

Working Paper No. 30/09

**CAN LAND REFORM BE AN EFFECTIVE
APPROACH TO ALLEVIATE POVERTY AND
INEQUALITY IN NEPAL?**

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ADMINISTRATION
Bergen, September 2009
ISSN 0803-4028

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Abstract

Land is the main source of income and consumption for the Nepalese people. This study analyses the economic relationship between access to land and poverty in Nepal by establishing the link between land and consumption as well as land and income. A generalised additive model (GAM) and ordinary least squares (OLS) demonstrate that greater access to land for the poor increases income and consumption and thereby reduces poverty. The significant marginal value of land for both consumption and income implies that an effective land reform policy could well be the most effective approach to alleviate rural poverty. However, land reform must come as part of a larger overhaul. Cluster analysis shows that land reform should target appropriate subgroups within the community in order to differentiate those who would make use of the extra land from those who would not, and apply appropriate strategies to each subgroup. It reveals the importance of subgroups in determining an appropriate strategy for tackling poverty. Three distinct groups are found within our dataset that explain most of the variation.

JEL: I30; C14; O12; Q15

Key Words: Poverty, Access to Land, Land Reform, Nepal.

CAN LAND REFORM BE AN EFFECTIVE APPROACH TO ALLEVIATE POVERTY AND INEQUALITY IN NEPAL?

1. Introduction

In recent years eliminating poverty has become the most important development objective (UNGA, 2000). As inequality in the distribution of production inputs, especially agricultural lands, seems to be the main cause of rural poverty and income disparity, combating rural poverty by providing greater access to land for poor households in developing countries is becoming increasingly common. The principal objective of this study is an exploration of how access to land might alleviate poverty and promote equity in Nepal. Indeed, policies to grant secure access to land for the rural poor can greatly increase their welfare. A successful redistributive land reform may increase small household production and contribute directly and immediately to reducing poverty and economic inequality. If the aim is to reduce poverty, the more important concern is not production increase *per se*, but on whose fields this production will increase. Increases on the fields of the poor will reduce poverty.

Among the range of policies being discussed to alleviate poverty, there is now a growing literature recommending improved access to land for the rural poor (Carter, 2003; Deininger, 2003; de Janvry et al, 2001). Conventional redistributive policies such as the redistribution of agricultural land through a land reform programme will have a direct impact on the incomes of the poor who benefit from these transfers. Deininger (2003) lends support to the land reform schemes, emphasising the important role that better management of land (and other production factors) has in providing more stable and higher incomes.

Redistributive land reform has been an increasingly important strategy for both poverty alleviation and socio-economic development (Binswanger *et al.*,

1995; Griffin *et al.*, 2002). Consequently, large-scale initiatives exist to implement land reform. However, in many countries large tracts of productive land lie idle while at the same time peasants with smaller holdings survive on marginal and often environmentally fragile lands (Heath and Binswanger 1996). The poor distribution of productive resources in general, and land in particular, has been identified as one of the root causes of economic stagnation in many developing countries, including Nepal. The one-time redistributive land reform has been particularly effective and politically powerful in addressing this.

What land reform implies in practice always depends on the context and particular circumstances, but the primary motivation of land reform is to alleviate poverty by reducing economic inequality (Lipton, 1974). The impetus for land reform is then the possibility of improved social justice and equity. Consider John Locke:

“Though the earth and all inferior creatures be common to all men, yet every man has a “property” in his own “person.” This nobody has any right to but himself. The “labour” of his body and the “work” of his hands, we may say, are properly his. Whatsoever, then, he removes out of the state that Nature hath provided and left it in, he hath mixed his labour with it, and joined to it something that is his own, and thereby makes it his property.” (Locke, 1689, cited in Morgan, 2005, p. 692).

Locke’s philosophical idea was that everyone should have a God-given right to property for their support and convenience which is essentially acquired by the application of their labour. Nobody has a right to take another’s property away for any reason without consent. He argues an issue of basic human rights. After all, access to land leads to access to shelter, food, employment and improved livelihood, amongst other things (Ghimire, 2001). Given that equity is a key factor in battling poverty, and that it can also increase social welfare (Sen, 1999; Tendulkar and Jain, 1995), Locke’s thoughts seem well founded.

Empirical studies in a variety of countries have identified a positive association between access to land and income (Jayne, *et al.*, 2002; Carter and May, 1999; Bouis and Haddad, 1990). Besley and Burgess (2000) provide evidence as to how specific aspects of land reform legislation in India have helped reduce poverty, and Lopez and Valdes (1997) found that land plays an important role in determining the per capita income of farming households in El Salvador and Paraguay. This effect on income through access to land via land reform programmes has been documented in studies for Taiwan, Zimbabwe, and the Philippines (Hoddinott *et al.*, 2000) as well as many others (Finan *et al.*, 2005, de Janvry and Sadoulet, 1999, Grootaert *et al.*, 1997, Gunning *et al.*, 2000, and Scott, 2000).

As an effective land reform programme must boost efficiency and promote equity, land ownership should be targeted towards those who use it most productively. As discussed, previous studies relating to land access and poverty using different methodologies have been conducted in many developing countries. However, these studies have been conducted on a piecemeal basis. For instance, a recent study conducted by Finan *et al.* (2005), covers only a limited geographical area. The data they used was from a 1997-98 survey conducted in targeted poor rural communities. Their analysis focused on the value of land for a particular segment of the rural population living in marginal communities.

However, there is an absence of solid empirical research that considers the real problems associated with land distribution issues, embracing both holistic and nationwide data. Therefore, in order to inform the policy-making processes for land reform, contributions to the literature and research in developing countries like Nepal are still required. Against this background, using Nepal Living Standards Survey (NLSS) data collected in 2003, this study shows for the first time how access to land reduces poverty by measuring the marginal poverty reduction value of land in Nepal.

Section 2 begins with a brief discussion pertaining to poverty, inequality and land reform in the Nepalese context. Conflicting ideas for land reform are considered in Section 3 while Section 4 discusses measurement of poverty. Section 5 provides data description and definition of model variables. Section 6 provides a theoretical model and Section 7 provides an empirical model. Empirical results are provided in Section 8 and Section 9 offers the conclusions.

2. Poverty, Inequality and Land Reform in Nepal

The alleviation of poverty is the biggest challenge faced by policy makers in Nepal. In the present socio-economic structure of the country, land is the main property and source of income for the majority of Nepalese (World Bank-WB, 2006). As poverty is increasingly concentrated among small farmers and agricultural labourers, an increase in agricultural productivity through secure access to land could potentially be one of the most effective approaches to alleviate rural poverty.

Over the last decade in Nepal, aggregate poverty fell significantly, from 42% to 31%. However, the decline was smaller in rural areas and is still high at 35% (WB, 2006). Whilst overall growth increased and overall poverty was reduced, the Gini coefficient increased from 0.34 to 0.41, indicating a rise in inequality. This suggests that growth was most evident in wealthier communities.

Unequal land distribution may be the major problem in Nepal which also constraints GDP growth. Nearly one third of all agricultural land is occupied by 7% of households, whereas nearly 20% of households have to survive on less than 3% of the total agricultural land (Central Bureau of Statistics-CBS, 2004a). Land is often misallocated, hampering agricultural development and perpetuating rural poverty. Those who have land do not know how to use it most effectively while those who know how to use land do not have it. Consequently, agricultural productivity is much lower than in other countries

in the region (WB, 2006). This would suggest that there is potential for increasing farm production. Some see the possibility for a three to four-fold increase through land and agrarian reforms (National Planning Commission-NPC, 1998). Clearly a policy designed to transfer agricultural land from unskilled to skilled farmers through an effective land reform programme could be an important instrument to alleviate poverty and disparity.

In past 50 years, there have been many attempts in Nepal to redistribute land to alleviate poverty and inequality, but without success. The land reform programme of 1964 had heightened social and psychological consequences, but had little impact on agrarian structure (Regmi, 1978). The government confiscated and redistributed only a very small fraction of the land that had been contemplated. In 1994 the High Level Land Reform Commission submitted the *Badal Commission Report* to implement land reform; however no steps were taken to do so. In 2001, another land reform programme with a revolutionary tag was announced. The focus of the programme was to amend the Land Act of 1964 in order to reduce the legal size of land holdings per family.¹ But Thapa (2001) points out that this was merely a political ruse as the political pronouncement was made without weighing up socio-economic implications, and was exclusive of any schemes or information related to land appropriation and redistribution. Consequently, there has been little progress in the last 50 years.

3. The Land Reform Controversy

Increasing access to land through land reform programmes is confronted with the following important issues.

First, some economists argue that the abolition of poverty can come only from development, not from redistribution (Boulding, 1968; Okun, 1975). They argue that redistribution wastes resources instead of making everybody richer. This type of development strategy may be applicable to some

¹ The land ceiling per family was 7 hectares in *Terai*, 2.75 hectares in the hills and 1.1 in the Kathmandu Valley.

developing countries, but it does not seem appropriate in Nepal as the country has few resources that are favourable to development. For example, Nepal faces much higher transport costs being land-locked (WB, 2007). Its only access to the sea is through India and so it depends greatly on its neighbour who in practice dictates its economy (Blaikie *et al.*, 1980). Further, factors such as its mountainous terrain make internal trade harder and so the arguments of Boulding and Okun seem unrealistic in our context.

Second, there are others who argue for a communal farming system. They maintain that this type of system in principle contributes to equity, efficiency, agricultural growth and a reduction in rural poverty (Mao, 1971). However, this argument has become politically discredited (Griffin *et al.*, 2002). Indeed, the Chinese communal farming system has been shown to be highly inefficient (Khan, 1983). The emphasis now in the former communist countries, where communal systems were widely adopted, is on de-collectivising and privatising state and collective farms.

Third, there are some arguments in favour of land tenure reform in lieu of redistributive land reform. However, Griffin *et al.* (2002) maintain that land tenure reform will either have no significant effect or make matters worse. The case for land reform rests not on the existence of defective tenure contracts, but on the concentration of land ownership rights and the inefficiency, inequality and poverty that this creates. The core of land reform is thus a redistribution of property rights in cultivable land.

Finally, land reforms sometimes confront the long entrenched view that large-scale, commercial agriculture is more productive, and that the reforms fragment land into unproductive, small units. However, various studies show that small farms have better total factor productivity than do large, and hence utilise resources more efficiently (Binswanger *et al.*, 1995; Heltberg, 1998).

4. Measurement of Poverty

Looking over the prevailing definitions of poverty, it is common practice that a household is considered to be poor if it falls below a given threshold level of welfare. In this connection, it is worthwhile to discuss briefly how welfare levels can be conceptualised. Broadly, three main approaches can be taken for assessing welfare. One is a welfarist approach in which welfare is solely compared on individual utility levels, depending on the assessment of the individuals themselves (Ravallion, 1994). This approach has been criticized because it uses subjective judgements to obtain social welfare functions (Sen, 1998). Despite this, economists, particularly in research work, have extensively used the welfarist approach.

The second approach to assessing welfare is the capability approach. This approach links poverty to health, nutrition and education. According to Sen, commodities are not seen as “ends”, but as “means” to fulfil desired activities (Sen, 1993; 1987b; 1987a). The author does not believe the value of commodities that an individual commands is as good a measure as capability. The capability approach focuses on human freedoms required to live a decent life and views poverty as the failure to achieve a basic capability, which is ‘the ability to satisfy certain crucially important functioning up to certain minimally adequate levels’ (Sen, 1993 p. 41). Theoretically, this provides a more satisfactory definition of poverty, as it embodies the lives people actually survive and the freedoms they enjoy (Ruggeri Laderchi, Saith and Stewart, 2003). In practice, however, to compute actual poverty, a measure must be developed in order to estimate wellbeing. The UNDP has attempted to construct a Human Poverty Index based on the capability approach, incorporating longevity, knowledge and a decent standard of living.

The third approach used to assess poverty is the basic needs approach, which is widely applied in many developing countries. This approach focuses on the fulfilment of basic human needs. Streeten *et al.* (1981) argue that emphasis

on primary health care, basic education, nutrition, and sanitation not only contributes directly to the alleviation of poverty and the reduction of fertility, but more importantly, it directly and indirectly improves productivity and accelerates economic growth. Choosing the food energy requirement and making an allowance for non-food consumption are the two problems associated with this approach, because across time these requirements may differ between individuals and places (Ravallion and Bidani, 1994). Despite these problems, the approach has been widely applied in developing countries by international development assistance agencies.

In Nepal, poverty lines were constructed using the third method (CBS, 2004b; WB, 2006). The most recent poverty lines were constructed for six geographical regions in order to measure poverty in the country. Adjustments were made for the differences in the cost of living in the different regions. Then consumption and income aggregates were derived from the NLSS data and compared with poverty lines. It was calculated in four steps as follows. First, the spatial and inter-temporal food price indices were derived to ascertain the corresponding food poverty line components. In the second stage, the spatial and inter-temporal non-food price indices were derived for the corresponding non-food poverty line components. In the third step, the food and non-food poverty line components were aggregated. Finally, overall total poverty lines were compared with nominal consumption and income aggregates derived from the survey data to categorise the population into poor and non-poor groups. A detailed procedure that was followed to construct the poverty line is found in CBS (2004b) and World Bank (2006).

5. Data Description and Variables

The data for this study were taken from the NLSS 2003 conducted by the CBS, with assistance from the World Bank and the UK Department for International Development (DFID). The NLSS completely follows the Living Standard Measurement Survey (LSMS) methodology, which is a household survey approach developed by the World Bank and applied in more than 50

developing countries. It provides a large database including detailed income and consumption data and a wide range of household-specific social and economic information. The sample was taken from six geographical strata and designed to provide enough observations within each zone to ensure adequate statistical accuracy, as well as enough variation in key variables for policy analysis. A two-stage stratified sampling method was used to select the sample households. The sampling population consisted of 36,067 Primary Sampling Units (PSU) spread over all 75 districts of Nepal. Out of 3,912 total sample households, a total of 2,585 households (observations) were taken for the analysis. The rest were excluded due to incomplete data.

Dependent Variable

Consumption and income are widely used as the monetary indicators of poverty. Consumption measures a household's welfare in relation to meeting current basic needs. Consumption being a smoother measure of welfare, it may more accurately reflect a family's long-term welfare (Ravallion, 1996; Deaton, 1997). Consumption can be viewed as realised welfare. Income on the other hand is a measure of potential welfare. However, households sometimes may be reluctant to report their true income.

In a predominantly subsistence economy such as Nepal, where much of the household income comes from agriculture, calculating actual income may be problematic. Moreover, income can be sensitive to shocks and is potentially volatile (Finan *et al.*, 2005). So, in the context of developing countries, consumption is preferred to measure poverty, rather than income (Deaton, 1997). Nonetheless, income can be useful in order to analyse welfare in terms of monetary sources (CBS, 2004b). In this study, both consumption and income are used to estimate the poverty reduction effect of the marginal value of land.

Explanatory Variables

Using a variety of methodologies, research has been conducted in many developing countries, but only a few studies have explored the determinants that cause poverty. However, there are similarities in the use of explanatory variables as Table 1 shows. All of these variables, i.e., age, household-size, education, infrastructures as well as regional variables² are included in the empirical model.

6. Theoretical Model

The theoretical model for establishing a link between improved access to land and poverty reduction in a given setting rests on understanding the operation of the land and labour markets in that context. Binswanger and Elgin (1998) have shown that even when rural factor markets are competitive and operate efficiently, the rural poor will have limited access to land. The competitive market outcome is that poor people, whose incomes are at the subsistence margin, are unable to purchase land at a competitive price due to the “fundamental financing problem of poor people” (Carter and Mesbah, 1993). They are unable to reduce their consumption below the subsistence margin in order to finance land purchases at competitive market interest rates, even though the land purchase would be profitable for them. The situation of the poor worsens with market imperfections.

The specific role of land market imperfections has been formalised in several of the farm-household models by introducing credit constraints based on the amount of land owned (Carter and Mesbah, 1993; Eswaran and Kotwal, 1986; Feder, 1985). More recently, such a modelling framework has been applied by

² The regional variables are geographic as Nepal is customarily divided into three ecological according to agro-climatic zone regions, viz., *Terai* (plain), hill and mountain. These zones vary with the elevation of the region. Mountain lies in the north at 3,000-8,848m above mean sea level whereas hill lies in the middle and *Terai* in the South at 300-3,000m and 60-300m respectively. Physiographically, 35% of its land lies in the mountains, 42% in the hills and 23% in the *Terai* (CBS, 2004c).

Finan *et al* (2005) to show how marginal returns to land can vary in a non-linear way with farm size and, hence, how such a pattern gives rise to a strong relationship between poverty reduction and land reform that increases access to land for the poor.

The theoretical concept behind this model is that agricultural production typically involves a period of several months between the time the inputs are purchased and the time the output is marketed. In many developing countries, due to their limited land, small farms have no access to credit, marketing and technology services (Fan and Chan-Kang, 2005). Due to asymmetric information, the problem of collateral and high fixed costs of lending, formal rural credit markets do not function properly in many developing countries (Stiglitz and Weiss, 1981). In poor agrarian economies, credit is invariably rationed to the ability to offer collateral. Private banks may lend to people who can offer transferable property rights (land) as collateral (DFID, 2007). Collateral increases the expected return to the lender because it partly or fully shifts the risk of loss of the principle from lender to borrower (Binswanger et al., 1989). Further, poor people often find themselves unable to secure loans due to the high cost of handling small loans and a perceived high risk of default. Financiers are reluctant to provide crop and livestock insurance coverage for small farmers (Adams, 2000).

The amount of credit a farmer can obtain therefore largely depends on the amount of land he owns, and thus his ability to offer collateral. Binswanger and Siller (1984) offer an insightful analysis into how different ownership of collateral (i.e., land) determines differential access to credit and gives rise to credit-rationing in an agrarian setting. Eswaran and Kotwal (1986) show that access to credit is functionally equivalent to ownership of the means of production. They explain that the amount of working capital a farmer has access to is typically determined by the assets he possesses, mainly the amount of land he owns. Binswanger and Rosenzweig (1986) point out that financial institutions routinely require collateral in the form of land as a condition for offering loans. Kevane (1996) and Heltberg (1998) have also

shown that credit depends on land ownership. Feder (1985) argued that if availability of credit is dependent on the amount of land owned (and if the performance of hired labor is affected by supervision from family members) then a systematic relationship between farm size and productivity prevails. The model explains how credit market imperfections affect the farm size-productivity relationship.

The lack of liquidity limits the ability of farmers to hire labour, purchase cash inputs, and also rent land during the planting seasons. Access to credit thus plays an important role in a farmer's decision. More precisely, our model explains that income (Y) is the function of labour (L_f), input (X), Land (H) and other social and economic factors (z), i.e.,

$$Y = PF(L_f, X, H; z) \quad (1)$$

where P is the exogenous market price.

The model assumes that cost of production (qX) is the function of initial capital (K), borrowed money $\Gamma(T)$ at interest rate i , and income from hiring out labour (L_s). So,

$$qX \leq K + i\Gamma(H) + (L_s) \quad (2)$$

where q is the input price.

The model further assumes that

$$\bar{L} \text{ (total labour)} = L_f + L_s \text{ (on-farm plus off-farm employment)}$$

$$L_s = w\Omega(L_s) = \text{number of days employed times rate of wages.}$$

The household's optimisation problem is then to choose time allocation and purchased inputs to maximize its income:

$$\max_{L_s, L_f, X} pF(L_f, X, H; z) - qX + w\Omega(L_s) - i(qX - K - w\Omega(L_s)) \quad (3)$$

Given the constraints,

$$L_s + L_f \leq \bar{L} \quad (3a)$$

$$qX \leq K + w\Omega(L_s) + \Gamma(H) \quad (3b)$$

$$L_s \geq 0, L_f \geq 0 \quad (3c)$$

Following Finan *et al.* (2005), in order to find the stationary point of (3) and therefore its maximum, we use the Lagrangian multiplier on constraint (3b), λ , to give

$$Y = pF((L_f, X, H; z) - qX + w\Omega(L_s) - i(qX - K - w\Omega(L_s))) + \lambda(k + w\Omega(L_s) + \Gamma(H) - qX) \quad (4)$$

Then, by considering the first order derivatives, we derive the equation for Y below.

$$Y = pF(L_f^*, X^*, H; z) - q(1+i)X^* + w(1+i)\Omega(L_s^*) + iK \quad (5)$$

Equation (5) can then be differentiated to illustrate how the expected marginal value of land may vary with the land endowment.

$$\frac{dY}{dT} = pF_T + pFL_f^* \frac{dL_f^*}{dT} - w\Omega' \frac{dL_f^*}{dT} - iw\Omega' \frac{dL_f^*}{dT} + pF_x \frac{dX^*}{dT} - q \frac{dX^*}{dT} - iq \frac{dX^*}{dT}. \quad (6)$$

$$= pF_T + (pFL_f^* - w\Omega' - iw\Omega') \frac{dL_f^*}{dT} + (pF_x - q - iq) \frac{dX^*}{dT} \quad (7)$$

$$= pF_T + \lambda q \frac{dX^*}{dT} + \lambda w\Omega' \frac{dL_f^*}{dT} \quad (8)$$

With no market imperfections ($\lambda = 0$) and if all household face the same prices with constant returns to scale in production, the marginal returns to

land is constant for land sizes. However, with imperfect markets ($\lambda \neq 0$) marginal returns will vary by size, in a non-linear manner (Finan et al., (2005).

8. Empirical Model

Ordinary Least Squares (OLS)

Our production model implies that any return to the productive assets of the household should influence the household's consumption and income, and demonstrate that they are indicators of poverty. Independent variables considered will include household demographics, constraints on factor use, as well as regional factors that capture employment opportunities and market integration as Tables 2 and Table 3 show. The equation for household consumption and income, specified as linear regression with control variables alongside land as the independent variable, is as follows.

$$y = \alpha + x\beta + g(z) + \varepsilon \quad (9)$$

where

y is a measure of household welfare (consumption or income),

x is a vector of control variables,

z is the household's land endowed,

α is constant term,

β is a vector of parameters of interest,

ε is the error term distributed normally.

As the data used in this study covers the whole of Nepal, both poverty and land were highly positively skewed, so they were log-transformed to fit the data better:

$$\ln(y) = \alpha + x\beta + \gamma \ln(z) + \varepsilon \quad (10)$$

In this specification, the marginal values are no longer the expected increase in income/consumption for one extra unit of land, as this depends on the value of z , but the expected percentage rise for 's' percent increase in land.

Next, consider the following:

$$\ln(y_1) = \alpha + x\beta + \gamma \ln(z) \quad (11)$$

$$\ln(y_2) = \alpha + x\beta + \gamma \ln(sz) \quad (12)$$

where, y_1 is the welfare (consumption or income) corresponding to the amount of land z and y_2 is the welfare corresponding to some s times of land compared to z . So, (12)-(11) give

$$\ln(y_2) - \ln(y_1) = (\alpha + x\beta + \gamma \ln(sz)) - (\alpha + x\beta + \gamma \ln(z)) \quad (13)$$

or

$$\ln\left(\frac{y_2}{y_1}\right) = \gamma \ln(s) \quad (14)$$

As equation (14) is independent of z it gives the estimates for the marginal value independent of land size. The percentage increase therefore is $100(s^\gamma - 1)$, whereas for other factors in the model the percentage increase is given by $100(e^\beta - 1)$ by similar algebra.

Generalised Additive Model (GAM)

As discussed earlier, the marginal value of land with respect to consumption or income may vary with the land endowment in a nonlinear way. Factor market imperfections lead to differences in the returns to land at different levels of farm size, and they are thought to be quite widespread in rural Nepal. Without knowing what the underlying frictions of our environment are, and hence the shape of the relationship between land and consumption and income, we relax the functional form for land and compare the results to those of the OLS.

In order to allow the possibility of a nonlinear relationship, a generalised additive model (GAM) is fitted which does not make the usual assumptions of linearity. The generalised additive model (GAM) is a statistical model initially developed by Hastie and Tibshirani (1986; 1990). GAM is a generalised linear model (GLM)³ with a linear predictor involving a sum of smooth functions of

³ A GLM relaxes the strict linearity assumption of linear model and allows for response distribution other than normal (Wood, 2006).

control variables (Wood, 2006). The GAM replaces one or more terms in a normal multiple regression with one or more functions $f(x_i)$:

$$E(Y) = \beta_0 + f(x_1) + f(x_2) + \dots + f(x_m) \quad (15)$$

The functions $f(x_i)$ are not constrained to be linear and so will provide a better fit than other methods. One advantage of these GAMs is their ability to model the situation more accurately and give better predictions, though perhaps this comes at the expense of interpretability of results.

Robinson (1988) comments that statistical inference on multidimensional random variables generally centre on approaches that are either linear or nonparametric. Finan *et al.* (2005), however, selected a semi-parametric approach using an equivalent approach to a generalised additive model (GAM) in order to model the data.

Using the same GAM, all the marginal values of land are calculated directly from the model using predicted values of the coefficients. Applying the GAM procedure, Finan *et al.* (2005) used a smoothing spline in their analysis to estimate the shape of land as splines are the smoothest interpolators. However, in this study, cubic smoothing splines are used as they always minimise the errors best.

8. Results and Interpretations

Estimation of Consumption Equation

Table 2 presents the parameter estimates for the marginal value of consumption. The estimated regression coefficients measure the change in household consumption from a change in explanatory variables. As the dependent variable is in natural log form, the estimated regression coefficients measure the percentage change in household consumption for an increase in the explanatory variable.

The coefficient estimates of the GAM procedure are very similar to the estimates of the OLS regression. This suggests that land is orthogonal to the other covariates.

Estimation of Income Equation

Table 3 shows the results when income is the dependent variable. As in the case of consumption, the coefficient estimates of the GAM procedure are very similar to the estimates of the OLS regression.

Interpretation of Empirical Results

These coefficients are quite similar to those of consumption, suggesting our model is robust. We now consider the implications of these findings.

Land is significant and positive and we also observe that household characteristics, complementary assets, and contextual circumstances greatly influence the income generating potential of land.

Education is important as expected as educational disparity is quite prevalent in Nepal. We have measured the effect of household members' education levels in four categories, namely, those with 10 years or less school education, an SLC (School Leaving Certificate-GCSE equivalent), an Inter (A level equivalent), and a bachelor's degree (B.A.) and above. The coefficients for these variables infer the contribution in household consumption that household members who have completed these education levels make, as compared to similar households in which no household member has attained such educational levels, all other things being equal. Consumption significantly increases with higher education. Having a member of the household who has an SLC, instead of 10 years or less education, raises consumption an extra 10% (9%) from the OLS (GAM). The key difference seems to be between those who then go on and get the Inter as well. Here the increase is an expected 19% (19%) for consumption or 23% (23%) for

income from OLS (GAM). The more adults and the more educated the adults, the less likely that a household will be poor.

Distance from the land to the road, primary school, and health-post or hospital was included as a measurement of infrastructure. The supposition is that as the distance increases, the costs to the household rise and consumption levels decrease. Reducing the time that rural households take to reach these locations should lead to improvements in consumption. The regression shows that the distance to primary schools and health-posts or hospitals is significant, whereas the distance to a road is not. Having a house twice as far away from a hospital, as another house, reduces consumption by 9%.

Those who live in the hills are more likely to have greater income and consumption than those in the *Terai* and mountains. The *Terai* land is supposedly more fertile and the general expectation is that households living in the *Terai* have more income and higher consumption. However, the result clearly reveals that people living in the hills have higher levels of income and consumption. The reason may be that households living in the hills have other income sources such as government jobs, employment in the British and Indian armies, or out-migrant work to India, Korea, Malaysia and a number of countries in the Middle East (WB, 2006). Mountainous land is much less fertile than *Terai* land and therefore, the result that consumption as well as income is higher for households in the mountain region than for *Terai* households is surprising. However, the result is not statistically significant. These results support the conclusion that a mere increase in land holding, without other complementary income sources, does not guarantee poverty alleviation.

Relationship between Poverty and Land

The coefficient for land gives an idea of the change in income and consumption using the OLS that would result from a 50% increase in land:

4.7% and 3.6% respectively. These figures are low and suggest that land has a small part in altering the poverty of these households.

Table 4 considers the marginal values from the GAM. This suggests that whilst income may go up as land is increased, consumption tends to go up more slowly. This would fit with the idea that the poor need every extra bit, whereas those richer can afford to spend more.

Finan *et al.* (2005) found that a small plot of land can increase welfare significantly in Mexican rural communities. They also found that households that face lower transaction costs, as measured by access to roads, provide a return to land that is two to three times as high as those without access to roads. For a country such as Nepal with high transport costs, this might explain the weaker relationship revealed in our dataset.

Indeed, one should remember that a household's ability to generate a sufficient economic livelihood also depends on the existing environment. The general expectation is that due to credit constraints and other unfavourable conditions, households with small land holdings have a lesser marginal value of land with respect to consumption. Larger farms have better access to credit, so an increase in landholding will increase the use of variable inputs and reduce the distortion in the input markets as well (Eswaran and Kotwal, 1986). As land endowments increase, access to credit improves and the household can allocate its labour more effectively. Hence, the marginal value of land begins to increase.

The resulting estimate of the consumption value of land, $g(X)$, is plotted in Graph 1a, where consumption appears as an increasing function of land. This shows that the relationship between consumption and land is not linear. This result suggests that a linear specification would be a poor approximation. The thin red line shows the GAM, that is not constrained to be linear. The thick blue line is linear (OLS) and gives the same percentage increase independent

of land size – 4.7%. The resulting estimate of the consumption value of land, $g(X)$, is plotted in Graph 1b and gives a similar shape.

The shape of Graph 1a, as well as 1b, reflects our theoretical prediction of the impact of a credit market constraint on return to land. This captures the fact that for small farmers, additional land produces a return that is lower than the simple production value of the extra plot of land.

Graph 2 displays the marginal value of land for consumption and income, with approximate 95% confidence intervals for the mean marginal increase of income and land based on the Bayesian posterior covariance matrix (see Wood, 2006 for details). It highlights the nonlinear relationship between land and the poverty measures. It suggests that those already with land will receive more consumption and income from an extra bit of land than the landless. This underlines the importance of not exclusively considering land reform as a measure to alleviate poverty.

The percentage increase is positive but not as large as we initially expected. Instead, whilst our findings still suggest that land can be an important element of poverty reduction strategy, we also observe that household characteristics, complementary assets, and contextual circumstances influence the consumption and income generating potential of land. For instance, households that face high transaction costs (e.g., distance to the nearest hospital) have a lower return to land. So the effectiveness of the process depends on many contextual factors. This includes, most particularly, the role of household characteristics, the availability of complementary assets, and where the land is used. So, besides better access to land, it is important to improve access to complementary assets such as education, and to improve the provision of public goods (infrastructure such as roads, hospitals, and schools) needed for people to make effective use of land. This all suggests that land access programmes be packaged as elements of more comprehensive programmes in order to secure the poverty reduction potential of land.

However, the fact is that there will be a limited amount of land available that can be redistributed even if a judicious ceiling on land is imposed (CBS, 2004a). This limits the possibilities of economic development and poverty alleviation by mere redistribution of farmland under the provision of any redistributive land reform. If the poverty reduction agenda is to operate properly, one option is that some people who are under the landownership ceiling but cannot use their land efficiently and productively will have to leave their land voluntarily and be replaced by people who can use land more efficiently. People with capital endowments and easy access to markets may be better off investing in industry and business rather than being involved in farming. The formulation of an appropriate policy might be initiated to discourage people from keeping their landholding for uses other than farming.

There are some studies that show that access to land through a land reform programme has little impact on income. McCulloch and Baulch (2000) documented that the impact of a policy giving two hectares of land to households in rural Pakistan with less than that amount had no effect on income. Lopez and Valdes (2000) found similarly in eight Latin American countries. They suggested that landholdings in rural areas of Columbia would have to quadruple in order for the poorest 40% of farm households to reach the poverty line. However, as stated by Finan *et al.* (2005), the methodology that has been used in these studies has several limitations, not the least being assuming a linear model.

Nevertheless, just because they struggled to establish a link does not mean the link does not exist and is not strong. For example, there are a number of clearly defined subgroups in our data as established by Graph 3. This uses cluster analysis to consider how many subgroups there are within our dataset using explanatory variables in our models. We can see that there are three groups that explain most of the variation in our dataset.⁴ The three groups include one younger well educated group with the smallest amount of land

⁴ For $R^2 \leq 0.56$ – note the clustering of groups towards the left, indicating most variability is explained by just a few groups.

that lives mostly on *Terai* and near local amenities, one older group with the most land and a number of adult workers, and one group that is poorly educated and lives in the mountains, therefore being far away from local amenities (school, road, hospital etc.). It seems wisest to target the first group who are well educated and have the knowledge to make use of extra land, and to leave the third group who have other factors inhibiting their growth, like education and location.

Our results show the importance of careful consideration of the link between land access and poverty. It seems clear that land reform must come as part of a larger overhaul that includes targeting the appropriate subgroups within the community and applying strategies to each one.

9. Conclusions

Land is the main source of income and consumption for the Nepalese people. This study analyses the economic relationship between access to land and poverty in Nepal by establishing the link between land and consumption as well as land and income. A generalised additive model and OLS demonstrate that greater access to land for the poor increases income and consumption and thereby reduces poverty. The significant marginal value of land for both consumption and income implies that an effective land reform policy could well be the most effective approach to alleviate rural poverty. However, land reform must come as part of a larger overhaul. The effectiveness of the consumption and income generating potential of land depends largely on many contextual factors, most particularly, the role of household characteristics, the availability of complementary assets, and the context in which the land is used.

The results show that both consumption and income appear as increasing functions of land. This implies that the relationship between consumption and land is not linear, suggesting that a linear specification would be a poor approximation. Income may go up as land holding is increased, while

consumption tends to go up more slowly. This indicates that a household's ability to generate sufficient economic livelihood depends on the environment in which the land exists. This supports the theoretical prediction of the impact of a credit market constraint on returns to land, capturing the fact that, for small farmers, additional land produces a return that is lower than the simple production value of the extra plot of land. Due to credit constraints and other unfavourable conditions, households with small land holdings have a lesser marginal value of land with respect to consumption and income. Larger farms have better access to credit and an increase in landholding will increase the use of variable inputs and reduce the distortion in the input markets as well. As land endowments increase, access to credit improves and the household can allocate its labour more effectively. Hence, the marginal value of land begins to increase. It suggests that those who already have land will receive more consumption and income from an extra bit of land than the landless. This underlines the importance of not considering land reform as an exclusive measure to alleviate poverty. This result supports the conclusion that a mere increase in land holding, without other complementary sources, does not guarantee poverty alleviation.

Cluster analysis shows that land reform should target appropriate subgroups within the community in order to differentiate those who would make use of the extra land from those who would not, and appropriate strategies should be developed for each subgroup. It reveals the importance of subgroups in determining an appropriate strategy for tackling poverty. It seems wisest to target the group who have the knowledge to make use of extra land more effectively and move other groups to other sectors of the economy, to industry for example.

Land reform is an effective approach to tackle poverty, but needs to do so as part of a larger, carefully constructed reform procedure. Whilst the data used to form these recommendations are restricted to Nepal, such patterns may apply more widely to other developing countries with similar issues and conditions. This study considered not a subsection of a country, as did

previous studies (see Section 1), but more broadly, the whole country. It therefore reaches into an unknown void. This gap will be duly filled by further studies in other nations that will verify just how widely applicable these findings are.

Table 1: Significant explanatory factors from previous studies

Authors and Dates	Land Size	HH Size	Education	Age	Gender	Infra-structure
Finan et al. (2005)	√	√	√	√	√	√
Lopez & Valdes (2000)	√	√	√	√		√
Gunning et al. (2000)	√	√	√			
Scott (2000)	√	√	√	√		
Szekely (1998)		√	√	√	√	√
Grootaert et al. (1997)	√	√	√	√	√	√
Coulombe & McKay (1996)	√	√	√	√	√	√
Rodriguez & Smith (1994)		√	√	√	√	√
Kyereme & Thorbecke (1991)		√		√	√	√

Table 2: OLS and GAM estimation of the consumption equation

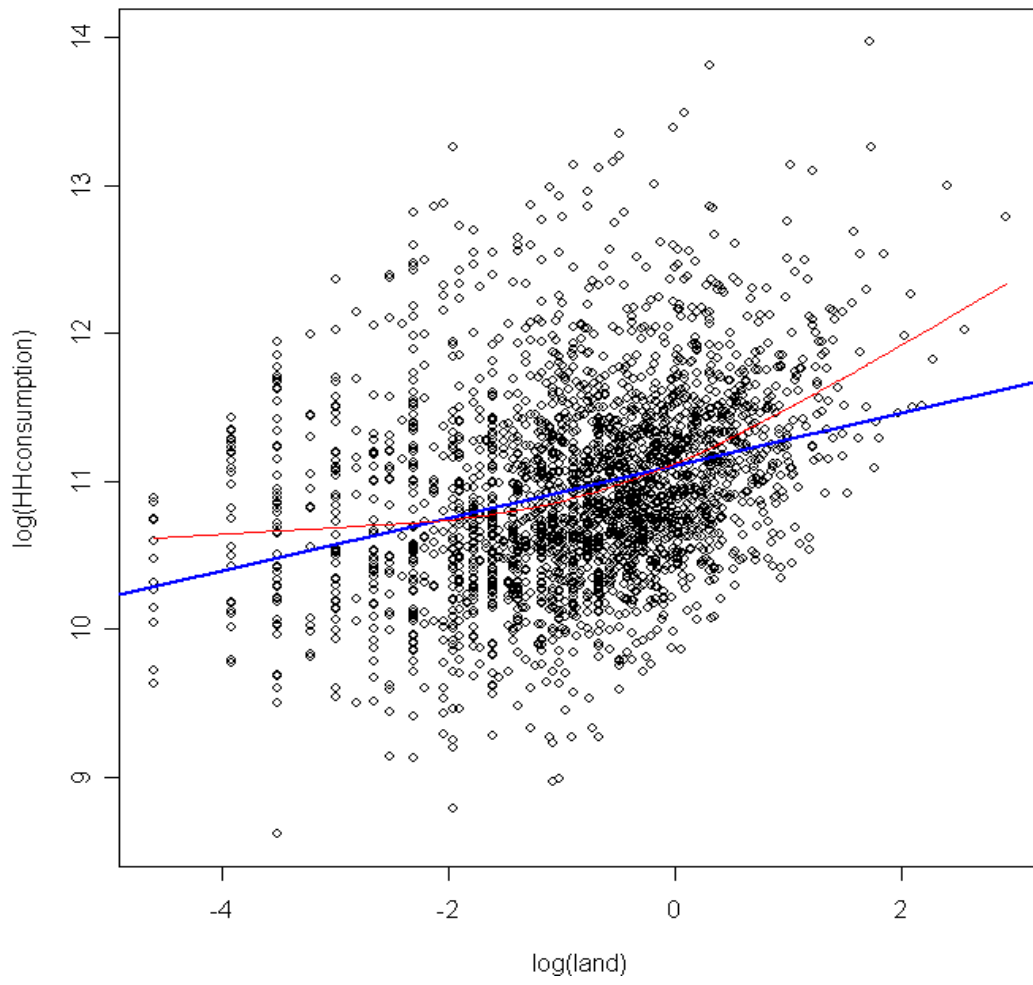
Coefficients:	OLS Estimation				GAM Estimation			
	Est.	St.Err	t-	P	Est.	St.Err	t-	P
Intercept	10.453	0.054	194.014	<0.001	10.400	0.052	201.550	<0.001
Age	0.001	0.001	1.097	0.273	0.001	0.001	0.958	0.338
HH Size	0.104	0.010	10.060	<0.001	0.104	0.010	10.095	<0.001
HHH Edu	0.037	0.003	11.177	<0.001	0.036	0.003	11.097	<0.001
Edu.<10	0.042	0.012	3.483	0.001	0.044	0.012	3.640	0.001
SLC	0.139	0.028	4.971	0.000	0.134	0.028	4.800	<0.001
Intermediate	0.331	0.048	6.876	0.000	0.320	0.048	6.660	<0.001
≥B. A.	0.314	0.067	4.719	0.000	0.312	0.067	4.696	<0.001
Age <10	-0.109	0.013	-8.546	<0.001	-0.109	0.013	-8.541	<0.001
Age10 to18	0.001	0.014	0.102	0.919	-0.002	0.014	-0.113	0.910
Age18 to 60	0.036	0.011	3.127	0.002	0.033	0.011	2.893	0.004
Age ≤ 60	0.013	0.020	0.633	0.527	0.011	0.020	0.548	0.584
Road	-0.001	0.001	-0.862	0.389	-0.001	0.001	-0.983	0.326
Pri. School	-0.058	0.020	-2.948	0.003	-0.060	0.019	-3.085	0.002
Hospital	-0.093	0.011	-8.546	<0.001	-0.091	0.011	-8.376	<0.001
Mountain	-0.054	0.032	-1.674	0.094	-0.053	0.032	-1.651	0.099
Terai	-0.094	0.023	-4.094	0.001	-0.101	0.023	-4.418	<0.001
Log Land	0.089	0.009	9.665	<0.001				
R²	0.437				0.440			

Table 3: OLS and GAM estimation of the income equation

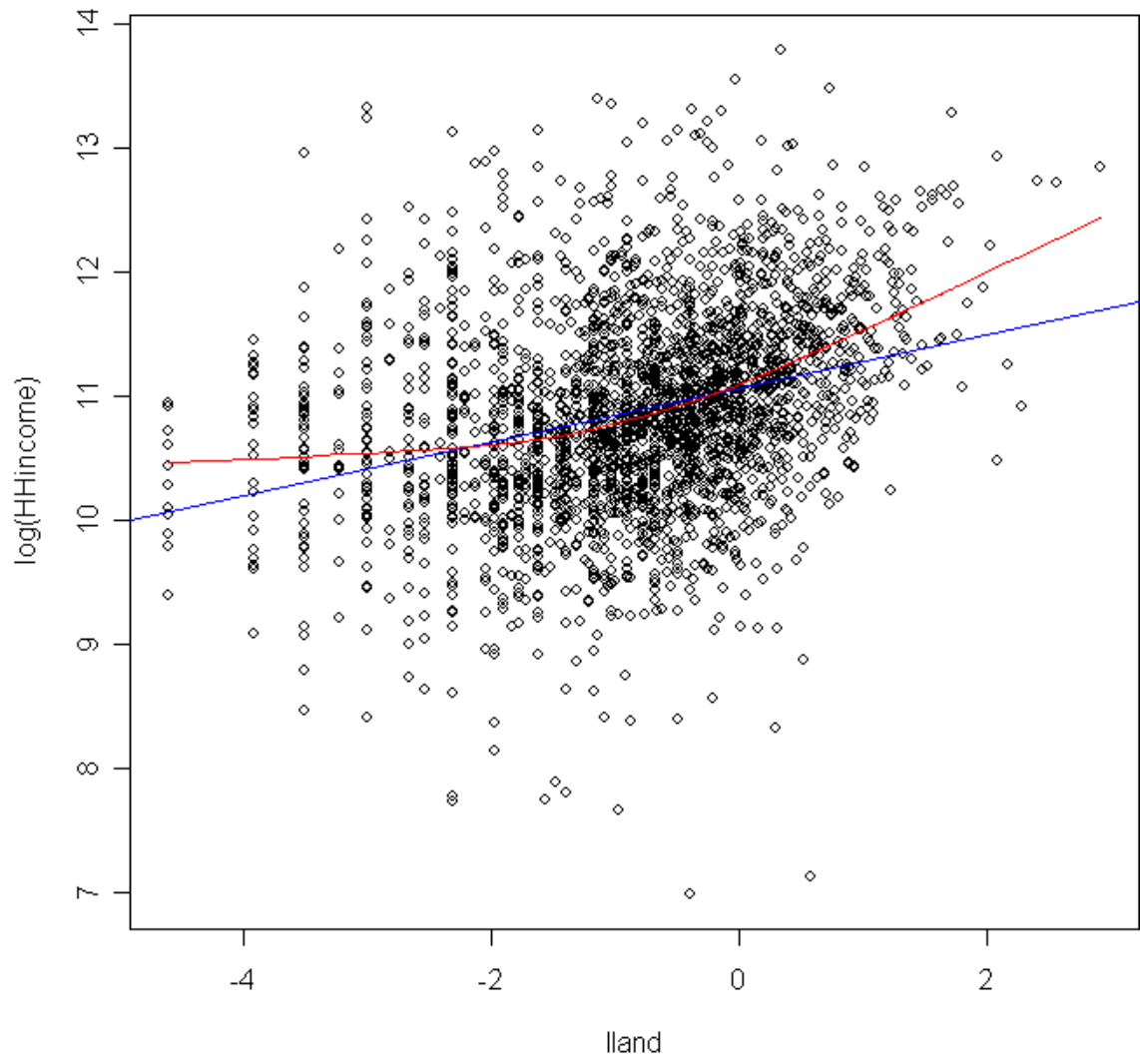
<i>Coefficients:</i>	OLS Estimation				GAM Estimation			
	<i>Est.</i>	<i>St.Err</i>	<i>t-</i>	<i>p</i>	<i>Est.</i>	<i>St.Err</i>	<i>t-</i>	<i>P</i>
Intercept	10.290	0.070	146.500	<0.001	10.220	0.067	152.300	<0.001
Age	0.002	0.001	1.902	0.057	0.002	0.001	1.760	0.079
HH Size	0.086	0.013	6.399	<0.001	0.085	0.013	6.375	<0.001
HHH Edu	0.045	0.004	10.430	<0.001	0.044	0.004	10.286	<0.001
Edu.<10	0.049	0.016	3.067	0.002	0.049	0.016	3.120	0.002
SLC	0.144	0.036	3.947	<0.001	0.137	0.036	3.757	0.000
Intermediate	0.375	0.063	5.983	<0.001	0.364	0.063	5.823	<0.001
≥B. A.	0.437	0.087	5.038	<0.001	0.434	0.087	5.017	<0.001
Age <10	-0.101	0.017	-6.034	<0.001	-0.100	0.017	-6.035	<0.001
Age10 to18	0.015	0.018	0.862	0.389	0.012	0.018	0.654	0.513
Age18 to 60	0.067	0.015	4.469	<0.001	0.064	0.015	4.294	<0.001
Age ≤ 60	0.036	0.027	1.364	0.173	0.033	0.027	1.234	0.217
Road	-0.001	0.001	-1.127	0.260	-0.001	0.001	-1.195	0.232
Pri. School	-0.071	0.025	-2.809	0.005	-0.074	0.025	-2.926	0.004
Hospital	-0.092	0.014	-6.439	<0.001	-0.089	0.014	-6.266	<0.001
Mountain	0.001	0.042	0.033	0.974	-0.002	0.042	-0.043	0.966
Terai	-0.089	0.030	-2.990	0.003	-0.097	0.030	-3.254	0.001
Log Land	0.115	0.012	9.516	<0.001				
R²	0.370				0.373			

Table 4: GAM estimation of marginal value of land for income & consumption

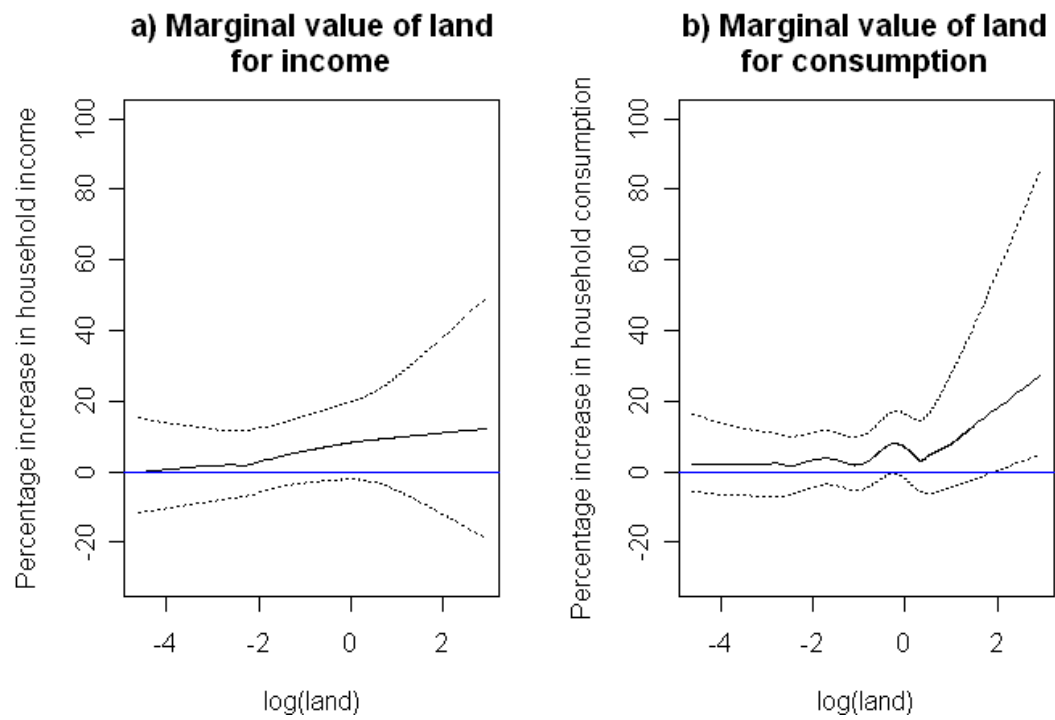
Land Owned (in Hectare)	Household Category	Income	Consumption
Less than 1	Small	5.25	4.17
between 1 and 2	Medium	8.76	4.16
Over 2	Large	9.75	11.92



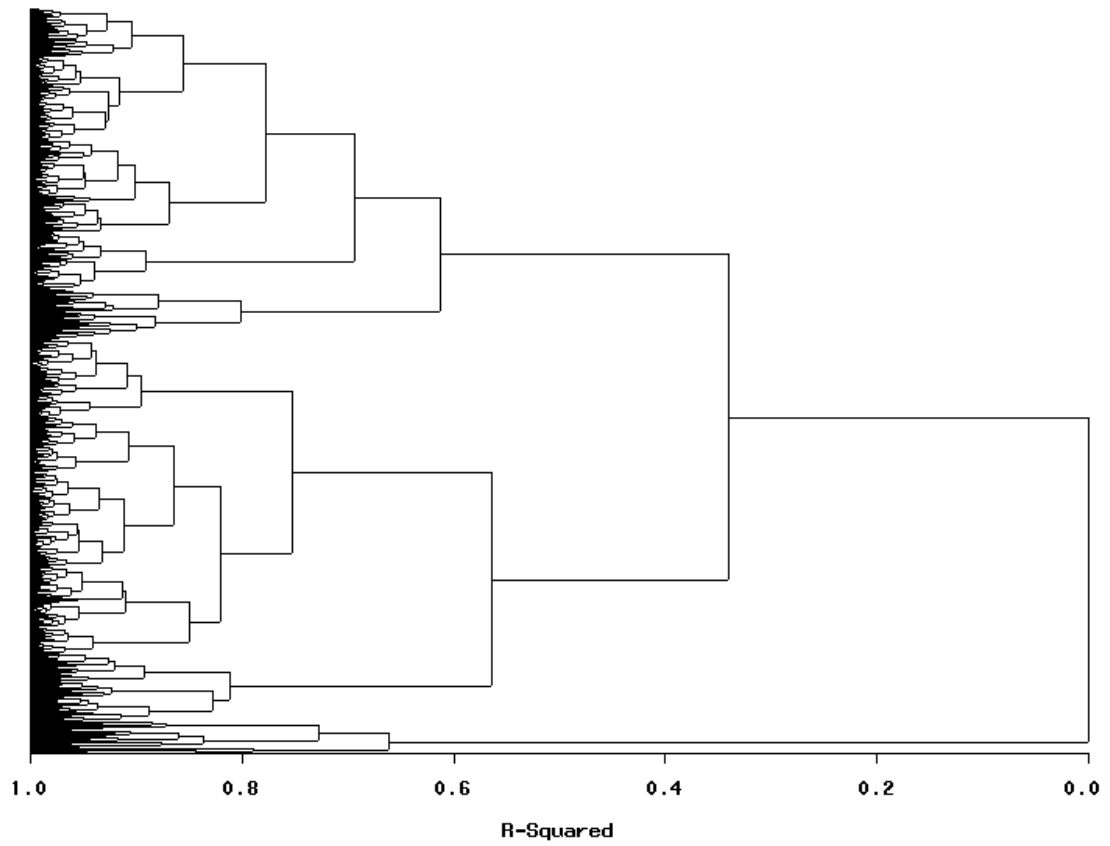
Graph 1a: OLS and GAM fitted to Nepal data for consumption



Graph 1b: OLS and GAM fitted to Nepal data for income



Graph 2: Marginal values of land for 50% increase in land



Graph 3: Dendrogram for explanatory factors within our model

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