Study on Forest Dependent Households under a Household Model Framework

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2008

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This study suggests that JFM households receive higher economic benefit after JFM: the physical increase of forest related works has a positive impact on the prices of the same influencing higher hours (time) of work which help them increase higher annual per capita net real income. The poorer the households are according to their economic status, greater is the dependence on forest and so greater is the extent of involvement in low return forest activities (NTFPs) and forest wage work. It might indicate that JFM plays a positive role for economic security of the forest fringe households.

Keywords: *Joint forest management (JFM) programme, JFM and non-JFM forests, forest dependent household, non-timber forest products, forest income.*

JEL Classification: *Q23, D13, H41, D12, Q28.*

Section I

That forest plays a very significant role for poverty alleviation of forest fringe communities and thereby contribute to more prominent role in rural poverty alleviation has come to a new focus in some recent studies (Fisher, 2004; Pattanayak et al., 2004; Angelsen and Winder, 2003; Kumar, 2002; Kumar et al., 2000; Arnold, 2001; World Bank, 2001; Wunder, 2001; Cavendish, 1999; Scherr et al., 2002; Somanathan, 1991). The World Bank Report (2006) indicates that forests offer vast potential for poverty reduction and rural economy growth in India while also supporting critical national conservation goals (World Bank, 2006:xiii). During the current years there is rich empirical evidence to suggest that forest is an important source of income for the poor

forest fringe households through the extraction of non-timber forest products (NTFPs) or non-wood forest products (NWFPs), low return forest activities (LRFA), with the help of cooperative management which help preserving the forest resource sustainable (Somanathan, 1991; Pattanayak et al., 2004; Guha, 1989; Jodha, 1986, 1992; Kumar et al., 2000; World Bank, 2001). Increasing interest in rural poverty alleviation has resulted in a new focus in the forest dependent poor (Fisher, 2004; Pattanayak et al., 2004; Angelsen and Winder, 2003; Kumar, 2002; Kumar et al., 2000; Arnold, 2001; World Bank, 2001; Wunder, 2001; Cavendish, 1999; Scherr et al., 2002; Somanathan, 1991). In an attempt to measure the effect of JFM on various social groups – landless, marginal farmer, small farmer, medium farmer and large farmer – Kumar(2002) observes that the poorer sections of village community are disproportionately dependent on non-wood forest products both for subsistence and extra income due to low opportunity cost of labour (p.770). Somanathan (1991) observe that without any legal punishment by law, traditional cooperative management system based on self-enforcing social norms and customs – each person knows that if they cheat, the other will as well, and to their supply of forest products in years to come will be jeopardized – were enough to restrain people from removing timber from forest and the prevailing conditions ensures that the forest dependent households did not suffer from a scarcity of forest resource on which they were so dependent (Somanathan, 1991:PE 38-9). This paper tries to examine whether the dependence on non-timber forest products (NTFPs)- low return forest activities- and forest wage work for JFM households increases the price/return of forest work and increases the hours of forest work which might help improve the economic conditions of JFM households after JFM situation.

The paper is organized as follows: Section II presents the importance of the study. The data set and methodology appear in section III. Section IV presents the key results of the study. Section V provides a simple theoretical model based on the empirical findings. Conclusions are contained in section IV.

Section II

While empirical evidence from across the world now confirms that community-based regimes are a viable option for the management of local common property

resources (Baland and Platteau, 1996; Berkes, 1989; Bromley, 1992; Correa, 1999; Lama and Buchy, 2002; Martin, 1992; Naik, 1995; Saxena and Sarin, 1999; Singh, 1994, 2001), the local communities in different parts of India have mobilized repeatedly since long past against the old custodian forest management systems – traditional emphasis on production of commercial wood and disregard for local needs – to protect 'their' local resources from manipulation by outside groups in keeping with the other parts of the developing economics. The emergence of a new community forest management system in south West Bengal, the area of our study, is grounded historically in tribal and peasant resistance movements (Sarmah and Rai, 2001:213; Poffenberger, 1995:342-50). Against the old custodian forest management system, the local forest fringe communities in different parts of India have mobilized repeatedly since long to protect 'their' local resources from manipulation by outside groups. The emergence of new community forest management system in south West Bengal including our study area is also grounded historically in tribal and peasant resistance movements. Against the custodian forest management system, the local forest fringe communities – *Santal*, *Bhumij* and *Mahato* tribal, and some low cast Hindus – in south West Bengal mobilized repeatedly against *Mughal* and *British* rulers to protect their traditional rights on forestland from long past. *Chur Rebellion* (1767-1805), *Naik Revolt* (1806-1816) and *Hul Rebellion* (1855) are the glaring examples of the history in south West Bengal (Poffenberger, 1995:342-49). During Chur Rebellion, the tribal communities of this area mobilized resistance through a series of armed revolts against the British empowered new class of *zamindars* who took attempts to clear forest land and convert it into agricultural land to increase their revenue. "Tribal guerrillas were so effective that even as late as 1800, after nearly forty years of British occupation, a collector reported that two thirds of Midnapore consisted of jungle, the greater part of which was inaccessible" (Sarker and Das, 2006a:271). Yet, gradually the British Company succeeded in strengthening its control, despite subsequent revolts by forest fringe people, such as the Naik Revolt. The pressure on the forest grew further by the 1860s as the growing railway system demanded immense quantities of sal logs to provide sleepers for rail bed. Commercial demand for timber accelerated forest cutting, and raised the value of forestlands. Timber merchants rushed in, even before the rail lines opened and began leasing or purchasing large tracts from the Midnapore Zamindary

Company and other Zamindars. In early 1855, six to seven thousand Santal tribal from, Birbhum, Bankura, Chotonagpur and Hazribagh began meeting for organizing resistance in response to their growing marginalization. On July 16, 1855 some ten thousand tribal, under the messianic leadership of four Santal brothers stood their ground firmly and fought with bows and a kind of battle-axe in a battle near *Pirpaiti* (Dutta, 1940:26). Although, the revolt collapsed eventually after half their members were reportedly killed, its effects were far-reaching. The Hul Rebellion (as it is known among the Santal) profoundly influenced the ideological development of many Santal communities (Duyker, 1987:35), and lives on in the songs and oral traditions of the tribal people of this area.

However in the context of Indian forestry, several strands have gone to the present emphasis on community involvement in forest protection. Joint forest management programme emerges as the latest in a long history of policy changes, attempting to create a new relationship between 'state' and 'community' (Sarker and Das, 2006a:269). Evidence of earliest forest management by the state is found in Kautilya's *Arthashastra* (BC 321) which refers to 'forests' being managed as 'state reserves for revenue' and for 'public use' (Sarmah and Rai, 2001:209). But, indeed, no rulers in India did execute this policy in the management of forest resource of our economy before 1988. Rather, the forest policy of India before the year 1988 was oriented with commercial need either of the government or of the rulers of India without safeguarding the traditional rights and concessions of the forest fringe communities on forestland. In fact there was no systematic management of forest in the country before 1865. Some of the recorded forest conservation measures were initiated by *Emperor Ashoka*, as is testified by the decrees inscribed in rock and pillar edicts. This concern continued till the beginning of the 6th century. The *Mughals* and the early *British* rulers, however, evinced little interest in forest conservation. Systematic management of forest in country began in 1864 with the appointment of Dietrich Brandis, a trained German forester, as the Inspector General of Forests. The government decided to treat forests as state property by enacting the Indian Forest Act, 1865 (Act VII of 1865). Although, the first act of forestry in India was enacted in 1865, the major laws governing forestry have formulated by the Indian Forest Act of 1878, Indian Forest Act of 1927 and the Forest Conservation Act of 1980 (World

Bank, 2006:xvi). The Forest Conservation Act of 1878 and that of 1927 emphasized commercial timber production. The Forest Conservation Act of 1980 and the National Forest Policy of 1988 shifted the pendulum strongly towards forest conservation and joint forest management (ibid:16-18). The National Forest Policy of 1988 constitutes a significant departure from earlier policies of forest management practice for its emphasizes on: (i) obtaining the active participation of local people in forest conservation and development programmes of local forest lands and (ii) the benefit sharing arrangements, which is intended to provide village communities living near the forests a stake in the protection and development on the degraded forests. The revision of national forest policy in 1988, therefore, marks a major difference from the earlier policies which emphasized on production of commercial wood and disregard for local need (Poffenberger, 1995:342-50; Sarmah and Rai, 2001:213). However in keeping with the local need the new policy lays (1988) emphasis on meeting the local needs in particular of the tribal and the rural poor living near the forest and in safeguarding their traditional rights and concessions subject to the carrying capacity of the forests. This study seems to be important in that it tries to examine whether JFM programme in India, which recognizes the need to fulfill the requirements of fuel wood, fodder and minor forest produce of JFM households, could facilitate improvements in the economic condition of the rural poor and tribal communities after JFM situation. The hypothesis is that physical increase of forest related activities (increase in the quantity of NTFPs, physical increase in forest wage work) has a positive impact on the price/return of forest related activities influencing higher hours of work.

Section III

The data have been collected through an intensive field enquiry covering all members from forest protection committee (FPC) villages under JFM programme (study group villages) and non-JFM villages (control group villages) – three sample female FPCs (core group), three joint FPCs (first control group) and two non-JFM villages (second control group). For the selection of female FPCs, random sampling technique (SRSWOR) is used. It is important to mention that each FPC under this study was formed in the respective village; so FPC/village is synonymous in this study. The field survey is

conducted during the year 2005-06 and the data during before situation of JFM are collected from all the households through the *reflexive comparison method* where 'after' and 'before' scenarios are compared for the participating households.

In order to study the different aspects of the stated objectives simple tabular analysis, which presents absolute numerical values, percentage change, simple proportion, descriptive statistics and test of significance[1], is used in this research work. The extent of dependence on forest in terms of monetary units (INR) is assessed by estimating net real earnings[2] (revenue minus cost in real term) from both forest and non-forest sources. Total revenue and total cost of earning sources of the surveyed households are estimated during both after JFM situation and before JFM situation[3] (Sarker and Das, 2008).

Section IV

At the very outset, we examine some characteristics of villages under study. More than 80 percent members of almost all JFM villages (both female and joint FPC-villages) and non-JFM villages are either schedule caste (SC) or schedule tribe (ST); more that 75 per cent households in each sample FPC village live below poverty line[4]; major part of income for all categories of households in all FPC/JFM villages and non-JFM villages is yielded from forest source during both before and after situations of JFM. All these might lead to low economic and social status of forest fringe communities in rural Indian society.

Table 1 presents per capita annual net real income (in INR) of various categories of households from forest source, non-forest source along with the change of income between two time periods (before and after situations of JFM). A common feature that emerges from Table 1 is that annual per capita net real income from forest source accounts for major share of per capita annual net real income for all categories of households under both JFM and non-JFM villages during both the situations. It also shows that per capita annual net real income for all categories of households increases during after JFM situation under both JFM and non-JFM villages. But such an increase is higher for all categories of JFM households than the increase for all categories of households in the non-JFM villages after JFM situation. Categorically, the increase of

forest income is higher for landless and marginal landholding households under JFM villages compared with same categories of households under non-JFM villages. The higher increase in income for landless and marginal categories of households under JFM villages has been made possible only due to substantial increase in income from forest source after JFM. It seems to be relevant to mention that during before JFM situation the share of per capita annual net real income from forest source out of per capita annual net real income from all sources for all households under our study (combining both JFM and non-JFM villages together) ranges between 63.56 and 70.58 percentage points indicating that forest was major source of income for all categories of households before JFM. After JFM, the share of per capita annual net real income from forest source for the households under JFM villages, combining both female and joint FPC-villages together, works out between 67.96 and 87.45 percentage points. For non-JFM villages, the share of per capita annual net real forest income from forest source out of per capita annual net real income for non-JFM households under our study ranges between 60.29 and 64.09 percentage points during before JFM situation, whereas after JFM situation it lies between 55.26 and 64.59 percentage points. Table 1 also shows that forest income for all households under JFM villages, irrespective of female and joint FPC-villages, has considerably increased after JFM programme; but the incidence of increase is much lower for the households belonging to the better economic position on land-based economic status.

As regards non-forest income for JFM households is concerned, out of annual per capita net real income of a range between INR 983.02 and INR 1107.90 in an average (combining both JFM and non-JFM households together), non-forest income of JFM households was lying between INR 338.69 and 396.72 during before JFM situation, whereas after JFM situation out of annual per capita net real income of a range between INR 1368.64 and 1371.18 in an average non-forest income works out between INR 202.85 and 279.87. Before JFM situation the contribution of non-forest income to per capita net real income for JFM households is around 35 percentage point, whereas after JFM situation the contribution of non-forest income works out to around 18 percentage points. So, the change of annual per capita net non-forest income out of change of annual per capita net real income is insignificant for JFM households after JFM situation due to

major contribution of forest income in annual per capita net real income for JFM households both before and after JFM situations.

Why does annual per capita net real forest income increase for JFM households after JFM influencing thereby to increase in their annual per capita net real income during the same period ? As may be seen in Table 2, the physical quantity related to collection of all NTFPs per day per household for all JFM households increases much higher rate after JFM, although the incidence of increase among JFM households is categorically higher for landless and marginal landholding households; but for non-JFM households, the rate of its increase is much lower after JFM situation.

Is it only the increase of NTFPs in physical terms that help to increase per capita net real income for JFM households after JFM ? Table 3 presents the break-up of household's dependence on forest and non-forest sources of income during after and before situations of JFM programme (share in percentage of annual per capita net real income). An important feature that emerge from the table is that annual per capita net real income (combining all forest sources – NTFPs, forestry wage and timber forest products – together) accounts for major share of per capita annual net real income for almost all categories of households under both JFM and non-JFM villages during both the situations. Table 3 also shows that timber income during after JFM situation for JFM villages is of two types: legal and illegal[5]. Legal timber earning for JFM villages is the share of government's timber revenue received by households legally from the JFM forest. But during before JFM situation households' income from timber for JFM villages was, basically, illegal. For non-JFM villages, timber income during both after and before situations is illegal. What is more important here is that after JFM situation the legal timber income constitutes a very small proportion of the annual per capita net real income for all households under JFM villages. Annual net real income from timber forest products (TFPs) generating from illegal source for JFM households decreases to a large extent during after JFM period. Conversely, there is a significant increase in income from NTFPs and forestry wage labour for JFM households after JFM.

As regards NTFPs are concerned, Table 3 shows that before JFM the share of NTFPs' income out of annual per capita net real forest income for JFM households in an average was below 25 percent, whereas it was around 16 percent for non-JFM households

during the same period. But after JFM situation the share of annual per capita net real forest income from NTFPs for JFM households marks a significant increase – around 158 percentage points for joint FPC households and around 193 percentage points for female FPC households – on an average, whereas such an increase is around 2 percentage points for non-JFM households on an average during the same period. However the incidence of increase of NTFPs' income is more prominent for landless and marginal landholding JFM households after JFM. With regard to forest wage income is concerned, before JFM the share of forest wage income out of annual per capita net real forest income for JFM households in an average was below 8 percent, whereas it was around 7 percent for non-JFM households during the same period. But after JFM situation the share of annual per capita net real forest income from forest wage work for JFM households shows much higher increase –around 194 percentage points for joint FPC households and around 149 percentage points for female FPC households- on an average, whereas it is around 12 percentage points increase for non-JFM households on an average during the same period. The incidence of increase of forest wage income is more prominent for landless and marginal landholding JFM households after JFM. Table 3 also shows that income other than NTFPs and forest wage work decreases for JFM households in an average after JFM. These results, however, imply that the increase of NTFPs' income and forest wage' income are the only factors for the increase of annual per capita net real income for JFM households after JFM.

Does the increase of wage rate and price per unit of NTFPs help to increase the annual per capita net real income for JFM households after JFM situation? As regard forest wage labour is concerned, not only the landless and marginal categories of households but also small landholding households are involved in forestry works after JFM situation. This is due to attractive high forestry wage rate in forest sector compared with local rural wage rate in non-forest sector. The prevailing wage rate for forest wage labour after JFM situation is fixed at INR 67.50 which is about a double of the prevailing average local wage rate for, usually, eight hours of service from 8am to 4pm (Sarker and Das, 2008). This rate is much higher than the forest wage rate of before JFM situation. However forest wage rate is fixed up by the government on the basis of market wage rate. It changes time to time. While we undertook our study after JFM situation forest wage

rate was fixed at INR 67.50. Moreover, although the local rural wage rate was between INR 30 – 35 while we conducted our survey, it was also higher than that of before JFM situation. But the number of working days for forest fringe communities as wage labour under forest department is more or less fixed. After JFM situation, usually, one person from each JFM household with a family size of five or less gets the opportunity of forest work from thirty five to forty days per year. If the size of member of a household is grater than five, usually, two persons get the opportunity of forest work for seventy to eighty days in total per year from the same family (ibid). The number of days of employment for each forest wage labour per household per year is fixed at 35-40 days for the family size of five or less than five; two persons of a poor household with a family size of greater than five get the opportunity of forest wage work for 70-80 days per year (ibid). As regards product price is concerned, Table 4 shows that the price per unit of all kinds of NTFPs increases after JFM. It also shows the period of collection of all types of NTFPs by the households we surveyed. Fuelwood is collected by the households for the whole year. The period of collection for sal leaves is about 10 months in a year. It seems to imply that fuelwood and sal leaves are the regular source of income for the households we surveyed.

We now examine the period of annual employment for JFM and non-JFM households under forest and non-forest sector (Table 5). It shows that average days of employment per household per year under forest sector has increased during after JFM situation for both JFM and non-JFM households irrespective of landless and land-based economic status; but such an increase is more pronounced for the JFM villages in general, and households belonging to lower economic status (landless and marginal landholding households) in particular. The table also reveals that average person per household employed in forest sector per year has increased significantly, ranging between 27.84 percentage and 48.94 percentage points, for landless and marginal categories of households under JFM villages during after situation of JFM programme, while such increase is observed much low for small category of JFM households, and all categories of households under non-JFM villages during the same period. As regards employment opportunities under non-forest sector is concerned, although average number of working days per household per year for intra-village off farm activities other than forest sector

has somewhat increased (from 49 days per household per year to 53 days per household per year for female FPC-villages and from 55 to 59 for joint FPC-villages) in JFM villages after JFM situation, the average number of working days per household per year in non-forest sector has significantly decreased for all categories of JFM households during the same period. The incidence of intra-village (within village) employment for JFM households increases after JFM and this is due to increase of off-farm employment in the forest sector. Conversely, there is high incidence of out-migration for non-JFM households for non-JFM villages after JFM. It might suggest that due to the implementation of JFM programme forest provides a significant increase of off-farm employment opportunities for all categories of JFM households within their own villages, the incidence of employment opportunities being higher for landless and marginal categories of households. On the contrary, due to non-execution of JFM programme the non-JFM households fails to receive these opportunities which influences our-migration for non-JFM households to a large extent after JFM situation.

However, some common characteristics that appear among JFM households from this study (without the comparison between sex and categories of households) for their execution of JFM programme are in the following lines:

a) After JFM, annual per capita net real income for JFM households is higher than non-JFM households, although no perceptible difference in annual per capita net real income is observed between JFM and non-JFM households before JFM situation.

b) Much higher economic benefit (per capita net real income) for JFM households after JFM situation is mainly due to forest source of income, the higher physical collection of NTFPs and processing & production of NTFPs-based enterprises being the major source of forest income for all categories of JFM households after JFM situation. The increase of collection of NTFPs is about hundred or more than hundred percentage points the quantity of before JFM situation for all categories JFM households after JFM situation, whereas the increase of the quantity of collection of NTFPs per day per households is in no case greater than twenty five percentage points of the quantity before JFM situation for all categories of non-JFM households after JFM situation. Before JFM the share of NTFPs' income out of annual per capita net real forest income for JFM households in an average was below 25 percent, whereas it was around 16 percent for

non-JFM households during the same period. But after JFM situation the share of annual per capita net real forest income from NTFPs for JFM households marks a significant increase – around 158 percentage points for joint FPC households and around 193 percentage points for female FPC households- on an average, whereas such an increase is around 2 percentage points for non-JFM households in an average during the same period. It implies that JFM programme has helped JFM households gaining a major increase for the collection of NTFPs, the major source of forest income, which non-JFM households fail to receive.

c) In keeping with the increase of the quantity of collection of NTFPs, JFM programme helped FPC-households receiving a high increase of forest wage work which non-JFM households fails to receive due to non-execution of JFM programme.

d) After JFM situation, the price per unit of all types of NTFPs is much higher than the price per unit of before JFM situation.

e) Wage rate of forest work after JFM is much higher than that of before JFM situation. Although local rural wage rate after JFM is higher than that of its before JFM, forest wage rate, which is fixed up by the government (INR 67.50 for eight hours of work usually from 8am to 4pm, on the basis of market wage rate) is about a double of the local rural wage rate after JFM situation.

f) As JFM programme has increased opportunities of work within forest sector (NTFPs and forestry wage work) for JFM households after JFM situation (by increasing collection of NTFPs more than double the quantity of before JFM situation, and high increase of forestry wage work the quantity of before JFM situation), both average days of employment per household per year and average person employed per households per year show much higher increase in the forest sector. It implies that higher increase of physical forest works brings about increase in the time of work in the forest sector after JFM situation for the JFM households.

However, if we consider household as a unit, the common feature that emerges out for JFM households after JFM situation for the execution of JFM programme is that physical increase of forest related works has a positive impact on the prices of forest related works influencing higher hours (time) of work influencing thereby increasing higher per capita net real income for JFM household.

Section V

Following Becker (1965) and Lancaster (1966) household's production function approach we assume:

$$U = U(v) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

i.e., consumers derive utility from the vector of attributes instead of receiving utility directly for marketed goods (q_i). They consume goods only after some transformation of those goods. We assume that for each v_i

$$T_i = t_i v_i$$

$$q_i = a_i v_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where t_i is a parameter indicating the per unit consumption of time for each v_i consumed; then the total time spent consuming some amount v_i is T_i. a_i is a parameter indicating the amount of market good q_i needed per unit of v_i.

Let T represents the total time available for all activities (i.e., 24 hours per day). In keeping with our empirical works we assume that consumer spends time working on collection of forest products (C_{fp}), forestry wage work (W_f), crop farming (C_f) and non-forest wage work (W_{nf}). To evaluate the model simple, we assume some constant wage rate/net return (r) per hour for all types of work performed by the consumer under our study. We also assume that the consumer has available non-wage income in the amount Y. Then we can write

$$U = U(v_1, v_2, \ldots, v_n)$$

subject to $\Sigma p_i q_i = r(C_{fp}+W_f+C_f+W_{nf})+Y$

$$= r(T_{aw})+Y$$

and $\Sigma T_i = T - (C_{fp}+W_f+C_f+W_{nf})$

$$= T - T_{aw}$$

where p_i = price per unit of q_i

and $T_{aw} = C_{fp}+ W_f+ C_f+ W_{nf}$

However, since time and goods are inextricably linked by the production equation (2), the two constrains can be combined. Replacing T_{aw} in the income constrain with $T - \Sigma T_i$ from the time constrain, we have the single constrain

$$\Sigma p_i q_i + \Sigma r T_i = rT + Y$$

Then substituting $T_i = t_i v_i$ and $q_i = a_i v_i$ we have the basic model

$$U = U(v_1, v_2, ..., v_n)$$

subject to $\Sigma(p_i a_i + r t_i) v_i = rT + Y$ ..... (3)

$p_i a_i + r t_i = \varepsilon_i$ may be interpreted as 'full price' – cash expenditure of $p_i a_i$ (rupee) plus the time expenditure of t_i (hours) – of consuming v_i when one unit of some attribute v_i is consumed. rt_i represents an opportunity cost of consuming v_i because the time could have used to produce income. However, the constraint of (3) represents an individual's full income equals non-wage income plus the amount of income that would be earned if the entire day were spent at work.

Idle time (and leisure) are attributes in the model. The total time spent consuming all attributes is $T_c = T - T_{aw} = \Sigma T_i$. As we are interested in characterizing consumer's response to changing wage level, price level (Table 4) and income level (Table 2), the situation with an ordinary demand curve the consumer is worse-off facing higher prices than lower prices since his income is constant. The problem is more relevant of constructing the Hicksian demand curve (sometimes called the compensated demand curve) by adjusting income as the price changes so as to keep the consumer's utility constant. As the consumer is compensated for the price change with constant utility, we consider the following expenditure minimization model

$$\text{Minimize } Y = \Sigma(p_i a_i + r t_i) v_i - rT$$

subject to $U(v_1, v_2, ..., v_n) = U^0$ ..... (4)

Assuming the first and second order conditions hold, the Hicksian demand curve is

$$v_i = v_i^u(\varepsilon_1, \varepsilon_2, ..., \varepsilon_n, r, U^0) = v_i^u(p, a, t, w, U^0) \text{ ..... (5)}$$

The structure of this model in ε_i and v_i is formally identical to the standard minimization model. Thus $\delta v_i^u / \delta \varepsilon_i < 0$. Moreover, as parametric change in either p_i, a_i or t_i increases ε_i by a proportional amount, it also follows that $\delta v_i^u / \delta p_i < 0$, $\delta v_i^u / \delta a_i < 0$ and $\delta v_i^u / \delta t_i < 0$.

Defining the Hicksian demands for the market goods as q_i and time spent on such goods as T_i^u respectively the technological relations follow that

$$\delta q_i^u / \delta p_i = a_i \left(\delta v_i^u / \delta p_i \right) < 0$$
$$\delta q_i^u / \delta t_i = a_i \left(\delta v_i^u / \delta t_i \right) < 0$$
$$\delta T_i^u / \delta p_i = t_i \left(\delta v_i^u / \delta p_i \right) < 0$$
$$\delta T_i^u / \delta a_i = t_i \left(\delta v_i^u / \delta a_i \right) < 0$$

The analysis of the important changes is as follows: if the price of commodity q_i increases (decreases), v_i attributes (idle time and leisure) for the consumer decreases (increases) leading to less (more) consumption of the market good q_i; decrease in price of q_i has negative effect on v_i leading to positive impact on t_i (per unit consumption of time for each v_i consumed); increase (decrease) in t_i will lead to decrease (increase) in v_i leading to less (more) consumption in q_i ; increase in a_i (amount of market good q_i required per unit of v_i) will lead to decrease in attributes which influences the decrease in total time spent consuming v_i.

But the analysis of changes in r is more problematic. The parameter r enters the full price of each and every v_i for which time is consumed. Therefore, the change in r necessarily changes many prices simultaneously, preventing the application of the law of demand. Since r appears in many first order equations, a refutable hypothesis of the compensated demand functions concerning the important parameter is impossible in this model. As the wage increases, consumption will in general switch to good that are relatively less time intensive (Becker, 1965). In order to derive such a result an additional assumption regarding the values of the various parameters in the model is required. The pure substitution effect for the total member of hours worked, however, does have a determinate sign.

Considering the relation Σ Ti = T – T_{aw} , we can express the expenditure minimization model in terms of the n +1 variables v_1, v_2, ..., v_n and T_{aw} , and two constrains

$$\text{Minimize } Y = \Sigma p_i a_i v_i - rT_{aw}$$
$$\text{subject to } U(v_1, v_2, ..., v_n) = U^0 \quad \text{..... (6)}$$
$$\text{and} \qquad \Sigma t_i v_i + T_{aw} = T$$

As regards the theorem on general methodology is concerned, the comparative static theorem for parameters appearing in only the objective function are the same as for

unconstrained model so long as the first and second order conditions are assumed satisfied. Here the parameter r does not appear in the constrain; it only enters the objective function in the particularly simple form $-rT_{aw}$ i.e., as a price of T_{aw}. As the expenditure function is a minimization problem it is concave in – r, then $\delta\left(-T_{aw}^{u}\right)/\delta r < 0$ or $\delta\left(T_{aw}^{u}\right)/\delta r > 0$ where T_{aw}^{u} denotes the compensating demand fro hours worked. Then $\delta T_{c}^{u}/\delta r = \delta\left(T - T_{aw}^{u}\right)/\delta r < 0.$ Thus, like the simple model of labour-leisure choice, this model reveals that a compensated increase in wages is an increase in opportunity cost of leisure and leads to a decrease in leisure consumed and a corresponding increase in the number of hours worked.

If we distinguish between two types of works – forest related works (FW) and non-forest related works (NFW), equation (6) can be written as

$$\text{Minimize } Y = \Sigma p_i a_i v_i - (r_1 T_{FW} + r_2 T_{NFW})$$

$$\text{subject to } U(v_1, v_2, ..., v_n) = U^0 \quad \text{..... (7)}$$

$$\text{and} \qquad \Sigma t_i v_i + T_{FW} + T_{NFW} = T$$

where r_1 and r_2 are the prices per unit of T_{FW} and T_{NFW} respectively.

Since equation (7) is a minimization problem, the expenditure function is concave in $-w$, that is $-\delta r_1/\delta T_{FW}^{u} < 0$ or $\delta r_1/\delta T_{FW}^{u} > 0$[6]. As the physical quantity of forest works (quantity of NTFPs and forestry wage work) increases r_1 also increases. Then $\delta\left(T - T_{FW}\right)/\delta r_1 < 0$, i.e., the total time consuming the forest attributes of v_i is $T - T_{FW} = \Sigma T_i + T_{NFW}$. Then $\delta\left(T - T_{FW}^{u}\right)/\delta r_1 < 0.$

Thus a compensated increase in quantity of T_{FW} (forest work) increases the price of T_{FW} influencing an increase in opportunity cost of leisure of forest attributes indicating a decrease in leisure consumed and a corresponding increase in the number of forest hours' worked.

Section VI

This study suggests that JFM households receive higher economic benefit after JFM situation for the execution of JFM programme: the physical increase of forest related works has a positive impact on the prices of the same influencing higher hours (time) of work which help them increase higher annual per capita net real income.

Increase in income from forest is due to two sources: NTFPs and forest wage work. NTFPs source from forest is the main source of the economic benefit for the members participating in the JFM programme irrespective of female and joint FPC-villages. As regard forest wage labour is concerned, not only the landless and marginal categories of households but also small landholding households are more involved in forestry works after JFM situation. This is due to attractive high forestry wage rate compared with local wage rate in non-forest sector.

This study, however, lends credence to the fact that works related to NTFPs and forest wage work form the very important part of the life of rural forest fringe households under our study. In terms of use of underemployed and unemployed family labour, there are huge employment opportunities for forest dependent communities and in particular to poorer households, which mostly tribal, in a big way. The poorer the households are according to their economic status, greater is the dependence on forest and so greater is the extent of involvement in forest related activities (NTFPs collection, processing, etc.-low return forest activities – and forest wage work). However in keeping with the declaration of National Forest Policy (1988) -"The life of tribal communities and other poor living within and near forests revolves around forests. The rights and concessions enjoyed by them should be fully protected" (SPWD, 1998:3)-in pursuant to which June 1990 JFM guideline came into existence, this study seems to suggest that JFM plays a positive role from the point of view of economic security of the forest fringe households we surveyed.

Notes

1. The problem here is to examine whether there is any significant difference between two mean values – mean values of two variables (after JFM situation and before JFM situation) for a given population say household related to collected quantity of NTFPs, etc. The problem may, however, consider the following form. Let the two random variables, x (after JFM situation) and y (before JFM situation), be drawn from a given population. We want here to find if JFM is really effective to change households' collected quantity of NTFPs, man days of employment in forest sector and so on. Suppose $x_1, x_2, \ldots, x_n$ be the values of n

random sample during after JFM situation and $y_1, y_2, \ldots, y_n$ be the corresponding values of n random sample during before JFM situation respectively. Now (x_i, y_i) are the pair of values in the i^{th} household during after JFM situation and before JFM situation respectively. In order to test the significance of the difference between two population-means (μ_x and μ_y) we can apply *paired t-test* because *x* and *y* are not completely independent, and they are dependent in pairs of observations (x_1, y_1), $(x_2, y_2), \ldots, (x_n, y_n)$ corresponding to 1^{st}, $2^{nd}, \ldots, n^{th}$ household respectively (Goon *et al*., 1985:310; Gupta, 1992:1228). The appropriate test statistic is given by

$$t = \frac{\bar{d}}{s\sqrt{n}} \text{ with d.f. = n-1}$$

where $d_i = x_i - y_i$ and $s^2 = \frac{1}{n-1}\sum_i (d_i - \bar{d})^2$ and the testing hypothesis is H_o: $\mu_x = \mu_y$ which is tested against the alternative hypothesis H_1: $\mu_x \neq \mu_y$.

2. Real earning (in Rs.) is determined after deflating the money income by Consumer Price Index for Agricultural Laborers (General) on the one hand, on other the procedures of estimation of net money income and hence cost and revenue during both before and after JFM situations are evaluated directly from our earlier study (Sarker and Das, 2008). It is worthwhile to mention that total revenue and total cost of rural forest fringe households under our study are estimated on two sources – forest (NTFPs, forestry wage and TFPs) and non-forest (farm, non-forest wage and others).

3. Although 'after situation of JFM' is simply the survey period (2005-06) of this research study 'before situation of JFM' is not the same for all FPC-villages. 'Before situation of JFM' of this study implies one preceding year of the formation of each FPC under our survey. It is worth important to mention that before situation of JFM of each surveyed FPC differs from one another. A single before situation is selected by the simple arithmetic mean for all FPCs under study.

4. Poverty line income in rural West Bengal on the basis of PCME (per capita monthly expenditure) by NSS of 56^{th} round (1999-00) is INR 350.17. Based on the CPIAL (Consumer Price Index of Agricultural Labour [General]) the poverty line income for the year 2005-06 is calculated as INR 394.00 approximately.

5. Never did the respondents say that their source of income was illegal; rather, while examining the answers from the respondents regarding the break-up of their source of income, the distinction between legal and illegal source was clearly demarcated.

6. The change of T_{NFP} (quantity of non-forest products) for JFM household is assumed to be constant after JFM situation .Table 2 clearly shows the change (decrease) of non-forest products in physical terms is insignificant for JFM households after JFM situation. In monetary terms(annual per capita net real income), the change of non-forest income out of total per capita net income is considered insignificant due to major contribution in forest income for JFM households both before and after JFM situation (mentioned in the text).

[*Details of methodology and dataset will add shortly in soft version*]

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