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Analysis of Risk Behavior of Households:
Evidence from Gender Sensitive JFM Programme in West Bengal

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In an attempt to examine the extent of risk faced by households under gender sensitive JFM programme in West Bengal, this study suggests that JFM programme could reduce more risk related hardship for JFM households by their increase (decrease) in time and income on forest (non-forest) related works which non-JFM households fail to receive. Within JFM villages, female FPC-households not only yield higher per capita net real income but also contribute female's higher share of their family income, which they only receive from forest source, than their men's after JFM situation indicating higher diversification of forest works in female FPC-villages.

I. Introduction

In real life, many of the choices that people make involve considerable uncertainty. Literally, uncertainty future of the decision variables is characterized by the term risk (Pindyck and Rubinfeild, 1995:138-9). High income risk is part of life in developing economies. Many studies (Townsend, 1994; Kinsey et al., 1998; Murdoch, 1995; Dercon, 2002) have reported high income variability related to risk of various forms – harvest failure as a result of drought, flood, frost and other climatic events; policy shocks, such as changes in taxation, bans of migration, etc.; labour problems; and

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individual or idiosyncratic risk like emergency consumption loan when income and consumption strategies fails, and loss of asset. Vulnerability to poverty linked to risk remains high among poor rural households in developing countries (Dercon, 2002:141). As most people are risk averse, they usually try to reduce risk by diversifying income or by insurance. As the market for insurance is typically absent or incomplete in developing countries (Fisher, 2004:138; Dercon, 2002:145), income smoothing strategy that reduces risk and fluctuation in income often involves diversifying income sources. On the other hand, although across the developing world there is a widespread scope for diversification of income sources (i.e. farm household may receive a substantial share of income from non-farm activities), diversification does not always result in income smoothing because farm and non-farm activities may move together which would severely limit the usefulness of diversification (Dercon, 2002:151). For example, draught may hamper not only crop production but also production of NTFPs in a region, where households mainly diversify their income sources between farm and forest, and hence to reduce risk it limits the usefulness of diversification from farm crop to forest produce and vice versa. Moreover, income diversification directly linked with household's economic condition: the poor have less diversified source of income than richer one.

However, poor rural households generally use a variety of income-based strategies like labour supply adjustment by household's members (Kochar, 1995; Moser, 1998; Jacoby and Skoufias, 1997; Frankenberg, 1999; Thomas et al., 2001), temporary migration to obtain work, working longer time, and collection and selling wild food and forest products (Davies, 1996; Rahmato, 1991), to cope up with the consequence of risk. This study seeks to examine the extent of risk faced by households under gender sensitive joint forest management programme and its possible impact based on a comparative study between some JFM (joint forest management) and non-JFM households in West Bengal.

What is the relevance of this issue in a gender sensitive JFM programme? It is said that women's multiple tradition of knowledge of forest resource for the nature of women's work which makes them closer to nature than men can be useful for the effective management of forest (Tinker, 1994:367; Hobley, 1996:19; Locke, 1999:235; Leach and Green 1995:10; Joekes et al. 1994:137-38; Agarwal 1992:147). As the major

stakeholder, women's interaction with the forest is based on their day-to-day dependence on forest for subsistence needs. Women, who live close to the forest areas, are primarily responsible for collection and processing of NTFPs and spend more time in the forest (Agarwal, 1999:105; Kumar, 2005:100, Das, 1994:60; Vyasulu, 2001:300). It is said that "men are responsible for processing timber for house construction and agricultural implements while women procure firewood for household needs" by the traditional gender roles (Kumar, 2005:100). According to the typical gender based divisions of roles and responsibilities in Indian forest belts, women are the primary collectors of a wide range of NTFPs for both subsistence and income (ibid). However, the rich empirical studies suggest that the outcome of community-based regime in forest management like JFM for women is disheartening and it points to continuing invisibility of women (Kelkar and Nathan, 1991, 2003; Bosu Mullick, 2000; Sarin, 1996, 2003; Subba, 2000; Vasundhara, 2000; Zhonghua, 2001; Sundar, 1997; Satyawadhana, 2003; Fuquan and Yuhua, 2003; Sarker and Das, 2002; Das, 1994). But, the little information available from some research studies suggest that where women are involved in decision-making about forest, they tend to take account of the needs of food, fodder, fuelwood and other non-timber forest products which are otherwise ignored by men sitting on forest protection on similar community-level committees (Kelkar and Nathan, 2003; Subba, 2000; Fuquan, 2000; Vasundhara, 2000; Singh, 1999; Fuquan and Yuhua, 2003; Sarin, 2003; Bosu Mullick, 2000). So, women's group as an important site for women's strength and mutual learning are increasingly accepted in national political and educational ideology (Kelkar and Nathan, 2003:34). In keeping with this, to provide explicit focus of gender planning in JFM by understanding women's needs for forest resources in development and management, the West Bengal Forest Department (WBFD) first established new management system of female FPC in India during early 1990s. Such a planning has been started from Bankura district in West Bengal (SFR, 2000). SFR (2001) reveals that seventeen female FPCs have been established in Bankura district and they cover two thousand nine hundred and thirty six hectares of forest areas under JFM programme. Although, the number of female FPCs is too small (0.43 per cent) as compared with general joint FPCs and the area female FPCs protected is 0.53 per cent of total forest area (548986 hectares) under JFM programme (SFR, 2000:50; 2001:67, 2005:72), the setting

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up of female FPC in some areas of West Bengal is a new innovative attempt by the WBFD to motivate women, in particular, in the process of seeking women's involvement and participation in the JFM programme by forming their (women) own group along with their own management system. This study is, however, important in that it examines the risk related hardship faced by households in two types of FPCs – female FPCs and joint FPCs – under JFM programme and control group villages under non-JFM programme, and its possible impact on diversification of works for their subsistence and income. The underlying hypothesis of this study is that JFM programme could reduce more risk related hardship for households under JFM villages in general and female FPC villages in particular by increasing higher net real income devoting more time and thereby increasing more income on forest related works with a decrease of time and income on non-forest related works which households under non-JFM villages fails to receive.

The next section presents a simple theoretical model which presents the behaviour of a typical risk averse individual who usually tries to reduce risk by diversifying his/her income sources. Section III discusses the basic empirical strategy. The data set appears in section IV. Section V presents the main results. Section VI concludes.

II. Theoretical Framework

Many problems in the economics of uncertainty are related to the trade off between the variability of income and its degree of riskness. Vulnerability to poverty linked to risk is a usual phenomenon for most of the households of rural forest fringe community in a developing country like India. The market for insurance is typically absent in this rural economy and most people are risk averse; they usually seek to reduce risk by diversifying their income sources. The theoretical foundation for such a risk averse individuals is postulated in the model.

An individual who is risk averse prefers a certain given income to a risky income with the same expected utility. Such a person has a diminishing marginal utility of income (the assumption that indifference curves are everywhere convex to the origin implies that individuals are risk averse). The indifference curve is defined by

$$\lambda_1 v(y_1) + \lambda_2 v(y_2) \equiv v_0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

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where uncertain prospect of income y_1 and y_2 with respective probabilities λ_1 and λ_2, and $v(y_1)$ and $v(y_2)$ satisfies expected utility property.

The slope of indifference curve is

$$dy_2/dy_1 = -\frac{\lambda_1 v'(y_1)}{\lambda_2 v'(y_2)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(2)}$$

where $v'(y_1) > 0$, $v'(y_2) > 0$

and the second derivative $d^2 y_2 / dy_1^2 = -\dfrac{\lambda_1 v''(y)}{\lambda_2^2 v'(y)}$ ....(3)

[assuming $y_1 = y_2 = y$]

The assumption that indifference curves are everywhere convex is equivalent to the assumption that the Von Neumann-Morgenstern (VNM) utility function is concave (Silberberg 1990:404). The more bowed away from the horizon axis (income axis) that the VNM utility function is, the greater is the degree of risk aversion. The magnitude of the second derivative of the indifference curves along the 45° certainty line is proportional to $-\dfrac{\lambda_1 v''(y)}{\lambda_2^2 v'(y)}$. This quantity is called the coefficient of absolute risk aversion or the Arrow-Pratt measure of risk aversion. The higher the coefficient of absolute risk aversion, the higher the risk premium the individual is willing to pay. Suppose a risk-averse individual has initial income y; he is willing to pay the risk premium $R_z(y)$ to avoid a fair gamble z (with mean zero and variance, σ_z^2). Then by definition

$$v\{y - R_z(y)\} \equiv E\{v(y+z)\}$$

Taking a first order Taylor series approximation on the left and a second order on the right, we obtain

$$\frac{v(y)}{0!} - \frac{v'(y)R_z(y)}{1!} \approx E\left[\frac{v(y)}{0!} + \frac{v'(y)}{1!}z + \frac{v''(y)}{2!}z^2\right]$$

or, $v(y) - R_z(y)v'(y) \approx v(y) + \dfrac{1}{2}\sigma_z^2 v''(y)$ [as mean is zero]

and so $R_z(y) \approx \dfrac{1}{2}\sigma_z^2 \dfrac{-v''(y)}{v'(y)}$ ....(4)

Thus the higher the coefficient of absolute risk aversion, the higher the risk premium the risk averse individual is willing to pay.

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But risk can be minimized by diversification: allowing one's resource to a variety of risk projects/jobs instead of allowing his/her resource to a single project/job. Risk can also be minimized by diversification of time of working hours of a risk-averse individual to different types of works/jobs instead of single one. If an individual invests his/her resource (time) in one risky project/job, z, then equation (4) shows that the risk premium of the individual is approximately $\frac{1}{2}\sigma_z{}^2 b$, where $b(=\frac{-v''(y)}{v'(y)})$ is the coefficient of absolute risk aversion. Suppose the individual taking steps to reduces his exposure to risk invest his/her resources (time) in n different projects with a $\frac{1}{n}$ share in each, the risk premium R for each project is given by

$$v(y - R) \equiv E[v(y + \tfrac{1}{n} z)]$$

Taking a first order Taylor series approximation in the left and second order approximation on the right, we have

$$\frac{v(y)}{0!} - \frac{v'(y)}{1!}R \approx E\left[\frac{v(y)}{0!} + \frac{v'(y)}{1!}\left(\frac{z}{n}\right) + \frac{v''(y)}{2!}\left(\frac{z}{n}\right)^2\right]$$

$$v(y) - v'(y)R \approx v(y) + \frac{v''(y)}{2}\frac{\sigma_z{}^2}{n^2} \quad \text{[as mean is zero]}$$

and therefore $R \approx \frac{1}{2}\frac{\sigma_z{}^2}{n^2}b$ ……………………............………. (5)

where $b = -\frac{v''(y)}{v'(y)}$

If the returns to the n projects are independent, the total risk premium of the risk-averse individual is given by

$$nR = \frac{1}{2}\frac{\sigma_z{}^2}{n}b \quad \text{……………………............……… (6)}$$

which is only $\frac{1}{n}$ of the risk premium for the undiversified investment i.e., the risk premium of diversified independent project will be less than that of undiversified project. Thus, the risk can be minimized by diversification in both dependent and independent

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projects provided that the price or return of one type of project is negatively correlated with the other.

III. Basic Empirical Strategy

Forest fringe households are expected to face a variety of income risks as a result of climatic events (like draught, flood, storm, etc.), policy shocks (like changes in taxation, bans of migration, etc.), labour problems (such as low wage rate during peak crop season, not finding of work when needed, etc) and individual/idiosyncratic risks (like emergency consumption loan when income and consumption strategies fail, loss of assets, etc.). Such a variety of income risks along with a number of individual-specific shocks leave households vulnerable to severe hardship. Many studies have responded high income variability related to risks of various forms. In the light of local community's participatory forest management programme we attempt to measure some risk related hardships forest fringe households usually face in lives.

Measurement of risk: Four types of variables – climatic risk, policy shock, labour problem and idiosyncratic risk – are used to determine the risk faced by the households in surveyed area. Moreover, an index of risk[1] (RI) is calculated from the score of risk for each of the categories of households under both study group villages (female FPC-villages and joint FPC-villages) and control group villages (non-JFM villages) by standard UNDP methodology. As regard the value of weight related to each of the individual dimensional variables is concerned, factor loadings for the first principal component have been used as weights, which have been assigned to average value of each indicator.

Multivariate analysis of risk: In order to quantify the important factor(s)/ indicator(s) of the amount of risk faced by the households, the following regression model has been adopted:

$$R = \alpha + \beta_{11}CR_1 + \beta_{12}CR_2 + \gamma_{11}PS_1 + \gamma_{12}PS_2 + \delta_{11}LP_1 + \delta_{12}LP_2 + \lambda_{11}IR_1 + \lambda_{12}IR_2$$
$$\theta_1 SIF + \theta_2 SIA + \theta_3 LL + \theta_4 FS + \mu_{11}D_{11} + \mu_{12}D_{12} + \mu_2 D_2 + \mu_3 D_3 + \varepsilon$$

IV. Data Set

The data have been collected through an intensive field enquiry covering all members from FPCs (forest protection committees) under JFM villages (study group

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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. In addition to the comparison on current data of after situation of JFM programme, data during before situation of JFM are also collected from all the households through the *reflexive comparison method* where 'after' and 'before' scenarios are compared for the participating households (Ravallion, 2001; Reddy et al., 2004; Reddy, and Soussan, 2004). A single 'before situation' is selected by the simple arithmetic mean of FPCs under study[2].

V. Results

At the very outset, we examine some characteristics of villages under study. More than 80 percent members of almost all JFM (both female and joint FPC) and control group 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[3]; major part of income for all categories of households in all FPC/ JFM and control group 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.

As may be shown in Table 1, annual per capita net real income for all categories of households under our study has increased during after JFM situation compared with before JFM situation under both JFM and control group villages (non-JFM villages). But such an increase is more pronounced in the JFM villages in relation to control group villages. Within JFM villages, annual per capita net real income is higher for female FPC villages. Categorically, the rate of increase is higher for landless and marginal landholding households under JFM villages (ranging between 13.64 and 57.65 percentage points) as compared with same categories of households under control group villages (6.68 and 17.42 percentage points respectively) and small landholding households under both JFM and control group villages (ranging between 0.16 and 3.02 percentage points). 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.

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However the important results that appears from Table 1 is that after JFM situation the per capita net real income of forest related works increases with a decrease of per capita net real income of non-forest related works for all categories of households in the JFM villages – negative relationship between two sources of income. Within JFM villages, the increase in per capita net real income is much higher for female FPC villages in general and among households belonging to poorer economic status (landless and marginal categories of households). But for all categories of households in an average and for small and marginal categories of households in particular in the non-JFM villages, the per capita net real income of both forest and non-forest sources increases at a very low percentage point after JFM situation (positive relationship between two sources of income) in relation to before JFM situation. It seems to imply that the diversification of forest works is more prevalent in the JFM villages after JFM situation. Within JFM villages, the incidence of diversification of forest works is higher for female FPC villages in general and among very poor categories of households. On the other hand, with regard to the non-JFM households is concerned, the scope of diversification might be limited for non-JFM households after JFM situation because both of their forest and non-forest income increases at a very low percentage point after JFM situation compared with before JFM situation, and forest also retains the major source of per capita net real income for all categories of non-JFM households even after JFM situation. The similar results holds good in Table 2 when the comparison appears in respect of time.

We now examine household's dependence (sex-wise) on forest income from different sources during after and before situations of JFM programme (Table 3) in order to examine the scope of diversification (sex-wise) of income within forest sector for all categories of households in the JFM and non-JFM villages. As may be seen from Table 3, forest retains the major share of household's income (combining share of income for male and female together) during both the situations for all categories of households in the JFM and non-JFM villages; but after JFM situation the extent of forest income has increased for all categories of households in the JFM villages for their higher involvement in forest related activities (like NTFPs, forestry wage) in relation to non-forest related works (crop farming, non-forest wage and others). These findings also

support our theoretical model that appears in section II. Such a diversification of forest works for all categories of households in the JFM villages has increased their households' share of forest income after JFM situation compared with non-JFM villages, although within JFM-villages such a diversification of forest related income generating activities is more pronounced in female FPC-villages in general and landless and marginal categories of households in particular. It seems to be relevant here to mention that NTFPs are the main source of forest income for females, and TFPs are the main source of forest income for males in both JFM and non-JFM villages, despite the fact that the incidence of females' contribution of their family income, which they receive from forest source only, is markedly higher for JFM villages in general and among landless and marginal categories of households in female FPC-villages in particular. However, the study is in conformity with other research works (Kumar, 2005:100; Agarwal, 1995:105; Das, 1994:60; Vyasulu, 2001:300) who argue that as the major stakeholders, women's contribution with forest is based on their day-to-day dependence on forest and they are primarily responsible for collection and processing of NTFPs for both subsistence and income. Table 3 also shows that women's share of family income for other forest related works (forestry wage and TFPs) for JFM villages has significantly increased after JFM situation in female FPC-villages whereas it has either reduced (TFP) or the rate of increase is lower (forestry wage work) for male compared with female in the same type of villages during the same period. This result might suggest that if women are empowered by their own management system under JFM programme by appropriate policy formulation establishing their (women) own management unit, women's contribution of their family income in the female FPC-villages will be sufficiently higher than men's contribution to their family income in the same villages as well as women's contribution to their family income in the joint FPC-villages. However, women's contribution of their family income is more pronounced for households belonging to lower land-based economic status (landless and marginal categories of households) in the female FPC-villages for their poorer economic condition. So, JFM programme in the FPC-villages has increased wider scope of all forest related works for women compared with men for female FPC-villages in general and the incidence of this scope is more pronounced among lower asset group (landless and marginal categories of households) in

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the female FPC villages in particular. Thus, diversification of work other than forest source has been decreased for households in the JFM villages in general and landless and marginal categories of households in particular after JFM situation. It might lead to an indication that the JFM programme has reduced the risk related hardship for households in the JFM villages in general and poor asset group (landless and marginal categories of households) in particular in the JFM villages by diversifying more on forest related works against non-forest works to the execution of JFM programme. But such a diversification on forest related works seems to more prevalent among women in the female FPC-villages because women's share of household's income, which they receive only from forest sources, are dominating over men's share of households income the latter receive from all sources.

The extent of magnitude of risk faced by the households under our study during both after and before situations of JFM is shown in Table 4. As regards the distinguishing characteristics between various determinants-such as climatic, idiosyncratic- of risk are concerned, the absolute qualitative values of these indicators, which appear from qualitative scores of four-point scale , depends on the response of individual respondents under study. In the aggregate analysis (Table 4), the responses are observed to be more or less homogeneous or are treated differently to the households of the same regions and different regions. If the responses are a little different from one another, based on the measurement of four-point scale, the average values of rankings that appears from aggregate analysis should be more or less equal to one another. For example, for 'lower price receive from market/LAMPS', a policy shock variable, Table 4 shows that average score of risk is high for all categories of households during before JFM situation. But , more importantly, the score obtained by all individuals within the same type of villages (female FPC/joint FPC/control group) for the same or different regions during before JFM situation are not are not exactly equal for this policy shock variable. This is mainly because the individuals of all households do not have the opportunity to sell their collected forest products to the same type of agents. Even as the market structure of these primary products is unorganized, the households have also to sell those products in different prices to the type of marketing agents (LAMPS/agents of market).

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Village-wise, it is revealed from the Table 4 that JFM villages face lower risk-related hardship because of the lower value of risk index (0.23 for female FPC-villages and 0.33 for joint FPC-villages) compared with non-JFM villages (0.87) during after situation of JFM. During before JFM, however, no perceptible difference of risk index is found among JFM and non-JFM villages (0.82 for female FPC-villages and 0.79 for joint FPC-villages under JFM villages and 0.83 for non-JFM villages). The study of Tables 1 and 2 reveals that households under joint FPC villages are more risk averse because they invest their labour service more on forest related works and less on non-forest related works (Table 2) and thereby receiving higher return from the former (Tables 1 and 3) which is more certain. Table 4 indicates that women participating in the JFM programme (female FPCs) are expected to be more risk averse because the index of risk (or weighted aggregate score of the amount of risk) for such FPC-villages (female FPCs) registers lower risk related value compared with joint FPCs influencing higher scope of diversification on forest related works among women in the female FPC villages. This is also supported by the results that women's share of household's income which they from forest sources are dominating over men's share of household's income the latter receives from all sources (Table 3).

As regard the multivariate analysis is concerned, the regression analysis of four important factors of income risk – climatic risk, policy shocks, labour problems and idiosyncratic income risk, and some socio-economic factors (income, literacy, family size, type of village and land-based status), affecting the amount of risk-related hardship faced by the surveyed households of this study are portrayed in Table 5. It shows that forest related hardship is of expected sign and it turns out to be highly significant predictor of the amount of risk faced by the households during both after and before situations of JFM. Non-forest related factors affect the households but most of them are not significant during both the situations.

Interestingly, out of all determinants of risk, neither labour problems nor idiosyncratic problems have significant impact on risk faced by households during both before and after situations of JFM programme. But both the factors of policy shocks – the receiving of lower price from market/LAMPS and ban on the collection of NTFPs – are of expected sign and significant during both the situations. But, more importantly, out of two

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climatic problems on risk considered in the relevant analysis, harvest failure of agricultural crops/NTFPs due to draught/flood, which has a positive significant impact on risk during before JFM situation, has no significant impact on risk after JFM situation, although the relation is of expected (positive) sign. On the other hand, Damage of NTFPs/livestock due to draught/storm is of expected (positive) sign and has significant impact on risk during both before and after JFM situations. It seems to imply that it is not the climatic problems related to harvest failure of agricultural crops due to draught/flood but both climatic problems and policy shocks on forest products and forest dependent living animals have high significant direct impact on risk faced by different categories of households under study during after JFM situation in particular. Moreover, among other variables, landless and marginal categories of households face significant risk-related hardship during both the periods. But the type of FPC (dummy) is significant predictors of risk-related hardship faced by the surveyed households during after situation of JFM. However, the negative sign of the type of village (dummy) during after situation implies that the level of risk-related hardship decrease for the higher value of type of village (JFM village). Thus the regression result suggests that although risk-related hardship is lower for JFM villages as well as for higher landholding households (small landholding households), the poor households (landless and marginal landholding categories), which almost live below poverty line and that mainly depend on forest for their subsistence and income during whole year, are significantly affected by the forest related shocks under this study.

VI. Conclusion

This study, however, lends credence to the fact that forest is the major source of income for all categories of households in all types of villages during both before JFM and after JFM situations and an individual/household is engaged in two types of activities-forest activities (NTFPs, forestry wage and TFPs) and non-forest activities (crop farming, non-forest wage income and others). But after JFM situation, the per capita net real income, average day's employment per household per year and average person employed per year for forest related works increase with a decrease of the same on non-forest related works for all categories of households in the JFM villages – negative relationship between two sources of income/time. Households under JFM

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villages are more risk averse after JFM situation because by investing labour service more on forest related works and less on non-forest related works they get higher return from the former which was more certain. It implies higher scope of diversification of forest related works for households of JFM villages after JFM situation. But this is not supported for households in the non-JFM villages after JFM situation. Positive (increase) relationship between two sources of income/time is observed to exist for all categories of households in an average and for small and marginal categories of households in particular in the non-JFM villages after JFM situation, although forest remains the major source for all categories of non-JFM households during the same period. So, the scope of diversification remains very limited for non-JFM households. Higher value of risk related hardship for non-JFM households after JFM situation also supports these findings.

However, within JFM villages, the increase in per capita net real income, average days employment per household per year and average person employed per year for forest related works is much higher for female FPC villages in general and among households belonging to poorer economic status(landless and marginal categories of households).It seems to imply that within JFM villages the incidence of diversification of forest works is higher for female FPC villages in general and among very poor categories of households. The lowest value of risk related hardship for women FPC villages after JFM situation seems to suggest that the incidence of diversification of forest works is more prevalent in the female FPC villages. This study, thus, supports the hypothesis that JFM programme could reduce more risk related hardship for households under JFM villages in general and female FPC villages in particular by increasing higher net return by devoting more time and thereby increasing more income on forest related works with a decrease of time and income on non-forest related works which households under non-JFM villages fails to receive.

Notably, the study also reveals that if women are empowered for management of forest resource by their own management system under JFM programme establishing their own management unit (female FPC), women's contribution of their family income which they receive only from different forest sources (NTFPs, forestry wage and TFPs) will be substantially higher than not only female's share of family income in the joint FPC-villages but also male's share of family income in the same type of villages (female

FPC-villages). Categorically, women's contribution of their family income is more dominating for households belonging to lower land-based economic status (landless and marginal categories of households) in the female FPC-villages for their stake on forest resource owing to their poorer asset status.

The regression results suggest that out of all determinants of risk, neither labour problems nor idiosyncratic problems have significant impact on risk faced by households during both before and after situations of JFM programme. More importantly, out of two climatic problems on risk considered in the relevant analysis, harvest failure of agricultural crops/ NTFPs due to draught/ flood, which has a positive significant impact on risk during before JFM situation, has no significant impact on risk after JFM situation, although the relation is of expected (positive) sign. On the other hand, Damage of NTFPs/livestock due to draught/storm is of expected (positive) sign and has significant impact on risk during both before and after JFM situations. It seems to imply that it is not the climatic problems related to harvest failure of agricultural crops due to draught/flood but both climatic problems and policy shocks on forest products and forest dependent living animals have high significant direct impact on risk faced by different categories of households under study during after JFM situation in particular.

The regression results also suggest that households belonging to poor economic status (landless and marginal categories of households) are significantly affected by the forest-related shocks during both the situations in all types of villages, whereas most of the non-forest related shocks are insignificant; but after JFM situation risk-related hardship decreases in the JFM villages.   .

The results of the study, however, might lend credence to the fact that the JFM programme has reduced the risk-related hardship for households in the JFM villages in general and households belonging to lower land-based economic status in the JFM villages in particular influencing thereby to contribute to eliminate then higher risks by higher diversification of forest works owing to the execution of JFM programme. Households under JFM villages are more risk averse after JFM situation because by investing labour service more on forest related works and less on non-forest related works they get higher return from the former which was more certain.

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More importantly, within JFM villages it is only women's own forest management unit (female FPC) under JFM programme which help them contributing higher share of their family income, they only receive from forest resource, than men's share of the family income in the same type of villages (female FPC-villages) after JFM situation; women's FPC-villages also score lower value of risk indices than joint FPCs. It seems to suggest that female FPC-villages within JFM villages could reduce higher risk-related hardship by higher diversification of forest work after JFM situation.

Notes:

1. Among others, Singh and Kaur (2004) uses qualitative score of four-point scale which provides a measure of the aggregate say of the i-th women across various decisions: $Y_i = \sum_{i=1}^{n} \sum_{k=0}^{3} R_{ijk}$ where R_{ijk} is the decision of the decision of the i-th women regarding the j-th action. Next, Y_i are also used as dependent variable to examine as to what characteristics of households are associated with greater say with the help of simple regression model. Y is used here for two types of analysis as the purpose of the same is different.

2. 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 FPCs/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. Now a *common before situation* (single period) is measured by the Consumer Price Index for Agricultural Labourer [General]. Computation of common before situation (average of one previous year of respective FPCs formation) is made in the following line:

Type of FPC	Administrative division	Name of FPC	Before situation of JFM	CPIAL of before situation	Average CPIAL
Female FPC	Bankura (N)	Agua	1992-93	169	$\frac{169+230+143}{3}$
	Bankura (S)	Malibona	1995-96	230	
	Panchayat (SC)	Brindabanpur	1990-91	143	$=180.67 \approx 181^{*}$
Joint FPC	Bankura (N)	Belboni	1992-93	169	$\frac{169+230+143}{3}$
	Bankura (S)	Baragari	1995-96	230	
	Panchayat (SC)	Katul-2	1990-91	143	$=180.67 \approx 181^{*}$

* The average CPIAL of common before situation of JFM is closely nearest to CPIAL of the year 1993-94 (188)

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3. Poverty line income in rural West Bengal on the basis of PCME (per capita monthly expenditure) by NSS of 56th 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.

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

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