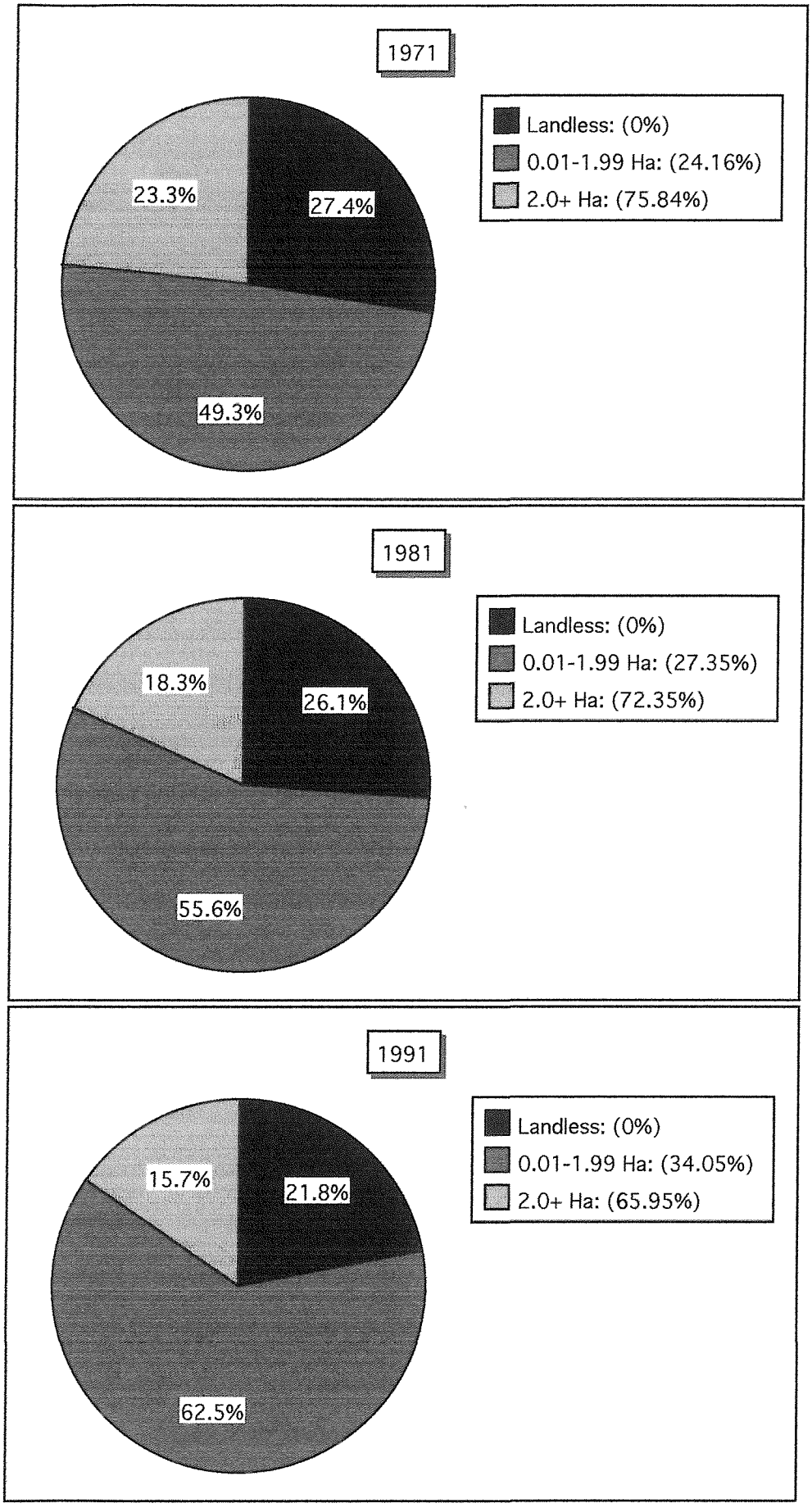
The rural market in India is seen to have a male literacy growth rate of 3.2 percent annually (based on the five year period 1987-88-1993-94, Sarvekshana, 1996), growth in the rural industry of just over 2 percent (Figure 1.1 d) and the growth in the labour force of 1.9 percent annually (over a base of 222 million in 1991). The current situation has caused increasing concern where Lipton (1997) has raised the issue of focusing efforts to stimulate both the demand and the supply aspects of the market in India. This may have special relevance to both the rural industry/service and the agricultural sectors. Here, although the positive effects of literacy on agricultural productivity and industrial growth are well established in some regions*, the demand for the services of educated labour in large parts of rural India remains low as indicated in Figure 1.1d.

In summary, improvement in the rural literacy level which is an important component of the endowment of an individual, is not being accompanied by forces that stimulate the demand for the services of educated labour in the rural economy. The endowment of many individuals has improved without the resulting improvement in the exchange entitlement or the bundle the individual can exchange for the endowment. This

* The Indian states of Kerala, Haryana and Punjab, all with rural literacy levels of over 55 percent, have the highest output per hectare in the country, while the number of nonagricultural households in poverty was the least in Kerala, the state with the highest literacy in India (Quibria,1994).

Figure 1.2

Distribution Of Rural Households By Holding Size And Area* Operated



***Figures in ( ) in the legend give the % of area operated.**

Source: Chelliah and Sudarshan, 1999 (based on Sarvekshana,1990 & Tendulkar,1997).

indicates a market failure where the resource of educated labour has not been allocated efficiently.

1.3.2 Value of Non-Labour Assets

In a predominantly agricultural market, ownership of land continues to be the major non-labour asset of the rural households. This section examines the distribution of operational holdings by size and area amongst rural households together with the ownership of other non-labour assets such as livestock and irrigation equipment. The objective of the exercise in this section is to assess the existing ownership of non-labour assets and relate it to the exchange entitlement of rural households in the concluding section.

Figure 1.2 shows the changes in the size distribution of holdings and area operated by households in rural India for the years 1971,1981 and 1991. The operational holdings are classified into three categories in this study* such that holdings less than 0.01 hectare are that of the landless households, the holding size 0.01 -1.99 hectares are classified as small farmers while holdings over 2.0 hectares are those of medium and big farmers.

The reduction in the percentage of landless households from 27 percent in 1971 to 22 percent in 1991 as seen in Figure 1.2 is a positive outcome of the land distribution measures undertaken by the government since the early 1960s.

The share of area operated by small farmers with holdings less than 1.99 hectares increased by 10 percent between 1971 and 1991 as shown in Figure 1.2. The demographic pressures on agricultural land appear to offset the benefits of land distribution. This is illustrated by the distribution of small farmers and area operated by such households between 1971 and 1991. The small farmer households accounted for 49 percent of the rural households and operated 24 percent of the total cultivated

* This classification remains the same in Papers - II and III. The National Sample Survey Reports classify the holdings into six categories.

Table 1.1

Distribution Of Non-labour Assets Amongst Households With Under 2.0 Hectare Holdings* In Rural India (1991-1992)

HOLDING SIZE (Hectare) → / NON-LABOUR ASSET ↓	0.00	0.02	0.21-0.50	0.51-1.00	1.01-2.00
LIVESTOCK OWNED PER 100 HOUSEHOLDS					
CATTLE	14	76	138	206	228
SHEEP, GOATS & POULTRY	69	89	160	296	338
PIGS	2	4	3	6	4
IRRIGATION EQUIPMENT OWNED PER 100 HOUSEHOLDS					
PUMP	0.51	1.58	7.04	11.69	22.12
INDIGENOUS WATER-LIFT	14.39	28.29	44.85	45.16	53.07
% OF HOUSEHOLDS	21.84	20.28	13.31	14.66	14.21

* Such households make up nearly 84 percent of the rural household population.

Source: Chelliah and Sudarshan, 1999

area in 1971. The same category makes up over 62 percent of all rural households and operates 34 percent of the area in 1991.

The increase in the percentage of small farmer households and a decrease in the percentage of landless households is accompanied by a decline of 10 percent in the share of area operated by the medium and big farmers households with holdings over 2.00 hectares in the period 1971 to 1991. The average area operated per household has decreased from 1.60 hectares in 1971 to 1.08 hectares in 1991, though the inequality in land distribution in rural India remains high with 66 percent of the area being operated by under 16 percent of the total rural households in 1991. The remaining 34 percent area is operated by 62 percent of rural households while the other 22 percent households are landless (1991).

Table 1.1 shows some characteristics and ownership of assets of small farmer (62 percent) and landless households (22 percent) which together accounted for 84 percent of the rural households in India in 1991. The under 2.00 hectare operational holding is further classified into four smaller holdings to enable a detailed assessment of the asset ownership of households in each category as opposed to aggregate level data that may smooth the variations in the asset ownership amongst households with different size holdings.

Working on the assumption made in the UNDP study (1999) that at least two heads of cattle per household is the minimum necessary for farming in the under 2.00 hectare holdings in rural India, Table 1.1 shows that the two lowest size groups, in all nearly 34 percent of the rural households do not possess this minimum. The next two size groups barely meet the two heads of cattle minimum criterion while the ownership of livestock amongst the landless class with an average of 0.85 per household* falls far below the subsistence requirement. Table 1.1 further shows that although between 45 and 53 percent of households with holding size of 0.21 and 2.0 hectares possess indigenous water lifting equipment, irrigation pumps are rare.

* Total livestock owned by 100 landless households /100

The inequality in the distribution of total assets of households of holdings under 2.0 hectare noted in Table 1.1, and those over 2.0 hectare is reported to be high with a Gini coefficient of 0.60 (Kulkarni et al , 1984, Chelliah & Sudarshan, 1999). Agricultural machinery is shown to be most unequally distributed with a Gini coefficient of 0.63 while cattle the most important asset (other than land) of the rural community has a Gini coefficient of 0.43.

In summary, the 62 percent of rural households operating holdings under 2.0 hectares (1991) and the 22 percent rural households that are landless (1991), in all 84 percent of the rural households can be characterised by a low non-labour and physical asset base. In the absence of intervention processes to supplement the land distribution policy, the benefits of the policy have been offset by the increasing population pressure on land. This has resulted in no real change in the non-labour assets of the majority of the rural households. The non-labour asset component of the endowment of most individuals in the rural sector therefore remains unchanged.

1.3.3 Return on Output and the Cost of Purchasing Resources

Food pricing policy plays an important role in determining poverty in a country, more so in a country like India where for a large proportion of consumers, expenditure on food makes up nearly 70 percent of the total expenditure. Quibria (1994) notes that 72 percent of the rural households in India are net purchasers of food.

The Indian Government has addressed the need for high agricultural prices to give incentives to domestic producers and low food prices for the consumers through the dual pricing system. Under this system ration cardholders can acquire selected consumer goods at prices below the market prices. However, the rural coverage of the system has been slow and generally no means test is applied while issuing the cards so that all cardholders have equal claims to the same subsidy (Chelliah and Sudarshan,1999).

The pricing policy involving high proportions of government subsidies to keep both the input and output prices low has been criticised (Quibria,1993) for raising the

Table 1.2
Inflation Rates In Consumer Prices In Rural India

YEAR → / INFLATION RATE ↓	1971-1979	1981-1989	1991-1996
ALL FOOD	7.5	7.2	7.4
NON-FOOD	7.5	5.5	6.8
ALL COMMODITIES	10.1	8.5	9.6

Source: Chelliah and Sudarshan, 1999

prices of foodgrains in the open market from which the rural households not covered under the scheme buy their food. This process appears to have contributed to the persistence of chronic food insecurity amongst a large proportion of rural households reported in a recent UNDP study in India (Chelliah and Sudarshan,1999).

The increasing subsidy allocations may further enlarge the growing government budget deficit and generate inflationary forces in the market. This has adverse effects on both consumers and producers while nullifying the benefits of the low food price policy. Table 1.2 shows the inflation rates in rural consumer price of food and non-food commodities for 1970s, 1980s and 1990s. Inflationary pressure while remaining same on the prices of food showed a decline on the prices of non-food commodities throughout the 1970s and the 1980s. The first half of the 1990s registered a rise in the inflation rates in the consumer prices of food and non-food commodities. This upward trend in inflation coincides with the slowdown in the downward trend in poverty noted in the UNDP study (1999).

In conclusion, a pricing policy which can address the needs of both the producers (through return on output) and the consumers (through low cost of purchasing) is critical in the development process. The existing dual pricing policy in agriculture has been slow in benefiting the rural poor where the subsidies are not targeted exclusively to the poor but also availed by the relatively better off owners of big landholdings. The falling agricultural wages as shown in Figure 1.1 and inflationary pressures in the context of food prices have affected the exchange entitlement of poor households adversely.

1.3.4 Economic and Social Benefits

Economic and social benefits to the rural population in India have been channelled through a range of rural development programmes designed to stimulate the agricultural rural economy and provide employment. The average expenditure on rural development in India's Five Year Plans has been 6 percent of GDP (Chelliah and Sudarshan,1999). Allocations to education and health have been high on the

government's priority such that the current allocation to education (rural sector) of 3.9 percent of GDP is to be increased to 6 percent of GDP by the year 2002.

Since the early 1970s the rural development strategy has been implemented through poverty alleviation and human development programmes with emphasis on health and education. The main components* of the poverty alleviation programmes include the Integrated Rural Development Programme (IRDP) involving the resources and income development schemes, training for rural youth for self-employment (TRYSEM) and the rural works programme (RWP).

The major bottlenecks in the implementation of the programmes have been slow mobilisation of resources and leakages in the allocated funds (Bhalla,1987, 1993), and more recently a UNDP (1999) study in India has questioned the programmes' efficiency in alleviating poverty in terms of linkages with the real market demand and supply. Earlier discussions (section 1.3.1) on skill mismatch between the supply of educated labour and the demand for its services in the rural sector illustrate the above concern. On the other hand, the theoretical investigations of Narayana et al (1988) show that such schemes if targeted and financed appropriately can be highly effective in alleviating rural poverty. Gaiha's (1996) study of two villages in the state of Maharashtra suggests that the dependence of the poor on rural works programme diminishes when employment and earning prospects improve.

Both positive and negative aspects of the rural development programmes exist, though on balance the success rate of such programmes in assisting the targeted households to cross the poverty line has been low**. This is further supported by only a marginal increase in the per capita calorie intake of the lowest 30 percent rural expenditure group from 1504 cal/day in 1973 to 1678 cal/day in 1993. The average calorie intake in rural India declined from 2268 cal/day to 2152 cal/day in the same period (Radhakrishna,1997). Social benefits to the rural population through education and health facilities show wide variations in different regions reflected in the cost

* For details see the Overview Paper O, section O.3.4.

** The evaluation of the programme in 1993 revealed that just under 15 percent of the assisted families could cross the poverty line (Chelliah and Sudarshan,1999)

households have to bear towards availing the subsidised services. Variations in such costs are noted to range between 10 and 230 percent in a study by Krishnan (1996).*

In summary, the economic and social benefits to the rural poor in India though channelled through a well established government policy have been uneven and slow. While some improvement is noted in the poverty levels amongst the poorest rural households, most households have not been able to exchange their ownership bundles for better commodity bundles.

In sections 1.3.1/2/3/4 data on variables noted to affect exchange entitlement of rural households through changes in the endowment were discussed. The discussions show that while some improvement is observed in the endowment of rural households through higher literacy the corresponding change in the exchange entitlement has not been manifest.

In conclusion, when the rural market is examined in terms of the factors that influence the exchange entitlement E(x) of households, it is observed that the combined exchange entitlement of the rural households that constitutes the rural market does not necessarily respond to the changes in its demand and supply forces. The increase in the supply of literate labour is not reflected in either an expansion of the rural services /industry or changes in real wages in the rural sector.

In recognition of the signs of market failure in the system the government introduced regulatory responses through land distribution (1960s), dual pricing policy (PDS) and the development programmes in the early 1970s. These measures have been slow in stimulating the rural economy such that 84 percent of the rural households in 1991 census were characterised by poor physical asset base in terms of land and livestock. The pricing policy - a producer price support cum consumer subsidy programme (PDS) has been criticised for its regional / urban bias and causing an upward pressure in the open market price of foodgrains (Radhakrishana, 1996). This adversely affects

* In states like Kerala with 90 percent literacy (Census of India,1991), such costs for the poorest tenth of the population account for 10 percent of the per capita consumption expenditure. These costs were as high as 230 percent of the annual per capita consumption expenditure for the poorest tenth of the population in states like Uttar Pradesh and Bihar.

the rural poor not covered under the PDS and those who although covered still depend on the open market to procure their complete food requirement.

The regulatory measures have altered the factors influencing the exchange entitlement of rural households over three decades in such a way that low income households with poor ownership bundles continue to dominate the population in rural India. The subsequent sections examine some of the causes for the poor response in the rural market to the stimulus generated through such measures.

1.4 Exchange Entitlement and the Rural Dual Sectors

This section seeks to examine the presence of distinct groups with different productive resources in terms of the exchange entitlement of rural households within the rural economy. The purpose of this analysis is to investigate whether any similarities can be drawn between groups with different ownership bundles within the rural sector in India and the dual economy models of Lewis (1954) and Fei and Ranis (1964). The findings are then evaluated to study the impact of such groups on the development process in rural India.

The presence of groups with different productive resources is discussed in the next section followed by similarities with the dual sector models within the entitlement framework in section 1.4.2. The impact of these on the development process is examined in section 1.4.3.

1.4.1 Exchange entitlement and Groups with Different Productive Resources

The exchange entitlement approach states that the alternative commodity bundles (the consumption bundle) a household can acquire, depends on its endowment or ownership bundle. Given the ownership bundle of a household in the rural sector under study, it is possible to establish the nature of commodity bundles that the household can acquire. The commodity bundle vectors available in the rural economy, can be classified into three broad categories:

(i) the set that satisfies the 'basic needs' requirement and in addition contains consumer goods, machinery, higher (technical & university) education and health facilities. This is expressed as (B+Si) where Si represents commodities other than basic needs set, i.e.$(B+Si) \subseteq X$

(ii) the set that satisfies the 'basic needs' requirement (B) i.e. $B \subseteq X$

(iii) the set that does not satisfy the 'basic needs' requirement (B).

In terms of the exchange entitlement mapping, households with endowments that can be exchanged for the commodity vectors (i)-(iii) can be expressed as intersection of the entitlement set of the household with the respective commodity vector as follows:

- $\mathbf{Ec(x) \supset (B+Si)}$
- $\mathbf{Es(x) \supset B}$
- $\mathbf{Eso(x) \cap B = \varnothing}$

The first category of households with entitlement set Ec(x) contains all the sets of commodity vectors that satisfy the basic needs package and additional consumption, production and human capital commodities. The components of the commodity vector represented by Si would depend on the strength of the ownership bundles of individual household.

Rural households with entitlement set Es(x) are able to acquire the basic needs package. The exchange entitlement of such households contains all the sets of commodity vectors that satisfy only the basic needs package but no additional commodity bundles. The literacy, skills and other aspects of human capital (health, nutrition) are available in the minimum level included in the basic needs package, i.e. food, clothing and human capital requirements that can be acquired in Rs 2220 per capita per annum or Rs 11,100 per household of size 5 annually (the Indian poverty line in 1991).

The exchange entitlement Eso(x) on the other hand contains no vector that satisfies the basic needs requirement set B. Such households live below the poverty line. Here, 'poverty set' P of ownership vectors consists of those vectors x in X such that the exchange entitlement set Eso(x) contains no vector satisfying the basic needs

requirement. i.e. $P = \{x|x \in X \ \& \ Eso(x) \cap B = \varnothing\}$. The feature which distinguishes the economic status of the rural households is the intersection of the entitlement set E(x) with the basic needs requirement set B. The additional commodity vector Si distinguishes between the groups that possess the potential for economic progress and those that do not. The strength of the entitlement set determines the set of commodity vectors the household can acquire.

In this study, the ownership bundle or the endowment of a rural household is assumed to consist of land, labour power (agricultural and industry) and a few other resources (e.g. cattle, tools) in varying quantities. Figure 1.2 and Table 1.1 show that 62 percent rural households operating holdings under 2.0 hectares (1991) and the 22 percent rural households that are landless (1991), in all 84 percent of the rural households are characterised by a low non-labour and physical asset base. To supplement the household income many households are involved in household industry (Papola, 1987). The endowments of such households are poor such that these do not possess the additional commodity vector Si. The group of such households comprises the resource poor sector in this study. The remaining 16 percent households in Figure 1.2 operate 66 percent of the total operated area with holdings over 2.0 hectares (1991). A small proportion of households involved in rural industry for which the returns are higher than household industry also belong to this class. The additional commodity vector Si indicating the potential for economic progress is present in varying levels, depending on the strength of the ownership bundle. Such households represent the capitalist sector in this study.

The cut off line between the resource poor sector and the capitalist sector in this study is taken as one dollar per day per capita (the lower World Bank poverty line). This translates to approximately Rs 30,000 per household of 5 members (in 1991 exchange rate) while the Indian poverty line per household of size 5 is Rs 11,000. The resource poor sector then comprises two sets of households: one that cannot acquire the basic needs bundle and lives below the poverty with household income under Rs 11,000 and the other that is able to acquire the basic needs bundle but has no additional commodity bundle Si. The household income of such households is between Rs 11,000 and Rs 30,000.

In the following section the characteristics of the two categories of households: the resource poor and the capitalist, with different ownership bundles resulting in different productive resources is examined within the context of the dual sector models.

1.4.2 Dual Sector Models and the Indian Rural Sector

In the literature the theory put forward by dual economy models states that in an economy consisting of an urban industrial sector and a rural subsistence sector, overall growth is achieved by transferring the surplus labour from the subsistence sector to the industrial sector. The basic assumption in the models is that the marginal productivity of labour in the subsistence sector is so low that workers can be transferred to industrial occupations without a fall in the output of food*.

This concept of classical dualism is applied here to examine the rural sector in India. The study diverges here from the normal application of the dual sector analysis to urban vs rural sectors (Lewis,1954, Fei-Ranis,1964). The analysis in this paper seeks to establish the presence of dual sectors, one with features common to the classical capitalist sector and the other similar to the traditional subsistence sector, *within* the rural economy.

Discussions in section 1.4.1 show that the rural market in India when examined in terms of ownership bundles and the resulting exchange entitlement sets, consists of two distinct economic groups, termed as the 'capitalist sector' and the 'resource poor sector' in this study.

The increasing pressure on land reflected by the decreasing land to man ratio** for rural India from 1.44 in 1971 to 1.02 in 1991 and the slow growth in other sectors (Figure 1.1) to absorb rural labour has resulted in a large pool of underemployed labour in the resource poor sector (Paul,1988). Labour exists in the resource poor sector such that it is available in abundance and can be removed without a fall in the

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* For a detailed discussion see the Overview Paper, section. O.2.

** Net sown area in hectares divided by total male agricultural workers.

agricultural output. The small size of the landholdings in this sector where the existing family members are often underemployed, have no requirement for additional labour. The weak ownership bundles of the household industry workers makes the use of efficient production methods and skilled labour difficult. The marginal productivity of labour in this sector is low.

The rural capitalist sector on the other hand, hires (pays wages to) agricultural and industrial labour to produce output. Within the rural capitalist sector, farmers with holdings over 4.0 hectares hire labour throughout the year. A large proportion of the labour hired by them is in permanent employment. The employment offered in this sector, although to a small percentage of the rural labour, is of a steady nature and pays wages higher than the manual agricultural labour earns (WDR,1995). If this labour is transferred, a positive opportunity cost is incurred, as the move would reduce the agricultural output. The marginal productivity of labour employed in this category is positive and the rising labour productivity has enabled the rise in the real wage rates of this group of labour (Bhalla,1993).

The farmers with holdings between 2.0-4.0 hectares mostly hire labour as required on a seasonal basis. The demand for labour goes up in both the above holdings during peak season. The growth in the rural industry and service sectors has been slow to absorb the rural literate labour (Figure 1.1).

In effect, the demand for labour in the rural economy is generated in the different components of the rural capitalist sector, i.e. agriculture, rural industry and other services. The interaction between the capitalist and the resource poor sectors and within the resource poor sector, in terms of the demand and supply of labour determines the rural wage structure.

Another consequence of the dual economy models: the rural-urban migration, regarding which, in recent years it has been found that almost all the urban slum dwellers are rural economic migrants (Bhalla,1987,1993)*, can be found within the

* A subject examined in detail by Todaro (1969).

rural context. The demand for labour in the rural capitalist sector far exceeds the steady level of employed labour during the agricultural peak season. This seasonal peak in the demand for labour induces the migration of agricultural labour from regions of high rural underemployment and high percentage of small landholdings: the resource poor sector (Bihar, east UP) to regions with a well established rural capitalist sector (Punjab,Haryana and west UP) in India (Breman,1996). In regions with a small rural capitalist sector the seasonal peak in the demand for labour is met by labour from the domestic resource poor sector.

In summary, the rural capitalist sector comprising households with strong ownership bundles employs labour both skilled and manual from the resource poor sector. Changes in the agricultural practice in this sector have encouraged the use of capital intensive technology (discussed in the next section) resulting in falling opportunities especially for manual labour. This process is similar to the framework outlined in the dual sector model of Lewis (1954) and its subsequent criticism*. The rural capitalist sector can be compared with the urban industrial sector and the resource poor sector with the traditional subsistence sector in Lewis's model.

The process outlined above resulted in growth and commercialisation of agriculture that is largely confined to the rural capitalist sector. The economic benefits to the resource poor sector households have been small. This has weakened their participation in the commercial and consumer activity within the rural sector and between rural-urban sectors.

1.4.3 Exchange Entitlement and Economic Progress

In section 1.4.2 the presence of two distinct economic groups within the rural sector is explained within the exchange entitlement framework. The labour market in the two groups is shown to exhibit features similar to the dual sector model of Lewis (1954).

This section examines the effect of a change in the level of factors employed through

* See the Overview Paper O, section O.2

Table 1.3

Factor Changes in the Agricultural Sector (1951-1991)

FACTOR ↓ / YEAR →	1951	1961	1971	1981	1991
GROSS CROPPED AREA (million hectares)	132.0	153.0	166.0	173.0	186.0
GROSS IRRIGATED AREA (million hectares)	22.5	27.5	38.2	50.0	62.0
AREA UNDER HIGH YIELDING VARIETY SEEDS (million hectares)	--	1.9*	15.4	43.0	65.0
USE OF CHEMICAL FERTILISERS PER HECTARE OF GROSS CROPPED AREA (million kilograms)	--	1.9	13.6	31.8	69.0
FLOW OF INSTITUTIONAL CREDIT FOR AGRICULTURE (Rupees 100 million)	24	214	679	2,126	3,973
FOOD GRAIN OUTPUT (million tonnes)	50.8	82.0	108.4	129.6	176.4
EMPLOYMENT IN AGRICULTURE (% of working population)	72.1	71.8	72.1	68.9	66.9
RURAL POPULATION (number in millions)	298	360	439	525	627

***Data for 1966-67**

Source: India Economic Year Book, 1996

government intervention on the exchange entitlement of the two groups. The analysis is intended to explain the causes for the different levels of economic progress achieved by the two groups in the last five decades.

The factors of production for agricultural output, i.e. labour, land, capital and technology in the rural economy in India have undergone significant change in the last four decades as indicated in Table 1.3. The agricultural output increased by over 3.5 times as a result of these changes (total foodgrain output increased from 50.8 million tons in 1951 to 180 tons in 1991, Indian Agriculture in Brief,1992).

Changes in the Indian agricultural practice during 1951-1991 can be classified into three periods, each representing a different emphasis on the combination of the factors: land under cultivation, labour input, the capital and the technology employed for agricultural production. The effect of each combination on the ownership bundles of rural households in both the resource poor and capitalist sectors is examined below.

Period -I (1951 through 1971) Extensive land reform resulted in the expansion of the total cropped area and increase in the demand for agricultural labour (Table 1.3). The new configuration of inputs resulted in a higher level output increasing to twice its initial value (51 million tons in 1951 to 108 million tons in 1971, ibid). During this period the policy resulted in enhancing the ownership bundles of the resource poor sector population both through increasing land ownership and providing employment. The technical change factor representing all the influences that determine the output besides land and labour, for the new production function can be classified as 'neutral' affecting all inputs except technological inputs.

Period-II (1971 through 1981) Influences of the green revolution introduced through multiple cropping practice, intensive use of fertilisers and high yield variety seeds* to enhance the output, dominated this period (Table 1.3). The emphasis was on altering the level of capital employed to accomplish intensive use of the existing land through technology. Any increases in the demand for labour were, however, offset by the

* The input factor r, section 1.5.

falling labour intensity and negligible expansion in the gross cropped area. The policy was strengthening the exchange entitlement of the rural households through inputs of fertilisers, high yield variety seeds and technology.

On examining the profile of the recipients of these benefits, in terms of the exchange entitlement approach (section 1.2.), it is found that households with strong ownership bundles i.e. the capitalist sector were the major beneficiaries of the changes during this period. (Ladjensky's (1969) study on the effects of green revolution in India also draws a similar conclusion). The technical factor influencing the production function in this category was 'capital augmenting' where the technical progress affected the inputs of capital and technology.

Period-III (1981 through 1991) The combination of factors during this period resulted in the output growing at over 35 percent: the highest growth recorded over a decade during the fifty year period. The new configuration of inputs involved changes in the factors of land, capital and labour. The emphasis of the new level of capital employed was on the mechanisation of the agricultural technology to enhance the output. This is substantiated by the sharp increase in the use of power (electric pumps, power tillers, power crushers, Economic Year Book, 1996) in the agricultural sector, from 17.6 percent of the total produced in the country in 1980-81 to 26 percent in 1990-91. The number of tractors in use more than doubled, from 65 thousand in 1980-81 to over 139 thousand in 1990-91.

The increasing use of capital intensive technology during this period on bigger farms appears to have created demand for skilled labour. The magnitude of this demand remains small, because of agricultural practice in the rural capitalist sector where a substantial amount of work is carried out manually (Bhalla,1993). Again, it is the rural capitalist sector households that have received the benefits of mechanisation through rapid increases in output. Although the higher use of machinery dampened the demand for manual labour, (despite moderate increase in land) it did strengthen the ownership bundles of the small proportion of skilled agricultural labour. The technical change factor brought capital augmenting progress in this period.

In summary, the impact of factor substitution and technological change in agriculture, over the last five decades, has been higher output and slow change in the exchange entitlement of households belonging to the rural resource poor sector. The first category of change (1951-1971) resulted in 'neutral' technical progress, affecting all inputs except technological inputs. This enhanced the ownership bundles of the resource poor sector population both through increasing land ownership and providing employment.

In the second (1971-1981) and the third category of change (1981-1991), emphasis was given to the technology and capital factors. The policy strengthened the exchange entitlement of rural households through inputs of fertilisers, high yield variety seeds, technology and capital inputs towards mechanisation. However, it is the rural capitalist sector households that have received most of the benefits of changes in the factors employed.

1.5 Exchange Entitlement and the Economic Prospects

The factors and policies that govern the existing exchange entitlement of rural households are discussed in section 1.3. Section 1.4 further examines the ownership bundles of rural households to investigate the presence of dual sectors within the rural sector. This section examines the relationship between the resulting exchange entitlement of individual households and the economic prospects open to them in the rural market. The exchange entitlement equation (i) derived in section 1.2 is investigated in terms of the production and trade possibilities open to a household. Direct production and trade parameters are incorporated at this stage to focus the effect of subsidies and incentive packages through rural development programmes discussed in section 1.3.4, on the exchange entitlement of households with different ownership bundles in the rural sector.

A rural household can use its ownership vector for own consumption, trade or production. The production possibilities open to the household represent, the set Q(s) of output vectors, produced by using any vector of inputs s. If household i owns xi and faces p the n-vector of prices then buys r to be used as inputs, buys y to be used

for consumption, sells z to meet the cost of purchases and produces q by using a part s of xi plus purchased inputs r, then the exchange entitlement is given by-

(iii) $E(xi)=\{(xi-s+q-z+y+r)|r,s,y,z \in X \& p(s+z)\leq p(x+q) \& q \in Q(s+r) \& f(r+y,z)\leq 0\}$

The functions Q(s+r) and f(r+y,z) are defined to include variables that reflect the interaction of the economic, social and political forces prevalent in the region, explained as follows:

The group of inputs r in (iii) for the rural sector in the study represents commodities such as fertilisers, irrigation facilities, electricity, bank loans/credits, machines, tractors and other agricultural implements, y the food and non-food consumer goods and z the labour and/or the agricultural output. As a measure of incentives to promote agriculture and related industry in the rural sector, the government policy has been to introduce strong subsidies through PDS (see section 1.3.3) on all the resources mentioned above (Five Year Plans, India Economic Information Year Book,1996). The resource package is then sold at different subsidised prices, contained within the vector of prices p.

In the case of bank loans and credits, a certain amount of security in terms of the owned assets is required in order to qualify for the concessional lending rates. Although the ceiling limit of collateral-free loans has been raised to just over $1000 (Rs 50,000, at current prices) by the Reserve Bank Of India in 1993 its effects on the household incomes have yet to be realised.

The interaction of policy with the economic forces occurs when the inputs are acquired by the rural community through exchange of money. The quantities of r and y that can be acquired are constrained by the ownership situation xi, which determines the strength of the exchange entitlement i.e. the purchasing power of the household. The vector of inputs s which is a part of the ownership bundle xi, will enable production when combined with r. Land (owned) requires seeds, fertilisers and agricultural implements (acquired inputs r) to produce the crop, labour (owned) requires machines and the agricultural produce for a food processing unit. Since s is a

Figure 1.3
Relationship Between Incentive Package And Ownership Bundles

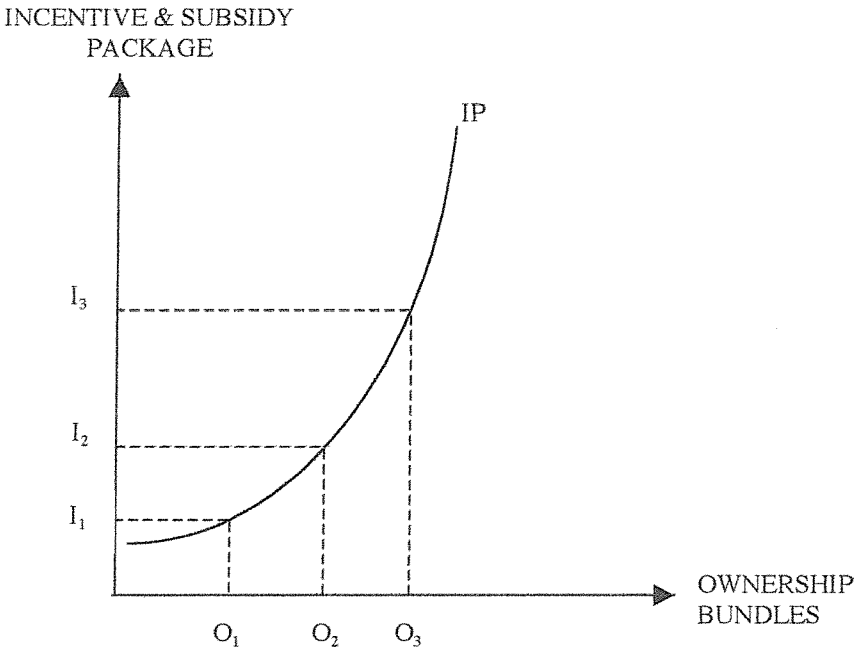

Fig. 1.3a

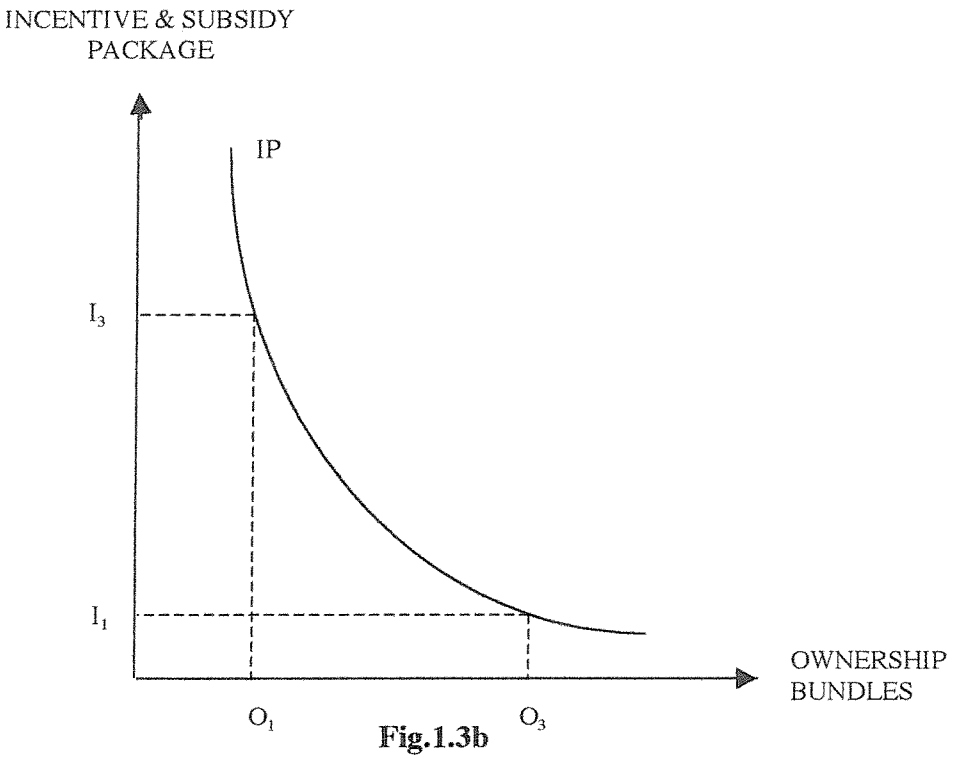

Fig.1.3b

part of the ownership bundle x, it contributes towards the exchange entitlement of the household, hence in determining the quantity of r that can be acquired.

A diagrammatic representation of this situation is shown in Figure 1.3a. IP is the locus representing the relationship between the incentives offered by the policy and the ownership bundles of the rural households. It has been argued above that households with limited ownership bundles are unable to take full advantage of the incentive and subsidy package. On the other hand, households with larger ownership bundles are better able to exploit the opportunities offered through these packages. Thus the IP locus has a positive slope. O_1, O_2 and O_3 show groups of households with different endowments and ownership bundles while I_1, I_2 and I_3 are the incentive and subsidy packages that may be acquired corresponding to the respective ownership situations. Households with O_3 ownership bundle consequently have access to the maximum benefits of the incentive policy while households with least endowment O_1 gain very little.

It is evident from the above discussion that the input vectors s and r are such related that larger the input s, higher the quantities of r can be acquired and smaller the input s, the poorer the vector of inputs. This is substantiated by the empirical evidence given in a World Bank Report (1991). The report indicates that benefits from agricultural input subsidies have gone overwhelmingly to wealthier, agriculturally advanced regions and to larger farmers i.e. groups with big ownership bundles. Good irrigation infrastructure, higher levels of input use and greater marketable surpluses (strong exchange entitlement) are attributed as the cause for the benefits accruing to this class.

The present system of development incentives in rural India appears to have its benefits linked to the strength of the ownership bundle and endowment of the household. Benefits accruing to households with poor ownership bundles and small endowments are consequently weak. This view is being increasingly recognised by development agencies (World Bank, 1999) which point to the starting endowment of household as being critical in poverty reduction in the past.

Figure 1.3b suggests the locus of a policy which would enable households with poor ownership bundles to access higher subsidy packages. The curve here represents the relationship between the ownership bundles and the incentive packages that may be acquired. Households with least endowment O_1 receive the maximum incentive and subsidy package I_3 while households with largest endowment O_3 receive the smallest subsidy package I_1. Such a policy may be aimed at building the endowment of poor households through measures appropriate to the household by providing the tools (literacy, skills , loans etc.) to enable participation in the market forces. While some work has been done regarding appropriate policies/intervention processes and the role of non-government organisations (NGOs) in the development process (Mencher, 1999), further research is needed to design and more importantly to draw up a framework for the effective implementation of such a policy.

1.6 Conclusion

This paper has examined the existing economic backwardness in rural India within the exchange entitlement approach introduced by Sen (1981) originally to explain famines and starvation. A theoretical framework is presented in which rural poverty and its persistence are examined within the context of the households' response to development incentives. This paper indicates that poor endowments and resource base are one of the causes of rural poverty and its persistence.

The entitlement framework is used in this paper to explain why economic progress has not reached the poorest households in rural India. The study examines the rural economy to indicate the presence of groups with different productive resources that fit in the dual sector framework within it. Here, the rural economy itself exhibits dual sector characteristics.

The exchange entitlement model explains the presence of the rural capitalist and the resource poor sectors in terms of the ownership bundles. It is seen that there exist close similarities between the predominantly agrarian rural sector in India and the framework described in the Lewis(1954) and Fei-Ranis(1964) models. The resource poor sector where the marginal productivity of labour is low, provides labour to the

rural capitalist sector. The seasonal surge in the demand for such labour during the peak season in regions with well established rural capitalist sectors manifests in migration of rural labour from regions dominated by the resource poor sector households.

The model shows that the difference between the economic status of the rural capitalist and the rural resource poor sectors lies in the strength of their exchange entitlement. A theoretical framework is then presented, which shows that the rural capitalist sector has been the major beneficiary of the development process. A relationship of increasing proportionality appears to exist between owned inputs (part of ownership bundle) and the incentive package that can be acquired. This shows that the rural capitalist sector households with large ownership bundles take maximum advantage of the benefit system. The rural resource poor sector households, on the other hand are able to acquire very few benefits offered in the incentive package because of their poor ownership bundles.

The exchange entitlement approach suggests that economic backwardness has persisted in rural India, despite the increasing emphasis on rural development, because of the inability of the development policy to bring about significant changes in the relative ownership bundles of a large proportion of population.

When the rural market is examined in terms of the factors that influence the exchange entitlement of households, it is observed that the combined exchange entitlement of the rural households does not necessarily respond to the changes in its demand and supply forces. In recognition of the signs of market failure in the system the government introduced regulatory responses through land distribution (1960s), dual pricing policy (PDS) and the development programmes in the early 1970s. These measures have been slow in stimulating the rural economy such that 84 percent of the rural households in 1991 census were characterised by poor physical asset base in terms of land and livestock.

The impact of factor substitution and technological change in agriculture, over the last five decades, has been higher output and slow change in the exchange entitlement of

households belonging to the rural resource poor sector. The regulatory measures have altered the factors influencing the exchange entitlement of households in a way that low income households with poor ownership bundles continue to dominate the population in rural India. The present system of development incentives in rural India appears to have its benefits linked to the strength of the ownership bundle of the household. Benefits accruing to households with small endowments are consequently weak. A policy locus is suggested which could enable households with poor ownership bundles to avail higher subsidy packages. Such a policy may be aimed at building the endowment of poor households through measures appropriate to the household by providing the tools (literacy, skills , loans etc.) to enable participation in the market forces.

It is concluded that the economic advantages of the development process have been reaped by the rural households that have strong exchange entitlements. Households belonging to the resource poor sector have not gained significantly from the technological changes. There is need to examine a process that can improve the ownership bundles of the economically backward households and strengthen their exchange entitlement to achieve higher economic welfare.

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PAPER - II

THE ROLE OF NONFARM SECTOR IN THE CONSUMPTION BUNDLES OF THE RESOURCE POOR HOUSEHOLDS IN RURAL INDIA

2.1 Objective and Outline of the Study

In Paper - I it is shown that a likely cause for the persistence of poverty and the presence of multiple sectors within the rural economy is the poor ownership bundles of households. This paper evaluates the effect of expanding the modern nonfarm sector on the consumption bundles of the participating resource poor rural households. For such consumption constrained resource poor households, positive changes in consumption are likely through improvement in the respective ownership bundles as discussed in Paper - I.

The objective of this paper is to evaluate the expansion of the modern nonfarm sector as a strategy to improve the consumption bundles of the resource poor rural households. The strategy may be relevant to an agency focusing on rural development. It can be implemented through investment in appropriate technology together with skill enhancement and literacy improvement of the resource poor population. Such inputs will enable the resource poor rural households to participate in the expansion of the modern rural nonfarm sector*. This paper examines the effect of implementing such a strategy on the consumption bundles of the resource poor households. Changes in the consumption bundles are examined by evaluating the response of the rural economy to price changes in the nonfarm sector goods, resulting from the expansion of the modern rural nonfarm sector.

The methodology deployed in the paper incorporates two types of nonfarm sectors: the modern and traditional. This classification is similar to the Ranis & Stewart (1993) study where the respective roles of the modern and traditional components in the development process are analysed within a theoretical framework. Hymer-Resnick (1969) and Bautista (1971) have examined different aspects of the nonfarm sector

* The rural nonfarm sector is defined here as the range of economic activities, other than farming, that take place in rural areas of developing countries.

using comparative statics. Hymer-Resnick (1969) predict a decline of activities in the nonfarm sector with improving terms of trade between the agricultural output and imported goods (urban/foreign source). Bautista's (1971) work contradicted the generally pessimistic prognosis of Hymer-Resnick and indicated that the nonfarm sector can in fact contribute in changing the terms of trade between agriculture and imported goods (urban/foreign source) in the long run. Unlike the mentioned works, the present study focuses on the changes in the rural economy reflected in improvement in the consumption bundles of the participating households.

The model in this paper is developed to demonstrate how price changes in the modern rural nonfarm sector can affect the consumption pattern and the agricultural output of the participating households. Expansion of the modern nonfarm sector is suggested as a possible route that can improve the consumption bundle of the participating households. The hypothesis arises from the causes of persistence of poverty analysed in Paper - I and the increasing recognition of the role of nonfarm sector in the development process (Mellor,1976, Chuta & Leidholm,1979, Papola,1987, Bhalla, 1990 and Quibria,1994). The conclusions of the present paper show that in a densely populated low-income agrarian rural economy, the improved and lucrative modern nonfarm sector offers new opportunities to enhance consumption bundles.

This has useful policy implications in regions which have large proportions of resource poor households, where the labour absorption capacity of the agricultural sector is seen to be declining (Bhalla,1993) and avenues to improve the household income are limited (Quibria,1994). The present paper suggests that emergence of the modern nonfarm sector in such regions can improve the consumption bundles of such households and increase the volume of trade via monetary transactions between rural and urban centres over a period.

The present study is distinct from similar studies of the nonfarm sector (details given in the Overview Paper - O) in its focus on the role of the modern nonfarm sector in the rural economy by examining the linkages that arise from the nonfarm sector to the other sectors. The model here builds on Batutista's (1971) model by assuming modern nonfarm output to be substitutable for most urban goods and that a proportion of nonfarm income may be invested in agriculture. This permits examination of the

impact of price change in the modern nonfarm sector output on the (1) consumption of the urban goods in the region and (2) on the consumption of agricultural output of the region. Both issues are analysed by studying the response of the rural consumer to the price change in the modern nonfarm output. The overall changes in the two variables will then reflect the impact of the price change on the consumption bundle of the rural households. The analysis is also expected to show the relationship between the price signals, the consumers' response to it and the level of future output of the modern nonfarm sector.

This paper evaluates the strategy of expanding the modern nonfarm sector to stimulate development in the resource poor rural sector of eastern Uttar Pradesh within the characteristics and findings regarding the rural sector in India noted in Paper - I. The model is based on the regional characteristics and data of the eastern rural districts of the state of Uttar Pradesh in India. The model shows the configurations of the relevant consumption variables in the rural economy of the region under study with different levels of modern nonfarm sector output. The analysis is not unique to this region and can be applied to other developing countries by modifying the model variables according to the relevant regional characteristics.

The findings in the paper show that expansion of the modern nonfarm sector can improve the consumption bundles of the participating resource poor households and stimulate rural -urban trade via monetary transactions over a period.

2.2 Organisation of the Paper

The paper is divided into six sections and an appendix.
Sections 2.3 and 2.4 provide an introduction to the terms, concepts and data used in the model. The framework of the rural nonfarm sector together with the necessary definitions and the categories deployed in the model are presented in section 2.3. The characteristics of the selected region, relevant to the issues being examined in this paper are presented in section 2.4.

In section 2.5 a theoretical model is developed, based upon the characteristics of the region under study. The unique features of the model and the assumptions made therein are given in the sub-sections 2.5.2 / 3/ 4.

In sections 2.6 and 2.7 the model developed in the previous sections is analysed with the objective of studying the impact of change in the price of the modern rural nonfarm sector on the consumption bundles of the rural households. Comparative static is used to express the effect of change in the price of the modern nonfarm sector output in terms of the Slutsky equation. The Slutsky income and substitution effects are derived in sub-sections 2.6.1 and 2.6.2. The Slutsky indicators are then applied to examine the effect of the price change of the modern nonfarm sector goods on the individual variables (section 2.7.1). The overall effect of the price change on the consumption bundles of the rural households is then presented.

The theoretical framework here draws its assumptions regarding the system to react to price signals from the well established monetised transactions in consumer goods within the rural sector in India over the last 40 years (Quibria,1994, Schiff,1994). The works of Dantwala (1967), Mellor (1968), Hayami et al (1982) about the pricing system and consumers' and sellers' response to it within the rural context indicate the presence of distinct reactions to price signals.

The conclusions from the model are discussed in section 2.8.
The appendix contains the detailed mathematical derivations used in the model.

2.3 Definition of Rural Nonfarm Sector and its Components Used in the Model

In this paper the term 'rural nonfarm sector' is used to encompass a wide range of economic activities: services and manufacturing, other than farming, that take place in rural areas.* The range of such economic activities can be classified into two distinct sectors on the basis of the production technology adopted and not necessarily along

* This is based on the definition used in the World Bank publication by Anderson and Leiserson (1978 and 1980).

product lines (Mukhopadhyay, 1985). This classification has been adopted to describe the nonfarm activities in the present study.

Output of the rural nonfarm sector serves as input to other sectors in the form of 'forward' linkages: tools and equipment manufactured in the rural nonfarm sector are used as inputs in agricultural production. On the other hand in the 'backward' linkages, the rural nonfarm sector provides a demand for the outputs of other sectors: food processing units in rural nonfarm sector use agricultural output to produce processed food. These linkages make the nonfarm sector an integral part of the rural economy such that a well established nonfarm sector can generate opportunities to meet the demand and supply targets of the nonfarm and the agricultural sectors. This has been the major principle guiding the setting up of the model in the present study as will be evident in subsequent sections.

This study identifies two broad types of rural nonfarm sectors termed as follows:
(1) The Modern Rural Nonfarm Sector or Z^M (where M is for modern) comprises products, services and/or activities belonging to enterprises that function as units with targets of surplus generation. Such enterprises primarily employ hired labour and use modern appropriate technology (this corresponds to the rural industrial sector in Paper - I). The ownership bundles of households involved in Z^M activities are such that their exchange entitlements contain the vector Si^* implying that these households possess the potential for economic progress.

Both forward and backward linkages of this sector are likely to be strong such that the nonfarm sector provides the tools and implements for agricultural production and the agricultural output is the raw material for the processing units in the nonfarm sector. Examples of such units are found in the sugarcane growing western region of Uttar Pradesh where the sugarcane crushing units use power driven machines to produce jaggery and other by-products while other units specialise in the repair of tractors, threshers and pump sets using modern technology.

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* see Paper I, sec 1.2.2 for details

(2) The Traditional Rural Nonfarm Sector or Z^T (where T is for traditional) comprises products, services and/or activities that primarily employ unpaid family labour and unlike the Z^M units operate on a seasonal basis. Such units use primitive technology catering mostly for the local market and respond more to the supply side of the labour market than to the market demand for the output (this corresponds to the rural household industry in Paper I). Basket and rope making and pottery units in the eastern region of Uttar Pradesh are examples of Z^T units. The ownership bundles of such households are poor and the exchange entitlement does not contain the vector Si.

It follows then the main features that distinguish between Z^M and Z^T units are :
(1) The use of modern appropriate technology in all Z^M units and its distinct absence in all Z^T units.
(2) The emphasis of the Z^M units in meeting the growing/existing demand for specific products in contrast with the labour residual sector philosophy of the Z^T units.
(3) Poor ownership bundles in terms of appropriate skills and capital resources of the Z^T households in contrast with the Z^M households' ownership bundles that possess the required skills and have higher levels of income.

Some production units enter the Z^M sector as a result of improvement in technology in former traditional inherited Z^T enterprises, others are new entrants. Investment by a development agency, that is independent of the current ownership bundles* of the households in the Z^T sector in terms of literacy, appropriate technology and the relevant skill training, would transform it to the Z^M sector, for which economic returns are higher.

Within the Z^M sector, certain goods and services have a growing demand in the rural sector while others are consumed in both the rural and the urban sectors. The current production levels of such goods are low and most consumption goods are produced in the urban sector. This paper suggests that the expansion of the modern nonfarm sector be directed towards the category of goods mentioned above i.e. those that have

* In Paper I it is suggested that because investment through subsidies, bank loans and other poverty reduction schemes is linked to the ownership bundles of the households, households with weak ownership bundles are unable to gain access to the full advantages of the incentive packages, hence remain poor.

a growing demand in the rural sector. Responding to a growing market will encourage future output levels. This would give an advantage to the locally produced Z^M goods that have a lower price than the urban goods in the rural market.

The paper will argue that the process of expanding the Z^M sector can trigger a chain of economic changes such as an increase in the demand for food, clothing and other consumables and alter the consumption bundles of the participating consumption constrained resource poor households.

2.4 The Rural Nonfarm Sector in a Region Relevant to the Study (Eastern Uttar Pradesh, India)

The present study has focussed on the eastern districts of the state of Uttar Pradesh in India, on the agriculturally fertile Gangetic plains because of its high levels of rural poverty and population density with limited employment opportunities.

The region accounted for 49 percent (44 million) of the state's 111 million rural population in the 1991 census with one of the highest population density levels of 500 persons per square kilometre and the lowest land-man ratio* of 0.68 in the country (Census of India, UP, 1991). The region was found to have literacy levels of under 15 percent as compared to the 36 percent overall rural literacy in the state.

Eastern Uttar Pradesh ranks amongst the most economically backward regions in the country with 47 percent of the rural households in the region living below the Indian poverty line of Rs 2220, per capita, per annum (1991, at current prices, Census Of India, 1991).

The rural economy of the region has well defined multiple sectors that fit within the dual sector framework discussed in Paper I, such that 84 percent of the households belong to the resource poor sector (this includes the 47 percent living below the Indian poverty line). Under 35 percent have exchange entitlement Es(x) (Paper I,

* Net sown area in hectares divided by total male agricultural workers.

section 1.2.3), such that it contains all the sets of commodity vectors that satisfy only the basic needs package but no additional commodity bundles. All aspects of human capital (health, nutrition, literacy) are available in the minimum level included in the basic needs package, i.e. food, clothing and human capital requirements that can be acquired in the range of $123 and $370 per capita per annum (the range between the Indian poverty line and the World Bank poverty line, in 1991, for details see Paper -I, sec 1.4.1). The remaining households have exchange entitlement Eso(x) such that it contains no vector that satisfies the basic needs package i.e. these households live below the Indian poverty line of $123 per capita per annum (in 1991, Rs 2220 per capita per annum at the 1991 exchange rate).

The region is shown to exhibit surplus labour (see Vaidyanathan,1986, Paul, 1988 and Bhalla,1990) such that there exists labour in excess of the needs of the agricultural sector. It is seen that the declining labour absorption capacity in the bigger farms is accompanied by rising underemployment in the small farms. The existing level of rural nonfarm sector provides employment through rural industry to only 3.2 percent (1991) of the total rural main workers* (Census of India, Up,1991).

The small proportion of the population employed in the rural industry constitutes the rural labour employed in the nonfarm sector (Z^T and Z^M) of the state. Services (transportation, repairs, tailoring etc) are a major component of the nonfarm sector in the region. Textiles constitute the single largest product group followed by wood products, edible oil, food and non-metallic mineral products. The production units in the sector are found to be operating mainly as household businesses employing family members as labour in the Z^T sector (Papola,1987). Some services are managed by government agencies while others are operated both in the Z^M and the Z^T sectors**.

The major part of the nonfarm sector consists of traditional industries (Z^T sector)

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* Defined in the Census of India, 1991, as a person who was engaged in any economically productive activity for 183 days or more in the year preceding the date of enumeration.

** Since the categorisation of Z^T and Z^M is more along the production technology adopted, similar products can be produced by employing Z^T or Z^M technologies (see sec,2.3), e.g. Some rope making units may be household businesses employing family labour and obsolete technology (Z^T) while others may use appropriate technology as Z^M units to produce better quality ropes.

catering for the local consumption needs and for the small production requirements of agriculture (Papola,1987). The same study shows that despite the increasing output in agriculture, rural manufacturing and processing units in the rural nonfarm sector are unable to attain economic viability due to the severe paucity of the necessary resource base (appropriate technology, training and skills): the poor ownership bundles (see Paper - I). The study points out that in the absence of any alternative for income generation, the rural nonfarm sector (mostly its Z^T component) continues to provide employment to households as a means of subsistence, rather than as commercial ventures, especially in regions (east U.P, Bihar,Orissa,West Bengal) which have a very high proportion of small landholdings (< 1.0 hectare).

The current pattern of economic development* indicates the presence of distortions in the labour market as already discussed in Paper - I. In recent years it has been suggested amongst others by Mellor and Desai (1985), Bhalla (1993) and Ray (1993) that the agricultural sector alone cannot absorb the rural labour and reduce poverty. There is need to supplement it through expansion of opportunities in other rural occupations.

2.5 The Z-Goods Model for the Selected Region (Eastern Uttar Pradesh, India)

The mainly agrarian rural resource poor sector of eastern Uttar Pradesh is characterised by a large number of small farmers and a small proportion of big farmers. (60 percent of the landholdings are less than 1.0 hectare, 21 percent are between 1.0 and 2.0 hectares and 19 percent are over 2.0 hectare, details are given in Paper - I).

The households in the rural sector of the region under study can be divided into four economic groups (A^M, Z^M, A^T, and Z^T) with different productive resources that fit within the dual sector concepts (details given in Paper - I). Here the households involved in traditional agriculture and nonfarm activities (A^T and Z^T) namely the large numbers of individual small holdings, landless labour, the Z^T households and all non-

* In terms of changes in poverty levels, per capita income, employment opportunities and the agricultural output in the rural sector of the state.

workers* connected to such households represent the resource poor households in the rural sector. The capitalist sector comprises the households of big and medium farmers (A^M), households employed in the Z^M activities and all non-workers connected to such households.

The output of the small holdings is consumed domestically with only a small proportion being traded to obtain other essentials. For a majority of small farmers in the region under study and other populous states** of India the marketable surplus, defined as the agricultural output minus the domestic rural demand is less than*** or equal to zero (Schiff,1994). It can therefore be inferred that in terms of the total surplus agricultural output, the share of the 60 percent small holdings is negligible compared to the output of landholdings over 2.0 hectares. The output of these holdings (big and medium) far exceeds the requirement for rural consumption. The surplus is traded making Uttar Pradesh the biggest supplier of sugarcane, wheat and food grains in the country in 1991 (Economic Information Year Book,1995).

This paper attempts to evaluate the strategy of expanding the modern rural nonfarm sector to improve the consumption bundles of the resource poor households within the theoretical framework of the Z goods model. The Z goods model is developed to study the response of the rural community to the newly expanded Z^M sector. This is done by examining the effect of price change in the Z^M output on the consumption bundles of the participating rural households. The Z goods sector in the concerned region employs a small proportion (2.8 percent in 1981 and 3.2 percent in 1991, Census of India 1981, 1991, with significant inter district variations****) of the total rural working population.

Papola's (1987) study of the rural industry in the region shows that of all the households employed in the Z sector over 90 percent work in the traditional nonfarm

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* Defined in the Census of India (1991) as a person who had not done any paid work at all in the year preceding the date of enumeration. This includes unpaid housework, students, dependents and those looking for work.

** e.g. Bihar, West Bengal, Orissa and Madhya Pradesh.

*** when the amount required for rural consumption exceeds the output of small holdings.

**** Papola (1987) has related the inter district variations to the degree of urbanisation, its proximity and the local tradition of artisan activity.

activities Z^T and belong to the category of resource poor households. According to the same study between 4 - 10 percent of all households carry out Z activities that fulfil the Z^M sector criterion. The Z sector in this study, therefore has a dominant presence of the Z^T units and a small number of Z^M units.

The traditional activities include some services (tailoring, shoe repairs etc), pottery, basket making and carpentry whereas all units in cane crushing, plastic jewellery and production of edible oils are new ventures. Some rope making units are traditional while others are run by new entrepreneurs. Units manufacturing agricultural implements have been set up as new enterprises in the region during the latter part of the last decade. Many traditional activities continue to operate despite the poor returns, due to the absence of other sources of earnings and the inability of the agrarian sector to absorb the ever expanding labour force (see Paper - I for details). The newly set up enterprises of improved agricultural implements, artificial plastic jewellery, cane crushing, oil manufacturing and blacksmiths with the use of power indicate growth points in the rural industrial structure of the region under study.

In summary the main characteristics indicated in sections 2.4 and 2.5 that are most relevant to the model are:

1. Given the low elasticity of demand for labour in the agricultural sector, the labour allocated for agricultural production can be assumed to be fixed.
2. There is no shortage of labour for the nonfarm sector i.e. no constraints of labour in the production of nonfarm output.
3. Resource constraints of technology, skills and capital present amongst 80 percent of the households in the region resulting in skill mismatch in the modern nonfarm sector.
4. Less than 10 percent of all households employed in rural industry (3.2 percent of the main rural workers) work in the modern nonfarm sector.

2.5.1 The Model

The model in this paper as noted in section 2.5 is developed to demonstrate the effect of change in the price of Z^M goods on the consumption bundles of the participating rural households.

The agricultural sector (A^T) here is composed of numerous small holdings producing food for local consumption. Most of the crops (wheat, paddy and other food grains) grown in the traditional agricultural sector (A^T) here are also produced in the modern agricultural sector (A^M). The output of the crops produced in both sectors is represented as the agricultural output (F) sold at price Pf in the model. For all other purposes such as changes in production, wages and employment, the modern agricultural sector (A^M) has been entirely excluded from the model. This step enables in focusing on examining the changes in the consumption bundles of the resource poor sector households: A^T and Z^T, resulting from implementing the strategy of expanding the modern nonfarm sector.

The purpose of the strategy being evaluated in this paper as noted earlier, is to improve the consumption bundles of the resource poor households through expanding the modern nonfarm sector. Improvement in the consumption bundles of such consumption constrained households is possible through strengthening of the ownership bundles as discussed in Paper - I. This paper evaluates these changes through examining the effect of price change of the modern nonfarm goods on the consumption bundles of the participating rural households.

The resource poor households face constraints towards adopting appropriate technology and skills as noted in section 2.4 and 2.5. However there are no constraints in the availability of labour in the resource poor sector. Here L is the total labour available in the rural sector (between 15-60 years old), L_F the labour allocated for agricultural production which is fixed, while ($L-L_F$) is available for nonfarm production. Since there are no constraints in the availability of labour in the resource poor sector, the production constraint function of the community does not have labour (L_F, $L-L_F$), as one of its variables.

It is assumed in the model that the rural sector of the region under study produces two goods: Z and F (where Z-goods represent the nonfarm output and F the agricultural output produced in both A^T and A^M sectors). The Z-goods sector in the model includes the entire rural nonfarm activities: services, traditional Z^T and modern Z^M. Here both Z^T and Z^M goods are tradeable and Z^T is an inferior good ($\partial Z^T/\partial I<0$) such that the demand for Z^T goods will decrease with a rise in the household income. The resource poor households in the region produce Z^T and A^T goods. The production functions with the existing level of factors employed in the agrarian and the nonfarm sectors of the region can be written as:

(1) $\mathbf{F = F\,(Z^T - Z^T_c,\ Z^M - Z^M_c)}$

(2) $\mathbf{g = g\,(Z^T, Z^M)}$, **or**

$\mathbf{Z^M = -G(Z^T) \Rightarrow \partial Z^M/\partial Z^T < 0,}$

where $(Z^T-Z^T_c)$ and $(Z^M-Z^M_c)$ indicate the quantities of Z goods used as intermediate goods to produce the agricultural output. Z^T_c and Z^M_c are the nonfarm goods consumed by the rural households. Households producing traditional nonfarm output Z^T face resource constraints and cannot produce the modern nonfarm output Z^M.

In this model, the transactions between the nonfarm sector and the rest of the rural economy are shown in terms of:

(a) trading the Z goods (of which the output Z_c is consumed) locally and by exporting to rural areas in the vicinity or exporting for urban consumption, at a price Pt (of Z^T-Z^T_c goods) and Pm (of Z^M-Z^M_c goods),

(b) agricultural production (F) of which the amount (F-F`) is marketed at price Pf (F` is the agricultural output consumed domestically, obtained in part or whole from the capitalist agricultural sector A^M at price Pf) and

(c) consumption of non-domestically produced consumer goods and imported inputs V at a price Pv (from urban markets).

The terms of trade or the exchange equation for the region (which would also be the budget constraint of the concerned households, with no savings) can be expressed as follows:

(3) $PvV + PfF` + PtZ^T_c + PmZ^M_c = PtZ^T + PmZ^M + PfF$, or

$$\mathbf{PvV = Pt(Z^T - Z^T_c) + Pm(Z^M - Z^M_c) + Pf(F - F`)}$$

In equation (3) above, the quantity of the urban goods (V) at price Pv that can be consumed by the rural community would have to be equal to the income generated by selling the nonfarm output ($Z^T - Z^T_c$ & $Z^M - Z^M_c$ at prices Pt and Pm) and the agricultural surplus (F-F`) at price Pf, given that there are no savings*.

It can be assumed that the rural households of the region under study would have a set of indifference curves for given levels of utility between $Z^T_c, Z^M_c, F`$ and V goods. This utility function X is given by :

(4) $\mathbf{X = X(Z^T_c, Z^M_c, F`, V)}$

The community would maximise the above utility subject to its production and trading constraints. Using a Lagrangean function to solve this maximization gives the following expression :

$$\mathbf{\Im = X(Z^T_c, Z^M_c, F`, V) + \lambda[PvV - Pt(Z^T - Z^T_c) - Pm(Z^M - Z^M_c) - Pf(F - F`)]}$$

substituting F by **(1)** and Z^M by **(2)** the following expression is obtained, where λ is the Lagrangean multiplier.

$$\mathbf{\Im = X(Z^T_c, Z^M_c, F`, V) + \lambda[PvV - Pt(Z^T - Z^T_c) - Pm(-G(Z^T) - Z^M_c) - PfF(Z^T - Z^T_c, -G(Z^T) - Z^M_c) + PfF`]}$$

Differentiating with respect to each of the endogenous variables ($Z^T, Z^T_c, Z^M_c, F`$, V and $\lambda$) the following set of first order conditions (where $X_i = \partial X/\partial i$, for $i = Z^T, Z^T_c, Z^M_c, F`$, and V) is obtained :

(5) $\mathbf{X_{Z^T_c} + \lambda Pt + \lambda PfF_{Z^T_c} = 0}$

(6) $\mathbf{-\lambda Pt + \lambda Pm G_{Z^T} - \lambda PfF_{Z^T} + \lambda Pf(FG_{Z^T} + GF_{Z^T}) = 0}$

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*This formulation of the model rests on the simplifying assumption that the value of the nonfarm output sold is the same as the quantity used as intermediate goods in equation (1). This is a restrictive assumption that requires further investigation.

(7) $X_Z{}^M{}_c + \lambda Pm + \lambda PfF_Z{}^M{}_c = 0$

(8) $X_F` + \lambda Pf = 0$

(9) $X_V + \lambda Pv = 0$

(10) $PvV - Pt(Z^T - Z^T{}_c) - Pm(-G(Z^T) - Z^M{}_c) - PfF(Z^T - Z^T{}_c, -G(Z^T) - Z^M{}_c) + PfF` = 0$

Totally differentiating the first order conditions (5) through (10) the following linear system is obtained. The subscripts in the equations denote the partial derivatives.

(11) $(X_Z{}^T{}_{cZ}{}^T{}_c + \lambda PfF_Z{}^T{}_{cZ}{}^T{}_c)dZ^T{}_c + X_Z{}^T{}_{cZ}{}^T dZ^T + X_Z{}^T{}_{cZ}{}^M{}_c dZ^M{}_c + X_Z{}^T{}_{cF`} dF` + X_Z{}^T{}_{cV} dV$
$+ (Pt + PfF_Z{}^T{}_c)d\lambda = -\lambda dPt - \lambda F_Z{}^T{}_c dPf$

(12) $\lambda Pf(FG_Z{}^T{}_{Zc}{}^T + GF_Z{}^T{}_{Zc}{}^T)dZ_c{}^T + \lambda Pf(FG_Z{}^T{}_Z{}^T + GF_Z{}^T{}_Z{}^T)dZ^T +$
$\lambda Pf(FG_Z{}^T{}_{Zc}{}^M + GF_Z{}^T{}_{Zc}{}^M)dZ^M c + \lambda Pf(FG_Z{}^T{}_{F`} + GF_Z{}^T{}_{F`})dF` + \lambda Pf(FG_Z{}^T{}_V + GF_Z{}^T{}_V)dV +$
$(Pf(FG_Z{}^T + GF_Z{}^T - F_Z{}^T) - Pt + PmG_Z{}^T)d\lambda = \lambda\, dPt - \lambda\, G_Z{}^T dPm + \lambda(F_Z{}^T - FG_Z{}^T - GF_Z{}^T)dPf$

(13) $(X_Z{}^M{}_{cZ}{}^T{}_c + \lambda PfF_Z{}^M{}_{cZ}{}^T{}_c)dZ^T{}_c + (X_Z{}^M{}_{cZ}{}^T + \lambda PfF_Z{}^M{}_{cZ}{}^T)dZ^T +$
$(X_Z{}^M{}_{cZ}{}^M{}_c + \lambda PfF_Z{}^M{}_{cZ}{}^M{}_c)dZ^M{}_c + (X_Z{}^M{}_{cF`} + \lambda PfF_Z{}^M{}_{cF`})dF` + X_Z{}^M{}_{cV} + + \lambda PfF_Z{}^M{}_{cV})dV +$
$(Pm + PfF_Z{}^M{}_c)d\lambda = -\lambda dPm - \lambda F_Z{}^M{}_c dPf$

(14) $X_{F`Z}{}^T{}_c\, dZ^T{}_c + X_{F`Z}{}^T\, dZ^T + X_{F`Z}{}^M{}_c\, dZ^M{}_c + X_{F`F} dF` + X_{F`V}\, dV + Pfd\lambda = -\lambda dPf$

(15) $X_{VZ}{}^T{}_c dZ^T{}_c + X_{VZ}{}^T dZ^T + X_{VZ}{}^M{}_c dZ^M{}_c + X_{VF`} dF` + X_{VV} dV + Pvd\lambda = -\lambda dPv$

(16) $(Pt + PfF_Z{}^T{}_c)dZ^T{}_c - (Pt + PfF_Z{}^T)dZ^T + (Pm + PfF_Z{}^M{}_c)dZ^M{}_c + PfdF` + PvdV =$
$-VdPv + (Z^T - Z^T{}_c)dPt - (G(Z^T) + Z^M{}_c)dPm + (F - F`)dPf$

The above second order conditions will be examined in the subsequent sections in order to derive the response of the agrarian economy to changes in the price of the modern nonfarm sector output Z^M.

2.5.2 Unique Features of the Model

This paper examines the changes in the consumption bundles of the participating rural households due to price change in the modern nonfarm sector goods (Z^M). Improvement in the consumption bundles of such consumption constrained households is likely through strengthening of the respective ownership bundles.

Here Z^M is a normal, tradeable good and already exists, though in small proportion, (only 4 -10 percent units are of the Z^M type, see section 2.5). This is a major deviation from the H-R model (Hymer and Resnnick,1969, see section O.5.1 of the Overview Paper - O) where Z^M goods are non-existent and the generic Z good is non-tradeable. The H-R model examined changes in the production of inferior non-tradeable Z goods caused by differing terms of trade (dZ/dP) as more cash crops are exchanged for imported goods. Ranis and Stewart (1993) have shown that by relaxing the restrictive assumptions about Z-goods in the H-R model, and considering the agricultural sector as comprising a cash crop producing and a domestically oriented food producing component, the Z-sector can play an important role in development. The H-R model and different versions of it (Ranis and Stewart, Bautista) are discussed in section O.5.1 of the Overview Paper - O.

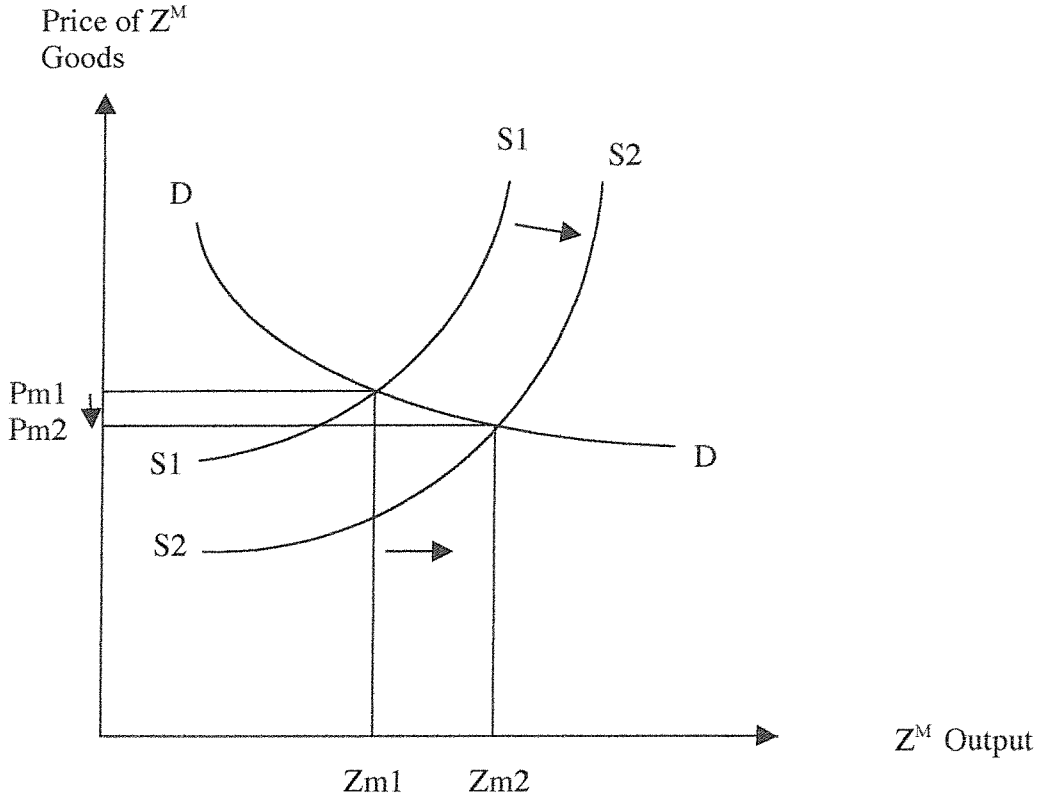
The agricultural sector in the Z-goods model in this study consists of (1) a single food-producing component A^T and (2) A^M that produces both cash crops and crops that are consumed domestically. The model examines the effect of changes in the price of Z-goods on the consumption bundles of the rural households through comparative static methodology unlike the graphical illustrations in the Ranis and Stewart model.

Since the resource poor households in the region have no exogenous income, the right hand side of equation (3) describes the income pattern of such households through a set of endogenous variables (also see section 2.6).

2.5.3 Assumptions made in the Model

In this model changes in the demand for urban V goods and the consumption of agricultural output F` induced by a price change in the Z^M goods are examined using the Slutsky Equation. As noted earlier (section 2.1), this paper examines the effect of expanding the modern nonfarm sector on the consumption bundles of the resource poor households. The strategy of expanding the modern nonfarm sector may be implemented as noted in section 2.1, through investment in appropriate technology and skill enhancement of the participating resource poor households.

Fig. 2.1
Changes in the Zm Output



The price change in Z^M goods is then assumed to take place as a direct consequence of relaxing the resource constraint faced by the households through investment towards expansion of Z^M units. This takes place by setting up new Z^M units and also by transforming the existing Z^T units into Z^M units. Z^M units have a more efficient production technique than Z^T units, hire rural labour and use local natural resources and raw materials. The cost-effective package of the factors of production enables Z^M goods to be priced competitively relative to all Z^T goods and most V goods in the rural sector.

It is assumed in the model that the expansion of Z^M units is directed towards those goods and services that have a growing demand in the rural market (termed as the growth points in Papola's study, 1987). Responding to the market demand would encourage the future levels of output. With respect to the above category of goods, a fall in the price due to the increase in supply would be offset by the growing demand such that the incentives to produce such goods would still exist. Examples of such goods and services may be tools/implements (agricultural, building, construction and manufacturing), household consumption goods that have more use in the rural sector such as better quality baskets, ropes, sacks, pottery and utensils etc. Transportation, repairs and tailoring are services that have a growing market in the rural sector. Furthermore, lower price of locally manufactured Z^M would give an advantage to such goods over the corresponding urban products. The price elastic demand here would enable the market share of Z^M to increase and encourage future output.

Fig. 2.1 shows the demand curve for the modern nonfarm goods and the response of the rural consumers to the shift in the supply curve. DD shows the price elastic demand curve and S1 shows the supply locus of modern nonfarm goods with distortions. By relaxing the production constraints faced by rural households, the supply curve for the modern nonfarm goods shifts to S2. This results in lowering the price from Pm1 to Pm2 and an increase in the quantity demanded from Zm1 to Zm2.

The assumptions discussed above are crucial for the strategy of expanding the modern nonfarm sector to enhance the consumption bundles of the participating households, to succeed. In the absence of these assumptions i.e. the newly set up Z^M units *not*

concentrating on the production of those goods that have a growing demand, the following possibility may arise:
Z^M units producing goods for which there is a price inelastic demand or non-existent rural market would not be responding to the demand signals of the market. Excess supply of such goods will have a downward pressure on the prices making the production process cost ineffective.

In the above scenario the demand for the goods is restricted. This presents limitations to expanding the modern nonfarm sector which is the core of the strategy being evaluated through the Z-goods model.

The Z-goods model in this paper evaluates the response of the rural community to price change of those Z^M goods which have an existing and growing demand to assess the impact on the consumption bundles. The present strategy focuses on the role of the nonfarm sector on the consumption bundles of the participating households in the region under study. The analysis explores a possible solution to the findings in Paper - I which focus on the weak ownership bundles that lead to poor consumption bundles of households and prevent the spontaneous development of the rural sector. This view is supported in the works of Ladejinsky (1969), Mukhopadhya (1985), Harriss (1992) and Bhalla (1993) who have pointed to the constraints in poor ownership bundles as causing economic backwardness in the rural subsistence sector.

2.5.4 Initial Conditions in the Model

The initial conditions in the model (based on the empirical data of eastern Uttar Pradesh) can be summarised as follows:
(1) of the total households employed in the Z-sector, less than 10 percent work in Z^M units while the remaining 90 percent households operate Z^T units (Papola, 1987).
(2) the resource poor households in the rural sector represent over 80 percent of the population in the region. Such households have easy availability of labour but face constraints of appropriate technology and skills. Here the agricultural output A^T of F and the income from exchanging Z^T goods are very low. The agricultural output (F-F`) is the amount exchanged or marketed out of necessity to obtain other essentials,

where F` is the subsistence amount consumed domestically. Ceteris paribus, an increase in the consumption of F` indicates higher household income or lower price of the agricultural output F.

2.6 The Model to Examine the Effect of Price Change

In this section, the theoretical model developed earlier (section 2.5.1) is used to examine the static effects of a change in the prices Pt, Pm, Pf and Pv respectively in the form of the Slutsky equation. The Slutsky equation decomposes the comparative static derivative (direct effect of a price change on the quantity of the good demanded) into two components: a substitution effect and an income effect. It permits a more definitive treatment of the direction and strength of substitution and income effects than is possible with only a graphical analysis in models having more than one good as done by Ranis and Stewart (1993). The present model therefore builds on the contribution made by Ranis and Stewart (1993) by focusing on the precise components of the nonfarm sector and the respective strengths of the income and the substitution effects that bear the potential to improve the consumption bundles of the participating households.

In the Four-Goods model the total income of the consumer is given by the R.H.S of the budget constraint equation (3). The absence of any exogenous income as indicated by this equation is another feature of the model. Since income is generated by trading the agricultural output (F) and the non-agricultural goods (Z^T and Z^M) at prices Pf, Pt, and Pm respectively, a shift in the production function $F=F(Z^T-Z^T_c,Z^M-Z^M_c)$ represents a change in income.

2.6.1 Derivation of the Income Effect

A change in income in this model is indicated by a shift in the production function $F=F(Z^T-Z^T_c,Z^M-Z^M_c)$ (noted above in section 2.6). Therefore changes in the income of the households in the region can be examined by finding the derivatives when $dF\neq0$. To identify the income effect in this model, the comparative static derivatives when

PfdF $\neq 0$ are examined* Since dF does not appear in the set of equations 11- 16, equation (16) can be rederived from (10) as follows:

(10) $\mathbf{PvV - Pt(Z^T - Z^T_c) - Pm(-G(Z^T)- Z^M_c) - PfF(Z^T-Z^T_c,-G(Z^T)-Z^M_c)+ PfF` = 0}$

**(16`)**$\mathbf{(Pt+PfF_Z{}^T_c)\,\partial Z^T_c- (Pt+PfF_Z{}^T)\,\partial Z^T+(Pm+PfF_Z{}^M_c)\,\partial Z^M_c + Pf\partial F`+ Pv\partial V =}$

$\mathbf{-V\partial Pv+ (Z^T-Z^T_c)\partial Pt + (Z^M-Z^M_c)\partial Pm +[F(Z^T-Z^T_c,Z^M-Z^M_c)-F`]\,\partial Pf + Pf\partial F}$

Using equation 16` in place of 16 and totally differentiating the first order conditions (5) through (10) a new linear system of equations is obtained which is represented by the matrix equation (A)(see Appendix for details).

To study the effect of a change in the income of the consumer, let dPt=dPm=dPf=dPv=0 but keep dF$\neq$0. The matrix is then divided by PfdF. Interpreting each ratio of differentials as a partial derivative, the effect of change in the income on the consumption of each of the four goods, the income effect, is derived using Cramer`s rule. The derivatives indicating the income effect with respect to each good can be written as follows:

(I) $\mathbf{\partial Z^T_c/Pf\partial F = 1/|D|.(-)D_{61}}$

(II) $\mathbf{\partial Z^M_c/Pf\partial F = 1/|D|.(-)D_{63}}$

(III) $\mathbf{\partial F`/Pf\partial F = 1/|D|.D_{64}}$

(IV) $\mathbf{\partial V/Pf\partial F = 1/|D|.(-)D_{65}}$

|D| in equations I-IV is the determinant of the coefficient matrix (A).

Dij represents the minor obtained by deleting the ith row and jth column of the determinant |D|.

2.6.2 Derivation of the Substitution Effect

The Slutsky substitution effect is derived as follows:

The income effect can be neutralised by compensating an amount numerically equal to PfdF so that the remaining component in the derivative measures the change in Z^M_c (Z^T_c,F`,V) due entirely to price induced substitution of one commodity for

* I am most grateful to Dr Mukerji for pointing out this vital issue.

another: the substitution effects of the change in Pm(Pt,Pf,Pv) are of the following form (for the working see the Appendix).

(V) $\partial Z^T_C/\partial Pm = \lambda/|D|.(-G_Z{}^T.D_{21}-D_{31})$

(VI) $\partial Z^M_C/\partial Pm = \lambda/|D|.(-G_Z{}^T.D_{23}-D_{33})$

(VII) $\partial F`/\partial Pm = \lambda/|D|.(-G_Z{}^T.D_{24}-D_{34})$

(VIII) $\partial V/\partial Pm = \lambda/|D|.(-G_Z{}^T.D_{25}-D_{35})$

|D| in equations V-VIII is the determinant of the coefficient matrix (A).

Dij represents the minor obtained by deleting the ith row and jth column of the determinant |D|.

λ is the Lagrangean multiplier, which has been used to solve the maximisation of the utility (equation 4) subject to its production and trading constraints.

2.7 The Analysis

In the following sections the effect of a change in the price of Z^M goods on the consumption bundles of the resource poor households is examined using the Slutsky indicators. The analysis is intended to evaluate the hypothesis that changes in the price of the modern nonfarm sector (Z^M) output can alter the consumption bundles. Positive changes in the consumption bundles are expected to reflect improvement in the ownership bundles of the participating resource poor consumption constrained households. A competitive modern rural nonfarm sector in this study results through resource inputs of appropriate and effective technology in Z^M. It is assumed that this process would lower the price of Z^M relative to the urban V substitutes*, therefore the effects of an expansion in the Z^M sector are simulated through a fall in the price Pm.

Changes in the consumption bundles of the rural households are analysed with three different levels of Z^M output. The three configurations indicate the state of the consumption bundles of the resource poor rural households with different levels of the traditional Z^T and competitive Z^M output. These configurations are defined as follows:

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* Urban V goods in the study comprise two types of goods: one that have Z^M substitutes while others have no Z^M or Z^T substitutes.

Configuration - I : most of the nonfarm output is produced by the traditional Z^T units (rural nonfarm sector has over 90 percent of Z^T units). Z^T goods are inferior and traded locally at price Pt. Very few units are of the Z^M type.

Configuration - II: some of the existing Z^T units transform and join the small number of competitive Z^M units already in operation. Z^M will not necessarily be > Z^T at this point. $Z^M > = < Z^T$ depends upon the effort of the government and the developmental /funding agency to improve the Z^T units, together with the capital and appropriate technology inputs towards achieving it.

Configuration - III: most nonfarm output is produced by Z^M units. Z sector has a dominant presence of Z^M units, where Z^M is a normal good ($\partial Z^M/Pf\partial F \geq 0$) and can be traded both in the local and urban markets at price Pm.

It is assumed that due to the lower costs of the factors of production (cheaper rural labour, local raw materials and lower transportation costs) involved in the production of Z^M goods, Pm < Pv for all Z^M that have V substitutes in the local market.

2.7.1 Change in the Price Pm of Z^M Goods

The analysis to evaluate the promoting of the Z^M sector to benefit the resource poor households is carried out by studying the effect of change in the price Pm of Z^M goods (where Z^M is a normal good [$\partial Z^M/Pf\partial F \geq 0$] and traded at price Pm). This is done by holding the price of other goods constant i.e. dPt = dPf = dPv = 0, and keeping dPm≠0, and dividing through by dPm in the linear system of equations 11-16. The result is expressed in the matrix equation (B) (see Appendix for details).

The derivatives indicating the effect of change in the price Pm, on the consumption of Z^T,Z^M,F` and V, can be expressed as follows :

(17) $\partial Z^T_c/\partial Pm = I/|D|.(-G_Z{}^T .D_{21} - D_{31}) - (Z^M - Z^M_c)/|D|.D_{61}$

(18) $\partial Z^{Mc}/\partial Pm = -I/|D|.(-G_Z{}^T .D_{23} - D_{33}) - (Z^M - Z^M_c)/|D|.D_{63}$

(19) $\partial F`/\partial Pm = -I/|D|.(-G_Z{}^T .D_{24} - D_{34}) - (Z^M - Z^M_c)/|D|.D_{64}$

(20) $\partial V/\partial Pm = I/|D|.(-G_Z{}^T .D_{25} - D_{35}) - (Z^M - Z^M_c)/|D|.D_{65}$

SLUTSKY INDICATORS AND THE TOTAL EFFECT*

	Configuration I			Configuration II			Configuration III		
	SE	IE	TE	SE	IE	TE	SE	IE	TE
$\partial Z_c^T / \partial Pt$	-	-	-	-	-	-	Z^T ceases to exist		
$\partial Z_c^M / \partial Pt$	Z^M is negligible			+	-	+[1]			
$\partial F' / \partial Pt$	-	-	-	-	-	-			
$\partial V / \partial Pt$	+	-	-	+	+	+			
$\partial Z_c^T / \partial Pm$	**Z^M is negligible**			**+**	**+**	**+**			
$\partial Z_c^M / \partial Pm$				**-**	**-**	**-**	**-**	**-**	**-**
$\partial F' / \partial Pm$				**-**	**-**	**-**	**-**	**-**	**-**
$\partial V / \partial Pm$				**+**	**-**	**+**[2]	**+**	**-**	**-**[3]
$\partial Z_c^T / \partial Pf$	-	-	-	-	-	-	Z^T ceases to exist		
$\partial Z_c^M / \partial Pf$	Z^M is negligible			-	-	-	-	-	-
$\partial F' / \partial Pf$	-	+	+	-	+	+	-	+	+
$\partial V / \partial Pf$	-	-	-	-	-	-	-	-	-
$\partial Z_c^T / \partial Pv$	+	-	+	+	-	+	Z^T ceases to exist		
$\partial Z^M / \partial Pv$	Z^M is negligible			+	-	+[4]	+	-	-[5]
$\partial F' / \partial Pv$	-	-	-	-	-	-	-	-	-
$\partial V / \partial Pv$	-	+	+	-	+	+	-	+	+

*The rows in bold letters show the effect of the price change Pm of Z^M goods on other goods. This is the focus of the analysis discussed in the model (sections 2.6-2.7)
SE = Substitution Effect, [$\partial Xi / \partial Pi \mid_{U=U'}$], $Xi = Z^T, Z^M, F', V$, $Pi = Pt, Pm, Pf, Pv$, IE = Income Effect, [$-Xi\ \partial Xi / pf \partial F$] TE = Total Effect

1 The income effect due to a price change in Z^T is weak because of the nominal role of Z^T in the consumer budget. The +ive substitution effect dominates.

2 Z^M does not have a prominent role in the consumer budget. The -ive income effect would not be strong enough to offset the +ive substitution effect.

3 Z^M has a prominent place in the consumer budget. The -ive income effect offsets the +ive substitution effect.

4 The -ive income effect is weak because of the nominal role of Z^M in the consumer budget, the +ive substitution effect dominates.

5 The income effect is strong because of the increasing prominence of Z^M in the total budget. It offsets the +ive substitution effect.

The signs of the substitution and income effects are obtained by applying the sufficient condition for quasi-concavity (see Appendix 2. Derivation of Substitution Effect). Together with their combined (total) effect these are shown in Table 2.1 and discussed in the following section.

Effect on Z^T Goods

(17) $\partial Z^T_c/\partial Pm = I/|D|.(D_{21} + D_{31}) + (Z^M - Z^M_c)/|D|.D_{61}$

The Slutsky equation (17) shows the cross effect of a change in the price of Z^M on the optimal consumption Z^T_c in terms of the substitution effect (first term, $\partial Z^T_c/\partial Pm|_{U=U'}$, from equation V) and the income effect (second term, $(Z^M - Z^M_c)(\partial Z^M/Pf\partial F)$ from equation I). The combined effect of the Slutsky indicators (equation (17) in the three configurations described in section 2.7 are shown below.

	I			II			III		
$\partial Z^T_c/\partial Pm$	SE	IE	TE	SE	IE	TE	SE	IE	TE
	Z^M is negligible			+	+*	+	Z^T ceases to exist		

When the price Pm falls, the positive substitution effect (shown above and Table 2.1) lowers the quantity Z^T_c being consumed.

The income effect causes the consumption Z^T_c to drop. As a result of a fall in the price Pm a household would have greater 'real income', hence it could attain a utility level higher than that attainable previously. However since Z^T is an inferior good this increase in the purchasing power would be directed to other non-inferior goods. The overall effect then, of a change in the price Pm of Z^M goods on the consumption Z^T_c is that the cross substitution and income effects would reinforce each other to cause reduced consumption.

A fall in the demand for Z^T goods resulting from lowering of Z^M prices as shown above would slow the production of Z^T goods. This is also demonstrated by equation

* Z^T is inferior good ($\partial Z^T/Pf\partial F$)<0, therefore ($-Z^T\partial Z^T/Pf\partial F$) is +ive

(17) where in configuration II lower prices of Z^M (achieved through appropriate and effective technology) speed up the process of displacement of Z^T by Z^{M*}.

Effect on Z^M Goods

(18) $\partial Z^M_c/\partial Pm = -1/|D|.(D_{23}+D_{33}) - (Z^M-Z^M_c)/|D|.D_{63}$

The derivative $\partial Z^M_c/\partial Pm$ in the above equation shows the effect of a change in the price Pm on the consumption Z^M_c. The R.H.S. of the equation (18) can be expressed as the Slutsky compensated substitution effect (first term) from equation (VI) and the income effect (second term) from the derivation in equation (II). The combined effect of the Slutsky indicators (equation (18) in the three configurations described in section 2.7 are shown in Table 2.1 and discussed below.

	I			II			III		
$\partial Z^M_c/\partial Pm$	SE	IE	TE	SE	IE	TE	SE	IE	TE
	Z^M is negligible			-	-	-	-	-	-

When the price Pm of Z^M goods falls the negative own substitution effect (shown above and Table 2.1) causes higher quantities of Z^M_c to be purchased. The income effect reinforces the substitution effect towards higher Z^M_c consumption. The price decline increases the households' purchasing power, permitting movement to a higher indifference curve.

In configuration II a fall in the price of Z^M would enhance its consumption Z^M_c and lead to increase in its production. In configuration III** a fall in the price of Z^M would reinforce the higher consumption Z^M_c and increase in the production of Z^M goods. The above changes in the supply curve of Z^M goods are graphically demonstrated in Figure 2.1 where the response to (own) price change due to an increase in the supply leads to an expansion in the demand for Z^M goods.

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* Since Z^M has an insignificant presence in configuration I and Z^T does not exist in configuration III, the effect of changes in Pm on Z^T are not valid in configurations I and III.

** Where all Z^T have been displaced by the competitive Z^M. The term Pt Z^T will then vanish from eq(2).

Effect on the Agricultural Consumption F`

(19) $\partial F`/\partial Pm = -l/|D|.(D_{24}+D_{34}) - (Z^M-Z^M_c)/|D|.D_{64}$

The derivative ($\partial F`/\partial Pm$) in the above equation shows the cross price effect of a change in the price Pm of $Z^M$ goods on the consumption of agricultural output (F`).The R.H.S of equation (19) can be expressed as the Slutsky substitution (first term) from (VII) and the income effect (second term) from the derivation in (III). The combined effect of the Slutsky indicators (equation (19) in the three configurations described in section 2. 7 are shown in Table 2.1 and discussed below.

	I			II			III		
$\partial F`/\partial Pm$	SE	IE	TE	SE	IE	TE	SE	IE	TE
Z^M is negligible	-	-	-	-	-	-	-	-	-

When there is a fall in the price Pm the negative cross substitution effect (above and Table 2.1) leads to an increase in the consumption of the agricultural output F`*. In the agrarian sector, agricultural output F and the amount consumed within the sector F` bear a complementary relationship with the non-agricultural output Z^M (and Z^T) which are used by the rural community as intermediate goods for agricultural production. The income effect reinforces the substitution effect because a fall in Pm leads to an increase in the purchasing power of the household permitting movement to a higher indifference curve.

A fall in the price Pm in configuration II would encourage the use of locally manufactured tools and implements (Z^M, easy availability of intermediate goods) to enhance agricultural production. Cheaper intermediate goods are likely to increase the level of intermediate goods use in agriculture bringing about a change in the factors employed. This causes a shift in the supply curve of agricultural output and a new market equilibrium is reached as shown in Fig. 2.2. At the new equilibrium E_1 higher quantity of agricultural output F1` is consumed at a lower price $Pf_1$. In configuration III lower price of $Z^M$ would further increase the production and hence the consumption of the agricultural output F`.

* A fall in the price of Z^M : complements, used as inputs for agricultural production, would lead to a fall in the price of the agricultural output and an increase in consumption.

Effect on V Goods

(20) $\partial V/\partial Pm = -l/|D|.(D_{25} + D_{35}) - (Z^M - Z^M_c)/|D|.D_{65}$

The derivative $\partial V/\partial Pm$ in the above equation shows the cross price effect of a change in the price Pm of Z^M goods on the consumption of the urban goods V. The R.H.S of (20) can be expressed as the Slutsky substitution effect (first term) from equation (VIII) and the income effect (second term) from equation (IV). The combined effect of the Slutsky indicators (equation (20) in the three configurations described in section 2.7 and Table 2.1 are shown below.

	I			II			III		
$\partial V/\partial Pm$	SE	IE	TE	SE	IE	TE	SE	IE	TE
Z^M is negligible	+	-	+	+	-	-			

When there is a fall in the price Pm the positive cross substitution effect (shown above and Table 2.1) would lower the consumption of the urban V goods. The income effect would result in increased consumption of V goods. A fall in the price Pm would lead to an increase in the 'real income' of the household enabling it to attain a utility level higher than the previous one. However, both V and Z^M are normal goods ($\partial V/Pf\partial F \geq 0$, $\partial Z^M/Pf\partial F \geq 0$), most V and Z^M are substitutes ($\partial V/\partial Pm|_{U=U^{'}>0}$) and it is assumed in the model that for comparable V and Z^M Pm < Pv. Therefore the greater purchasing power of the household would be directed towards consumption of those V goods for which there are no Z substitutes.

Here the derivative showing the income effect is multiplied by the amount of Z^M purchased ($Z^M - Z^M_c$) since it is this quantity that reflects the extent to which changes in the price Pm affect the purchasing power. The income effect would become stronger with the increasing prominence of Z^M in the total budget of the household*.

*This will happen only when all Z^T and most V have been displaced by Z^M

In configurations II and III a fall in the price Pm would have the following effect on the consumption of V goods:

The positive substitution effect would cause a decline in the consumption of V goods. This would be diluted or offset by the income effect. In configuration II the income effect would not be strong because only a small proportion of the total household budget (which was previously being spent on Z^T_c) would be allocated towards the purchase of Z^M_c. The effect of the positive substitution effect would therefore dominate, leading to a fall in the consumption of V goods. In configuration III the lower price of Z^M would make the substitution effect very strong leading to displacement of all comparable V goods. This would result in a considerable proportion of the household's budget being allocated for Z^M_c goods (previously spent on V + Z^T_c). The increasing prominence of Z^M in the total budget would cause the income effect to become stronger leading to purchase of V that do not have Z^M substitutes. Examples of such goods would be electrical/eletronic goods, machinery, medical services/medicines and other urban manufactured goods.

2.7.2 Impact of the Price Change on the Consumption Bundle of Households

The overall effect of a change in the price of Z^M goods on the consumption bundle of households comprising Z^T_c, Z^M_c, F` and V goods in configurations II and III can be summarised as follows:

- A fall in the price of Z^M in configuration II would accelerate the displacement of Z^T by Z^M. The consumption of Z^M goods would increase accompanied by an increase in the consumption of the agricultural output F`. The demand for V goods that have Z^M substitutes would fall.

-In configuration III lower price of Z^M would lead to displacement of all comparable V goods thereby further reducing the demand for V. However the strong income effect would lead to the purchase of V that do not have Z^M substitutes. A strong income effect leading to consumption of V goods with no Z^M substitutes in this configuration results through the dominance of the Z^M goods in the rural economy. This indicates an effective expansion of the Z^M sector. It can therefore be concluded that a successful Z^M strategy is accompanied by an increase in the consumption of

urban V goods that do not have Z^M substitutes. The consumption of the agricultural output F` would also go up. Consumption of Z^M goods would increase.

- Z^T goods would be displaced leading to decline in the production of Z^T.
- Z^M goods would begin to compete to gain the market share of some urban V goods*.

The consumption bundles of households in configuration III therefore contain : (1) modern nonfarm goods Z^M_c, (2) agricultural output F` and (3) urban goods V that do not have any Z substitutes. The utility function X' in configuration III can then be written as $X' = X'(Z^M_c, F', V)$

The analysis of the Z-goods model in the paper shows that by changing the price of Z^M goods the quantity of each of the goods consumed by the community improves such that (1) Z^M is consumed in large amounts (Z^M_c) through substituting all Z^T and all comparable V (2) V goods that do not have Z substitutes appear in the consumers' budget and (3) the amount of agricultural output consumed (F`) by the resource poor households increases. This indicates that each of the consumption variables in the utility function X' are an improvement over the consumption variables in the initial utility function X [$X=X(Z^T_c, Z^M_c, F`, V)$, equation (4), section 2.5.1].

Improvement in the consumption bundle of the resource poor households implies that the relevant households can exchange their ownership bundles in configuration III for a consumption bundle better than the consumption bundle that could be acquired in configuration I. The positive change in the consumption bundles of such consumption constrained households reflects better ownership bundles resulting from the expansion of the modern nonfarm sector in the relevant region. This indicates the potential of the Z^M goods towards improving the ownership bundles of the resource poor households.

2.7.3 Impact Of The Price Change On The Local Economy

In this study the effect of changes in the price of Z^M goods on the consumption bundles of the resource poor households are examined through the Z-goods model.

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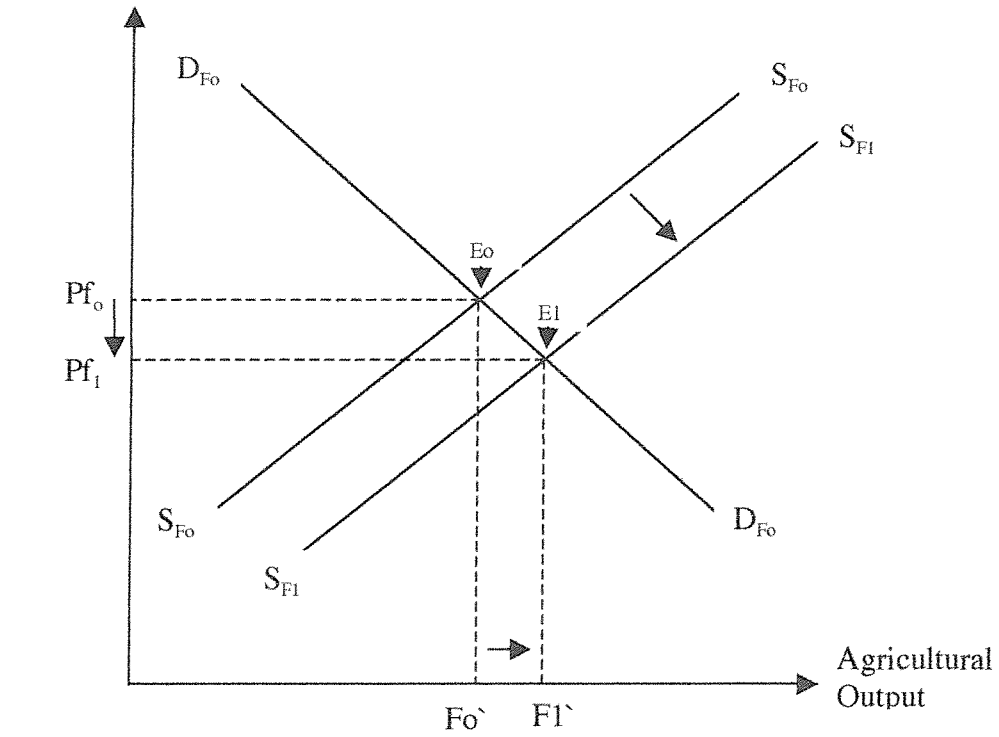
* V and Z^M goods that satisfy the condition $\partial V/\partial Pm|_{U=constant} > 0$ i.e. V and Z^M are net substitutes.

Fig. 2.2
Impact of Higher Levels of Intermediate Goods on the Agricultural Output



The findings of the model are analysed in three configurations reflecting the consumption bundles with different levels of the Z^M output. Configuration I where Z^M output is very small shows the actual state of the consumption bundles of the resource poor households in the region. Configurations II and III show the changes in the consumption bundles as a result of changes in the price of the modern nonfarm sector output caused through its expansion in the region.

The findings of the model in sections 2.7.1 and 2.7.2 show that change in the price of Z^M goods results in the increase in consumption of the modern nonfarm output Z^M, increase in demand for urban goods that do not have Z substitutes in the rural sector and increase in the consumption of agricultural output (F`). It can be inferred that each change will have an impact on the rural economy by stimulating the factors that affect the demand and supply forces in the rural sector. An increase in demand for urban goods that do not have Z substitutes and export of Z^M to urban areas would encourage rural -urban trade in monetised terms in the long run. At the same time a rise in the consumption of Z^M output locally would encourage the expansion of Z^M sector for which the returns are higher than the traditional nonfarm sector Z^T.

A further consequence of the increase in the consumption of Z^M may be on the agricultural output F where Z^M goods are used as intermediate goods. Easy availability of better quality cheaper intermediate goods would encourage the use of locally manufactured tools and implements (Z^M) bringing about a change in the factors employed to produce the agricultural output F. Fig. 2.2 demonstrates this change and its effect on the demand for the agricultural output (the food consumed domestically, F`). With the initial supply curve $S_{Fo}S_{Fo}$ of the agricultural output and $D_{Fo}D_{Fo}$ its demand curve, the market equilibrium is at Eo. $F`_o$ amount of food is consumed at price Pf_o. A change in the factors employed through higher levels of intermediate goods (Z^M-Z^M_o) used in the agricultural production shifts the supply curve to $S_{F1}S_{F1}$. The new market equilibrium is now at point E_1 such that higher quantity of food $F`_1$ is consumed at a lower price Pf_1.

2.7.4 Changes in the Price Pt of Z^T Goods, the Price Pf of the Agricultural Output F and the Price Pv of V Goods

The objective of this study is to examine the effect of a price change of Z^M goods on the consumption bundles of the resource poor households in rural east Uttar Pradesh. This has been done in the model in section 2.7.1 by studying the effect of changes in the price of Z^M goods, assumed to take place as a consequence of a competitive Z^M sector.

Although examining the effect of changes in the price of Z^T goods (where Z^T is an inferior good $[\partial Z^T/Pf\partial F < 0]$, agricultural output F and the urban goods V on the rural economy is not the prime focus of this study, these are discussed briefly in the following sub-section because of the critical role these prices play in determining the consumption bundles of the relevant households.

The effect of changes in the price Pt, Pf and Pv could be examined in a similar way to that outlined in section 2.7.1 for the price Pm. The signs of the income and the substitution effects are given in Table 2.1. The overall effect of the change in the price Pt can be summarised (based on Table 2.1) as follows:

(1) The substitution effect due to a rise in Pt would cause displacement of Z^T goods by V and Z^M goods. i.e. a decrease in the production of Z^T.

(2) The income effect of a rise in Pt would lead to a reduction in the demand for V and Z^M goods i.e. works in the opposite direction to the substitution effect. However, since Z^T has a nominal role in the household budget, the income effect due to the change in its price would be very weak and would not offset the substitution effect.

(3) Both the substitution and the income effect due to a rise in Pt would lead to a decline in the demand for the agricultural output F because of the complementary nature of the relationship between agricultural output and non-agricultural output Z^T.

A fall in Pt can be achieved by improving the production technology. This process will convert Z^T into Z^M, marketed at price Pm. Changes in Pm are examined in section 2.7.1.

The overall effect of the change in the price Pf can be summarised (based on Table 2.1) as follows:

(1) The complementary nature of relationship between the agricultural output and the Z^M goods ($\partial Z^M/\partial Pf|U=U` <0$) implies that a fall in the price of the agricultural output would lead to an increase in the demand for Z^M goods. A rise in the price of the agricultural output on the other hand would cause a decline in the consumption of Z^M goods.

(2) The income effect is negative (Table 2.1) and is multiplied by the agricultural surplus (F-F`). The negative sign of the income effect shows that when the price Pf of the agricultural output rises the income effect ($\partial F`/Pf\partial F$) would cause lower quantities of Z^M to be purchased because the price rise reduces the individual's purchasing power thereby forcing movement to a lower indifference curve.

(3) Similarly a fall in the price Pf leads to an increase in the purchasing power of the household permitting movement to a higher indifference curve, hence larger quantities Z^M would be consumed.

Because of the complementary nature of the relationship between the agricultural output and the non-agricultural output, both substitution and income effects work in the same direction. (In section 2.5.2 it has been shown how lower prices i.e. increase in the production of Z^M can enhance the consumption and hence the total agricultural output of the agrarian sector).

The overall effect of the change in the price Pv can be summarised (based on Table 2.1) as follows:

(1) The cross substitution effect ($\partial Z^M/\partial Pv|_{U=U`}$) compensated is positive as shown in Table 2.1 indicating that a rise in the price Pv of urban goods would lead to an increase in the consumption of Z^M.

A fall in the price Pv such that Pv < Pm would cause displacement of Z^M by V, i.e. the consumption of Z^M goods would fall .

(2) The income effect indicates that a fall in the price Pv would lead to an increase in the 'real income' of the household enabling it to attain a utility level higher than the previous one. This would result in an increased consumption of Z^M goods only when Pv >Pm otherwise the consumption of V would rise.

A rise in the price Pv implies a decline in the 'real income' of a household thereby the household can now attain a utility level that is lower than that could be attained before the price rise. The effect of this lower utility level would be a reduction in the consumption of V and increase in the consumption of Z^M if Pm<Pv.

Again because it is the effect of a price change of V that is being examined, the income effect is multiplied by V. The income effect would become stronger with the increasing prominence of V in the total budget of the household.

2.8 Conclusion

This paper evaluates the strategy of expanding the modern rural nonfarm sector to improve the consumption bundles of the resource poor households within the theoretical framework of the Z-goods model. For such households positive changes in the consumption bundles are likely through improvement in the ownership bundles as noted in Paper-I. It can therefore be inferred that positive changes in the consumption bundles of resource poor households would reflect stronger ownership bundles.

The Z-goods model in this paper illustrates the effect of a price change of the modern nonfarm goods (Z^M) that have a growing rural market, on the consumption bundles of the resource poor rural households. Changes in the price of the Z^M output are assumed to take place through inputs of appropriate technology, literacy and training which are the essential conditions for implementing the strategy. This investment is expected to make the factors of production employed more cost-effective and enable Z^M goods to be priced competitively relative to all Z^T goods and most V goods in the rural sector.

The analysis of the Z-goods model in the paper shows that by changing the price of Z^M goods the quantity of each of the goods consumed by the community improves. The consumption bundle of the household improves both in terms of quantity and quality as a result of change in the price of the modern nonfarm sector output. The community now has higher utility than it had prior to the change in the price of the modern nonfarm sector output. This implies that the relevant households can

exchange their ownership bundles for a consumption basket that has a better value than the consumption basket that could be acquired prior to the price change. The better value consumption bundles resulting from changes in the price of the modern nonfarm sector goods reflect positive change in the ownership bundles of the resource poor households. This indicates the potential of the Z^M goods towards improving the ownership bundles of the resource poor households.

The findings of the model show that a reduction in the price of Z^M has the following effects:

- Displacement of all Z^T and comparable V goods by Z^M goods followed by increase in the demand for those V goods that do not have Z substitutes.
- Increase in the consumption of Z^M goods.
- Increase in the consumption of the agricultural output.

It can be inferred that each change will have an impact on the rural economy such that an increase in demand for urban goods and export of Z^M goods to urban areas would encourage rural -urban trade in monetised terms in the long run. At the same time a rise in the consumption of Z^M output locally would encourage the expansion of the Z^M sector for which the returns are higher than the traditional nonfarm sector Z^T.

A further consequence of the increase in the consumption of Z^M may be on the agricultural output F where Z^M goods are used as intermediate goods. Easy availability of better quality cheaper intermediate goods (Z^M-Z^M_c) will alter the factors employed in agricultural production causing an outward shift in the supply curve. This results in a new market equilibrium at a higher equilibrium quantity of food and a lower equilibrium price. The participating households in the resource poor sector are thus able to improve the consumption of food. For the small farmers a shift in the supply curve to the right would imply a positive marketable surplus (A^T-F`), which is seen to be either zero or very small in the region under study.

This paper suggests that expansion of the modern nonfarm sector can improve the consumption bundles of the resource poor rural households. These changes indicate the potential of the modern nonfarm sector in assisting the development process in the region under study.

APPENDIX

1. Derivation Of The Income Effect

Using equation 16` in place of 16 and totally differentiating the first order conditions (5) through (10) a new linear system of equations (11)- (16`) is obtained which is represented by the matrix equation (A)

$$(11)\ (X_Z{}^T{}_{cZ}{}^T{}_c+\lambda PfF_Z{}^T{}_{cZ}{}^T{}_c)dZ^T{}_c + X_Z{}^T{}_{cZ}{}^T dZ^T + X_Z{}^T{}_{cZ}{}^M{}_c dZ^M{}_c + X_Z{}^T{}_{cF`}dF`+X_Z{}^T{}_{cV}dV$$
$$+ (Pt+PfF_Z{}^T{}_c)d\lambda = -\lambda dPt - \lambda F_Z{}^T{}_c dPf$$
$$(12)\ \lambda Pf(FG_Z{}^T{}_{Zc}{}^T+GF_Z{}^T{}_{Zc}{}^T)dZ_c{}^T+\lambda Pf(FG_Z{}^T{}_Z{}^T+GF_Z{}^T{}_Z{}^T)dZ^T+$$
$$\lambda Pf(FG_Z{}^T{}_{Zc}{}^T+GF_Z{}^T{}_{Zc}{}^T)dZ^Mc+\lambda Pf(FG_Z{}^T{}_F+GF_Z{}^T{}_F)dF`+\lambda Pf(FG_Z{}^T{}_V+GF_Z{}^T{}_V)dV+$$
$$(Pf(FG_Z{}^T+GF_Z{}^T-F_Z{}^T)-Pt+PmG_Z{}^T)d\lambda = \lambda\, dPt -\lambda\, G_Z{}^T dPm+ \lambda(F_Z{}^T-FG_Z{}^T-GF_Z{}^T)dPf$$
$$(13)\ (X_Z{}^M{}_{cZ}{}^T{}_c+\lambda PfF_Z{}^M{}_{cZ}{}^T{}_c)dZ^T{}_c+(X_Z{}^M{}_{cZ}{}^T+\lambda PfF_Z{}^M{}_{cZ}{}^T)dZ^T+$$
$$(X_Z{}^M{}_{cZ}{}^M{}_c+\lambda PfF_Z{}^M{}_{cZ}{}^M{}_c)dZ^M{}_c+(X_Z{}^M{}_{cF`}+\lambda PfF_Z{}^M{}_{cF`})dF`+X_Z{}^M{}_{cV}++\lambda PfF_Z{}^M{}_{cV})dV+$$
$$(Pm+PfF_Z{}^M{}_c)d\lambda = -\lambda dPm - \lambda F_Z{}^M{}_c dPf$$
$$(14)\ X_{F`Z}{}^T{}_c\, dZ^T{}_c + X_{F`Z}{}^T\, dZ^T + X_{F`Z}{}^M{}_c\, dZ^M{}_c + X_{F`F`}dF` + X_{F`V}\, dV + Pfd\lambda = -\lambda dPf$$
$$(15)\ X_{VZ}{}^T{}_c dZ^T{}_c + X_{VZ}{}^T dZ^T + X_{VZ}{}^M{}_c dZ^M{}_c + X_{VF`}dF` + X_{VV}dV + Pvd\lambda = -\lambda dPv\ (13)$$
$$X_Z{}^M{}_{cZ}{}^T{}_c dZ^T{}_c + X_Z{}^M{}_{cZ}{}^T dZ^T + (X_Z{}^M{}_{cZ}{}^M{}_c+\lambda PfF_Z{}^M{}_{cZ}{}^M{}_c)dZ^M{}_c + X_Z{}^M{}_{cZ}{}^M dZ^M$$
$$+X_Z{}^M{}_{cF`}dF` + X_Z{}^M{}_{cV}dV + (Pm+PfF_Z{}^M{}_c)d\lambda = -\lambda dPm - \lambda F_Z{}^M{}_c dPf$$
$$(16`)\ (Pt+PfFZ^T{}_c)\,\partial Z^T{}_c - (Pt+PfFZ^T)\,\partial Z^T + (Pm+PfFZ^M{}_c)\,\partial Z^M{}_c + Pf\partial F` + Pv\partial V =$$
$$-V\partial Pv + (Z^T-Z^T{}_c)\partial Pt + (Z^M-Z^M{}_c)\partial Pm + [F(Z^T-Z^T{}_c, Z^M-Z^M{}_c)-F`]\,\partial Pf + Pf\partial F$$

The above system of equations can be expressed as a matrix equation, the L.H.S. of which can be written as:

I

$X_Z{}^T{}_{cZ}{}^T{}_c$	$X_Z{}^T{}_{cZ}{}^T$	$X_Z{}^T{}_{cZ}{}^M{}_c$	$X_Z{}^T F`$	$X_Z{}^T V$	$(Pt+PfF_Z{}^T{}_c)$
$\lambda PfFG_Z{}^T{}_{cZ}{}^T{}_c$	$\lambda PfFG_Z{}^T{}_{cZ}{}^T$	$\lambda PfFG_Z{}^T{}_{cZ}{}^M{}_c$	$\lambda PfFG_Z{}^T{}_{cF`}$	$\lambda PfFG_Z{}^T{}_{cV}$	$\varnothing$
$X_Z{}^M{}_{cZ}{}^T{}_c$	$X_Z{}^M{}_{cZ}{}^T$	$X_Z{}^M{}_{cZ}{}^M{}_c$	$X_Z{}^M{}_{F`}$	$X_Z{}^M{}_V$	$(Pm+PfF_Z{}^M{}_c)$
$X_{F`Z}{}^T{}_c$	$X_{F`Z}{}^T$	$X_{F`Z}{}^M{}_c$	$X_{F`F`}$	$X_{F`V}$	Pf
$X_{VZ}{}^T{}_c$	$X_{VZ}{}^T$	$X_{VZ}{}^M{}_c$	$X_{VF`}$	X_{VV}	Pv
$(Pt+PfF_Z{}^T{}_c$	$\varnothing$	$(Pm+PfF_Z{}^M)$	Pf	Pv	0

$$=\begin{bmatrix} -(\lambda dPt + \lambda F_Z{}^T{}_c dPf) \\ \lambda dPt - \lambda G_Z{}^T dPm + \lambda(F_Z{}^T - FG_Z{}^T - GF_Z{}^T)dPf \\ -(\lambda dPm + \lambda F_Z{}^M dPf) \\ -\lambda dPf \\ -\lambda dPv \\ -VdPv + (Z^T - Z^T{}_c)dPt + (Z^M - Z^M{}_c)dPm + (F - F`)dPf + PfdF \end{bmatrix}$$

The terms $F_Z{}^T{}_Z{}^T$, $F_Z{}^T{}_{cZ}{}^T{}_c$,etc in the equation system (11)- (16) are defined as the curvature effect. If the production function were a straight line, the curvature effect would be zero and the above terms become zero in the equation system. These do not then appear in the matrix I.

$\varnothing$ in the above system equals $(Pf(FG_Z{}^T + GF_Z{}^T - F_Z{}^T) + PmG_Z{}^T - Pt)$

This matrix is represented by the matrix equation (A) throughout the model.

(A)

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} & a_{46} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{bmatrix} \begin{bmatrix} dZ^T{}_c \\ dZ^T \\ dZ^M{}_c \\ dF \\ dV` \\ d\lambda \end{bmatrix} \begin{bmatrix} -(\lambda dPt + \lambda F_Z{}^T dPf) \\ \lambda dPt + \lambda F_Z{}^T dPf \\ -(\lambda dPm + \lambda F_Z{}^M dPf) \\ -\lambda dPf \\ -\lambda dPv \\ -VdPv + (Z^T - Z^T{}_c)dPt + (Z^M - Z^M{}_c)dPm + (F - F`)dPf + PfdF \end{bmatrix}$$

To study the effect of a change in the income of the consumer, let dPt=dPm=dPf=dPv=0 but keep dF≠0. The matrix is then divided by PfdF. Interpreting each ratio of differentials as a partial derivative, the effect of change in the income on the consumption of each of the four goods, the income effect, is derived using Cramer`s rule. The four comparative static derivatives indicating the income effect with respect to each good can be written as follows:

(I) $\partial Z^T{}_c / Pf\partial F = 1/|D|.(-)D_{61} = 1/|D|.D_{61} > 0$

(II) $\partial Z^T / Pf\partial F = 1/|D|.D_{62} = 1/|D|.D_{62} < 0$

(III) $\partial Z^M_c/Pf\partial F = 1/|D|.(-)D_{63} = 1/|D|.D_{63} > 0$

(IV) $\partial F`/Pf\partial F = 1/|D|.D_{64} = 1/|D|.D_{64} < 0$

(V) $\partial V/Pf\partial F = 1/|D|.(-)D_{65} = 1/|D|.D_{65} > 0$

|D| in equations I-IV is the determinant of the coefficient matrix (A) such that $|D|=H_5$ and $|D| < 0$.

Dij represents the minor obtained by deleting the ith row and jth column of the determinant |D|.

2. Derivation Of The Substitution Effect

To examine the effect of dPt, dPm=dPf=dPv =0 in the original budget constraint equation (16), can be rewritten as:

$-(Pt+PfFZ^T)dZ^T - (Pm+PfFZ^M)dZ^M + PfdF` + PvdV = Z^TdPt$

(16) $(Pt+PfF_Z{}^T{}_c)dZ^T_c - (Pt+PfF_Z{}^T)dZ^T + (Pm+PfF_Z{}^M{}_c)dZ^M_c - (Pm+PfF_Z{}^M)dZ^M + PfdF` + PvdV = (Z^T - Z^T_c)dPt$

Since the indication of the effectual income loss to the consumer lies in the expression $(Z^T-Z^T_c)dPt$ which appears only in equation (16), to compensate the consumer means to set this term equal to zero giving rise to A` -the vector of constants in matrix A.

The substitution effect of change in the price Pm, is similarly derived by letting dPt=dPf=dPv=0, and equating the term $(Z^M-Z^M_c)dPm=0$ in (16) giving rise to B` the vector of constants in matrix A.

The substitution effect of change in the price Pf, can be similarly derived by letting dPt=dPm=dPv=0, and equating the term (F-F`)dPf = 0 in equation (16) giving rise to C` the vector of constants in matrix A. .

The substitution effect of change in the price Pv, can be similarly derived by letting dPt=dPm=dPf=0, and equating the term VdPv = 0 in equation (16) giving rise to D` the vector of constants in matrix A.

Using each of the vectors A`,B`,C` and D` in turn with the L.H.S. of the matrix equation A, the sixteen comparative static derivatives, which measure the change in Z^T,Z^M, F` and V due entirely to price induced substitution of one commodity for

another, are derived. The income compensated substitution component of the Slutsky equation in the model are of the form:

(VI) $\partial Z^T_C/\partial Pm = -\lambda/|D|.(G_Z{}^T D_{21}+D_{31}) > 0$

(VII) $\partial Z^T/\partial Pm = -\lambda/|D|.(G_Z{}^T D_{22}+D_{32}) > 0$ (expanding D_{22} and D_{32} gives a (-)).

(VIII) $\partial Z^M_C/\partial Pm = -\lambda/|D|.(G_Z{}^T D_{23}+D_{33}) < 0$ (expanding D_{23} and D_{33} gives a (-)).

(IX) $\partial F`/\partial Pm = -\lambda/|D|.(G_Z{}^T D_{24}+D_{34}) < 0$

(X) $\partial V/\partial Pm = -\lambda/|D|.(G_Z{}^T D_{25}+D_{35}) < 0$ (expanding D_{25} and D_{35} gives a (-)).

$|D|$ is the determinant of the coefficient matrix of the equation system 11-16. $G_Z{}^T < 0$ from (2) where $Z^M = -G(Z^T) \Rightarrow \partial Z^M/\partial Z^T = -G_Z{}^T < 0$

The actual signs of the above expressions indicating the compensated substitution effect are derived by applying the sufficient condition for quasi-concavity i.e.

$|Dn|\{^{<}_{>}\}\ 0$ if n is $\{^{odd}_{even}\}$ where n is the order of the principal minor being borderd in the original Hessian bordered matrix I. For example, D_{11} in matrix I and (A) is the matrix H_4 given by-

$$\begin{matrix} a_{22} & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{32} & a_{33} & a_{34} & a_{35} & a_{36} \\ a_{42} & a_{43} & a_{44} & a_{45} & a_{46} \\ a_{52} & a_{53} & a_{54} & a_{55} & a_{56} \\ a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{matrix}$$

(the row and column in italics show the Hessian border).

It follows that $|D| = H_5 < 0$ through out the model,(from the quasi-concavitiy condition). Table 2.1 shows the overall effect due to the individual income and substitution effects as a result of a particular price change.

3. Change In The Price Pm Of Z^M Goods

The comparative static analysis towards developing a growth strategy (by promoting, Z^M units) is examined by studying the effect of change in the price Pm of Z^M goods (where Z^M is a normal good $[\partial Z^M/Pf\partial F > 0]$ and traded at price Pm) by letting dPt = dPf = dPv = 0,. Holding the price of other goods constant and keeping $dPm \neq 0$, and

dividing through dPm in the linear system of equations 13-17, the result is expressed in the following matrix equation (B):

(B)

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} & a_{46} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} \end{bmatrix} \begin{bmatrix} \partial Z^T_c/\partial Pm \\ \partial Z^T/\partial Pm \\ \partial Z^M_c/\partial Pm \\ \partial F`/\partial Pm \\ \partial V/\partial Pm \\ \partial \lambda/\partial Pm \end{bmatrix} \begin{bmatrix} 0 \\ -\lambda G_Z{}^T \\ -\lambda \\ 0 \\ 0 \\ (Z^M - Z^M_c) \end{bmatrix}$$

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PAPER - III

SIMULATION MODEL FOR A SEGMENTED ECONOMY USING SYSTEM DYNAMICS METHODOLOGY

3.1 Introduction

In Paper - II a theoretical framework was developed to explore the extent to which price changes in the modern nonfarm sector goods resulting from a higher level of modern nonfarm sector output, can be effective in improving the consumption bundles of the resource poor households. For such consumption constrained households positive changes in the consumption bundles reflect stronger ownership bundles as discussed in Paper - I. This paper adopts a different methodology and builds on the earlier analysis to establish the potential of the modern nonfarm sector to enhance the ownership bundles of the participating resource poor households. This is attempted by evaluating a nonfarm employment project involving Social Forestry. The region of interest continues to be eastern Uttar Pradesh in India, due to its poverty characteristics discussed in Paper - II and also because it was the first region within an Indian state to implement the Social Forestry project.

The Social Forestry project, in which only some households participated directly, was initiated in 1979 to stimulate nonfarm employment in the region under study. A direct comparison of the incomes of those households that participated in the project with those that did not, is of limited value as it does not explain the process that enabled income flows to be established. Understanding the inter-dependencies in the local economy is necessary to gain insight into the income flows. System Dynamics, the selected method of investigation in this paper is one way of simulating the inter-dependencies in the local economy.

The model developed in this paper combines two elements: economic groups with different levels of productive resources (Papers - O and I) and a strategy for the

nonfarm sector (Paper - II)*. The model represents the economic status of households in the rural sector in eastern Uttar Pradesh through income flows. The simulations of the model examine the income flows of two populations within the region under study: one that did not directly participate in the project and the other that was actively involved in the Social Forestry project. The results of the two simulations are then compared with the objective of exploring and establishing the potential of modern nonfarm employment to enhance the earnings of low-income households.

One of the first development studies where System Dynamics simulation methodology was adopted was carried out by Saeed in 1980. Saeed used the approach for evaluation of past and exploratory development policies and later (1994, 1996) to search for appropriate technological development policies that support economic growth. Saeed conducted the study through a hypothetical model with parameters representing different states of the world. He then introduced the technology input, again at a hypothetical level and examined its effect on the other system variables.

The key difference between Saeed's work and this study is in the focus on the evaluation of the real-world data to anchor the simulations in the present study as distinct from hypothetical examination** only. All relationships in the present paper represent a real situation and incorporating the social forestry inputs gives rise to examination of another set of variables that reflect the state of the real world. This application can be extended to appraise ongoing development projects and suggest policy actions to achieve desired objectives. The implications of the new outcomes on the economy can in turn be examined with this method before the implementation of the policy. The combination of techniques in System Dynamics, involving examining the reality and hypothetically evaluating the different configurations of the system variables can thus offer useful perspective on the assessment of development projects.

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* In Paper I Sen's entitlement approach is used to show that poor ownership bundles cause persistence of poverty and multiple sectors that conform with the dual sector concepts, within the rural economy. Paper II examines expansion of the modern nonfarm sector to improve the consumption bundles of poor households.

** where the model does not necessarily reflect the configuration of the variables as found in reality.

The methodological component of this paper builds on earlier work (Tiwari, 1989) to show how varying levels of rural nonfarm employment affect the incomes of the poorest households. The evaluation process, while examining the effectiveness of nonfarm employment to enhance household income brings into focus the limitations of such projects and their effect on the rural economy. The findings validate the recent study by Reddy and Chakravarty (1999) who have shown the positive influence of nonfarm income related to forestry on poverty in the northern region of Uttar Pradesh. The present paper explores the impact of Social Forestry* on the ownership bundles of the participating rural households within a System Dynamics model. The results of the simulations carried out in this study show that households of all income groups that participated in the project were better off than the households in the respective income groups that did not participate in the project. The simulations also show that the economic benefits in terms of strengthening the ownership bundles of the participating low income households occurred mostly as a consequence of income through short-term projects and employment within the project.

This paper demonstrates that a higher level of nonfarm employment is an effective way to promote stronger ownership bundles and higher exchange entitlement of the poorest households. It indicates the potential role of nonfarm employment as a development tool for income enhancing projects in the rural sector. This is an important perspective in rural development since it offers a growth strategy for the populous subsistence sector in regions with limited employment opportunities.

3.1.1 Outline of the Study

The study is organised in five sections. Section 3.2 presents a socio-economic profile of the region (3.2.1) where the project of Social Forestry was first implemented. The objective of the section is to present the economic variables that are expected to change as a consequence of expanding nonfarm employment through the Social Forestry project. This is done by building on the rural poverty analysis presented in

* The project of Social Forestry, though an integral part of the Forest department since its inception in 1979, has the primary objectives of providing economic and environmental benefits to the local community. This project was not implemented in the region examined in Chakravarty and Reddy's work. The forestry objectives emphasise the propagation and protection of forests.

Paper - I and the economic profile of rural east Uttar Pradesh examined in Paper II. The paper then describes the Social Forestry project (3.2.2), which was implemented in the region for the first time in the country in 1979.

Section 3.3 explains the System Dynamics methodology (3.3.1) deployed in the study to examine the income enhancing potential of the nonfarm employment strategy. Some justifications are then presented (3.3.2) for the use of System Dynamics in development studies.

Section 3.4 shows how the model, which represents the income flows in the rural sector, is developed and then relates the system variables to the Social Forestry project. The employment and income flows in the rural sector (3.4.1) are presented within the System Dynamics framework, which describes the construction and analysis of the model (section 3.4.2). An assessment is made of the relationship between the income flows, nonfarm employment and the Social Forestry project (section 3.4.3). The objective of this step is to enable the model to evaluate the effect of expanding the nonfarm employment on the ownership bundles of low-income households through the Social Forestry project.

Section 3.5 presents simulation steps that attempt to evaluate the success of the project in generating income for households through the expansion of nonfarm employment. Here the model developed in section 3.4 is given the data from the region under study. The functioning of each of the variables is such that the model replicates the linked income flows between the different economic groups. The objective of the simulation model is to examine the effect of income from nonfarm employment on the income flows of the participating households in the rural economy. This is carried out in two stages. In stage I, the interactions of the existing flows and the resultant household incomes of the different groups that did not participate directly in the Social Forestry project are examined over ten years. In stage II, income flows generated through the Social Forestry project are included in the model to examine the resulting incomes of households that directly participated in the project.

In section 3.6 conclusions and limitations of the study are discussed, followed by an appendix. The appendix incorporates the finer details of the System Dynamics methodology and derivations of certain functions incorporated in the model.

3.2 The Social Forestry Project in Uttar Pradesh

This section presents the regional and the socio-economic profile of the eastern region of the state of Uttar Pradesh (3.2.1) where the Social Forestry project was implemented. The objective of the project was to change some of the socio-economic characteristics in the region by generating employment and consequently increasing the incomes of those employed by the project.

The description of the Social Forestry project is given in section 3.2.2. This project is evaluated for its ability to increase the income of households through expansion of nonfarm employment in the simulation experiments in section 3.5

3.2.1 Regional and Socio-economic Profile of Eastern Uttar Pradesh

The findings of the analyses of rural poverty (Papers - O and I) and the socio-economic profile of the region (Paper -II, section 2.5) can be summarised as follows:

In the census year 1991, 47 percent of the rural households in the region were found to live below the Indian poverty line of Rs 11,000 (at current prices, per household of size 5, Census Of India, 1991). The region has a low rural literacy rate of under 15 percent (ibid). The rural economy of the region has well defined multiple sectors that fit within the dual sector framework discussed in Paper - I, such that over 80 percent of the households belong to the resource poor sector (this includes the 47 percent living below the Indian poverty line).

The eastern region of the state has one of the highest population density levels of 500 persons per square kilometre and the lowest land-man ratio* of 0.68 in the country

* Net sown area in hectares divided by total male agricultural workers.

(Census of India, UP, 1991). The Lewis type surplus labour condition is also reported to exist in the region (see Bhalla,1990) The existing level of modern rural nonfarm sector provides employment through rural industry to under 4 percent of the total rural main workers* (ibid). The rural population in the region, as elsewhere in India is divided into economic levels and social levels based on the caste system. In general there are the 'upper' castes which are economically better off than the 'lower' castes that are economically backward. However, often there are distinct economic divisions within a caste.

Eastern Uttar Pradesh is one of the five economic regions: Western Uttar Pradesh, Central Uttar Pradesh, Hills, Eastern Uttar Pradesh and Bundelkhand that constitute the state of Uttar Pradesh. Western Uttar Pradesh is one of the most affluent regions in the country and has its agricultural productivity amongst the highest in the country. In contrast, Eastern Uttar Pradesh ranks amongst the most economically backward regions in the country. (Papola, 1987, Census of India, 1981,1991). Per capita income of Uttar Pradesh, despite the economically advanced western region, in the census year 1991 was the second lowest at Rs 4000 as compared to the average of Rs 5600 for the country and Rs 9600 (the highest) for the state of Punjab (India, Economic Information Yearbook, 1995).

In the following section the salient features of the nonfarm employment project of Social Forestry implemented in the above region in 1979 are described. The project was intended to bring about a change in the poverty and income levels (noted above) of the participating households through the expansion of nonfarm employment in the region.

The simulation experiments in section 3.5 will examine the effect of the nonfarm income generated by this project on employment and income levels of the low-income groups.

* Defined in the Census of India, 1991, as a person who was engaged in any economically productive activity for 183 days or more in the year preceding the date of enumeration.

3.2.2 The Social Forestry Project*

Project Background

The Social Forestry project was initiated in Uttar Pradesh in 1979, for the first time in India. This government-assisted project was based on the planting of trees outside the reserved forest areas by the local people to create resources for their own use. The project was aimed at providing forest goods and services in rural areas where they were most needed. This was to be achieved by establishing multi-purpose plantations that would supply fuel, timber and fodder to meet the basic requirements of rural communities. A major emphasis of the project was to generate nonfarm employment: directly by providing jobs in planting, harvesting, marketing of trees and indirectly by providing raw materials for cottage industries. These plantations were to be established on unused land such as strip planting on road, canal & rail reserves and block planting in village common land, wastelands and degraded forest.

The World Bank (51 percent) and State & Central Governments (49 percent) financed the project. It was implemented in 40 administrative districts located in the Ganjetic plains (eastern Uttar Pradesh). Although the forest cover before the implementation of the project was small such that per capita availability of forests was only 0.01 hectare, there was no shortage of land for tree planting. An estimated half a million hectares of under-utilised or unproductive land was suitable for such planting: along roads, canals, rails and on village common land unsuitable for cropping. There were also tracts of forest reserves in need of rehabilitation which could be utilised for planting.

During the implementation year (1979) of the project, most of the 80 million rural people who lived in the Ganjetic plains of Uttar Pradesh lacked the means to purchase fuel wood and fodder, which were not available in adequate quantities from village lands and other forest reserves. Also the demand for forest based raw material by

* Source material and data for the project have been acquired from the Forest Department of Uttar Pradesh. All references are given in the bibliography.

cottage industries far exceeded the supply made available by the forests. This was a major bottleneck in the development of cottage industries such as paper, matchsticks and packaging.

Project Targets

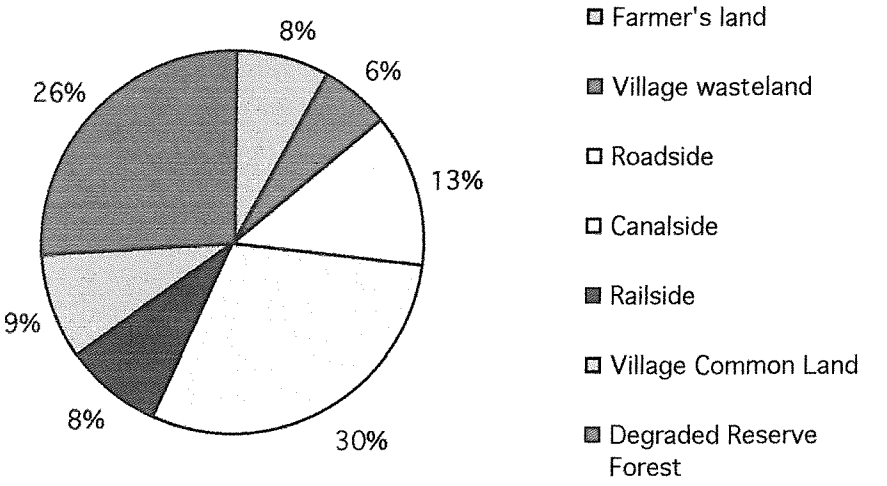
The project aimed to cover a total of 52,600 hectares by the end of year 11 with 5,440 hectares as the annual target. Figure 3.1 shows the planned composition of the plantations and of the employment generated in the plantations. It was envisaged that in all the areas under the project: the canal side, degraded forest, road & rail side, village common and farmers' own land, the highly labour intensive plantings would be carried out by labour employed by the forest department. This process would in turn generate employment in planting and protection & maintenance of the plantations. Priority in these jobs was to be given to households with an income below the lower poverty line of Rs 2000 per household in 1978-79. The wage rate would be set at the 1978-79 minimum wage of Rs 5 per person day. In the terminology of this paper such households (the landless labour households) are classified as G3 (see section 3.4.1).

Each participating village was expected to have 2 to 10 hectares of multiple product plantation to provide fuel wood and fodder. In areas which were technically difficult to manage (wasteland) the forest department was to plant mulberry and arjun trees to benefit the poorest villagers (income Groups 2 & 3, see section 3.4.1). Mulberry or arjun plantations would provide full time employment to a family of three working members through rearing of silkworms and maintaining the plantation (sericulture).

The project was to generate a total of 19.3 million person-days of employment to establish and maintain the plantation over five years. The major beneficiaries of this would be the poorest households, since manual jobs such as digging pits and trenches (short-term nonfarm projects) are normally done by them. The project was to also create jobs for people engaged in the marketing and processing of minor forest produce (Z^M, in Paper -II). In particular, about 170 family units in year 7 increasing up to 1500 in year 11 would be employed permanently in raising silkworms.

Figure 3.1
PLANTATION AND EMPLOYMENT COMPOSITION OF THE SOCIAL FORESTRY PPROJECT

PLANTATION COMPOSITION



100 % is the target area of 52,600 hectares

EMPLOYMENT COMPOSITION

0-5 Years	6-10 years
Plantation 230 person days/hectare Protection & Maintenance 120 person days /hectare	170 households increasing to 1500 involved in silkworm rearing, Wood products & carpentry, Services linked with the supply of forest produce to the cottage industry

Source: Social Forestry Project Report, 1979, Forest Department Uttar Pradesh

Additional supplies of scarce raw material to local industries, such as seed to oil mills, tree bark to tanning industries and timber to carpentry shops would have created additional jobs.

Project Benefits

Direct benefits from project plantings were expected to be:
(1) Generating income through employment in the rural areas and providing a resource base for the development of cottage industries.
(2) Provision of fuel and fodder for rural households.
(3) Environmental stability on which a satisfactory quality of life and continued food production depend.

Project Risks

Three areas of major risk, that would render the project uneconomic were identified at the implementation stage of the project. These areas were:
(1) Poor rural community involvement, which could slow the rate of planting, followed by failure of plantations.
(2) Inefficient execution and implementation of the project by the State Forest Department.
(3) Possibility that households of higher income (Group 1) in the rural community become the major beneficiaries of the project.

Since the focus of this dissertation is on the direct assessment of nonfarm income and its effect on rural poverty, project benefit (1) will be examined in detail in the simulation experiment in section 3.5. While project benefits (2) and (3) have important implications on the environment of the rural community, the assessment of the resulting economic benefits falls outside the boundaries of the present work. Again, in keeping with the objective in this paper of appraising the project of social forestry in meeting its targets and the effect on the income of the participating households in the 10 year period (1979-1989), the project risks identified above have

not been taken into account. Further research is needed to examine why the project did not meet all its targets and how the identified impediments could be overcome.

Project Status 1989-90

A term (10 year) review conducted by the funding agencies (the World Bank, Central and State Governments) concluded the following:

(1) There was significant progress in achieving the physical planting targets.

(2) Increases in the total production of wood products were being efficiently accomplished by farmers planting trees on their own land.

(3) Rural incomes improved notably during the initial stages where short-term jobs were provided. The inadequate data on income advantages from silkworm rearing indicated slow progress.

(4) Most of the planting programs provided positive environmental benefits.

In summary, the Social Forestry project was implemented in Uttar Pradesh with the objective of generating income through expanding nonfarm employment, providing fuel & fodder to the rural communities and benefiting the environment. While most planting targets and the resulting benefits had been met after a ten-year period, issues and objectives of the project regarding sustained economic benefits to the low-income households remained unresolved.

The effectiveness of the Social Forestry project in changing the economic profile of the participating rural households (Project status item 3 and Project Targets item 1) in the region is evaluated through simulation experiments. This is achieved first by replicating the income flows, representing the ownership bundles of the rural households that did not participate in the project, and then examining the effect of the nonfarm income generated by the Social Forestry project on the ownership bundles of the households that participated in the project. The System Dynamics methodology used in the simulation experiments is explained in section 3.3.

3.3 The System Dynamics Methodology and the Need for its Application to Study the Rural Economy

This section explains the System Dynamics methodology applied in the simulation experiments in this study. Forrester (1961,1968) developed the technique originally known as Industrial Dynamics, now referred to as System Dynamics. Its creation was in response to a recognition that many problem solving methods, particularly those linked to Management Science, were not able to provide needed insight and understanding of problems in complex systems. Although in its early years of development the applications were largely industrial, during the latter part of 1970s and 1980s its scope widened, covering most traditional disciplines with a strong emphasis on socio-economic areas. (Coyle, 1977, Richardson and Pugh, 1981, Forrester et al, 1983). Some benefits of its application in the development studies are discussed in section 3.3.2.

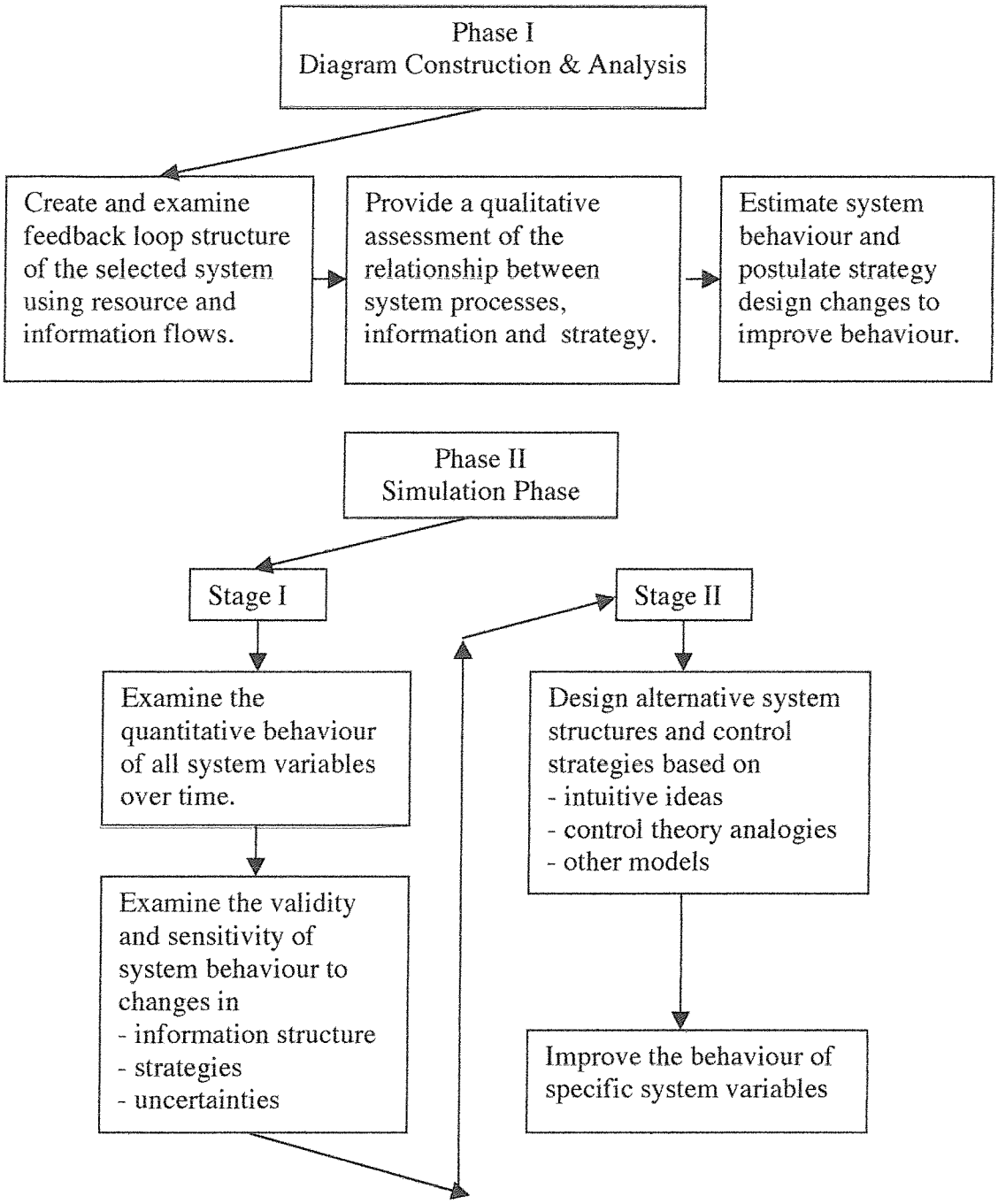
3.3.1 The System Dynamics Methodology

System Dynamics has been defined as "that branch of control theory which deals with socio-economic systems, and that branch of management sciences which deals with problems of controllability" (Coyle, 1977). The word 'system' in the term is used to denote any combination of real world elements which are linked and form a set of endogenous variables. The system or the boundary is selected to include the set of variables that are to be examined by the analyst. System Dynamics makes it possible to influence the behaviour of the system by altering the relevant variables.

This methodology represents the system in terms of its structural inter-dependencies (feed back loop), seeking to identify internal influences and explain the policies that generate current behaviour. The system behaviour is dynamic in nature i.e. it is an ongoing process, such that the variables, which measure the state of the system, change as time passes. When analysing social systems, System Dynamics deals with forces that arise within a system and change through time.

Figure 3.2

A Subject Summary Of System Dynamics



Source- System Enquiry, Wolstenholme,1990

The System Dynamics procedure is to observe the behaviour of a system over time and to create a valid representation (model) of the system, capable of reproducing the existing system behaviour. The objective of this process is to facilitate the design of alternative system structures, strategies and policies that can improve the existing system behaviour.

Figure 3.2 shows a summary of the steps involved together with the respective objectives in this method in two separate phases. Phase I describes the diagram/model construction and its analysis while Phase II shows the simulation process in two stages. Other details and terms used are given in the appendix.

3.3.2 The Value of System Dynamics in the Present Study

The value of System Dynamics in development studies, where it is often observed that implementation of certain policies have lead to unintended outcomes, is illustrated by the following example. It has been noted and well documented amongst others by Bardhan (1989) and Ladejinsky (1977) that investment in the agricultural sector through the green revolution, land reform and other subsidies was made to reduce rural poverty in India. In practice as Quibria (1993) argues, this strategy further strengthened the ownership bundles of the well to do farmers while poverty persisted amongst resource poor households (also see Paper-I). The System Dynamics methodology is well suited to exploring such issues.

Unintended outcomes can be detected by deploying a model that represents the actual situation such that the interacting variables can be tracked for the desired length of time. By replicating the complete situation under study and observing the effect of any one variable on the whole system as well as on other relevant variables the possible outcome of a policy may be examined. Unexpected outcomes and variables causing them can be detected and appropriate changes can be made to reduce the probability of a course of action leading to unintended results at this stage.

The application of System Dynamics to evaluate the effect of the Social Forestry project on the employment and income of the rural households begins with the representation of the current employment and income status of the relevant households in the rural sector under study. The System Dynamics simulations permit the examination of the simultaneous interaction of variables within the system over a specified period. These also enable the analyst to identify the variables that may influence the system over a period of time. The overall effect of the policy change on a system may then be examined prior to its implementation.

Unlike the System Dynamics models where a situation is examined within the entirety of its context, most socio-economic models address the problem of explaining and expressing relationships between certain limited aspects of the system.

Although System Dynamics is a very useful tool of analysis especially in the context of developing countries where it allows the use of subjective data in the model, a word of caution has to be mentioned regarding the simulation results. Wolstenholme (1990) amongst others has pointed out that because the System Dynamics methodology is more concerned with the shape/trend of change over time with the objective of redesigning the structure and strategies in a system, far less importance is given to deriving accurate predictions. Also since predictions on the basis of past performance assume that the structure and strategy of the future will not be too dissimilar from the past, simulations of socio-economic systems should be examined for the trends that are produced rather than the actual figures. Variables causing a particular trend can then be studied and an appropriate policy can be formulated.

In this work the model of the employment status of the rural population in terms of income levels is simulated using the computer software package STELLA-II. The next section describes the process (phase I in Figure 3.2) by which the model that replicates the income flows in the rural economy under study is developed.

3.4 Model for a Multiple Sector Rural Economy

This section explains how the model which represents the income flows in the rural sector in this study is developed. It is then shown how the Social Forestry project relates to the system variables. These issues are presented within the System Dynamics framework for phase I (Figure 3.2) which describes the construction and analysis of the model. This is done by first creating and then examining the feed back loop structure of the ownership bundles through employment and income levels in a population of 1000 households that are representative of the rural economy under study* (section 3.4.1). In the second component of phase I an assessment is made of the relationship between the income flows, nonfarm employment and the Social Forestry project (section 3.4.2). The objective of this step is to enable the model to evaluate the expansion of nonfarm employment as a way to improve the ownership bundles of low income households through the Social Forestry project (phase II, section 3.5).

The term multiple sector economy in this work reflects the presence of distinct economic groups in the rural sector. These economic groups (A^M, Z^M & A^T, Z^{T**}) are defined by their different ownership bundles and fit within the dual sector concept in the rural sector (Paper - I). Although the ownership of assets is highly concentrated in the upper and middle income classes (A^M & Z^M, rural capitalist sector) output produced by the capital owned by one income group flows in part to other income groups in the form of wages/payments. Such income linkages are crucial for the analysis of policy and have an important role in the model. While these indicate the interdependence between the different sectors (Chenery et al, 1974) a closer examination resulting from the simulation experiments reveals some linkages that impede economic growth in the resource poor sector (section 3.5).

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* This is done to reduce the large numbers that will be generated in the model due to the multiplicative nature of relationship amongst the variables and the large population base in the region. The model will demonstrate the effect of expanding nonfarm employment on a smaller representative population.

** A^M and Z^M represent the modern agriculture and the modern nonfarm employment respectively while A^T and Z^T represent traditional agriculture and traditional nonfarm employment respectively.

3.4.1 Components of the Model

The objective of the model in this paper is to evaluate the potential of the nonfarm sector to provide higher* household income through employment in nonfarm activities. Here the focus is on examining the effect of expanding modern nonfarm employment at wages that are higher than the traditional nonfarm and agricultural wages, on the ownership bundles and income levels of the participating households. Consequently, the system selected in the study assumes all wages (agricultural and nonfarm) are determined outside its boundary. Unlike most economic models, wages in the simulation analysis in this study are taken as exogenous variables.

The effect of an increase in earning opportunities in the nonfarm sector on the equilibrium wages in other sectors within and outside the rural economy whilst interesting, is outside the scope of this paper. This area may represent a potential extension of the present study such that the effect of expanding nonfarm employment at certain wages can be studied on the equilibrium wages in other sectors e.g. agriculture.

The analysis first replicates the interaction of the existing economic variables in the rural sector of eastern Uttar Pradesh, with the given level of wages in different income groups before the implementation of the Social Forestry project. The simulation results reflect the economic reality of households that did not directly participate in the project. The model then incorporates the economic linkages generated by the project with the objective of simulating the income flows of households that participated in the project.

The detailed structure of the model encompassing the income flows for the 1000 households that represent the composition of the rural sector under study is given in this section. Section 3.4.2 describes how these income flows form the feedback loop structure of the System Dynamics model.

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* It is shown in Paper I that wages in the modern nonfarm sector are amongst the highest in the rural economy.

The following notations are used for the variables in the model.

Yi = Income of Group i(i=1,2,3), G1-rural capitalist sector, G2-rural resource poor sector, G3-landless labour households - also in rural resource poor sector, G2 income is between Rs 11,000 - Rs 30,000,* at the end of the simulation run, assumed to be the cut off line between the resource poor and capitalist households in this study. The household income of G3 households is below the Indian poverty line of Rs 11,000 per household of 5 members at current prices in 1991 (see Paper - I for details). The classification of households in this study is purely on the basis of household income .

Ai = Agricultural income accruing to group i.

Zi = Nonfarm income accruing to group i.

Qai = Agricultural output (measured in monetary units) from Group i and

Qzi= Non-agricultural (nonfarm) output (measured in monetary units) from Group i

Ni = Household population of group i such that $\sum$ Ni=1000, i=1,2,3. The number of households in each category represents the proportion of such households in the rural population of the region under study. (Since the poverty line in this paper is taken as a certain annual income per household, the population unit throughout the study is a household of size 5, the average (5.2) household size as given in the Census of India,1991, and not a person).

An attempt is made in this model to express the income flows in the rural sector of the region under study, in terms of income from agriculture and nonfarm activities accruing to the households. Income linkages between the three economic groups are built into the model to replicate the actual nature of income flows. The model examines the flow of nonfarm income accruing to the lower income groups. Analysis resulting from the above exercise is presented to show how changes in nonfarm income can affect the distribution of income in the rural population. Nonfarm income indicates the inflow of money from nonfarm employment or the value of output in monetary units from such work in the case of self-employed households. Agricultural income is the inflow resulting from doing work related to agriculture and/or the value of the agricultural output of land owners/sharecroppers (farmers) in monetary units.

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* The range between the Indian poverty line and the World Bank poverty line $123 and $370 per capita per ammum, in 1991, for details see Paper I, section 1.4.1.

Table 3.1

Distribution Of Agricultural And Nonfarm Gross Income

GROUP	G 1	G 2 (G2 & G3 comprise the A^T & Z^T households- the resource poor sector)	G 3
DESCRIPTION	Rural Capitalist Sector - Households whose ownership bundles are sufficient to acquire the basic needs package and have the additional commodity vector Si * (households A^M & Z^M)	Small farmers and other rural households who can barely exchange their ownership bundles for the basic needs package.	Rural households of most landless labour whose weak ownership bundles are insufficient to acquire the basic needs package.
AGRICULTURAL INCOME Ai = wij Qai, Where wij are the wage share ratios which give the share of group i in output from j, assumed constant in the model. Qai is the agricultural output in monetary units of group i.	A1 = Value of agricultural output in monetary units, Qa1 = w11Qa1 where w11 is the wage share of Qa1 received by G1.	A2 = Agricultural wages received from G1 + value of output Qa2 in monetary units, = w21Qa1+ w22Qa2 where w21 is the wage share of Qa1 received by G2 & w22 is the wage share of Qa2 received by G2.	A3 = Agricultural wages received from G1 = w31Qa1 where w31 is the wage share Qa1 received by G3.
NONFARM INCOME Zi = k QZi Where k is the income share from the particular occupation, QZi is the nonfarm output of group i in monetary units.	Z1 = Value of Z^M output in monetary units + repayment of debt + return on share cropping = QZ1 (m+d+s) where m is the income share from the monetary value of Z^M output, d the income share from repayment of debt and s the income share from sharecropping rent =mQZ1+d QZ1+ (1-w22)Qa2 here sQZ1=(1-w22)Qa2	Z2 = Value of output QZ2 of G2 in monetary units and /or wages from taking up nonfarm work + income from services to group3 = QZ2(t+x) where t is the income share from the monetary value of Z^T output, x the income share from price of services sold to group3.	Z3 = Value of output QZ3 of G3 in monetary units and /or wages from taking up nonfarm work = QZ3 (seasonal components of w31Qa1 and QZ3 are the casual wages in the model)
TOTAL GROSS INCOME Yi = Ai + Zi	Y1 = A1+Z1 =w11Qa1+QZ1(m+d)+(1w22)Qa2	Y2 =A2 + Z2 =w21Qa1+w22Qa2+QZ2(t+x)	Y3 = A3 + Z3 = w31 Qa1 + QZ3

* See Paper I,sec 1.4.1

The total income of each group (Yi) is the sum of agricultural (Ai) and nonfarm (Zi) incomes accruing to the respective economic groups. Yi = Ai + Zi.

The summary of the distribution of agricultural and nonfarm incomes (gross) for each economic group is given in Table 3.1. This table shows the distribution of the agricultural and the nonfarm incomes between the three income groups in terms of the inflows accruing to each group. At this stage the outflows from each income group are not depicted, therefore Table 3.1 shows the composition of the total gross income of each group. It is seen that the distribution of income among the three groups is determined by the distribution of wage and productivity parameters.

The explanation of the derivations is presented below.

Distribution of Agricultural Income

This section shows the linkages in the agricultural wages (agricultural income) acquired by doing work related to agriculture and /or the value of agricultural output in monetary terms, between the different economic groups (Table 3.1).

The agricultural income accruing to Group 1 (rural capitalist sector-big and medium farmer households) is the value of its agricultural output in monetary units Qa1. If w11 is taken as the share of output Qa1 in terms of money received by this group then the agricultural income is given by A1 = w11Qa1.

In the simulation experiment (section 3.4) A1 is assumed to be not affected by changes in the supply of labour and wages that are paid to labour, because of the surplus labour condition that exists in the region under study (Paper -I and section 3.2). In the event of the nonfarm sector expanding such that capitalist agricultural sector competes with the nonfarm sector for labour, the above assumption would not be valid and A1 would be determined by the labour market.

The agricultural income of Group 2 is the sum of agricultural wages received from Group 1 and the value of its agricultural output in monetary units: Qa2. Agricultural

wage received from Group 1 is given by w21Qa1, where w21 is the wage share of output Qa1 received by Group 2. Monetary value of output Qa2 received by Group 2 is given by w22Qa2, where w22 is the wage share of output Qa2 received by Group 2. The agricultural output Qa2 is used for household consumption in Group2 and to pay the share cropping rent (1-w22)Qa2 to Group1.

A2 = w21Qa1 + w22Qa2

Agricultural income of Group 3 is given by the casual* wages received from Group 1. If w31 is the wage share of output Qa1 received by Group 3 then the income A3 is :

A3 = w31Qa1.

The wage share ratios wij which give the share of group i in output from j are assumed to be constant throughout the length of the time during which the model is under study (about 10 years)**.

Distribution of Nonfarm Income

As mentioned earlier, nonfarm income in this model represents inflows of money (wages) resulting from taking up nonfarm employment or the monetary value of output from such work. Each of the three income groups undertake different categories of nonfarm employment. (Summary given in Table 3.1). The nonfarm income Z1 of Income Group 1 has the following sources:

(1) income from repayment of debt from Group3. Households in income Group1 lend money at high rates (upto and over 200 percent, as reported in Hogendorn, 1992) to many households in Group3 whose income is insufficient to meet the basic needs package. The repayment of this debt is a source of income to Group1. If d be the income share due to repayment of debt from nonfarm output QZ1, then the total income from debt repayment is given by dQZ1. (In case of default the

* Defined as seasonal work in both agriculture and nonfarm sectors, Census of India, 1991. Such work is labour intensive with low skill requirement e.g. manual lifting of grain sacks, household services of cleaning, sweeping etc.

** The origins of this are (1) since the wages are taken as exogenous during the period of study here, the wage shares remain constant, (2) the Chenery (1974) model of distribution and growth where such an assumption limits the generality of the function in a neo-classical framework unless the elasticity of substitution is unity. In conditions of labour surplus wage shares remain unchanged.

households are found to borrow more to repay the debt, pawn the few owned assets or pay back in kind).

(2) income from return on sharecropping. Many households of small farmers (Group2) enter into sharecropping arrangements with bigger farmers of Group 1 to supplement their income. The Group 1 farmers get the rent, mostly a fixed proportion - a third or half of the total output in terms of either cash or kind from the tenants (the remaining forms the part of the agricultural income of G2, w22Qa2). If s be the income share due to sharecropping rent from QZ1 then the total income from sharecropping to Group1 is given by sQZ1.

(3) income from undertaking modern nonfarm activities: Z^M. The modern nonfarm sector (Z^M) employs under 4 percent of the rural working population (Paper -II). If m be the income share due to Z^M activities from QZ1 then the income from such work to Group1 is given by mQZ1.

The total nonfarm income Z1 to Group1 is the sum of (1)+(2)+(3) above i.e.
$Z1 = dQZ1 + sQZ1 + mQZ1$.

The purpose of this study is to examine the effect of the expansion of Z^M activities on the household incomes of the participating households, without directly changing other income sources. However, it may be expected that once Z^M activities offer sustained source of earnings to lower income groups, the level of sharecropping and borrowing in such households will decline.

(Here the equation shows the different components of the nonfarm income Z1. Section 3.5 shows how some of these are affected by expanding employment opportunities in the nonfarm sector).

Non-agricultural income Z2 to Group 2 results from undertaking nonfarm employment in the form of services and manufacturing in the traditional nonfarm

sector* (Z^T, Paper - II). The agricultural output Qa2 brings insufficient income and most households supplement their income through nonfarm employment. Although nonfarm employment is categorised in the unorganised sector and is more often taken up as the only available measure to supplement income (see Paper - II) it does bring some additional spending money. A small amount of resources and services (use of indigenous water pumps, building tools etc) are sometimes rented to group3. The rental from such activities: xQZ2 is the other source of nonfarm income. The total nonfarm income accruing to Group2 is the value of the non-agricultural output tQZ2 in monetary units and xQZ2, such that here

$Z2 = QZ2\ (t+ x)$.

Where t is the income share due to Z^T activities from QZ2 and x the income share due to services from QZ1.

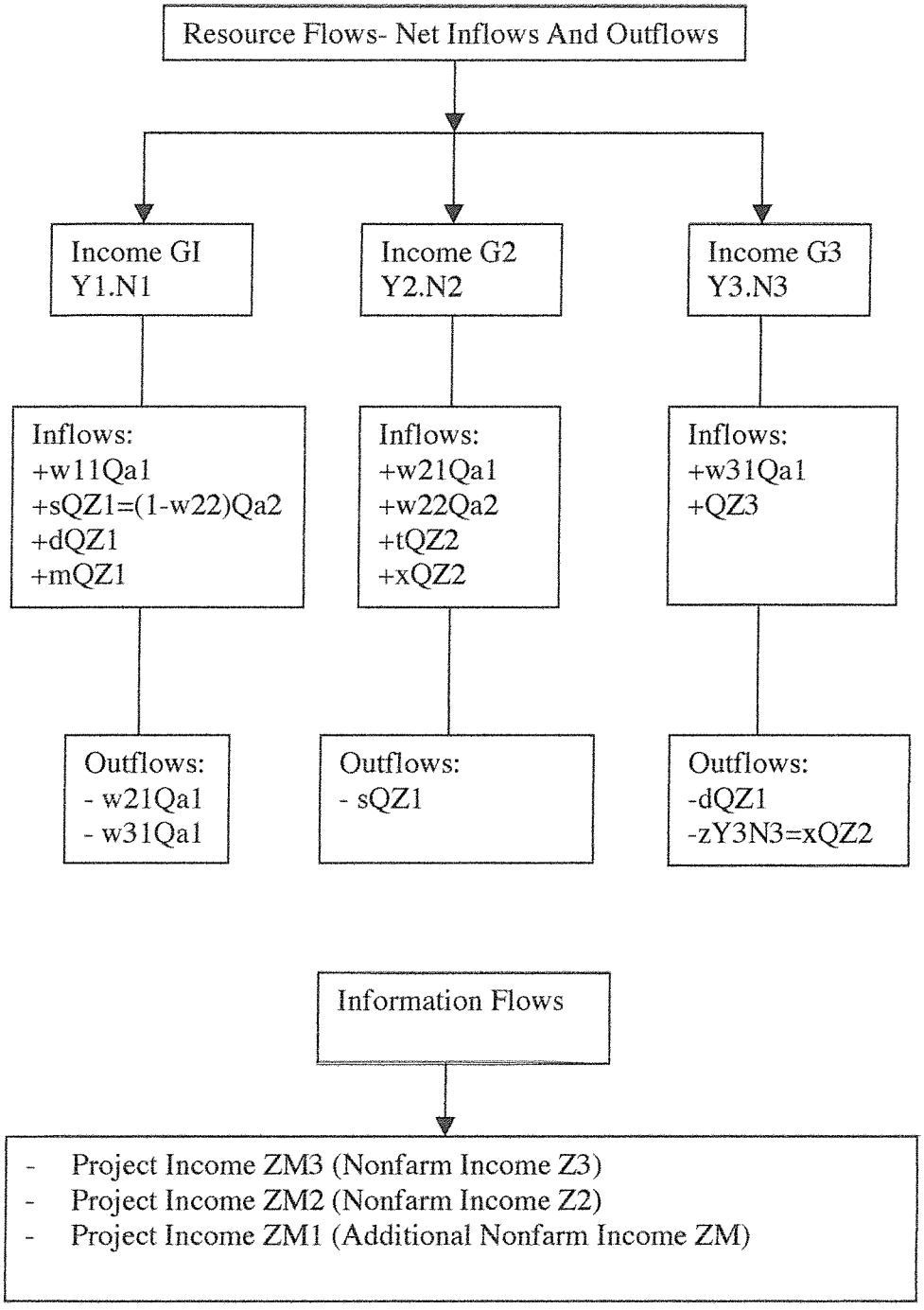
Group 3 also undertakes nonfarm employment in the traditional Z^T sector to enhance its income. (The effect of Z^M employment and income on the ownership bundles of participating households of Group 3 is examined in the simulation experiments, also see the footnote). The value of the non-agricultural output QZ3 in monetary units from nonfarm employment comprises the nonfarm income Z3 such that here

$Z3 = QZ3$.

The nature of income linkages shown above (Table 3.1) is such that the lower income groups receive agricultural and casual wages from the higher income group (w21Qa1, w31Qa1). There is an outflow of resources from the lower income groups to the higher income group in the form of debt repayment (dQZ1) and rent from sharecropping (sQZ1). In effect the total incomes Y2 and Y3 of Groups 2 and 3 are being depleted continuously by high debt repayment and sharecropping rent rates. The moneylenders charge interest in the range of 200, 300 or even 500 percent (Hogendorn, 1992). This is reflected through the high debt repayment factor in the

* The model replicates the existing income flows in the region under study where the limited Z^M activities are not accessed by Group 2 and 3 households because of their capital and skills constraints. Since the majority of the households undertake nonfarm activities in the Z^T sector, the income flows here reflect income accruing from employment in the traditional nonfarm sector. The effect of Z^M employment and income on the ownership bundles of participating households in G2 and G3 is examined in the simulation experiments.

Figure 3.3
System Resource And Information Flows



model. On an average the landlord gets fifty percent of the output either in cash or in kind (Rao, 1971). These income flows (described here and in preceding sections) are the basic building blocks of the simulation model described in the next section.

3.4.2 The System Dynamics Components of the Model

This section explains the formation of the different components of the System Dynamics simulation model, from the existing income flows in the rural sector noted in section 3.4.1. The objective here is to simulate the linked income flows in the region under study, then to apply the principles of System Dynamics for analysing the overall process at work. The model expresses the net resource of each economic group and the flow of the resource (in terms of money) to other economic groups. (Detailed explanation and description of the System Dynamics terminology is given in the appendix).

Figure 3.3 gives a summary of the derivation of the total (net) resource and flows of each income group in terms of the linked (gross) income flows discussed in section 3.4.1 (Table 3.1). The total resources of a particular economic group are calculated by multiplying the annual income of a household by the total number of households that have the above annual income, i.e. Annual income (Rs) * Total number of households having this income = Yi*Ni ($\sum$Ni=1000, i=1,2,3 for the duration of the study, also see section 3.4.1).

Income Group1 (big and middle farmers and Z^M households) is the resource group INCOME G1. The outflows from and inflows to this group are as follows -

The outflow of economic resources:

(1) Wages to hired agricultural labour from Group 2 (w21Qa1)

(2) Wages to hired casual labour from Group 3 (w31Qa1)

(3) Expenses towards costs of living (expenditure on acquiring the basic needs bundle, Exp 1, explained in the appendix)

The inflow of economic resources:

(1) Rent paid by the small farmers (income Group 2) for sharecropping or using the land of bigger farmers to supplement their income sQZ1, (sQZ1= (1-w22)Qa2).

(2) Repayment of debt from income Group 3 (dQZ1)

(3) Value of Z^M output in monetary units (mQZ1)

The class of small farmers, and agricultural labourers- Group2, constitute the resource group INCOME G2. The total economic resources of this group are obtained by multiplying the average annual household income by the number of households in this class. The outflow of economic resources from and the inflow of economic resources to this group are:

Outflow of economic resources:

(1) Sharecropping Rent- rent paid to the bigger farmers who let some of their land to the small farmers (1-w22)Qa2 = (sQZ1).

(2) Expenses towards costs of living (expenditure on acquiring the basic needs bundle, Exp 2, explained in the appendix).

The inflow of economic resources:

(1) The agricultural wages earned by working as hired agricultural labour (w21Qa1).

(2) Income accruing from undertaking nonfarm work Z2 (tQZ2)

(3) Income from rental of services to group3 (xQZ2)

Households with income below an annual income of Rs 3500* per household constitute the resource group INCOME G3. Members of this class are mostly landless households and agricultural labour. Total economic resource of this group is the product of the total number of households in this class multiplied by the annual income.

The outflows from and inflows to the group resource are:

The outflow of economic resources:

(1) Debt Repayment: the money that is paid back to the private moneylenders, who belong to income Group1 (dQZ1).

(2) Cost of services to group2.

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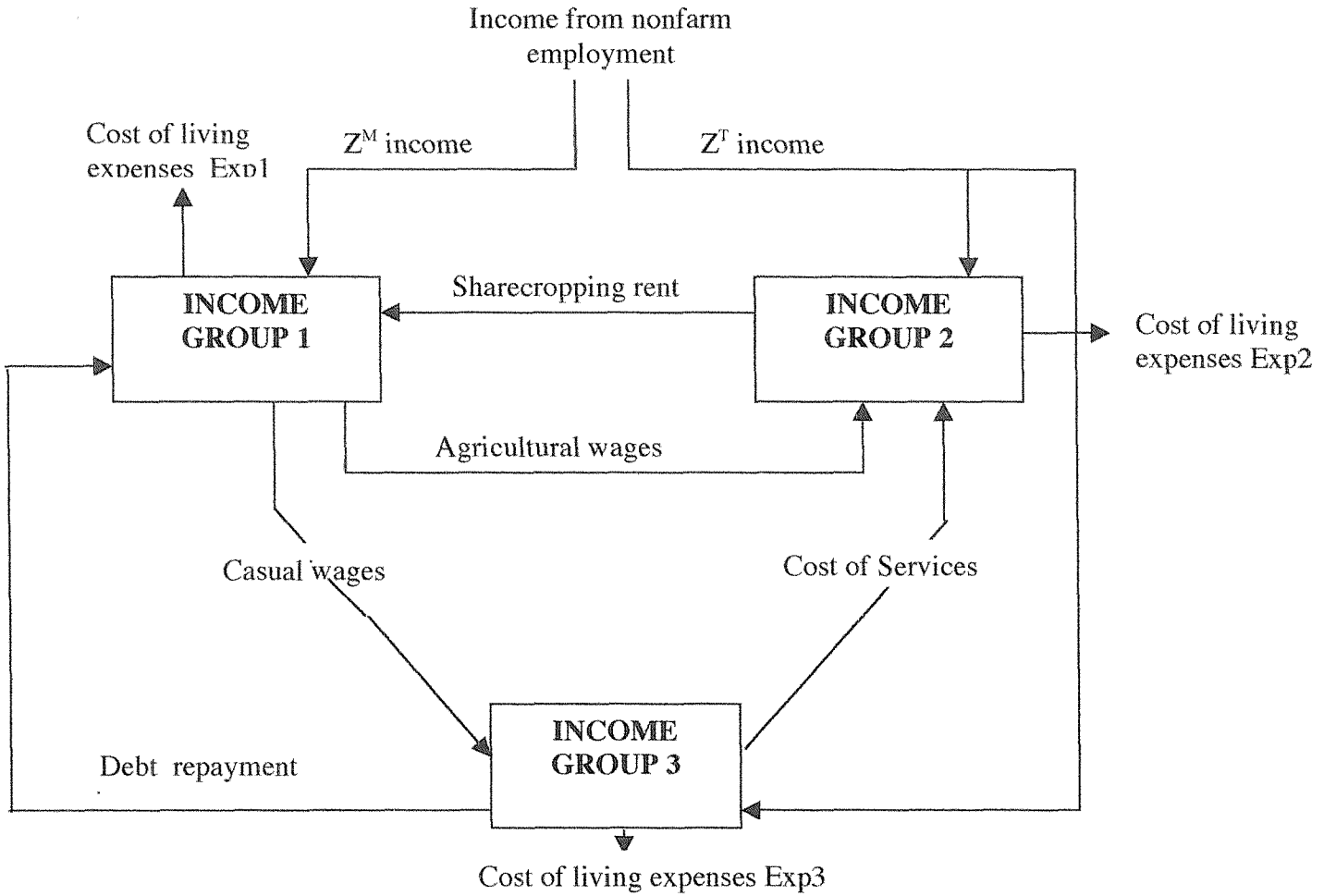
* Approximate Indian poverty line per household in the year (1979) the project was implemented.

Figure 3.4

Influence Diagram of the Income Flows Model for Households that did not Participate in the Project



(3) Expenses towards costs of living (expenditure on acquiring the basic needs bundle, Exp 3, explained in the appendix).

The inflow of economic resources:

(1) Casual wages earned by the labour (w31Qa1)

Figure 3.4 gives the influence diagram of the model. It shows the feedback structure of the model and income flows in the form of wages/payments linking the three resource groups - INCOME G1, INCOME G2, and INCOME G3. This looped configuration of variables represents the income flows system arising from employment in the agricultural and the nonfarm sectors in the region under study. Outflow of tax and inflow of interest on savings to Group 1 are excluded from the simulation experiment because the model is primarily concerned with the low-income groups. The tax/saving proportion of the lower income groups' income is either insignificant or non-existent. (Indian tax thresholds and costs of living). The low-income group with whom the model is primarily concerned is unlikely to pay significant tax or save.

In the simulation experiment in section 3.5, growth in income from modern nonfarm employment Z^M is incorporated in the model by the graphical function*. (For detailed explanation see appendix).

3.4.3 Nonfarm Employment Income and Other System Variables

This section explores the relationship between income acquired by undertaking nonfarm employment and other variables in the system under study. The nonfarm employment generating components of the Social Forestry project are explored in the context of the relevant system and related to the system variables.

* This function permits the use of subjective data and trends available on the desired variable. Here a curve is drawn based on the available qualitative data showing the relationship between the dependent and the independent variables. The existing value in the base year of each variable is represented by the point (1,1) and the subsequent values are extrapolated from the trend.

Discussions in section 3.2.1 show that households of income groups 2 & 3 (G2& G3) enter into sharecropping and borrow money to supplement the insufficient household incomes. In turn the outflows debt repayment and sharecropping rent deplete the resources of G2 and G3 and further weaken their already poor ownership bundles. It is expected that an increase in the household income by undertaking nonfarm employment will diminish the need to borrow and enter into sharecropping arrangements. This will reduce the outflows debt repayment and sharecropping rent, and enhance the earning capacities of G2 and G3.

It is concluded from the above that higher levels of nonfarm employment can affect the following flows:

- The outflow of resources from income G3 to G1 in the form of debt repayment,
- The outflow of resources from income G2 to G1 in the form of sharecropping rent.

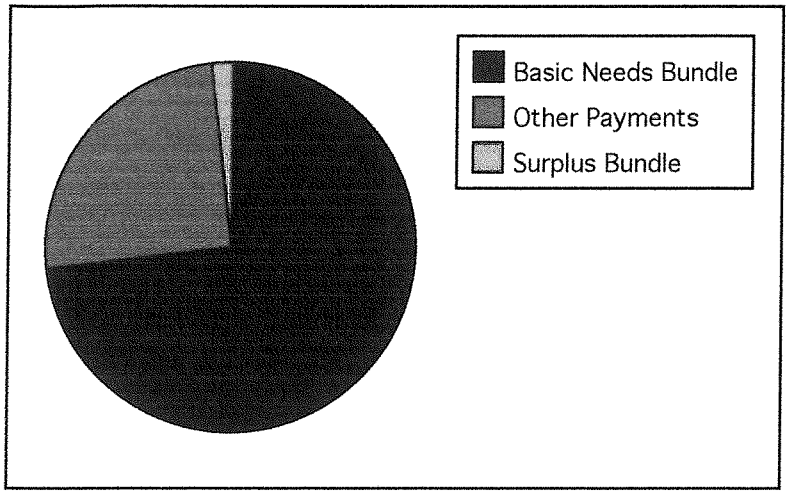
In summary, income from employment in the nonfarm sector can slow the variables that deplete the resources of low-income groups and enable the strengthening of their ownership bundles. Strengthening of the ownership bundles is measured in the model through the variable surplus bundle of the respective group, which represents the net resource of each group after taking into account all the additions and depletions of resources. Additions to the resources reflect wages and revenue from the sale of output (agricultural and nonfarm) while depletions indicate all expenditure.

An important component of household expenditure incorporated in the model is the value each household must pay to meet the basic needs requirement*. The basic needs requirement in this study as defined in Paper - I indicates a bundle that satisfies the nutritional calorie requirement of 2250 calories per capita per day. The value of the basic needs bundle: the poverty line is deducted from the gross income of each group through the variables Exp1, Exp2 and Exp3 respectively in the model. The variable surplus bundle then shows the strength of the ownership bundles of households in

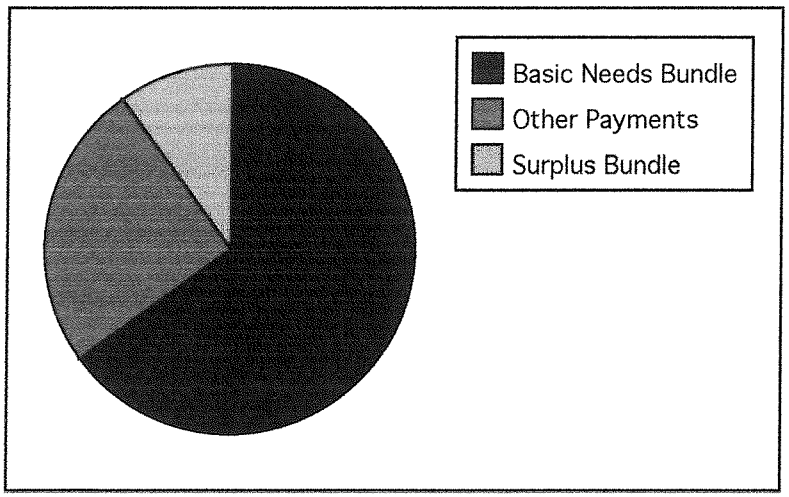
* The basic need requirement set B, see Paper I, section 1.4.1 for details.

Figure 3.5
Proportion (Approximate) Of Expenditure And Surplus Bundle of Different Groups

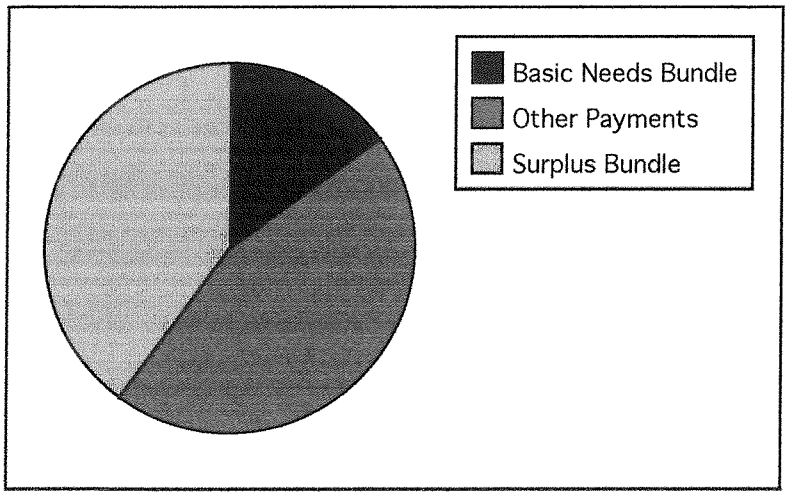
INCOME GROUP 3



INCOME GROUP 2



INCOME GROUP 1



acquiring the basic needs requirements and indicating the presence of additional resources. The larger these additional resources: the surplus bundle, the greater the potential for economic progress as shown in Paper - I.

Figure 3.5 shows the surplus bundle variable as a proportion of the total expenditure for each of the three income groups in this paper. For income groups 2 and 3 (households in the resource poor sector) the basic needs bundle accounts for nearly 70 percent of the total expenditure as indicated in Paper - I. Other depletions (payments) shown in the figure indicate the outflows for each group discussed in section 3.4.2. These configurations are indicated by the Surplus Bundle equations for each income group in the Appendix. The structure of these equations dictates the working of this variable for each income group in the model, shown in the system dynamics terminology in Figures A and B in the Appendix.

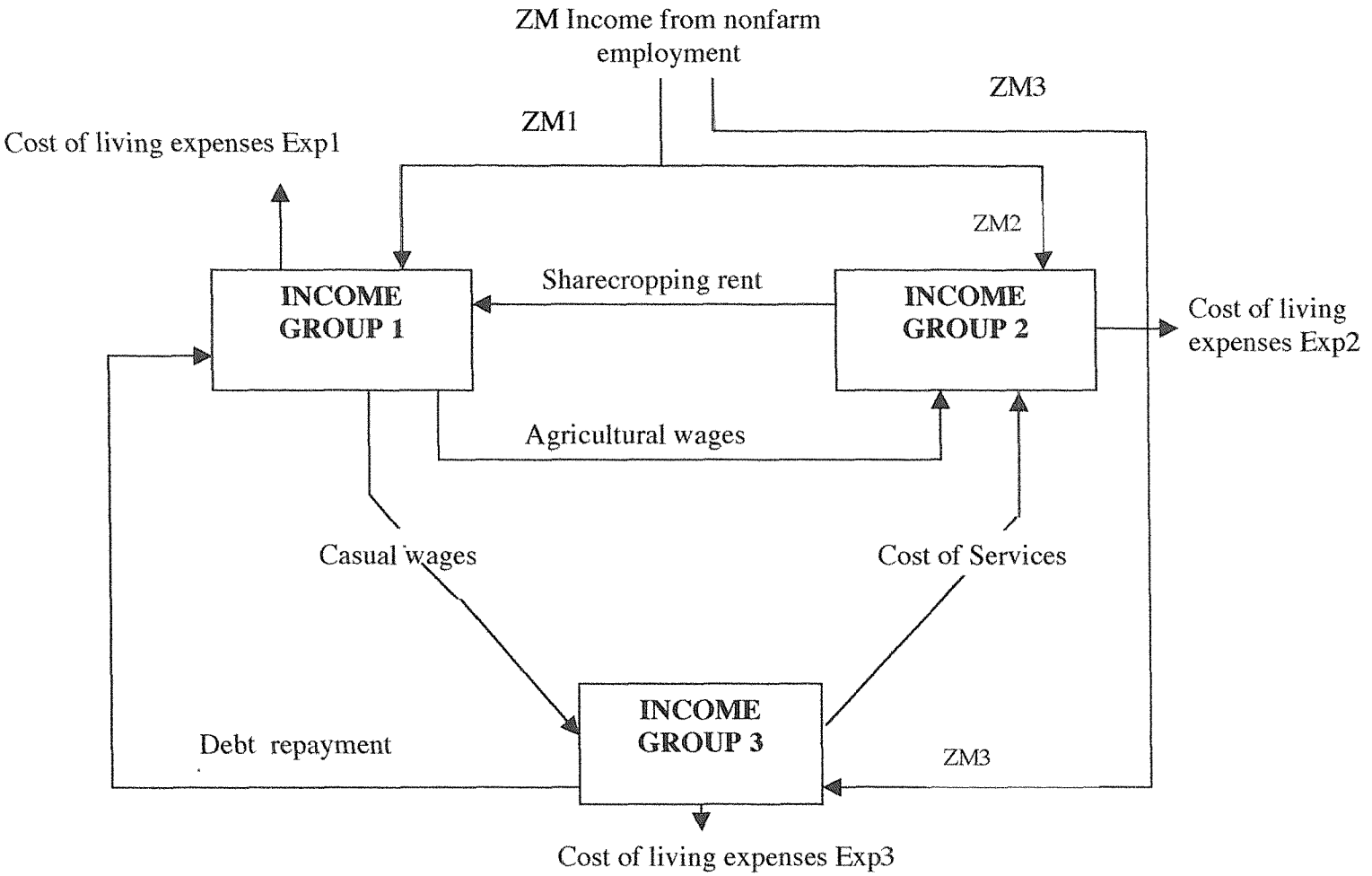
The simulation experiment in section 3.5 examines the influence of the nonfarm income generated by the Social Forestry project by studying the variable surplus bundle for the respective income groups.

Section 3.2.2 shows that the Social Forestry project was aimed at generating Z^M activities through (1) digging and planting, ZM3 in the model in Figure 3.6 and Figure B (2) processing and marketing of silkworms and other cottage industry products, ZM2 & ZM1 in the model in Figure 3.6 and Figure B. The project appraisal at the end of 10th year indicated that most planting targets were met but no significant progress was made in the expansion of cottage industry. The effect of the income from activities on meeting the planting targets on the total resources of the participating households (the ownership bundles) is examined by the variable ZM3 in the model. In the empirical evaluation of the project this variable is incorporated in the graphical function by using the trend of the actual wages generated by such work.

The ZM2 and ZM1 activities generated by the project are incorporated in the model through a graphical function. In the absence of consistent data on income from the expansion of cottage industry (for details see appendix), the graphical function helps to extrapolate the trend of growth in income from such activities. This step ensures

Figure 3.6

Influence Diagram of the Income Flows Model for Households that Participated in the Project



taking into account the increase in the income of some lower income households where members were employed in the forest department on a permanent basis at wages that were much higher than the ZM3 income. Such services form an important component of the Z^M sector in the region (Paper - II).

3.5 Analysis of the Model

Analysis of the model in this section describes phase II (stage I and stage II in Figure 3.2) of the simulation process. In stage I the behaviour of the system variables is examined over a period without making any changes. The simulation run of the model in this stage is carried out by giving the different variables the respective natural growth rates. The results of the unshocked model represent the economic reality of households not affected by the Social Forestry project in the short-term period of 10 years. The flow diagram used for the model is given in Figure 3.4 and the STELLA-II version of the model (Figure A) is given in the appendix.

In stage II of the simulation process certain system variables are modified. The modified structure is intended to evaluate intervention strategies and the income flows of households that directly participated in the Social Forestry project. The simulations examine the effect of implementing different pathways of the Social Forestry project over a 10-year period. The focus of the experiment will be income Groups 2 and 3 because the purpose of this paper is to explore nonfarm employment strategy that can enhance the household incomes of these groups. The model here examines the effect of changes in variables affecting the economic status of income Groups 2 and 3 on their respective ownership bundles.

Discussions in section 3.4.3 together with the conclusion of Paper - II show that the variable income from nonfarm employment has the potential to positively affect the ownership status of the participating households. In this section changes are made in the variable income from nonfarm employment in the model as shown in Figure 3.6 and Figure B in the appendix to incorporate income from all Z^M activities (ZM3 & ZM2, ZM1, see section 3.4.3) generated in the project.

Changes in the surplus bundle, which as discussed in section 3.4.3 reflects the net resource after taking into account all the additions (revenues) and depletions (expenditure) of resources of the respective group* are examined for both categories of households: ones that did not participate in the project and those that directly participated in the project. The comparison of the simulation results for the pattern of change in the surplus bundle of each category of household within a group is expected to indicate the effect of the Social Forestry project on the distribution of income in different economic groups.

Certain aspects of the System Dynamics methodology, which are crucial in this study, are emphasised here before the analysis of the simulation results in subsequent sections (3.5.1, 3.5.2 and 3.5.3). The inclusion of qualitative data by using the graphical function makes the pattern of change observed more important than the actual absolute numbers that are obtained. In line with the importance given to trends in System Dynamics (see section 3.3.2), certain variables where changes are made using the graphical function, are best examined for the pattern produced. Due to its ability to represent reality, the model can be used to analyse the pattern in detail by considering the intervention process as a separate system and working with actual data.

3.5.1 Simulation Results for Surplus Bundle of Group 3 Households

Table 3.2 gives the result of the simulation for the variable Surplus Bundle per household (average) for income group 3 in 1991 prices. Here column one shows the changes in the surplus bundle of households that did not participate in the Social Forestry project while column two shows the changes in the surplus bundle of households that directly participated in the project.

The simulation is carried out with the actual income and growth rate of nonfarm employment (Z^T in G3 & G2 and Z^M in G1) prior to the implementation of the project over the ten-year period. The nonfarm activities here are given a low growth rate to

* Also see the Surplus Bundle equations for each income group in the Appendix

Table 3.2
Simulation Results for Surplus Bundle of Group 3 Households
(in 1991 prices)

Year	Surplus Bundle of Group 3 Households that did not Participate in the Project (Rs per household)	Surplus Bundle of Group 3 Households that Participated in the Project (Rs per household)
0	-1,129	-1,129
1	-776	473
2	-234	733
3	153	966
4	522	1,485
5	637	1,864
6	827	1,029
7	881	1,242
8	930	1,658
9	1,029	2,287
10	1,096	2,751

Source: Simulation Results Run I, using
STELLA-II

reflect the existing slow and unsystematic spread of the rural nonfarm employment sector in the region under study. The simulation run here indicates the economic reality of the representative population of the region under study that did not participate directly in the Social Forestry project in the 10 year period.

The surplus bundle of households that did not participate in the project is found to have a negative initial value which decreases over the next two years to give a positive balance in the third year. The value of the surplus bundle increases at a slow rate in the subsequent years as shown in Figure 3.7. The negative value of the surplus bundle shows the inability of these households to acquire the basic needs bundle based on the official calorie requirements. The small positive value in year 3 and the slow change in subsequent years indicates that the selected households are barely able to acquire the basic needs bundle. This conforms to the respective trend in the actual data which indicates that incomes of many of the poorest households changed very little during this period and poverty was experienced by the same households year after year (World Development Report 1990).

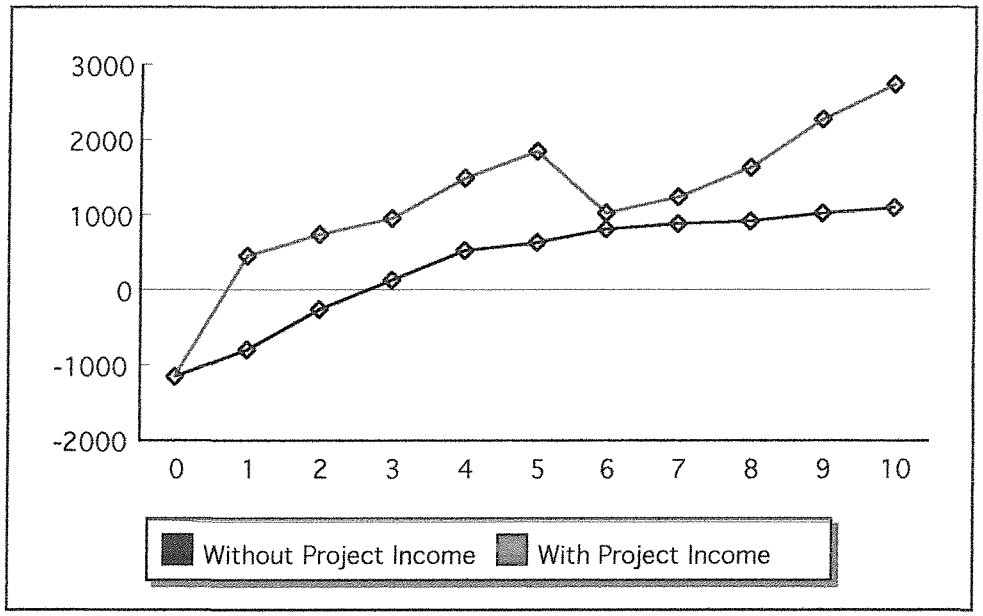
The surplus bundle of group 3 households that participated in the project is shown in column two in Table 3.2 and Figure 3.7. For such households nonfarm income accruing to group 3* through planting and digging (project income ZM3) is introduced in the model. The growth factor for such activities is based on the trends of short-term work introduced under the rural works programme in India (Narayana et al, 1988). The surplus bundle here with an initial negative value shows an increasing trend and a clear dip in year six. The decline in the incomes of households that participated in the project in year six indicates the short-term nature (5-6 years, for details see section 3.2.2) of the jobs that were taken up by this group.

A recovery in the value of surplus bundle in subsequent years shows that although many opportunities were terminated in year six, some of the participating individuals were able to enhance their skills while employed in the project and find better paid jobs both within and outside the project. This is substantiated by the fact that a small

* Data from Social Forestry Reports 1979 & 1989 shows that group 3 households were the beneficiaries such jobs.

Figure 3.7

Pattern Of Average Surplus Bundle Of Group 3 Households With And Without Project Income



proportion of those involved in such project activity was absorbed by the forest department at higher wages than ZM3 wages on a permanent basis. It can be inferred then that the incomes of such households would break the poverty line barrier: a fact reflected in Gaiha's (1996) work on the Employment Guarantee Scheme in the state of Maharashtra in India. The study shows that while chronically poor households became dependent on short term, low skilled work for their livelihood with little improvement in skills, a considerable number withdrew from the scheme when the overall economic conditions improved in terms of skills and income. Such schemes as noted in Paper - O and Quibria (1993) have been criticised for inappropriate targeting and low emphasis on skill enhancement. The Social Forestry project was able to sustain the benefits offered to some of the participating group 3 households as shown in Figure 3.7. This is attributed to the emphasis given in the project on enabling forestry related skill improvement of the persons employed in short-term jobs and subsequently the project absorbing a proportion of such labour on a permanent basis.

3.5.2 Simulation Results for the Surplus Bundle of Group 2 Households

Table 3.3 and Figure 3.8 show changes in the surplus bundle of households of group 2. Column one in Table 3.3 shows the surplus bundle of group 2 households that did not participate in the project while column two shows the surplus bundle of households that participated in the ZM activities generated by the project.

The simulation is carried out with the actual income and growth rate of nonfarm employment Z^T in G2 prior to the implementation of the project over the ten-year period. The growth rate of such work in the simulation reflects the existing slow and unsystematic spread of the rural nonfarm employment sector in the region under study. The simulation run here indicates the pattern of the surplus bundle of the representative population of group 2 households in the region under study that did not participate directly in the Social Forestry project in the 10 year period. Group 2 households as noted in section 3.4.1 belong to the resource poor sector defined in Paper I with incomes between the Indian poverty line and the World Bank poverty line.

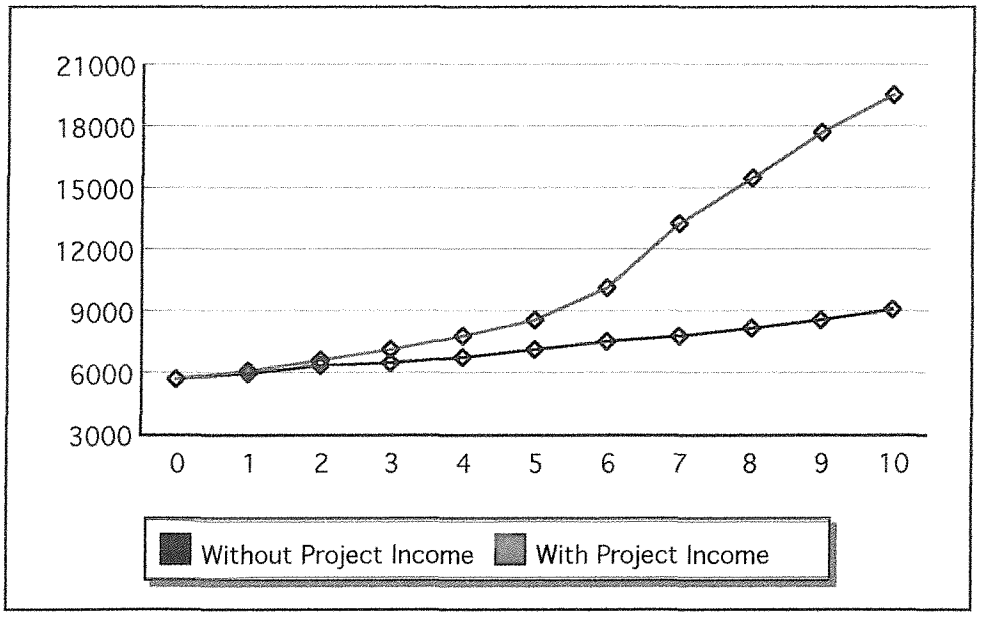
Table 3.3
Simulation Results for Surplus Bundle of Group 2 Households
(in 1991 prices)

Year	Surplus Bundle of Group 2 households that did not Participate in the Project (Rs per household)	Surplus Bundle of Group 2 Households that Participted in the Project (Rs per household)
0	5,763	5,763
1	6,009	6,101
2	6,453	6,674
3	6,541	7,185
4	6,753	7,832
5	7,197	8,594
6	7,558	10,170
7	7,793	13,289
8	8,226	15,519
9	8,647	17,794
10	9,134	19,515

Source: Simulation Results Run II, using
STELLA-II

Figure 3.8

Pattern Of Average Surplus Bundle Of Group 2 Households With And Without Project Income



The surplus bundle of group 2 households that did not participate in the project shows an increasing trend in the period under examination in this study. The pattern of the surplus bundle of such households shown in Figure 3.8 conforms with the findings of the study by Dutt & Ravallion (1998) which shows that households of rural poor in India linked to agriculture (small farmers and agricultural labour: G2 in this paper) experienced both relative and absolute gains throughout the eighties. While such gains have been noted to improve the living standards of the relevant households, these have not been sufficient to enable the households to break the resource poor sector cut off line.

The surplus bundle of group 2 households that participated in the project is shown in column two in Table 3.3 and Figure 3.8. For such households nonfarm income accruing to group 2 through forest based cottage industry products (project income ZM2) is introduced in the model. The growth factor for such activities is based on the trends of the existing modern nonfarm sector activities (Z^M in Paper - II). The sericulture component of the project has been excluded from the simulation experiment because of the slow progress and absence of data on such activities reported in the ten year review of the project by the funding agency. Surplus bundle here (Table 3.3 and Figure 3.8) shows a well defined upward trend with average surplus of households increasing considerably at the end of the tenth year. This is sufficiently large even after taking into account the leakages* in the system, to enable some of the group 2 households to break the resource poor sector barrier.

3.5.3 Simulation Results for the Surplus Bundle of Group 1 Households

Changes in the surplus bundle of households of group 1 are given Table 3.4. and Figure 3.9. Column one in Table 3.4 shows the surplus bundle of group 1 households that did not participate in the project while column two shows the surplus bundle of households that participated in the ZM activities generated by the project.

* In recent years leakages of designated funds and inefficiency in implementation of development projects have been attributed to the low success rate of such schemes - Chelliah (1999) and Quibria (1993).

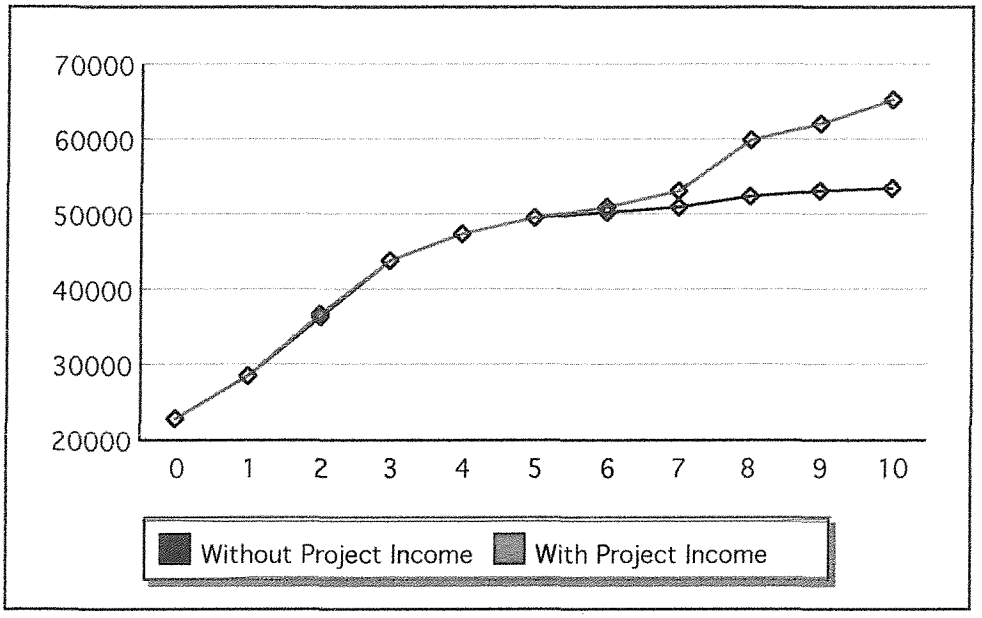
Table 3.4
Simulation Results for Surplus Bundle of Group 1 Households
(in 1991 prices)

Year	Surplus Bundle of Group 1 Households that did not Participate in the Project (Rs per household)	Surplus Bundle of Group 1 Households that Participated in the Project (Rs per household)
0	22,994	22,994
1	28,607	28,681
2	36,488	36,651
3	43,766	44,100
4	47,558	47,597
5	49,527	49,693
6	50,195	51,198
7	50,900	53,160
8	52,397	59,953
9	53,323	62,242
10	53,465	65,327

Source: Simulation Results Run II, using
STELLA-II

Figure 3.9

Pattern Of Average Surplus Bundle Of Group 1 Households With And Without Project Income



The simulation is carried out with the actual income and growth rate of nonfarm employment Z^M in group 1 prior to the implementation of the project over the ten-year period. The growth rate reflects the existing trend of the modern rural nonfarm sector Z^M in the region under study*. The simulation run here indicates the pattern of the surplus bundle of the representative population of group 1 households in the region that did not participate directly in the Social Forestry project in the 10 year period. Group 1 households as noted in section 3.4.1 belong to the capitalist sector defined in Paper - I.

The surplus bundle of group 1 households that did not participate in the project shows a strong increasing trend throughout the period under examination in this study. This reflects the well established phenomenon in India where the incomes of the richer households have increased significantly more than those of the resource poor households (as shown in column one of Tables 3.2 & 3.3) in the last two decades. The pattern here also validates the findings in Paper - I which show that households with stronger ownership bundles (income group 1) benefit far more from the development incentives than households with poor ownership bundles (income groups 2 and 3).

The surplus bundle of group 1 households that participated in the project is shown in column two in Table 3.4. For such households nonfarm income accruing to group 1 mostly through plantations on the farmers' own land (project income ZM1) is introduced in the model. The growth factor for such activities is based on the Social Forestry project report, which indicates that return from such plantations can be expected after five years of planting and reaching to a maximum between 10-15 years. In the initial stages the return was through revenue from the sale of oil seeds and fruits while the sale of timber from certain varieties of trees gave the return in the latter years. This is reflected in column two in Table 3.4, which shows that the surplus bundle of the participating households of group 1 increased more rapidly from year six onwards. While the benefits to the participating group 1 households are considerable in the ten year period as compared to the group 1 households that did not

* Detailed discussion is given in Paper II.

participate in the project, the proportionate benefits in the lower income groups for the ten year period are higher: just under 3 times in G3 and under two times in G2 as seen in Tables 3.2 and 3.3. Group 1 households are reported to have benefited most from the sale of trees planted on their own land. The revenue from such activity is not included in the simulation due to it starting in the year that falls outside the period under examination in this study.

In summary, an appraisal of the nonfarm employment strategy: the Social Forestry Project, using System Dynamics methodology indicates that households of all income groups that participated in the project were better off than the households in the respective income groups that did not participate in the project. The simulation results further indicate that the economic benefits in terms of strengthening the ownership bundles of the participating low income households occurred mostly as a consequence of income through short-term projects (ZM3) and employment within the project. The cottage industry based Z^M activities (ZM2 & ZM1, rearing and marketing of silkworms) that could further sustain the economic benefits accruing directly to the low-income groups showed slow progress. Therefore despite the many environmental and economic benefits brought in by the project, not all the poorest households could be the major beneficiaries, perhaps due to the slow spread of its planned Z^M activities.

The results of the System Dynamics simulation discussed above, when examined in terms of the segmented economy model (section 3.4.1) explain the functioning of economic linkages between the three economic groups as follows. The variable Land Rent is the nonfarm income sQZ1 of Group1, coming from Group2 as rent for sharecropping. Likewise, the variable Debt Repayment is the nonfarm income dQZ1 of Group1, coming from Group3 as repayment of the money borrowed. As shown in the segmented economy and System Dynamics model, the source of both sQZ1 and dQZ1 are the insufficient incomes Y2 (= A2+Z2) and Y3 (= A3+Z3) of Groups 2 and 3 respectively. Since it is the role of the nonfarm sector in the rural economy that is being examined in this work, income arising from undertaking nonfarm employment (Z2 &Z3) are taken as ZT (traditional) in the replication stage and ZM3, ZM2, in the analysis stage of the model (section 3.5).

Results of the simulation show that higher level of nonfarm employment in the region enhances the nonfarm incomes Z2 and Z3. This can, in turn, reduce the amount borrowed by Group3 (and hence the amount repaid as dQZ1) and diminish the need to enter sharecropping at unfavourable terms, bringing down the sharecropping rent sQZ1. By reducing the outflows from and increasing the inflows to the total resources i.e. the ownership bundles of G2 and G3, the net effect is an increase in the respective resource or a stronger ownership bundle of the relevant households.

The System Dynamics version of the model (Figures A & B) and the equations used there in are shown in the appendix.

3.6 Conclusion

In this paper, the hypothesis that 'nonfarm employment can improve the earnings of the economically backward rural households' has been examined through a System Dynamics simulation model.

The nonfarm employment strategy (Social Forestry) has been appraised and its data incorporated in the model to study the effect of higher levels of nonfarm employment on the incomes of the participating households in the rural economy under study. This has been done by first developing a model for a segmented economy, which expresses the income flows in the rural sector in terms of the agricultural and nonfarm incomes accruing to the households. Income linkages between the three economic groups are built into the model to replicate the dynamics of the income flows. Analysis of the economic profile of the region brings out the factors that determine the total income of the three relevant economic groups. The model further shows that changes in nonfarm income affect the overall distribution of income in the rural population. The results of the simulations indicate that earnings from nonfarm employment play a critical role in improving the household incomes of the poorest households.

Changes in household income are examined by incorporating data from a nonfarm employment project (Social Forestry) implemented in the region. Stage I of the

analysis where the income flows of households that did not participate in the project are examined, shows that the poorest households (G3) are barely able to acquire the basic needs bundles at the end of the ten year period. Households of group 2 experienced some gains during the period under examination. These gains, although exhibiting an increasing pattern are not sufficient to bring about the desired levels of change in the rural economy. This conclusion conforms to the fact that over 40 percent of the rural population in the region under study currently (1998) lives below the poverty line (Chelliah and Sudarshan, 1999).

In stage II income flows of households that participated in the project are examined by introducing nonfarm incomes ZM3, ZM2 and ZM1 . This is seen to accelerate the rate of change in the surplus bundles of each group.

Based on the above observations, it may be concluded that higher levels of nonfarm employment can enhance the total income of the poverty groups and thereby improve the economic status of the participating rural households.

This paper has examined the value of the nonfarm employment in the economic growth of the rural sector with the help of a System Dynamics simulation of a multiple sector economy. It has also reviewed the economic benefits to the lower income groups from the Social Forestry Project and found that ZM2 and ZM1 type activities need to be targeted, in order for the advantages to be sustainable. Though the importance of short-term projects (ZM3 income) is well recognised in rural development (Gaiha, 1996, Narayana et al, 1988), sustainable, long term benefits can be achieved by complementing short-term activity with employment in the modern nonfarm sector.

3.6.1 Potential Extensions and Limitations of the Simulation Analysis

The present study can be extended to examine the different types of activities and services in the Z^M sector that command different levels of skills and wages and the respective effects on the selected economic parameters. Changes in the wage structure of other sectors caused as a consequence of the expansion of the modern rural nonfarm sector can be studied by modifying the chosen system in the present model.

A further extension may be to study the mobility of households from one income group to another as the income of the household changes over a period. Such income mobility exists in the region and it is measured by the number of households crossing the poverty line in a given period. In the present study the emphasis is given to examining the income profile of a household in a particular group over a period.

The simulation analysis in this paper, while focusing on the effect of expanding the Z^M sector on the ownership bundles of the resource poor sector households, assumes a set of predetermined wages. All wages in this paper are treated as exogenous variable because they are outside the boundary selected for the simulation. This perspective does not take into account the changes in the wage structure of other sectors as a consequence of stimulating the nonfarm employment and wage structure in the rural economy.

Although System Dynamics models have found acceptance and application in a wide variety of social science disciplines (Forrester, 1971, Wolstenholme, 1990), the absence of any mechanism to check the individual relationships that make up the model has been questioned by those involved with econometric modelling (Nordhaus, 1974, Pindyck & Rubinfeld, 1991). A more robust technique has evolved by combining econometric estimation methods with the "data-less techniques" of System Dynamics (Pindyck & Rubinfeld, 1991). Extension of the present study within the above framework, such that the effect of expanding nonfarm employment at certain wages can be studied on the equilibrium wages in other sectors e.g. agriculture is next on the agenda.

APPENDIX

SYSTEM DYNAMICS AND ITS APPLICATION TO THE RURAL EMPLOYMENT SITUATION

Components of System Dynamics Model

Most components of socio-economic systems exhibit dynamic and inter-connected behaviour. The 'feedback' (or closed loops) paths are therefore used as the basic building blocks of such systems (Forrester, 1968). These paths are of information, choice and action, connecting the output to the input, application of which gives rise to a chain of cause-and-effect. In the modelling process these feedback loops control the dynamic behaviour. The self-reinforcing cycles are the positive feedback processes that change in the same direction (wage-price spirals). Negative feedback processes reverse the direction of change and try to restore balance to return the system to an equilibrium state (Coyle, 1977).

Whilst the underlying process is highly mathematical, employing the techniques of Kurt Runga etc, the variables are supplied and calculated through a relatively simple computer interface using the feedback loop metaphor. The loop itself has the following four main components (using the package STELLA- II) - Stocks, Flows, Converters and Connectors. Each of these behaves according to specified rules as explained below to maintain system and mathematical integrity.

The stock variables are produced by the accumulation of quantities, defined as items, whose value would not drop to zero if all the flows in the system were stopped, such as population and inventory.

The flow variables are the policy statements that govern the changes in a system. Flows represent activity. The rates of flow change the stock variables. Any path through a system network encounters alternating stock and flow variables. In all systems, the units-of-measure for the flow must be the same as those for the stock except for 'per time'.

Converters can play the role of either a stock or a flow. Converters can be used to represent stock concepts whenever (1) a parallel representation of the stock which differs only in its units of measure is required, or (2) the inflow and outflow processes associated with the stock in question are not a relevant concern. Converters when used as substitutes for flows break up cumbersome flow equations into simpler components and make the feedback loop easier to understand. Converters define the finer structure of the system, indicating the way the stocks govern future flows.

The graphical function is a special converter, useful due to its versatility. Graphical functions fall into three categories - time series inputs, unit-of-measure converters and the 'effects' or 'impacts'. The most important use of graphical function is to enable the simulation of 'effects' where it appears in a flow equation as a multiplier. The 'effect' then regulates the flow. 'Effects' can be generated by non-physical stocks and can influence physical stocks. As already indicated the computer metaphors are essentially a user-friendly way of defining the mathematical processes, which are compiled and calculated by the software.

Connector is the final building block. It is used to link stocks converters to other converters. It carries an 'input' or an 'output' signal unlike a flow, which carries an inflow or outflow volume.

Most socio-economic systems can be expressed using the above universal principles of structure, especially due to its emphasis on identifying internal dynamics. Time is a vital factor in the study of these systems where the variables may grow exponentially. The variables interact to produce 'system' behaviour. In order to understand the dynamics of the system, it is necessary to establish the boundary within which interactions take place. The boundary is selected by identifying those interacting components that are necessary to generate behaviour of interest. The concept of a closed boundary implies that at least some system behaviour is intrinsic and autonomous, not necessarily imposed from outside. The outside occurrences can be viewed as events that impinge on the system, but do not themselves give the system its internal characteristics (Forrester, 1968). Their influence, however, on the system is mediated by the intrinsic mechanisms noted within the boundary.

System Flows

There are six flows in all, the derivations of which are explained along with the flow expressions (summarised in Figure 3.2).

1. Debt Repayment

The rate with which economic resources flow out from the stock INCOME GR3 in the form of repayment for the borrowings to the stock INCOME GR1 is given by the flow : debt repayment. The flow debt repayment is a function of : the average amount of money borrowed by a household and total number of GR3 households borrowing money.

The low earnings of income Group3 force it to borrow money in order to meet the basic necessities. Because of the inability of this class to provide any security against loan it has no other choice but to undertake non-institutional credit in the form of the local moneylenders and the landlords. The interest rates are often in the range of 200, 300 or even 500 percent (Hogendorn, 1992). This leaves the borrowers in a debt-trap and they end up borrowing nearly Rs 3000 annually - about 80 percent of their annual income.

The amount of money a household in this class borrows depends upon its income. The income in turn depends upon the availability of employment for this class in the rural area. As the income goes up the household borrowing would decrease.

2. Land Rent

The flow showing the transfer of economic resources from the stock INCOME G2 to the stock INCOME G1 in the form of rent paid for sharecropping is given by land rent. The flow land rent is a function of: the average sharecropping rent per household and percentage of income Group 2 households entering into sharecropping. Some households of small farmer and agricultural labour class (income Group2) enter into sharecropping with the bigger farmers (income Group3) to supplement their

insufficient income. Sharecropping appears to be the easiest option to enhance their income because of the familiarity with the production processes and no requirement for other inputs. However the gains in reality are not very significant due to the high rent rates. On an average the landlord gets fifty percent of the output either in cash or in kind. (Rs 3500, which is half the annual household income of this class paid as land rent in the model).
From data on operational landholdings it is derived that approximately 40 percent of households in this class enter into sharecropping to enhance their income.

Again, more options with better economic returns would be available to enhance the household income with higher levels of nonfarm employment in the rural area. As income rises, the percentage of households renting land would decrease.

3. Agr Wages

The outflow of economic resources from the stock INCOME G1 to the class of small farmers and agricultural labourers (INCOME G2) in the form of agricultural wages (w21Q1) is given by the flow agr wages. The flow agr wages is a function of the variables: average agricultural daily wages, growth in agricultural wages, average number of days of agricultural work in a year and total number of agricultural workers. 6.21 in rupees is the average daily wages of an agricultural labour (for the year 1981). The number of days of agricultural work in a year is found to be approximately 200 days (Hazell & Singh, 1993).

4. Casual Wages

The flow Casual Wages illustrates the transfer of money as wages from the stock INCOME G1 to the stock INCOME G3 (the landless class). The flow Casual Wages is a function of the variables : average daily wages of a casual worker in G3, average number of days of casual work in a year, total number of casual workers and growth in casual wages.

The average daily wages of a casual worker is Rs 5.00 (in the base year, 1981). On an average such work is available for approximately 50 days in the year (Census of India, 1991).

5. Nonfarm Income (ZT, ZM)

All three income groups undertake nonfarm activity in the region under study. Employment in the modern nonfarm sector ZM is seen to be taken up by 4-5 percent of group 1 households (Paper - II, Papola, 1987) while employment in the traditional nonfarm sector ZT is undertaken by over 40 percent of households in groups 2 and 3. Growth in both ZM and ZT sectors has been low, under 2.5 percent in the ten year period.

In the model analysis ZT income to group 3 is replaced by the project income ZM3 while project income ZM2 replaces ZT income to group 2. The participating households of group1 receive the project income ZM1. Here ZM3 represents income through employment in short term (5-7 years) project activities related to planting of trees. The graphical function indicating the growth factor in such income incorporates the project life over which such income is generated, a small percentage of labour that was absorbed on a permanent basis in such activities by the forest department and the termination of such income for other households.

Income flows ZM2 and ZM1 reflect sustainable incomes through forestry related cottage industries. The graphical function representing the growth factor for such incomes reflects the growth in the modern nonfarm sector in the region and the projections in the project (Social Forestry Project Report, 1979,1990).

6. Cost of Living Expenses (Exp1,Exp2 & Exp3)

For each income group such outflows relate to the essential costs that must be incurred to meet the basic needs recquirement bundle. These are calculated through a graphical function that shows the changes in the costs of living: the basic needs bundle over the ten year period. The basic needs requirement in this study as defined

in Paper - I indicates a bundle that satisfies the nutritional calorie requirement of 2250 calories per capita per day. The value of the basic needs bundle: the poverty line is deducted from the gross income of each group through the variables Exp1, Exp2 and Exp3 respectively in the model.

7. Surplus Bundle Equations

-Surplus _Bundle_Gr1 = INCOME_GR1-(Agw+Csw+Exp1* INCOME_GR1)
-Surplus_Bundle_Gr2 = INCOME_GR2-(Land_rent+C_Services_Rent+Exp2* INCOME_GR2)
-Surplus _Bundle_Gr3 = INCOME_GR3-(C_Services_Rent +Debt_Repayment +Exp3* INCOME_GR3)

Figure A
'STELLA' diagram of the model to show the income flows of households that did not participate in the Social Forestry project

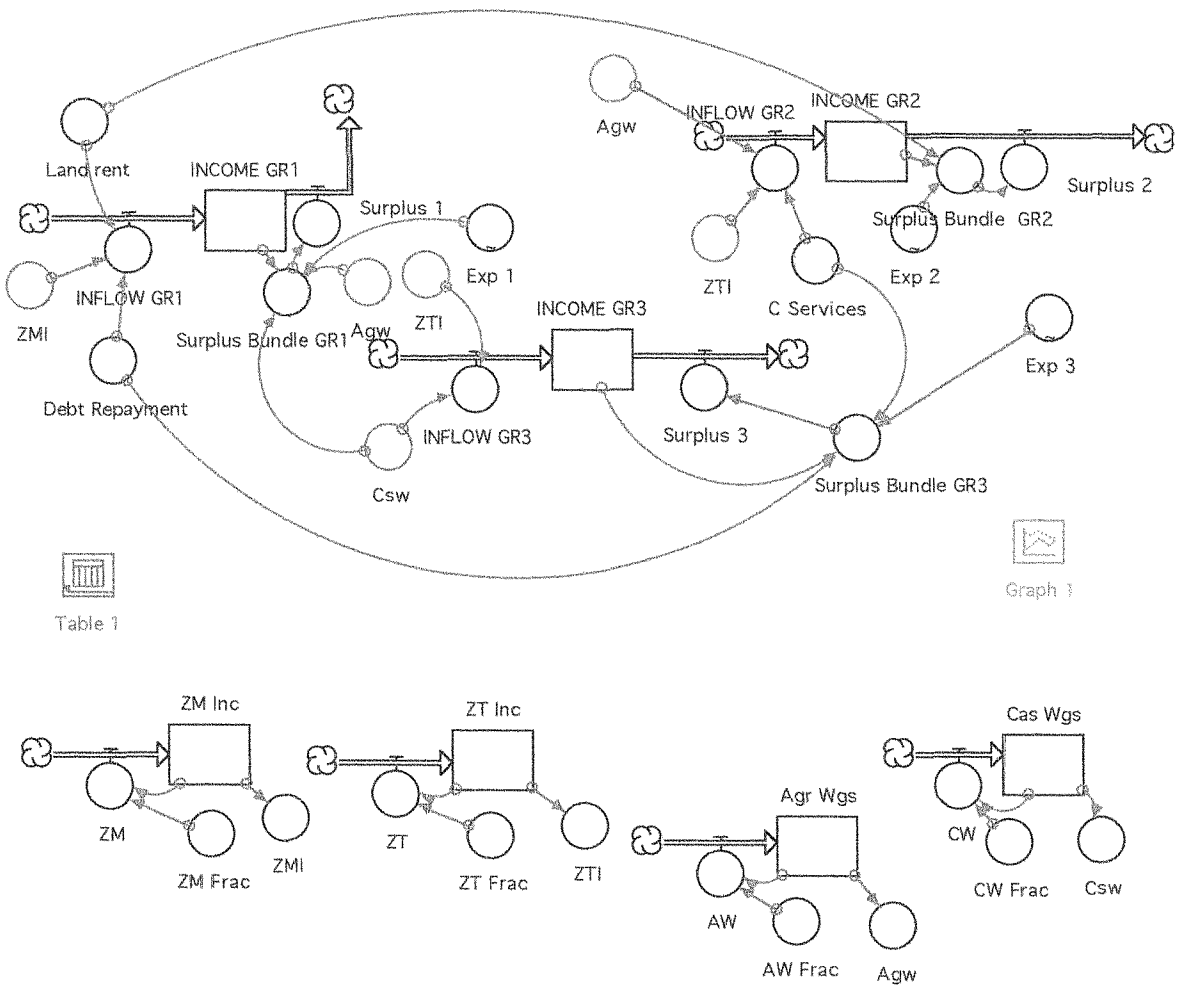
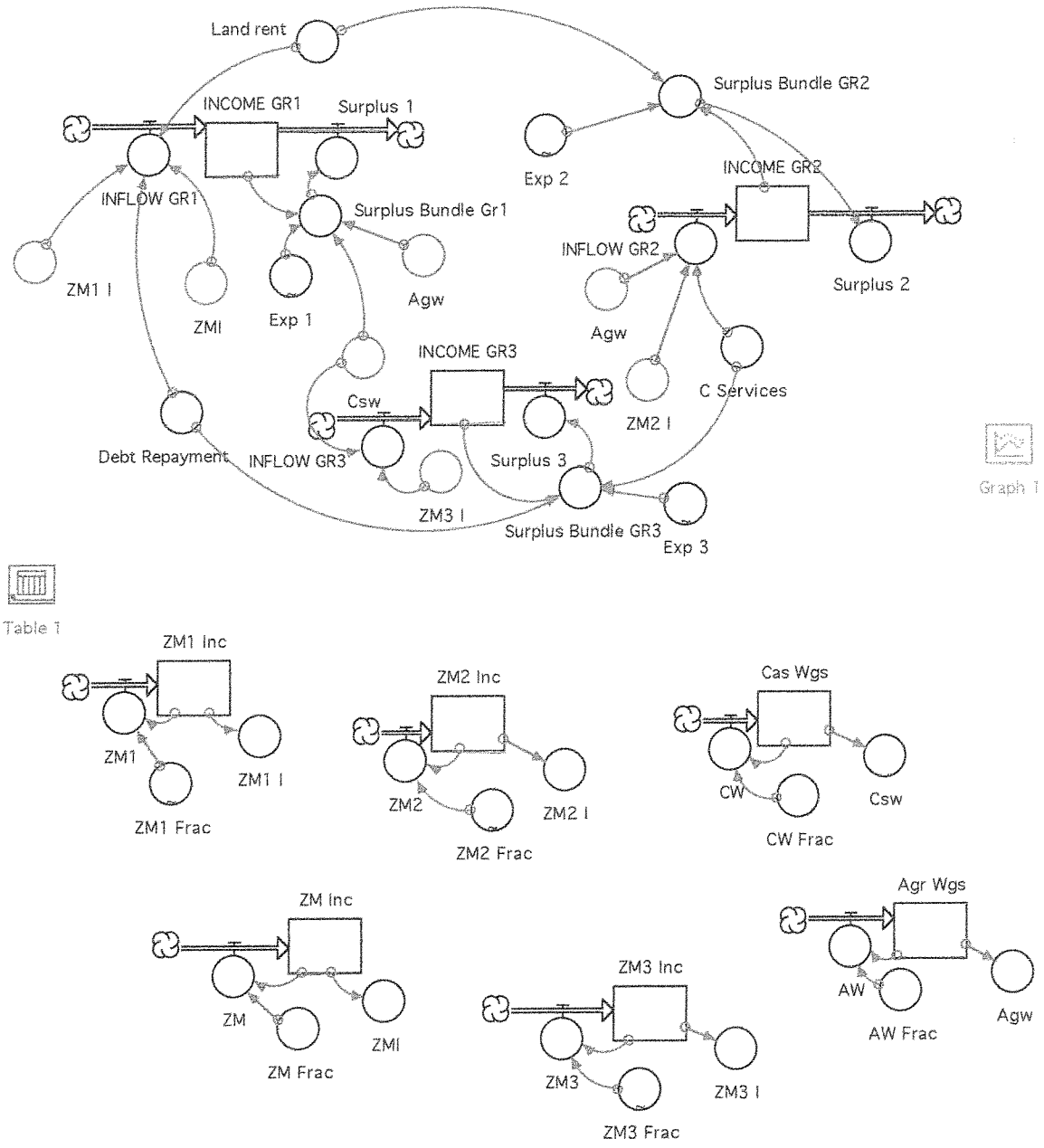


Figure B
'STELLA' diagram of the model to show the income flows of households that participated in the Social Forestry project



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