Welfare Effects of Community Forest Management: Evidence from the Rural Hills of Nepal

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ABSTRACT

In response to devastating loss of forest cover and to persistently high rates of deforestation, the Nepalese government in 1993 implemented a large-scale institutional change in its forest management, devolving responsibility to the community level. Case study literature suggests that community forestry in the middle hills region has halted degradation and improved the resource, but that the expected benefits from community level resource management and exploitation have been unevenly shared within the communities, with the relatively more poor most negatively-impacted.

Employing the Nepal Living Standards Surveys administered in 1995 and in 2003, I examine the impact of this institutional shock on household welfare and on distributional equity. After correcting for self-selection bias, I find that growth of per capita expenditure falls by 35 percent for households in those communities that are new to community forestry, but that there is a catch-up effect as user group management persists. Additionally, there is evidence to support the hypothesis that inequality is worsening in these communities in the short term.

Given that authority for forest management is increasingly being devolved to the local level, these results suggest that welfare and equity considerations should take a more prominent role, particularly in developing countries where those populations dependent on natural resources for their livelihoods have little welfare to cede, even in the short term.

Keywords: Natural resource management, forestry, inequality, Nepal

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I. INTRODUCTION

Since 1978, forest cover in Nepal has declined at an annual rate of 1.7%. During the 1990s alone, the annual rate was 1.8%, amounting to a loss of 78,000 hectares per year (FAO, 2003). Forest policy in Nepal since early democratization in the 1950s has been a step-wise shift away from what turned out to be failed centralized control towards local-level management. Community forestry was mandated in the Master Forest Plan of 1988, which transformed the priority of the Department of Forests from actual forest management to the identification and organization of community groups to which responsibility for forest management could be rendered. The actual transfer of forests formally began after rules were written and codified in 1993, and by the end of 2006, over 14,300 forest user groups (FUGs) were formed and given operational control over 1.2 million hectares, or almost 25% of the total forest land of Nepal.

The middle hills of Nepal, which lie in the east-west belt of the country between the lower fertile agricultural belt of the Terai and the high Himalayan region, are especially suited to the introduction of community forestry. Forests here are not of commercial value, due to their degree of degradation and lack of easy accessibility. For this reason, the government of Nepal does not view its transfer of authority as a loss of potential revenue and is willing to enlist the sizeable rural labor pool for protection, monitoring and enforcement of use restrictions (which it itself had been unable to do over the course of the twentieth century). At the same time, the significant dependence of local communities on forest resources for subsistence agricultural inputs and fuelwood (among other uses) provides substantial incentive for households and communities to take appropriate collective action.

The formation of FUGs is initiated by local forestry staff of the Department of Forests (DoF), which first identifies a forest for transfer and enumerates all users. An operational plan is formulated consistent with an outline provided by the DoF which defines the area to be managed and describes the practices for management and harvesting, including protection methods, penalties, etc.

Localized empirical work suggests that ecological sustainability is occurring, but often at the expense of the poorest members of the communities whose livelihoods are most affected by resource availability. Use restrictions and mandatory participatory labor requirements disproportionately disfavor the landless and those with limited opportunity for livelihood diversification or alternatives. Additionally, the putative equitable distribution of benefits yielded from community forests tend to be weighted more towards those least likely to need them. While the initial focus of success measures were on forest protection and regeneration, researchers noted that welfare considerations were being ignored and that equity concerns were becoming critical as the poor were becoming even more marginalized having been left out of community forestry operation and benefits.

While case studies may reveal incipient welfare and equity considerations, these remain in large part anecdotal and may fail to record positive effects evident in a larger sample. This paper attempts to fill this gap.

The paper is organized as follows: Section II discusses literature related to the connection between welfare, equity and community forestry, specifically targeting the experience of Nepal. Section III discusses the analytical model on which the empirical analysis is based and its general equilibrium outcomes. Data is discussed in Section IV, followed by estimation in Section V, and Section VI concludes.

II. LITERATURE

Although households in the middle hills in Nepal are among the poorest, with over 40% of the population living below the poverty line [HMGN (2005)], Springate-Baginski, *et al.* (2003) describe the differential dependencies on community forests of community segments. All households are highly dependent on forest resources for cooking fuel. Agriculture is the primary livelihood activity, which is carried out on small terraces of irrigated or unirrigated land. The richest in the community have extensive landholdings with their own tree resources, thus their dependence on community or government forest

resources may be relatively low. They may own grazing land and private forests and own a substantial number of livestock. They often have land outside the village and will usually have one or more members who earn an income from service employment. Middle-class households are often the most dependent on community forests because they have landholdings and cattle but few private tree resources and less grazing land to supply leaf fodder, grass and leaf litter for compost-making. The poorest households commonly have little or no land and depend on tenuous livelihood strategies such as providing agricultural labor, portering, collection and sale of firewood and other non-timber forest products (NTFP), blacksmithing and artisanal production.

Community forest management begins with the preparation of an operation plan, which specifies the objectives of forest management, which products are to be produced and which may be harvested or collected. Although the outline of the plan is provided by DoF forestry staff, the community itself determines the specifics, with collective decision-making negotiated among local parties. Maskey, Gebremedhin and Dalton (2003) find that wealthier households are more likely to participate in the decision-making and in the management activities themselves, given the higher relative opportunity costs of labor of poorer households, and that the distribution of benefits from forests is determined by the level of participation in management; therefore not only are the imperatives of the poorest ignored because their voices are not heard during the decision-making and negotiation, distribution is also not made in accordance with need.

Bhattarai and Ojha (2000) estimate the costs and benefits received from the forests of two FUGs and find that net benefits accruing to the poor are actually negative for these same reasons, a finding concurred by Neupane (2003). Malla (2000) describes carefully how general equilibrium effects of the implementation of community forestry negatively impacts the poorest through use restriction, unequal distribution of benefits, differential opportunity costs and general community price effects.

In spite of equity problems, there are many studies confirming the success of community forestry in regenerating the forest resource [Edmonds (2002), Pokharel (2002), Yadav*, et*

al. (2003) Dev, *et al.* (2003)]. Baland, *et al.* (2002) examine the effects of inequality on deforestation by examining its effect on firewood collection. They find evidence that collective action reduces firewood collection and that inequality leads to lower collection but fail to find support for the hypothesis that inequality itself impedes collective action. Varghese and Ostrom (2001) find that despite heterogeneity in a community being a potential hurdle to collective activity, groups can develop institutional corrections to overcome these hurdles provided that the benefits from coping with heterogeneities outweigh the costs.

Simulation exercises on a general equilibrium model of a forest-based community with two wealth classes show that under reasonable assumptions, welfare worsens for all members of the community but more so for the relatively more poor, worsening inequality within the community [Cooper (2007a)]. As substantiated by case study literature, this is caused by three effects: (1) exclusion for a necessary resource in the absence of available alternatives; (2) increase in the price of resource products due to supply pressures in the face of increased market demand; and (3) general inflation due to substitution away from the restricted (unpriced) good.

Finally, analysis of behavioral responses to FUG implementation in Nepal shows that despite the apparent effectiveness of FUGs at reducing labor allocated to firewood collection from community forests, it is only households in communities without FUGs that substitute private resources for community resources, that households in communities with FUGs allocate equal time to resource collection in spite of available alternatives [Cooper (2007b)]. This study highlights increases in inequality once FUG management is implemented but finds evidence that welfare is improved under community forestry.

Thus localized case studies show that FUG management is effective at reducing firewood collection and therefore halting resource degradation, and provide anecdotal evidence that management rules and use restrictions are negatively impacting the poorest segments of the forest communities, exacerbating inequality within forest communities and perhaps negatively impacting welfare in general. The next section outlines the general equilibrium

model which simulates these findings model and provides some insight on the channel through which welfare and equity may be impacted.

III. ANALYTICAL FRAMEWORK

The general equilibrium framework outlined in this section is presented in detail in Cooper (2007a), and is based upon a model presented in Charkravarti, *et al.* (2005). It is a framework intended to uncover the underlying relationships between community characteristics (such as preferences, group heterogeneity and alternative income opportunities) and the incentive regime.

It is a static general equilibrium model of a forestry-based economy in which community forestry is to be implemented. The forest resource is owned by the central government; the community that lives within the forest depends upon it as a resource for livelihood. The forest community is segmented into the elite and the non-elite, differentiated by preference structure and relative size.

The forest department of the government harvests the forest asset using local labor; its main goal is profit maximization. The harvested timber is sold both domestically and to an export market.

The forest department also hires protection or forest management labor. This serves to improve the condition of the forest resource. Labor is supplied by the forest community. The wage paid for this service is fixed by the forest department. If the forest department is not interested in promoting reforestation using community labor, it may choose to set the wage to zero.

In addition to legally harvested timber, some forest products are collected informally by the forest community, using its own labor.

As an alternative to forest products, the model provides a market good which is manufactured by the market sector using labor hired from the forest community. The market good is consumed by both the forest community and the market sector itself and its price is endogenously determined. Income taxes are levied on the gross profits of the market sector.

Thus there are three paid labor opportunities for forest community households: harvesting labor, protection labor and market labor. Harvesting labor is demand-determined. The forest community can choose to spend unpaid time on collection activities or at leisure. If forest protective services are unpaid, the forest community may still choose to supply labor to this activity if it values the forest resource.

Utility for the forest community is a function of its consumption of forest products (either harvested timber or collected forest products), of the market good, of whatever government transfers it receives, and of leisure. Additionally, the value that forest community places on the forest asset is represented by an externality function that is itself a function of the state of the forest. Utility of the market sector is a function of its consumption of harvested timber, of the market good, of the government transfer it receives, and of the externality value of the forest.

The externality function is based on the state of the forest, which is diminished by harvesting and by collection and is enhanced by protective and management services. The forest asset regenerates according to a logistic biometric function.

The model is calibrated to yield outcomes that are broadly consistent with case study literature. A depiction of the model is shown in Figure 1.

The introduction of a management regime gives the forest communities a level of responsibility for the protection of the forest asset, in return for a share of the timber revenues and perhaps wage payments for management labor. Once co-management is introduced, several resource use rules are implemented; for example, informal collection of

forest products is restricted, and violation of use rules is enforced with penalties. In addition to exclusion and rules enforcement, the forest department may undertake a training program to educate the local community on the value of its resource (*environmental training*) or on productive protection and management methods (*silvicultural training*).

From the first order conditions of the optimization problem, one would expect that revenue sharing will impact the forest community's budget constraint; as the forest community receives an increasing share of the timber revenues, it is more likely to increase its purchases of both harvested timber and of the market good. For the forest department, however, sharing more of its revenue with the forest community reduces its budget and it will be more likely to hire less harvesting labor.

Simulation results of community forestry are described as follows:

With the additional income from the share of the timber revenues, incomes of the forest communities increase. This additional infusion generates increased demand for both timber and the market good, leading to price increases. Increased production of the market good in response to higher demand fuels the market sector, and which also sees increasing incomes. The competition for labor bids up the market wage, however, and the price of the market good rises. (Imports of the market good are triggered when the domestic price rises above a given level, moderating the demand for local production.)

The forest department meets increased demand for timber by raising its price. The increase in the price of timber induces a substitution towards the market good. The imposition of hefty fines discourages informal collection of forest products. The combination of decreased consumption of forest products (harvested and informal) is not offset by the increased consumption of the market good and thus welfare falls for both forest communities, more so for the non-elite than for the elite.

At the same time, there is a decline in deforestation to such an extent that reforestation occurs.

Thus, consistent with case study literature, the improvement in forest cover and increased incomes are not accompanied by welfare improvement in the forest community, and the non-elite or poor suffer more than the elite or non-poor. This is a case of "saving the forest at the expense of the poorest."

Such localized studies, however, are still anecdotal. To examine if there is evidence for a broad impact of forest user group implementation, the next section discusses the data to be used in estimation.

IV. EMPIRICAL SPECIFICATION AND DATA

Given the model as presented, the following two reduced form empirical specifications are estimated:

$$ln(welfare_{ijt}) = \alpha + X'_{it}\beta + Y'_{jt}\gamma + \eta(FUG_{jt}) + \varepsilon_{it}$$

$$ln(welfare_{ijt}) - ln(welfare_{ijt\text{-}1}) = \alpha + (X_{it} - X_{it\text{-}1})'\beta + (Y_{jt} - Y_{jt\text{-}1})'\gamma + \eta(FUG_{jt}) + \varepsilon_{i}$$

The first specification will be used to compare results for the two separate surveys to determine whether outcomes are different before the institutional shock and after. The second specification will be used on the smaller panel data to estimate improvement in welfare (or lack thereof) due to the institutional shock.

The Nepal Living Standards Survey is a multi-topic survey following the Living Standards Measurement Survey (LSMS) methodology developed by the World Bank, collecting data on various aspects of household welfare, including consumption, income, housing, labor markets, education and health, accompanied by a community-level survey on facilities, prices, demographics, etc.

The first round of the NLSS (NLSS I) was administered from June 1995 to May 1996, interviewing 3,388 households across Nepal. Our interest is in the rural hills region of Nepal, which comprises approximately 40% of Nepal. Of the households surveyed in the NLSS I, 1,136 were in the rural hills region in 92 communities. The second round (NLSS II) was administered from April 2003 to April 2004, interviewing 4,008 households of which 1,244 were in the rural hills in 96 communities. The panel sample is drawn from 1,232 households from the NLSS I that were re-interviewed in 2003, of which 326 were in the rural hills in 31 communities.

The data is examined for relevant features relating to the hypotheses that both household welfare and distributional equity within communities were negatively impacted as a result of the institutional shift towards community forestry. The dependence of communities on forest resources is shown in Table 1. The percentage of communities reporting wood as the primary source of cooking fuel in 1995 was 97.59%; this number fell slightly by 2003 but clearly the dependence on forest resources is demonstrated in both periods.

The handover of national forests to communities can be detected in the data shown. In the 1995, 51.76% of the communities surveyed had a community forest; by 2003, this grew to 72.92%. There is a corresponding increase in the percentage of communities reporting the community forest as their primary source of firewood, from 30.12% to 49.47%. Similarly, there is a large increase in the number of communities with FUGs, from 29.35% to 57.29% in 2003.

It appears that the effect of community forestry and forest user group implementation has indeed been to improve the forest. In 1995, 36.14% of the communities reported the forested are improving; by 2003 that number was increased to 53.68%. More significantly, by 2003, 68.52% of the communities with FUGs reported an increase in forested areas, compared to 34.15% of the communities without FUGs.

Housing characteristics are shown in Table 2. During the two surveys, there was a shift in wall construction towards cement-bonded bricks, and in roof construction from straw to

galvanized iron or cement, reflecting both an upgrade in the durability of houses and the lower reliance on forest products for their construction.

Welfare Indications:

The income and asset holdings of households in the data are shown in Table 3. Because the 1995 and 2003 are cross sections, the third column reports the percentage change in the averages of these variables.

Average land ownership in 1995 was 0.54 hectares per household, increasing to 0.63 hectares by 2003. Livestock ownership increased from 6.09 head in 1995 to 6.80 head in 2003. Average incomes as measured by per capita expenditures increased substantially over the period. While house values and households assets showed only small increases, farm assets (which include such items as tractors, ploughs, carts, generators, threshers, etc.) increased more than two-fold, while the value of businesses owned declined.[2]

To directly compare how *individual* households' incomes and asset holdings increased over this time (as opposed to sample averages) the changes in income and asset holdings of the panel data are shown in the fourth column of Table 3. Incomes increased by an average of 40.64%, consistent with the report of poverty trends prepared by the Central Bureau of Statistics [HMGN (2005)]. Furthermore, with the exception of business value, all categories of asset ownership also increased over the period. Again, there was an especially large growth in farm assets as households intensified agricultural work.

To be convinced that communities with or without FUGs are different, we must examine income and asset holdings under the different management regimes. The first two columns of Table 4 show the average income and asset holdings of households in communities without FUGs in 1995 and 2003, while the fourth and fifth columns show these variables for households in communities with FUGs in both periods. As above, the percentage

[2] The category called "all assets" includes the prior four items, while "non-house assets" includes "all assets" less the value of the household's owned house.

change in the averages over time are also shown. For example, average land holdings increased 12.73% for households in communities without FUGS compared to increase of 25.49% for households in communities with FUGs. The average increase in income is larger for households in communities with FUGs than without, increasing by 23.82% versus 10.71%. Average household assets fell dramatically in communities with FUGs, while average total assets increased by 52%, versus a decline of 3.73% in communities without FUGs.

Again, sample composition has changed over time in these tables because these are cross sectional data. To examine the changes in these variables in the panel set, a different exposition is employed. Figures 2 through 6 show the change in variables for the three types of user group regimes in the panel data set: (i) "No FUG" are those communities that did not have an FUG in 1995 nor in 2003 (represented in blue, with diamond termination points); (ii) "Old FUG" are those communities which had an FUG in 1995 and in 2003 (represented in green, with square termination points); and (iii) "New FUG" are those communities that did not have an FUG in 1995 but did 2003, indicating a relatively new implementation of community forestry (represented in red, with triangular termination points).

These figures show that the improvement in non-house asset ownership between the two periods was more significant for the households in communities with newly-formed forest user groups than for other communities. On the other hand, income improvements and total asset ownership occur at a slower rate for these households. The difference in asset ownership can be explained by the change in house values, which grew much more slowly for households in communities with FUGs as restrictions on timber removal were implemented.

These data suggest that the benefits of FUG management are felt in asset accumulation and income improvement over the long run but that incomes may be negatively affected in the short run as forest user groups are first implemented.

Inequality Indications:

Turning to indications of inequality within communities, the literature indicates that results vary according to wealth status and that the poor are negatively affected. If so, the impact of community forestry should be evident in the distributional changes over time and management regime. To look for this evidence, Gini indices are constructed for each income and asset category in each community. To simplify the exposition, I reduce the discussion of asset categories by dropping the individual house, farm and business assets.

Table 5 displays the average values of the Ginis in the cross-sectional data. The third column shows the percent change in the average Gini over the time period. From this table, it would appear that with the exception of inequality of per capita real expenditures (which remains virtually unchanged) inequality in the rural hills communities has fallen between 1995 and 2003. In particular, significant declines in inequality are shown in land ownership, total asset ownership and non-house asset ownership.

Examining the Ginis by management regime, shown in Table 6, it is clear that inequality in the communities without FUGs has fallen during the time period in all asset and income categories. The results are more mixed in communities with FUGs, with inequality in asset ownership improving while inequality in incomes widening.

The changes in the average Ginis over time do not wholly support the supposition expressed in case studies that inequality is worsening in these communities. However, the panel sample suggests a different result. Table 7 shows the Ginis for those communities that have recently implemented community forestry, compared to those without forest user groups. Although the sample size is small, for all asset and income categories except land ownership, inequality increases in the former sample, while for the latter again we see inequality has declined over the period.

From the descriptive statistics, therefore, it seems plausible that there is a negative (short term) impact of user group management on income and that equity worsens in those communities that are new at organizing forest user groups.

V. ESTIMATION

A. Welfare Effects

(i) Cross section data

The estimation strategy employed is straightforward. To determine if there is support in the data for a negative effect of forest user group management on welfare, the following welfare function is estimated individually on data from both periods (t = 1995, 2003):

$$ln(welfare_{ijt}) = \alpha + X'_{it}\beta + Y'_{jt}\gamma + \eta(FUG_{jt}) + \varepsilon_{it}$$

where welfare is measured by per capita real expenditure and by asset ownership of household i in community j, X is a vector of household characteristics, and Y is a vector of community characteristics.

The dependent variables in the estimation are per capita real expenditures, value of housing, reported value of business, and total asset holdings. Explanatory household variables include the following:

(i) The percent of the household that is active is taken to represent the household's supply of labor. It includes any household member between the age of 15 and 59, and is expected to have a positive effect on welfare;

(ii) The percent of the household that is literate represents an income advantage and is expected to have a positive effect on welfare;

(iii) High ethnicity, a dummy variable taking the value of one if the household is Brahmin or Chhetri, also representing an income advantage and expected to have a positive effect on welfare;

(iv) The amount of land owned by the household, representing the wealth of household;

(v) Net remittances received by the household, representing income received from outside the household and expecting to have a positive effect on welfare. Remittances from abroad are an important component of income for households in the rural hills, comprising between 16.0% and 25.9% of total household income in a sample of seven hill districts [LFP (2003)].

Community variables include:

(i) The distance to the nearest market center, which is indicative of how remote the community is and is expected to have negative effect on welfare;

(ii) An irrigation dummy which takes the value of one if there are irrigation facilities in the community such as canals or borings, to capture the general wealth of the community;

(iii) The percent of households in the community with electricity, also to capture the general wealth of the community and expected to have a positive effect on household welfare.

The variable of interest is forest user group management. For each period, a dummy variable representing the existence of a community forest user group is included. Recall that in 1995, less than a third of communities have forest user groups, this number almost doubling by 2003. An additional specification includes the age (in months) of the user group, under the expectation that user groups that have been in existence for longer periods of time have been able to overcome transitional shocks and ameliorate welfare declines.

Table 8 displays the cross section OLS estimation results for per capita expenditures. In both survey periods, model I includes the forest user group dummy, while model II includes the forest user group dummy and the user group age. In the 1995 survey, all the household variables have coefficients of the expected signs and are very significant; similarly, in 2003 all household variables with the exception of the high ethnicity dummy are positive and significant. Looking at the community variables, the distance to market is negative as expected but only marginally significant in 2003 and not significant at all in

1995. The community irrigation dummy and percent of households with electricity are also significant and positive in 1995 as expected, but the irrigation dummy is negative in 2003.

Our variables of interest show that in 1995, there is no evidence of any effect of forest user group management on household welfare. By 2003, however, there is a positive effect, although once the age of the user group is introduced, the effect is positive for older user groups only. This validates our concern that a newly formed user group has an immediate negative impact on welfare.

We might be concerned, however, that there is endogeneity among the regressors. In the earlier period, forest user group formation occurred as a result of internal processes and therefore community characteristics that affect per capita expenditure may also have been those that encouraged collective action to protect the forest. For example, communities in forests that were very degraded and had no outside livelihood option may have been motivated to form protective user groups but would then also have been those that experienced lower incomes (and hence lower per capita expenditures). Our estimated coefficient for the FUG dummy variable would in this case be biased downwards.

To accommodate such endogeneity, a two-stage model is employed where the existence of a FUG is estimated using several community variables; its predicted value is then used in the second-stage estimation for per capita expenditure. The choice of instruments is based on hypotheses of collective action. First of all, user groups are assumed to be dependent on the availability of a community forest, therefore one of the instruments is the community forest dummy variable. Second, a more degraded forest has a higher marginal benefit of protection and is expected to be more likely to encourage user group formation; hence a second variable is a "forest decreased" dummy. This variable takes the value of 1 if the respondent household feels that the forest area has decreased over the past five years. Other community variables used as instruments include: the number of households in the community to represent the transaction cost of collective action, and the distance to market

representing remoteness and unavailability of alternatives[3]. The results are shown in Table 9. [4]

Once we correct for the endogeneity of user group formation, the forest user group dummy in 1995 has a positive and significant coefficient, indicating that forest user group management has a positive impact on household welfare. This is true whether we account for the age of the user group or not. By 2003, however, the positive coefficient on the forest user group is made insignificant once the age of the user group is accounted for. This would suggest that only user groups of longer duration have a positive effect on welfare, although neither of the coefficients are significant.

Table 10 shows the estimation results using OLS when the dependent variable is the household's housing value. Since houses are manufactured from timber or other forest products, the restrictions from extraction will affect the household's ability to construct its house. Here we see that even in the earlier survey period, the management of a forest user group had a significantly negative impact on the reported value of the household's house. While this appears straightforward, there may be causation in the opposite direction – communities with such degraded forests that user groups formed organically in the earlier years are also those without the timber resources with which to build substantial homes. Given a lack of suitable instruments, to sort out the causation we will examine the panel data, which is done below. In any case, by 2003 households in communities with forest user groups have significantly higher housing values, and again this effect is stronger for those with older user groups, although the coefficients lose their significance.

One of the substitution effects predicted by the simulations was a shift towards non-forest livelihoods. To see if this effect occurs in the field, Table 11 shows the estimation results when the dependent variable is the net earnings from other activities. These activities are labeled and described as follows:

[3] From the OLS estimation, we know that the distance to the nearest market is not significant in 1995 but it is in 2003. Therefore, the instrument chosen to represent remoteness in 2003 is the distance to the nearest paved road.
[4] All first-stage results are shown in Table 21.

(i) Agricultural: Crop sales; income from renting farm machinery, net of expenditures

(ii) Livestock: Sale of livestock products, such as milk, eggs, meat, etc., net of expenditures

(iii) Business: Revenues from enterprises owned, net of expenditures

Because the value of net earnings can be negative, the dependent variables in these estimations are real 1995 Rupees rather than logarithmed values. A two-stage estimation method is employed, using the same instruments employed for per capita expenditures above. The results are shown in Table 11. In the earlier survey period, after accommodating the possible endogeneity user group formation, all the coefficients on the forest user group dummy in all three types of earnings are positive, although not significant. This is suggestive of the positive impact of forest user group management on a shift towards non-forest products livelihoods. By the 2003 survey period, the impact of forest user group management on outside earnings is negative for agricultural activities (but not quite significant) and significantly negative for business activities. This is not supportive of our hypothesis, and we will revisit this in when looking at the panel data.

Finally, the estimation results when the dependent variable is total asset ownership are shown in Table 12. Total assets include household assets, farm assets, value of all businesses owned and housing value. Again a two-stage estimation method is employed. These results show that forest user group formation had a negative but not significant impact on welfare in the earlier survey period, and user groups of longer duration have a more favorable effect on total asset holdings. By 2003, user groups have a positive effect on asset holdings, although this effect is muted by duration.

Taken together, for the two survey periods, forest user group management has a positive effect on per capita expenditure, housing values and total asset holdings in the second survey period. Earlier results are ambiguous but once endogenous user group formation is accounted for, forest user groups have a positive effect in per capita expenditure but negative on asset holdings and housing values.

Cross section data is problematic because the sample compositions have changed over time. We turn, therefore, to an examination of the panel data.

(ii) Panel data

The estimation of the panel data uses the second empirical specification, in the following three variations:

$$ln(welfare_{ijt}) - ln(welfare_{ijt\text{-}1}) = \alpha + (X_{it} - X_{it\text{-}1})'\beta + (Y_{jt} - Y_{jt\text{-}1})'\gamma + \rho \ln(welfare_{ijt}) + \eta(FUG_{jt}) + \varepsilon_i$$

$$ln(welfare_{ijt}) - ln(welfare_{ijt\text{-}1}) = \alpha + (X_{it} - X_{it\text{-}1})'\beta + (Y_{jt} - Y_{jt\text{-}1})'\gamma + \rho \ln(welfare_{ijt}) + \eta(FUG_{jt}) + \varphi(FUG\ age_{jt}) + \varepsilon_i$$

where the same welfare measures and household and community characteristics are used as above. The first variation introduces the type of management regime (whether it is an "old" user group of a newly-formed one), while the second variation introduces the age of the user group to capture duration effects. Because the dependent variable is the difference in logs, the coefficients on the independent variables will represent the effect on the growth of welfare. Recall that on average there has been an improvement of approximately 43% in per capita expenditure over this period in Nepal.

Table 13 shows the results when the dependent variable is the change in per capita real expenditure, conditioned on its beginning value. The coefficient on the "older" user group is positive and significant, indicating a positive effect on per capita real expenditure as a result of being in a community with a forest user group management regime. The coefficient on the "newly-formed" user group shown in the third column, however, is negative and significant, showing the negative effect of the institutional shock of user group management. This result implies a fall in income growth of 29.95%. The fourth column in the table shows the positive effect of the duration of the user group, equaling a catch-up of approximately 0.1% per month of user group age but a fall in income growth of 34.58%.

Table 14 shows the estimation results for the change in housing values. Recall that the cross section estimation was unsatisfactory in supporting our hypotheses. Using the panel data, however, it is clear that again, households in communities with older user groups experience a positive effect on the growth of their housing value as a result of forest user group management, while newly-formed user groups again have a negative impact on the growth of housing values, although the coefficients are not significant.

Is there a shift towards non-forest livelihoods? The estimation results for the change in business values are shown in Table 15. Although the coefficients are not quite significant, there is some evidence to support the hypothesis that there is a substantial shift as the growth of business values increases by 269.14% for households in communities with newly-formed forest user groups. To corroborate this finding, Table 16 shows the estimation results when the dependent variable is the net earnings received (revenues less expenditures) for the household from three different activities: agricultural activity, livestock-related activity and business activity. Because net earnings can be less than zero, as above these variables are not logged. The coefficients on the newly-formed user groups show that there is an increase in growth of earnings from livestock and agricultural activities and from business activities. This is entirely consistent with the simulation results as households find alternative livelihood strategies once restrictions to the forest resource are implemented and enforced.

Finally, the results for the change in total assets are shown in Table 17. The coefficients on the variables of interest are not significant, and their magnitudes are also small, implying that overall, the growth of asset holdings of households are not impacted by the management of forest user groups, suggesting instead a shift between asset categories.

B. Inequality

(i) Cross section data

A similar estimation strategy is employed as above to examine the impact of community forestry on distributional equity. The following function is estimated individually on data from both periods (t = 1995, 2003):

$$ln(gini_{ijt}) = \alpha + X'_{jt}\beta + \eta(FUG_{jt}) + \varepsilon_{ijt}$$

where the Ginis are those calculated and discussed above, estimated conditional on *X,* a vector of community characteristics, and the management regime.

Explanatory community variables include:

(i) The population of the community, in the expectation that a large community would be more urban and therefore somewhat more unequal;

(ii) The distance to the nearest paved road, to capture the remoteness of the community, in the expectation that more remote communities would be less unequal;

(iii) The inequality in land distribution, measured by the Gini index for land, which is expected to have a positive impact on inequality;

(iv) The average household income in the community, in the expectation of a positive relationship between average income and inequality; and

(v) The number of local schools per household to capture the ability of the community to find alternate livelihoods, in the expectation that more schools will reduce inequality.

The variable of interest is forest user group management. The models include a dummy variable that takes the value of one if there is a forest user group in the community. Also included is the age of the forest user group, if any.

Table 18 displays the OLS estimation results for 1995. Each column pair represents the estimation results for a different Gini as dependent variable. Within each pair, one model includes a dummy variable for the presence of a forest user group; the second includes a variable indicating the duration of the forest user group. The explanatory power of these models to account for inequality is very low, with *F*-statistics significant at the 5% level (or less). Nonetheless, some variables are significant: the land Gini is positive across all models and significant (weakly in the case of non-house assets). Average household income is also positively related to inequality. Larger villages appear to have less

inequality in income, while distance to market has no impact on inequality. The number of schools also has no impact on inequality in this time period.

Lastly, forest user group management did not have a significant impact on inequality in any of the measures used in this earlier time period.

The results for 2003 appear in Table 19. The explanatory power of these models is somewhat higher, with *F*-statistics significant at the 1% level or better, as the community characteristics better explain inequality in the communities. For example, larger communities are in general more unequal, as expected, as are richer communities, and communities with more unequal land distribution. Remoteness is not significant but the coefficient is consistently negative suggesting that remote communities are more equal. Additionally, in this period more schools have a positive impact on inequality in asset holdings.

However, the coefficients on the forest user group dummy are again not significant. After accounting for differences in community characteristics such as size, remoteness, average income level and land distribution, these is no evidence to support the hypothesis that forest user group implementation has a negative impact on distributional equity in per capita expenditures, in total assets or in total non-house assets.

This is consistent with the descriptive data seen above; however there appeared to be significant worsening in distribution for communities with newly-implemented user group. To find evidence for this again we need to look at the panel data.

(ii) Panel data

The estimation of the panel data uses the second empirical specification, in the following three variations:

$$ln(gini_{ijt}) - ln(gini_{ijt\text{-}1}) = \alpha + (X_{it} - X_{it\text{-}1})'\beta + \rho \ln(gini_{ijt}) + \eta(FUG_{jt}) + \varepsilon_{ij}$$

$$ln(gini_{ijt}) - ln(gini_{ijt\text{-}1}) = \alpha + (X_{it} - X_{it\text{-}1})'\beta + \rho \ln(gini_{ijt}) + \eta(FUG_{jt}) + \varphi(FUG\ age_{jt}) + \varepsilon_{ij}$$

where the same Gini measures and community characteristics are used as above. The first variation introduces the type of management regime (whether it is an "old" user group of a newly-formed one), while the second variation introduces the age of the user group to capture duration effects. Because the dependent variable is the difference in the Gini index, the independent variables are the changes in the variables used above:

(i) The population of the community, in the expectation that increased population will lead to worsening inequality;

(ii) Distance to the nearest market center, in the expectation that declining remoteness will lead to worsening inequality;

(iii) The average household income, in the expectation that increasing average incomes in the community will worsen inequality;

(iv) And the level of the Gini variable in the asset category in 1995, to measure any catch-up effect.

The variables of interest are again user group management. The hypothesis is that newly-formed forest user groups exacerbate inequality. The inclusion of two dummy variables will test this hypothesis: a dummy variable which takes the value of one if a forest user group existed since 1995, and a dummy variable which takes the value of one if a forest user group existed in 2003 but not in 1995.

The estimation results are shown in Table 20. These models are again not very good fits; however, we do see consistently positive and significant coefficients on the newly-formed FUG dummy, implying that newly formed FUGs lead to worsening inequality in income and household asset holdings. The coefficients on the "old FUG" dummy are not significant, but are negative. The evidence in support of our hypothesis is, however, weak.

VI. CONCLUSIONS

The large-scale institutional shift from centralized to local-level forest management in the middle hills region of Nepal in 1993 was intended to halt what had been alarmingly high rates of deforestation. Early evaluation of the success of this shift was therefore focused on resource protection and regeneration, much of which has been encouraging. Subsequent investigation however noted that the very institutional details enabling resource improvement, such as use restrictions and limited exploitation, were negatively impacting especially those households with few livelihood alternatives, in effect "saving the forest at the expense of the poorest." This not only left some households in the cold but resulted in increasing inequality within these communities that were necessarily now involved in promoting collective activity to enable effective resource management.

Employing a nationwide living standards data set, I test the hypotheses that community forestry is detrimental to welfare and that distributional equity worsens. I find that on the contrary, after correcting for possible endogeneity of user group formation, by 2003 per capita expenditure and housing values have been positively impacted in those communities with FUGs. However, panel data provides strong evidence that newly-formed forest user groups have a significantly *negative* effect on growth of per capita expenditures, and a negative but not significant effect on growth of housing values. As evidence of shift to non-forest livelihoods, the panel data shows an increase in the growth of business values and an increase in net earnings from other non-forest activities.

On the question of community inequality, there is only very weak evidence to support the hypothesis that forest user group management has an effect on distributional equality in general; in particular, inequality in per capita real expenditures and asset holdings increases in communities with newly-formed forest user groups.

These results imply that community managed forests can improve household welfare in the longer term but that the early transition period is welfare-reducing. These negative effects can be especially critical given that the implementation of community-level resource management is occurring in developing countries where income levels are low and livelihoods are especially dependent on local resource exploitation. Exclusionary rules and

mandatory participatory requirements have uneven effects on households with limited means for livelihood diversification. To prevent the poor from slipping further away, policymakers will need to consider transition plans that might include compensation for negative distribution effects and thereby encourage participation of all segments of those communities involved in and affected by this institutional shift. Such policy decisions have wider implications for the management of other resources as decentralization of authority becomes widespread.

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Figure 1
Forest-Based Economy Model

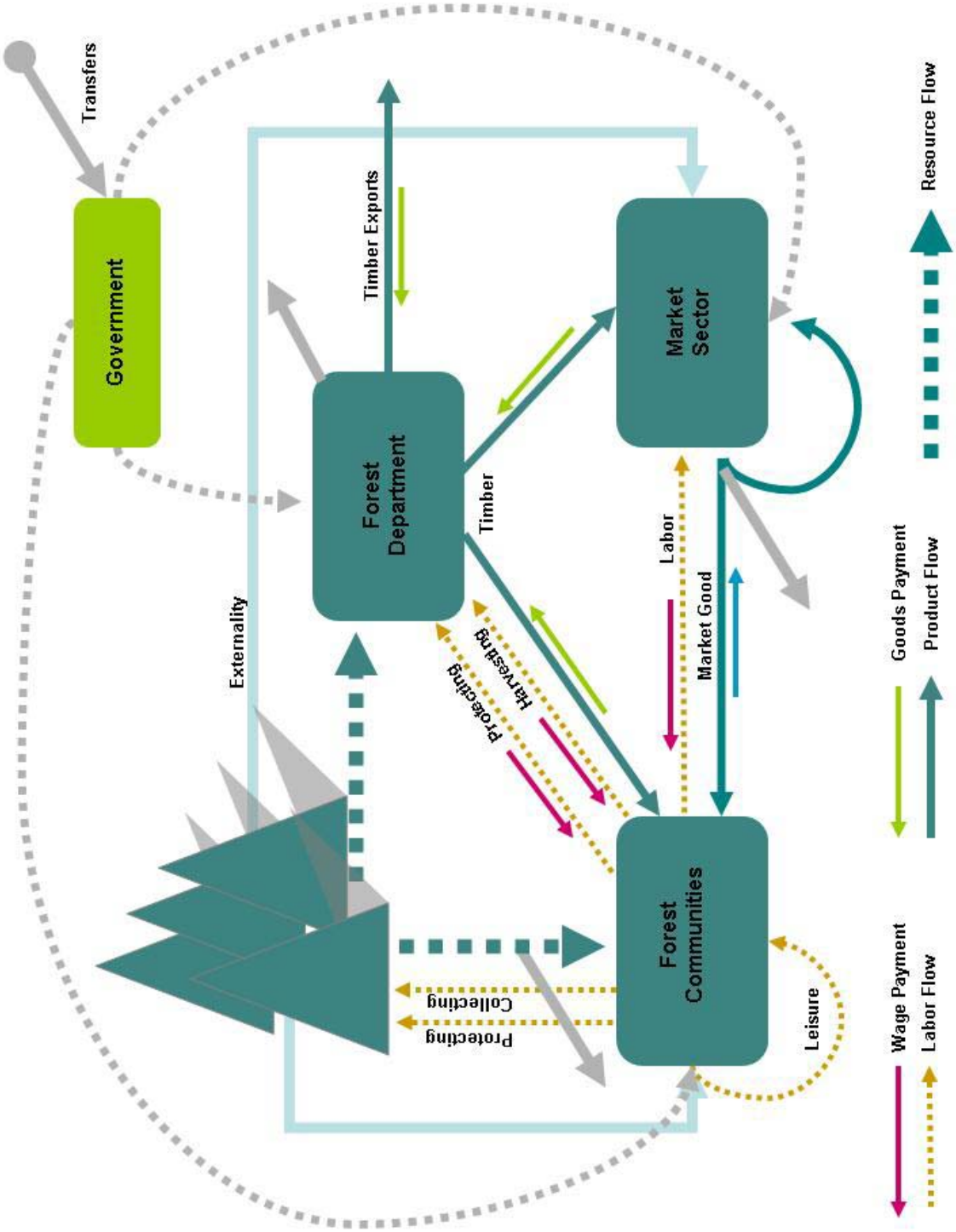


Table 1
Dependence on Forests

	1995	2003
% of communities reporting wood as the primary source of cooking fuel	97.59	96.84
% of communities with a community forest	51.76	72.92
% of communities reporting community forest as primary source of firewood	30.12	49.47
% of communities with FUGs	29.35	57.29
% reporting forested area improved	36.14	53.68
% with FUGs reporting forested area improved	46.15	68.52
% w/o FUGs reporting forested area improved	31.58	34.15
Observations	92	96

Source: NLSS1 and NLSS2

Table 2
Housing Characteristics

	1995	2003
Percent of total houses where the main construction material of the given component is:		
Walls:		
Mud-bonded bricks/stones	52.46	46.22
Wood / branches	19.45	16.05
Cement-bonded bricks / stones	16.87	23.80
Roof:		
Straw / thatch	43.02	28.04
Tiles / slate	25.91	27.45
Galvanized iron	15.09	22.88
Concrete / cement	11.24	18.48
Floor:		
Earth	82.38	73.26
Cement / tile	11.59	20.78
Wood / planks	2.88	3.66
Average size of interior (sq ft)	618.44	541.51
Observations	3373	3912

Source: NLSS1 and NLSS2

Table 3
Household Income and Asset Holdings

	Cross Section			Panel
	1995	2003	%Δ	%Δ
Land owned (hectares)	0.54	0.63	16.67	27.59
Livestock owned (head)	6.09	6.80	11.66	3.49
Average per capita real expenditure	7,293.50	8,615.51	18.13	40.64
Average per capita real food expenditure	4,380.80	4,856.30	10.85	49.04
Average value of owned house	62,669.29	65,851.45	5.08	21.11
Average value of owned HH assets	12,290.99	12,545.41	2.07	5.67
Average value of owned farm assets	658.18	2,211.89	236.07	202.19
Average value of businesses owned	7,213.18	6,247.91	(13.38)	(23.84)
Average value of all assets owned	82,831.65	86,856.66	4.86	15.16
Average value of non-house assets	20,162.35	21,005.21	4.18	2.79
Observations	1136	1152		326

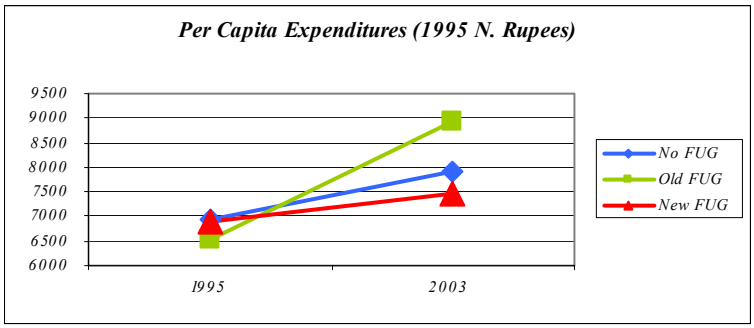
Real values in 1995 Nepalese rupees.
Source: NLSS1 and NLSS2

Table 4
Descriptive Statistics – Household Characteristics

	No FUG			With FUG		
	1995	2003	%Δ	1995	2003	%Δ
Mean land owned (hectares)	0.55	0.62	12.73	0.51	0.64	25.49
Mean livestock owned (head)	6.28	6.95	10.67	5.62	6.70	19.22
Mean per capita real expenditure	7,299.00	8,080.80	10.71	7,279.96	9,014.11 †	23.82
Mean pc real food expenditure	4,342.70	4,319.27	(0.54)	4,474.66	5,204.46 †	16.31
Mean HH assets	13,505.29	12,224.64	(9.48)	34,388.15 †	12,784.52	(62.82)
Mean farm assets	681.24	3,018.09	343.03	602.37	1,610.91†	167.43
Mean business value	5,681.66	5,853.60	3.03	10,985.96	6,541.85	(40.45)
Mean total assets	94,107.94	90,598.59	(3.73)	55,275.16 †	84,067.22	52.09
Mean NH assets	19,868.19	21,096.34	6.18	20,887.00	20,937.28	0.24
Observations	808	492		328	660	

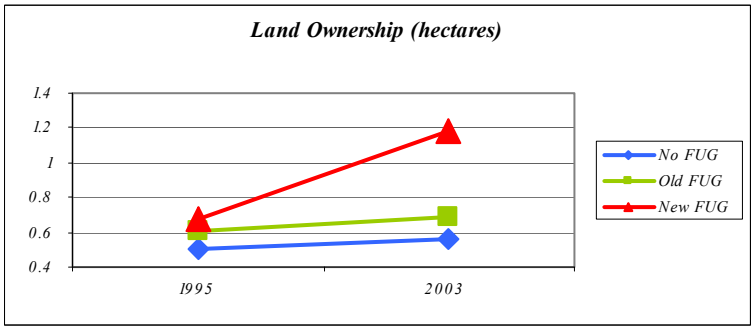
Real values in 1995 Nepalese rupees. † Significantly different from "No FUG" of same year value at 5% level of significance.
Source: NLSS1 and NLSS2

Figure 2
Trend in Per Capita Real Expenditures by Management Regime



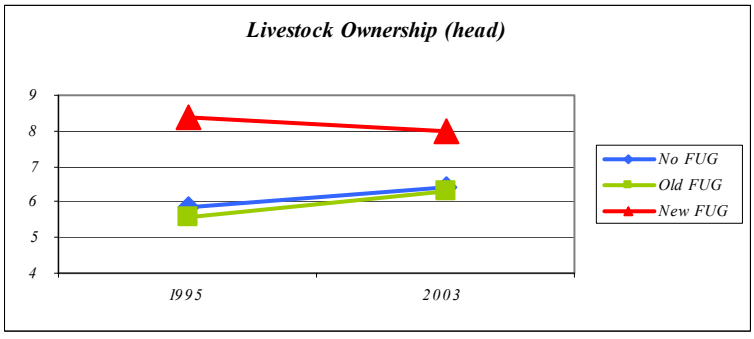
Source: NLSS1 and NLSS2

Figure 3
Trend in Household Land Ownership by Management Regime



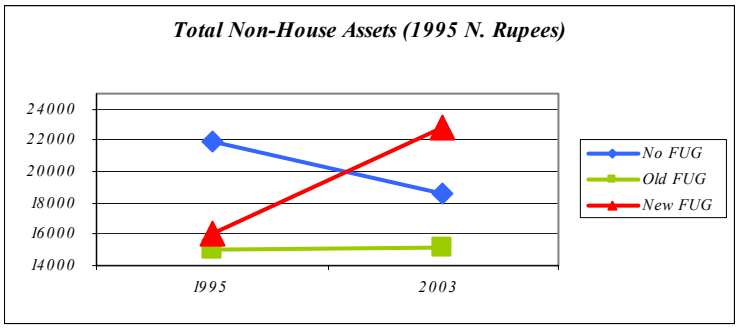
Source: NLSS1 and NLSS2

Figure 4
Trend in Household Livestock Ownership by Management Regime



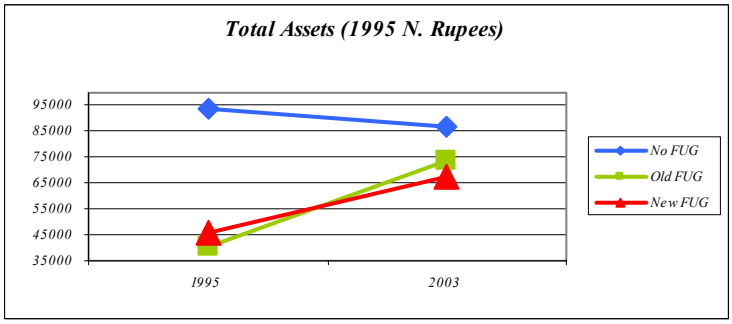
Source: NLSS1 and NLSS2

Figure 5
Trend in Household Non-House Asset Ownership by Management Regime



Source: NLSS1 and NLSS2

Figure 6
Trend in Household Total Asset Ownership by Management Regime



Source: NLSS1 and NLSS2

Table 5
Inequality (Ginis) in Rural Hill Communities

Variable	1995	2003	%Δ
Land ownership (hectares)	0.5399	0.4273	(20.86)
Livestock ownership (head)	0.3928	0.3676	(6.42)
Per capita real expenditures	0.2489	0.2491	0.08
Per capita real food expenditures	0.2285	0.2102	(8.01)
Real total assets	0.4172	0.3577	(14.26)
Real non-house assets	0.5011	0.4373	(12.73)
Observations	92	96	

Source: Author's calculations from NLSS1 and NLSS2

Table 6
Inequality (Ginis) in Rural Hill Communities (No FUGs)

Variable	No FUG			FUG		
	1995	2003	%Δ	1995	2003	%Δ
Land ownership (hectares)	0.5340	0.4496	(15.81)	0.5542	0.4108	(25.88)
Livestock ownership (head)	0.3865	0.3506	(9.29)	0.4078	0.3803	(6.74)
Per capita real expenditures	0.2506	0.2380	(5.03)	0.2446	0.2574	5.23
Per capita real food expenditures	0.2343	0.2009	(14.26)	0.2145	0.2170	1.17
Real total assets	0.4192	0.3618	(13.69)	0.4125	0.3547	(14.01)
Real non-house assets	0.5055	0.4359	(13.77)	0.4905	0.4383	(10.64)
Observations	65	27		41	55	

Source: Author's calculations from NLSS1 and NLSS2

Table 7
Inequality (Ginis) in Panel Rural Hill Communities (FUGS)

	New FUG			No FUG		
Variable	1995	2003	%Δ	1995	2003	%Δ
Land ownership (hectares)	0.4521	0.4021	(11.06)	0.5066	0.4173	(17.63)
Livestock ownership (head)	0.3601	0.3704	2.86	0.3562	0.3361	(5.64) †
Per capita real expenditures	0.1890	0.2509	32.75	0.2813 †	0.2692	(4.30) †
Per capita real food expenditures	0.2044	0.2478	21.47	0.2241	0.2201	(1.83)
Real total assets	0.3187	0.3261	2.32	0.3943	0.3157	(19.93) †
Real non-house assets	0.4357	0.4803	10.24	0.4920	0.4072	(17.24) †
Observations	6	6		16	16	

† Significantly different from "No FUG" of same year value at 5% level of significance.
Source: Author's calculations from NLSS1 and NLSS2

Table 8
Estimation Results (OLS) for Per Capita Real Expenditure

	1995			2003	
	I	II		I	II
Intercept	8.205 ***	8.225 ***		8.346 ***	8.340 ***
	(54.23)	(51.64)		(66.24)	(67.60)
% of household active	.369 ***	.369 ***		.356 ***	.356 ***
	(4.15)	(4.14)		(4.59)	(4.70)
% of household literate	.477 ***	.480 ***		.533 ***	.533 ***
	(7.33)	(7.45)		(8.26)	(8.19)
High ethnicity dummy	.109 **	.112 **		.062	.056
	(2.55)	(2.60)		(1.38)	(1.34)
Land owned (hectares)	.106 ***	.107 ***		.106 **	.106 **
	(3.80)	(3.82)		(2.56)	(2.56)
Net remittances received (1995 Rs)	.002 ***	.002 ***		.003 ***	.003 ***
	(5.02)	(4.90)		(2.21)	(2.37)
Ln(distance to market)	-.011	-.013		-.031 *	-.030 *
	(-.69)	(-.80)		(-1.66)	(-1.69)
Community irrigation dummy	.156 ***	.149 ***		-.102 *	-.098 *
	(2.93)	(2.77)		(-1.92)	(-1.83)
% of households with electricity	.004 ***	.004 ***		.005 ***	.005 ***
	(2.93)	(2.81)		(5.78)	(5.61)
FUG dummy	-.015	.014		.128 **	-.004
	(-.23)	(.19)		(2.45)	(-.05)
FUG age		-.000			.002 **
		(-.84)			(2.00)
R^2	.3354	.3364		.3551	.3601
F	37.48	35.46		23.10	22.02
Observations	1058	1058		1128	1128
Clusters	86	86		94	94

Numbers in parentheses are *t*-statistics. Regional dummies included but not reported.

Table 9
Estimation Results (2SLS) for Per Capita Real Expenditure

	1995			2003	
	I	II		I	II
Intercept	8.136 ***	8.126 ***		8.346 ***	8.337 ***
	(91.02)	(90.74)		(64.87)	(66.37)
% of household active	.349 ***	.349 ***		.360 ***	.363 ***
	(3.75)	(3.73)		(4.65)	(4.76)
% of household literate	.504 ***	.516 ***		.535 ***	.534 ***
	(7.05)	(7.27)		(8.21)	(8.11)
High ethnicity dummy	.094 **	.107 **		.058	.054
	(2.28)	(2.42)		(1.30)	(1.27)
Land owned (hectares)	.114 ***	.117 ***		.105 ***	.106 ***
	(3.95)	(4.02)		(2.57)	(2.58)
Net remittances received (1995 Rs)	.002 ***	.002 ***		.003 **	.003 **
	(4.08)	(3.77)		(2.24)	(2.36)
				-.030 *	-.030 *
				(-1.68)	(-1.72)
Community irrigation dummy	.113 *	.096		-.103 *	-.098 *
	(1.93)	(1.54)		(-1.93)	(-1.78)
% of households with electricity	.004 ***	.004 ***		.005 ***	.005 ***
	(3.51)	(3.44)		(5.62)	(5.43)
FUG dummy	.195 **	.271 *		.125 *	.004
	(2.02)	(1.89)		(1.66)	(.02)
FUG age		-.001 **			.002
		(-1.97)			(.98)
R^2	.3233	.3227		.3525	.3576
F	37.22	34.55		21.13	21.39
Observations	1022	1022		1116	1116
Clusters	83	83		93	93

Numbers in parentheses are *z*-statistics. Regional dummies included but not reported. Predicted value of FUG in 1995 based on (community_forest_dummy_95, ln_distance_to_market_95, user_group_dummy). F-statistic on first stage is 19.30; 10.99. Predicted value of FUG in 2003 based on (community_forest_dummy_ 03, forest_decreased_dummy). F-statistic on first stage is 60.80; 10.27.

Table 10
Estimation Results (OLS) for Household Housing Values

	1995			2003	
	I	II		I	II
Intercept	10.416 ***	10.358 ***		9.944 ***	9.942 ***
	(30.86)	(30.03)		(39.86)	(39.96)
% of household active	-.028	-.026		.110	.111
	(-.17)	(-.15)		(.89)	(.90)
% of household literate	1.019 ***	1.011 ***		.873 ***	.872 ***
	(7.39)	(7.41)		(7.26)	(7.22)
High ethnicity dummy	.179 **	.171 **		.043	.041
	(2.35)	(2.22)		(.59)	(.57)
Land owned (hectares)	.217 ***	.216 ***		.251 ***	.251 ***
	(5.64)	(5.73)		(4.04)	(4.04)
Net remittances received (1995 Rs)	.004 ***	.005 ***		.003	.003
	(3.22)	(3.16)		(1.41)	(1.44)
Ln(distance to market)	-.161 ***	-.153 ***		-.136 ***	-.136 ***
	(-4.50)	(-4.20)		(-4.52)	(-4.55)
Community irrigation dummy	.173	.193		.050	.051
	(1.58)	(1.79)		(.44)	(.45)
% of households with electricity	.012 ***	.013 ***		.007 ***	.007 ***
	(3.57)	(3.63)		(4.77)	(4.77)
FUG dummy	-.373 ***	-.455 ***		.219 **	.160
	(-2.77)	(-3.05)		(2.05)	(.99)
FUG age		.001			.001
		(1.13)			(.55)
R^2	.3577	.3594		.3818	.3822
F	21.24	20.28		19.72	18.78
Observations	1012	1012		1077	1077
Clusters	86	86		94	94

Numbers in parentheses are *t*-statistics. Regional dummies included but not reported.

Table 11
Estimation Results (2SLS) for Net Earnings

	1995				2003		
	Agricultural	Livestock	Business		Agricultural	Livestock	Business
Intercept	1413.98 (1.38)	1148.50 (.65)	10219.18 (1.52)		2788.47 * (1.69)	-413.32 (-.58)	7454.49 * (1.65)
% of household active	94.92 (.19)	317.12 (.73)	-6207.27 (-.80)		385.74 (.88)	638.24 (1.51)	2953.83 (1.61)
% of household literate	1662.10 *** (2.60)	1816.66 * (1.89)	8233.40 *** (3.66)		895.76 (1.56)	354.63 (1.20)	11774.35 *** (3.38)
High ethnicity dummy	54.24 (.21)	726.27 ** (2.41)	1929.22 (.91)		-900.69 (-1.43)	643.37 *** (2.91)	223.53 (.11)
Land owned (hectares)	1636.77 ** (2.55)	218.21 (1.28)	21.53 (.02)		2467.27 ** (1.97)	272.32 (1.48)	-788.00 (-.54)
Net remittances received (1995 Rs)	-6.60 (-1.11)	-4.74 * (-1.71)	-50.05 * (-1.68)		-39.45 * (-1.70)	-5.302 * (-1.86)	-82.36 ** (-2.19)
Ln(distance to market)	-165.13 (-1.54)	70.99 (.52)	-1010.70 (-1.57)		-275.07 (-1.29)	49.82 (.69)	-1598.00 *** (-2.60)
Community irrigation dummy	-618.27 (-1.54)	-719.00 * (-1.54)	2490.62 (1.09)		-1079.25 ** (-2.13)	-41.65 (-.12)	1964.27 (1.15)
% of households with electricity	-18.13 ** (-2.21)	-11.42 (-.89)	115.55 (1.07)		-3.23 (-.47)	10.10 * (1.77)	34.57 (1.57)
FUG dummy	843.44 (1.08)	842.14 (1.11)	898.68 (.24)		-1278.14 (-1.36)	124.57 (.37)	-4606.94 ** (-2.19)
R^2	.1078	.0764	.0269		.1251	.0750	.0451
F	1.83	2.99	2.14		2.27	3.08	3.04
n	1022	1022	1022		1116	1116	1116

Numbers in parentheses are *t*-statistics. Regional dummies included but not reported. Predicted value of FUG 1995 dummy based on (community_forest_dummy, user_group_dummy); predicted value of FUG 2003 dummy based on (community_forest_dummy, forest_decreased_dummy). *F*-statistic on first stage instruments is 20.32 (1995); 60.80 (2003).

Table 12
Estimation Results (2SLS) for Household Total Asset Holdings

	1995			2003	
	I	II		I	II
Intercept	10.559 ***	10.500 ***		9.666 ***	9.669 ***
	(34.89)	(34.20)		(46.12)	(46.17)
% of household active	.132	.131		.168	.165
	(.82)	(.82)		(1.30)	(1.28)
% of household literate	1.106 ***	1.105 ***		.982 ***	.980 ***
	(8.07)	(8.11)		(7.79)	(7.75)
High ethnicity dummy	.214 ***	.208 ***		.132 *	.139 *
	(3.08)	(3.00)		(1.71)	(1.73)
Land owned (hectares)	.300 ***	.298 ***		.395 ***	.394 ***
	(5.53)	(5.54)		(6.53)	(6.50)
Net remittances received (1995 Rs)	.004 ***	.004 ***		.003	.002
	(3.66)	(3.61)		(1.40)	(1.28)
Ln(distance to market)	-.146 ***	-.138 ***		-.073 ***	-.074 ***
	(-4.66)	(-4.35)		(-2.97)	(-2.87)
Community irrigation dummy	.037	.051		.036	.026
	(.35)	(.45)		(.41)	(.20)
% of households with electricity	.009 ***	.009 ***		.006 ***	.007 ***
	(2.97)	(3.01)		(5.18)	(5.25)
FUG dummy	-.205	-.249		.300 **	.499
	(-1.06)	(-1.02)		(2.14)	(1.37)
FUG age		.000			-.002
		(.73)			(-.74)
R^2	.3408	.3431		.3410	.3365
F	26.07	24.00		23.44	22.33
Observations	1022	1022		1116	1116
Clusters	83	83		93	93

Numbers in parentheses are *t*-statistics. Regional dummies included but not reported. Predicted value of FUG 1995 dummy based on (community_forest_dummy, user_group_dummy); predicted value of FUG 2003 dummy based on (community_forest_dummy, forest_decreased_dummy). *F*-statistic on first stage instruments is 20.32; 16.07; 60.80; 10.27.

Table 13
Estimation Results for Δ ln Per Capita Real Expenditure (1995-2003)

	I	II	III	IV
Intercept	4.458 ***	4.481 ***	4.307 ***	4.269 ***
	(7.04)	(6.90)	(6.53)	(6.59)
Δ % of household active	.381 ***	.370 ***	.358 ***	.366 ***
	(3.42)	(3.29)	(3.19)	(3.26)
Δ % of household literate	.150	.148	.143	.144
	(1.60)	(1.66)	(1.64)	(1.65)
High ethnicity dummy	.156 ***	.161 ***	.160 ***	.160 ***
	(3.37)	(3.24)	(2.92)	(3.01)
Δ Land owned (hectares)	.031	.033	.035	.036
	(1.11)	(1.13)	(1.16)	(1.25)
Δ Net remittances received (1995 N. Rs)	.000	.001	.001	.001
	(.39)	(.46)	(.68)	(.63)
PCE 1995 (ln)	-.515 ***	-.517 ***	-.494 ***	-.490 ***
	(-6.93)	(-6.81)	(-6.56)	(-6.60)
FUG in 2003 and 1995	.145 **	.251 *		
	(2.08)	(1.77)		
FUG in 2003 but not 1995			-.262 *	-.297 **
			(-1.69)	(-1.98)
FUG age (months)		-.002		.001
		(-.92)		(1.31)
R^2	.3399	.3449	.3550	.3583
F	13.93	12.82	14.11	14.75
Observations	325	325	325	325
Clusters	31	31	31	31

Numbers in parentheses are *t*-statistics. Regional dummies included but not reported.
Significant at * 0.10 level ** 0.05 level *** 0.01 level

Table 14
Estimation Results for Δ ln Housing Values (1995-2003)

	I	II	III	IV
Intercept	7.027 ***	7.126 ***	7.161 ***	7.180 ***
	(10.09)	(10.55)	(10.56)	(10.54)
Δ % of household active	.118	.065	.089	.081
	(.81)	(.45)	(.62)	(.55)
Δ % of household literate	.222 *	.222 *	.213 *	.216 *
	(1.75)	(1.76)	(1.73)	(1.74)
High ethnicity dummy	.082	.105	.091	.091
	(.72)	(.89)	(.75)	(.74)
Δ Land owned (hectares)	.003	.007	.007	.006
	(.12)	(.25)	(.22)	(.18)
Δ Net remittances received (1995 N. Rs)	-.001	-.001	-.001	-.001
	(-.84)	(-.64)	(-.66)	(-.65)
House value 1995 (ln)	-.653 ***	-.660 ***	-.662 ***	-.664 ***
	(-10.09)	(-10.54)	(-10.56)	(-10.53)
FUG in 2003 and 1995	.167	.516 **		
	(.82)	(2.35)		
FUG in 2003 but not 1995			-.291	-.259
			(-1.37)	(-1.19)
FUG age (months)		-.005 **		.001
		(-2.21)		(.55)
R^2	.5059	.5218	.5116	.5123
F	16.39	16.59	16.49	16.19
Observations	307	307	307	307
Clusters	31	31	31	31

Numbers in parentheses are *t*-statistics. Regional dummies included but not reported.
Significant at * 0.10 level ** 0.05 level *** 0.01 level

Table 15
Estimation Results for Δ ln Business Values (1995-2003)

	I	II	III	IV
Intercept	4.826 ** (2.49)	3.477 (1.46)	3.548 (1.69)	3.154 (1.48)
Δ % of household active	.991 (.45)	1.207 (.54)	1.664 (.80)	1.81 (.84)
Δ % of household literate	.617 (.61)	1.251 (1.01)	1.271 (1.16)	1.594 (1.34)
High ethnicity dummy	1.25 (1.36)	.811 (.77)	.851 (.90)	.673 (.71)
Δ Land owned (hectares)	.329 (.67)	.321 (.70)	.183 (.44)	.216 (.49)
Δ Net remittances received (1995 N. Rs)	.003 (.16)	.001 (.04)	.000 (.02)	.001 (.04)
Business value 1995 (ln)	-.580 ** (-2.67)	-.460 * (-1.83)	-.488 * (-2.09)	-.460 * (-1.96)
FUG in 2003 and 1995	-.133 (-.17)	-1.298 (-1.21)		
FUG in 2003 but not 1995			1.306 (1.39)	1.362 (1.57)
FUG age (months)		.017 (1.01)		.006 (.52)
R^2	.4174	.4492	.4687	.4800
F	2.59	2.05	2.31	2.62
Observations	29	29	29	29
Clusters	17	17	17	17

Numbers in parentheses are *t*-statistics. Regional dummies included but not reported.
Significant at * 0.10 level ** 0.05 level *** 0.01 level

Table 16
Estimation Results for Δ Net Earnings (1995-2003)

Variable	Agricultural		Livestock		Business	
	I	II	I	II	I	II
Intercept	-216.17 (-.47)	-526.31 (-1.26)	241.01 (.87)	180.30 (.62)	2501.19 ** (2.15)	2358.70 * (1.98)
Δ % of household active	401.15 (.47)	659.25 (.73)	164.10 (.78)	203.44 (1.03)	304.10 (.28)	384.53 (.35)
Δ % of household literate	-71.32 (-.10)	37.17 (.05)	225.64 (.62)	245.39 (.65)	1710.97 (1.26)	1758.17 (1.30)
High ethnicity dummy	-1672.82 ** (-2.59)	-1699.73 ** (-2.59)	-249.31 (-.94)	-261.68 (-1.01)	1620.56 (1.24)	1569.17 (1.30)
Δ Land owned (hectares)	567.26 ** (2.64)	567.72 ** (2.39)	63.62 (.89)	60.54 (.86)	-198.57 (-.68)	-223.40 (-.76)
Δ Net remittances received (1995 N. Rs)	-8.28 (-.75)	-10.60 (-1.05)	-7.91 * (-1.70)	-8.31 * (-1.82)	12.80 (.69)	11.92 (.66)
Net earnings 1995	-.544 * (-1.95)	-.542 * (-1.90)	-.679 *** (-4.61)	-.674 *** (-4.59)	-.412 *** (-6.22)	-.411 *** (-6.19)
FUG in 1995 and 2003	-2085.04 (-1.56)		-215.01 (-.78)		-3.76 (-.00)	
FUG in 2003 but not in 1995		2146.23 * (1.76)		379.32 * (1.86)		1105.67 * (1.79)
R^2	.2777	.2775	.5765	.5780	.3970	.3985
F	5.68	6.74	16.03	12.18	25.66	29.08
n	325	325	325	325	325	325

Numbers in parentheses are *t*-statistics. Regional dummies included but not reported.
Significant at * 0.10 level ** 0.05 level *** 0.01 level

Table 17
Estimation Results for Δ ln Total Asset Holdings (1995-2003)

	I	II	III	IV	V
Intercept	5.464 ***	5.475 ***	5.502 ***	5.473 ***	5.507 ***
	(11.39)	(11.17)	(11.37)	(11.59)	(11.52)
Δ % of household active	.169	.166	.151	.162	.151
	(.91)	(.90)	(.80)	(.86)	(.80)
Δ % of household literate	.263	.262	.260	.259	.259
	(1.63)	(1.63)	(1.60)	(1.61)	(1.61)
High ethnicity dummy	.063	.061	.070	.067	.067
	(.68)	(.68)	(.74)	(.71)	(.70)
Δ Land owned (hectares)	.026	.025	.026	.028	.026
	(.71)	(.69)	(.75)	(.76)	(.72)
Δ Net remittances received (1995 N. Rs)	.001	.001	.001	.001	.001
	(.71)	(.72)	(.79)	(.75)	(.79)
Asset holdings 1995 (ln)	-.498 ***	-.499 ***	-.500 ***	-.497 ***	-.500 ***
	(-12.61)	(-12.26)	(-12.41)	(-12.69)	(-12.51)
FUG in 2003 and 1995		-.050	.097		
		(-.38)	(.65)		
FUG in 2003 but not 1995				-.090	-.042
				(-.58)	(-.27)
FUG age (months)			-.002		-.001
			(-1.23)		(-1.12)
R^2	.4097	.4101	.4139	.4108	.4134
F	32.52	34.51	36.96	29.32	29.08
Observations	325	325	325	325	325
Clusters	31	31	31	31	31

Numbers in parentheses are *t*-statistics. Regional dummies included but not reported.
Significant at * 0.10 level ** 0.05 level *** 0.01 level

Table 18
Estimation Results for Inequality (1995)

Variable	Gini (PCE)		Gini (Non-house Assets)		Gini (Total Assets)	
Intercept	-.133 (-.47)	-.148 (-.52)	-.905 * (-1.94)	-.909 * (-1.93)	-.714* (-1.78)	-.717* (-1.78)
Ln (population)	-.036 ** (-2.13)	-.038 ** (-2.23)	-.042 (-1.52)	-.043 (-1.51)	-.005 (-.22)	-.006 (-.23)
Ln (distance to nearest market)	.001 (.20)	.000 (.08)	-.002 (-.32)	-.003 (-.33)	-.005 (-.72)	-.005 (-.72)
Gini (Land)	.123 ** (2.21)	.121 ** (2.16)	.161 * (1.75)	.160 * (1.73)	.134 * (1.70)	.134 * (1.69)
Ln (average household income)	.046 * (1.85)	.050 * (1.97)	.161 *** (3.80)	.157 *** (3.76)	.106 *** (3.00)	.107 *** (2.97)
Ln (number of local schools per household)	-.022 (-1.09)	-.021 (-1.01)	.006 (.19)	.007 (.20)	-.012 (-.41)	-.011 (-.40)
FUG dummy	-.007 (-.34)	.004 (0.18)	-.030 (-0.92)	-.028 (-0.73)	-.033 (-1.14)	-.030 (-.93)
FUG * FUG age (years)		-.000 (-.99)		-.000 (-.15)		-.000 (-.13)
R^2	.1123	.1525	.1848	.1850	.1663	.1706
F	1.69	1.58	3.02	2.56	2.66	2.32
Observations	87	87	87	87	87	87

Numbers in parentheses are *t*-statistics. Significant at * 0.10 level ** 0.05 level *** 0.01 level

Table 19
Estimation Results for Inequality (2003)

Variable	Gini (PCE)		Gini (Non-house Assets)		Gini (Total Assets)	
Intercept	-.666 ** (-2.54)	-.669 ** (-2.52)	-.552 (-1.44)	-.603 (-1.57)	-1.114 *** (-3.83)	-1.113 *** (-3.79)
Ln (population)	.017 (1.10)	.017 (1.09)	.066 *** (2.89)	.066 *** (2.91)	.071 *** (4.13)	.071 *** (4.11)
Ln (distance to nearest market)	-.004 (-.64)	-.004 (-.64)	-.011 (-1.28)	-.012 (-1.34)	-.012 * (-1.85)	-.012 * (-1.83)
Gini (Land)	.137 * (1.85)	.137 * (1.82)	.335 *** (3.09)	.322 *** (2.97)	.321 *** (3.91)	.321 *** (3.87)
Ln (average household income)	.075 *** (3.10)	.075*** (3.07)	.058 * (1.66)	.065 * (1.84)	.102 *** (3.82)	.101 *** (3.75)
Ln (number of local schools per household)	.010 (.56)	.010 (.56)	.050 ** (1.98)	.054 ** (2.11)	.046 ** (2.35)	.046 ** (2.32)
FUG dummy	.015 (.84)	.018 (.58)	.007 (.79)	.053 (1.22)	-.006 (-.33)	-.007 (-.22)
FUG * FUG age (years)		-.000 (-.11)		-.001 (-1.31)		.000 (.04)
R^2	.2847	.2848	.3578	.3578	.5706	.5706
F	5.84	4.95	6.92	6.92	19.49	16.52
Observations	95	95	95	95	95	95

Numbers in parentheses are *t*-statistics. Significant at * 0.10 level ** 0.05 level *** 0.01 level

Table 20
Estimation Results for Change in Inequality (1995-2003)

Variable	Gini (PCE)		Gini (Non-house Assets)		Gini (Total Assets)	
	I	II	I	II	I	II
Intercept	.732 *** (3.80)	.770 *** (3.76)	.161 * (1.87)	.115 (1.38)	.149 * (2.03)	.124 (1.56)
Δ population	.000 (.43)	.000 (.48)	.000 (.26)	.000 (.11)	.000 (1.09)	.000 (1.09)
Δ distance to market	-.000 (-.30)	-.000 (-.18)	-.000 (-.25)	.000 (.04)	.000 (.36)	.000 (.55)
Δ average household income	-.000 (-.90)	-.000 (-.81)	.000 (1.32)	.000 (1.53)	-.000 (-.28)	-.000 (-.06)
Gini(·) 1995	-2.48 *** (-3.63)	-2.51 *** (-3.50)	-.435 ** (-2.61)	-.394 ** (-2.51)	-.564 *** (-3.18)	-.495 ** (-2.70)
FUG in 1995 and 2003	-.137 (-.87)		-.025 (-.38)		-.049 (-.92)	
FUG in 2003 but not in 1995		.053 (1.72)		.118 * (1.88)		.047 * (1.85)
R^2	.4335	.4158	.3181	.4020	.3287	.3253
F	3.67	3.42	2.24	3.23	2.35	2.31
Observations	30	30	30	30	30	30

Dependent variable Δ Gini (·). Numbers in parentheses are *t*-statistics. Significant at * 0.10 level ** 0.05 level *** 0.01 level