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Economic Relationship between Access to Land and Rural Poverty in Nepal

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In the present socio-economic structure of Nepal, land is the main source of income and consumption for the majority of Nepalese. This study analyses the economic relationship between access to land and poverty in Nepal by establishing the link between land and consumption and land and income. The results show that greater access to land increases income and consumption of the household thereby reducing poverty. The significant marginal value of land for both consumption and income implies that an effective land reform policy could well be an effective approach to alleviate rural poverty. However, land reform must be 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.

Keywords: Poverty, Access to Land, Land Reform, Nepal.
JEL: I30; C14; O12; Q15

Introduction

In many developing countries eliminating poverty is 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 (Binswanger, H. P., Deininger K., & Feder, G. 1995). Indeed, policies to improve access to land for the rural poor can greatly increase their welfare (Ciamarra, 2004). The principal objective of this study is an exploration of how access to land might alleviate poverty and promote equity in Nepal. If the aim is to reduce poverty, the more important concern is not only production increase, but on whose fields this production will increase. Increases on the fields of the poor will help reduce poverty.

Among the policies being discussed to alleviate poverty, there is a growing literature recommending improved access to land for the rural poor (Carter, 2003; Deininger, 2003; de Janvry, A., Cordillo, G., Platteau, J., & Sadoulets, E., 2001). Conventional redistributive policies such as the redistribution of agricultural land through land reform will have a direct impact on the incomes of the poor who benefit from these transfers. Deininger (2003) lends support to land reform, emphasising the role of better management of land in providing stable and higher incomes.

Access to land for the poor has long been an important strategy for both poverty alleviation and socio-economic development (Binswanger et al., 1995; Griffin, K., Khan A. R., & Ickowitz, A., 2002). Consequently, initiatives exist to implement a land reform. In many countries large tracts of productive land lie idle while peasants with smaller holdings survive on marginal and often environmentally fragile lands (Heath & Binswanger 1996). The poor allocation 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 (Deininger, 2003). The impetus for land reform is then improved social justice and equity.

Locke's (1689) philosophical idea was that everyone has a God-given right to property for their support and convenience, which is essentially acquired by the application of their labour. He argues an issue of basic human rights. After all, access to land leads to an improved livelihood (Ghimire, 2001). Given that equity is a key factor in battling poverty as well as in increasing social welfare (Sen, 1999; Tendulkar & Jain, 1995), Locke's thoughts seem well founded.

Empirical studies in various countries have identified a positive association between access to land and income (Jayne, et al., 2002). 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 has been documented in studies for Taiwan, Zimbabwe, and the Philippines (Hoddinott, J., Haddad, L., & Mukherjee, S., 2000) as well as many others [1].

One of the limitations of this study is that we use cross section data which usually suffers from the problems of endogeneity and omitted variable biases. We include in our analysis the possible and relevant variables such as household's characteristics, demographic, complementary assets and contextual circumstances to address the problem of omitted variable bias. We acknowledge that our estimation model may be subject to various sources of endogeneity which may create bias in the estimated effect of land. To resolve this issue, many authors consider using instrumental variables as identification strategy. However, in our context it is not easy to find good instruments which are directly correlated with landholding but does not affect income/consumption. Consequently, we introduce instrumental variables for land, in particular district-wise average landholdings, gender of family head and ethnicity. However, the instrumental variable estimations of both income and consumption equations produced estimates that were not statistically different from the OLS estimations (not shown here).

Moreover, to test the robustness of our findings, normality tests are performed. Visually, the histograms of the residuals plotted from the consumption and income regression models illustrate (not shown here) that the actual distribution of the residuals (the histogram) is bell-shaped and resembles the normal distribution. Jarque-Bera (JB) tests also confirm the normalities. Possible existence of heteroskedasticity is investigated by residual plots and Goldfield-Quandt (GQ) tests. Both tests confirm that heteroskedasticity does not exist. So, despite various limitations for using cross sectional data we use household landholding as an exogenous variable throughout the analysis.

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[1] Finan et al., 2005, de Janvry and Sadoulet, 1999, Grootaert et al., 1997, Gunning et al., 2000, and Scott, 2000.

Most earlier studies assumed a linear specification to estimate the relationship between land and income (welfare). However, this assumption would be more restrictive if market imperfections constrain a household's ability to effectively use its resources. In this context, a complex nonlinear relationship between land and welfare may exist. Moreover, many of the earlier studies relating to land access and poverty have been conducted on a piecemeal basis; there is an absence of studies that considers the issues, embracing both holistic and nationwide data. Against this background, using nationwide Nepal Living Standards Survey (NLSS) data, this study for the first time shows how access to land reduces poverty by measuring the marginal poverty reduction value of land in Nepal employing a nonparametric technique-GAM which represents a major contribution to the literature.

Section 2 provides a brief discussion pertaining to poverty, inequality and land in the Nepalese context and presents different ideas about access to land. Section 3 describes the theoretical concept underlying the analysis. The empirical model is outlined in Section 4. Section 5 provides the data. Empirical results are presented in Section 6 while Section 7 offers the conclusions.

Poverty, Inequality and Land in Nepal

The alleviation of poverty is the biggest challenge faced by policy makers in Nepal (National Planning Commission-NPC, 1998). 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 could potentially be one of the most effective approaches to alleviate rural poverty (Adhikari, 2009). In Nepal, over the period 1995/96-2003/04, aggregate poverty fell 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 (Central Bureau of Statistics-CBS, 2004b). This suggests that growth was most evident in wealthier communities.

Unequal access to land may be the major problem in Nepal which also constrains GDP growth. Nearly one third of all agricultural land is occupied by 7% of households, whereas nearly 20% of households 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 (NPC, 1998). 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 (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 (Adhikari, 2009). In the past 50 years, there have been many attempts in Nepal to alleviate poverty and inequality, but without success.

The primary motivation of access to land for the poor through land reform policies is to alleviate poverty by reducing economic inequality (Lipton, 1974). However, increasing access to land to alleviate poverty is confronted with several issues.

First, some economists argue that the abolition of poverty can come only from development, not from access to land for the poor through redistribution of farmland (Boulding, 1968; Okun, 1975). They argue that redistribution wastes resources rather than makes everybody richer. This type of development strategy may not be applicable to some developing countries like Nepal where there have been few resources that are favourable to development. For example, being land-locked, Nepal faces very high transportation costs, depending greatly on India who in practice dictates its economy (Blaikie, P., Cameron, J., & Seddon, D., 1980). Further, mountainous terrain make internal trade cumbersome and so the arguments of Boulding and Okun seem unrealistic in our context.

Second, some argue for a communal farming system rather than access to land by the poor. They maintain that this type of system in principle contributes to equity, efficiency, agricultural growth and a reduction in rural poverty. However, this argument has become politically discredited. The Chinese communal farming system has been shown to be highly inefficient. The emphasis now in the former communist countries is on de-collectivising and privatising state and collective farms.

Third, there are some arguments in favour of land tenure reform in lieu of access to land for the poor through 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 access to land 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 access to land for the poor through land reform is thus a redistribution of property rights in cultivable land.

Finally, access to land for the poor sometimes confronts 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 ones, and hence utilise resources more efficiently (Binswanger et al., 1995; Heltberg, 1998).

Theoretical Concept

The theoretical concept for establishing a link between improved access to land and poverty reduction rests on understanding the operation of the land and associated labour markets. 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 & Mesbah, 1993). They are unable to reduce their consumption below the subsistence margin in order to finance land purchases, 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 farm-household models by introducing credit constraints based on the amount of land owned (Carter & Mesbah, 1993; Eswaran & Kotwal, 1986). More recently, such a modelling framework has been applied by Finan F., Sadoulet, E.,and de Janvry, A., (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.

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 holdings, small farmers have no access to credit, marketing and technology services (Fan & 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 (Stiglitz & Weiss, 1981). In poor agrarian economies, credit is invariably rationed by the ability to offer collateral. Collateral increases the expected return to the lender because it partly or fully shifts the risk of loss of the principal from lender to borrower (Binswanger, H. P., McIntire, J. and Chris, U., 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 & Siller (1983) offer an insightful analysis into how different ownership of collateral determines differential access to credit and gives rise to credit-rationing in an agrarian setting. Eswaran & 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. Binswanger & Rosenzweig (1986) point out that financial institutions 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. So, if availability of credit is dependent on the amount of land owned, then a relationship between land holding and productivity (income) prevails. With market imperfections, the marginal value of land may vary with the land endowment, and quite possibly in a nonlinear manner (Finan et al., 2005).

The Empirical Model

As already noted, the marginal value of land with respect to consumption or income may vary with the land endowment in a nonlinear way. This is because factor market imperfections may lead to differences in the returns to land at different levels of land holdings.

For this purpose, we first estimate a linear OLS model. Then, 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 fit a Generalised Additive Model (GAM) which does not make the usual assumptions of linearity and compare the results to those of the OLS.

Any returns 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 include household demographics, constraints on factor use, as well as regional factors that capture employment opportunities and market integration. The equation for household consumption and income, specified as linear regression with control variables alongside land as the independent variable, is as follows:

$$y = \alpha + x\beta + g(z) + \varepsilon \tag{1}$$

where y is a measure of household welfare (consumption or income), x is a vector of control variables, z is the household's land endowment, α is constant term, β is a vector of coefficients of controls, and ε is the error term distributed normally.

As the data covers the whole of Nepal, both consumption/income and land were highly positively skewed, so they were log-transformed to fit the data better:

$$ln(y) = \alpha + x\beta + \gamma\, ln(z) + \varepsilon \tag{2}$$

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.[2]

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[2] Consider the following:

$$ln(y_1) = \alpha + x\beta + \gamma\, ln(z) \tag{i}$$

$$ln(y_2) = \alpha + x\beta + \gamma\, ln(sz) \tag{ii}$$

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, (ii)-(i) gives

$$ln\left(\frac{y_2}{y_1}\right) = \gamma\, ln(s) \tag{iii}$$

As equation (iii) 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 $100(e^{\beta} - 1)$ similar algebra.

The generalised additive model (GAM) is a statistical model initially developed by Hastie & Tibshirani (1986; 1990). GAM is a generalised linear model (GLM)[3] with a linear predictor involving a sum of smooth functions of control variables (Wood, 2006). The GAM replaces one or more terms in a normal multiple regression with one or more functions $f(x_i)$:

$$E(Y) = \beta_0 + f(x_1) + f(x_2) + \ldots + f(x_m) \quad (3)$$

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 possibly at the expense of interpretability of results. 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, cubic smoothing splines are used as they can minimise the errors best. Using the computer software "R" the empirical models were estimated and graphs were produced

The Data

The data were obtained from the Nepal Living Standard Survey (NLSS) 2003 conducted by the Central Bureau of Statistics (CBS), Nepal, with assistance from the World Bank and the UK Department for International Development (DFID). The NLSS follows the Living Standard Measurement Survey (LSMS) methodology, a household survey approach developed by the World Bank and applied to more than 50 developing countries. It provides a large data base including detailed income and consumption data and a wide range of household-specific social and economic information. The sampling population was spread over all 75 districts and were taken from six geographical strata using a two-stage stratified sampling method to select the sample households; 2,585 households (observations) were included in the analysis.

Consumption and income are widely used as monetary indicators of poverty. Consumption measures a household's welfare in relation to meeting current basic needs. Consumption can be viewed as realised welfare. Income on the other hand is a measure of potential welfare. However, households may sometimes be reluctant to report their true

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

income. Moreover, income can be sensitive to shocks and is potentially volatile (Finan et al., 2005). Nonetheless, income can be useful in order to analyse welfare in terms of monetary sources (CBS, 2004b). In this study, consumption and income are used to estimate the poverty reduction effect of the marginal value of land.

All relevant socio-economic, demographic and regional variables[4] which determine household consumption/income are included in the empirical model. Descriptive statistics are presented in Table 1.

Table 1 Descriptive Statistics

Variable	Unit	Mean	Std.Dev.	Minimum	Maximum
HH Consumption	NRs	73268.34	69876.63	5491.00	1171621.00
HH Income	NRs	74416.29	76989.95	630.00	973974.40
Land	Hectare	0.75	0.98	0.01	18.62
HH Size	Members of Family	5.47	2.54	1.00	32.00
HH head Age	Years	46.09	14.06	14.00	91.00
HH head Education	Years	2.79	3.96	0.00	16.00
Education Less than 10 yrs	Members of Family	0.99	1.01	0.00	7.00
Education SLC	Members of Family	0.13	0.40	0.00	4.00
Education Intermediate	Members of Family	0.04	0.22	0.00	2.00
Education Bachelors and above	Members of Family	0.02	0.16	0.00	2.00
Age less than 10 year	Members of Family	1.48	1.40	0.00	14.00
Age 10 to 18 year	Members of Family	1.01	1.07	0.00	9.00
Age 18 to 60 year	Members of Family	2.59	1.44	0.00	12.00
Age more than 60 year	Members of Family	0.35	0.61	0.00	6.00
Distance to Road	KM	7.50	14.77	0.00	11.00
Distance to Primary School	KM	0.33	0.52	0.00	20.00
Distance to Health Post	KM	0.91	0.79	0.00	12.00

Source: NLSS (2003).
HH = household, NRs= Nepalese Rupee, Km=Kilometre,

[4] 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).

Results and Interpretations

Table 2 presents the parameter estimates for the marginal value of consumption. As the dependent variable is in natural log form, the estimated regression coefficients measure the relative (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.

Table 2 OLS and GAM estimation of the consumption equation

	OLS Estimation				GAM Estimation			
Coefficients:	*Est.*	*St.Err*	*t-*	*P*	*Est.*	*St.Err*	*t-*	*P*
Intercept	10.453	0.054	194.014	<0.001	10.4	0.052	201.55	<0.001
Age	0.001	0.001	1.097	0.273	0.001	0.001	0.958	0.338
HH Size	0.104	0.01	10.06	<0.001	0.104	0.01	10.095	<0.001
HH Head Education	0.037	0.003	11.177	<0.001	0.036	0.003	11.097	<0.001
Less than 10 yrs Education	0.042	0.012	3.483	0.001	0.044	0.012	3.64	0.001
SLC	0.139	0.028	4.971	0	0.134	0.028	4.8	<0.001
Intermediate	0.331	0.048	6.876	0	0.32	0.048	6.66	<0.001
Bachelors and above	0.314	0.067	4.719	0	0.312	0.067	4.696	<0.001
Age less than 10 year	-0.109	0.013	-8.546	<0.001	-0.109	0.013	-8.541	<0.001
Age 10 to 18 year	0.001	0.014	0.102	0.919	-0.002	0.014	-0.113	0.91
Age 18 to 60 year	0.036	0.011	3.127	0.002	0.033	0.011	2.893	0.004
Age more than 60 year	0.013	0.02	0.633	0.527	0.011	0.02	0.548	0.584
Distance to Road	-0.001	0.001	-0.862	0.389	-0.001	0.001	-0.983	0.326
Distance to Primary School	-0.058	0.02	-2.948	0.003	-0.06	0.019	-3.085	0.002
Distance to Health Post	-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				0.44			

Source: NLSS (2003)

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.

Table 3 OLS and GAM estimation of the income equation

	OLS Estimation				GAM Estimation			
Coefficients:	*Est.*	*St.Err*	*t-*	*P*	*Est.*	*St.Err*	*t-*	*P*
Intercept	10.29	0.07	146.5	<0.001	10.22	0.067	152.3	<0.001
Age	0.002	0.001	1.902	0.057	0.002	0.001	1.76	0.079
HH Size	0.086	0.013	6.399	<0.001	0.085	0.013	6.375	<0.001
HH Head Education	0.045	0.004	10.43	<0.001	0.044	0.004	10.286	<0.001
Less than 10 yrs Education	0.049	0.016	3.067	0.002	0.049	0.016	3.12	0.002
SLC	0.144	0.036	3.947	<0.001	0.137	0.036	3.757	0
Intermediate	0.375	0.063	5.983	<0.001	0.364	0.063	5.823	<0.001
Bachelors and above	0.437	0.087	5.038	<0.001	0.434	0.087	5.017	<0.001
Age less than 10 year	-0.101	0.017	-6.034	<0.001	-0.1	0.017	-6.035	<0.001
Age 10 to 18 year	0.015	0.018	0.862	0.389	0.012	0.018	0.654	0.513
Age 18 to 60 year	0.067	0.015	4.469	<0.001	0.064	0.015	4.294	<0.001
Age more than 60 year	0.036	0.027	1.364	0.173	0.033	0.027	1.234	0.217
Distance to Road	-0.001	0.001	-1.127	0.26	-0.001	0.001	-1.195	0.232
Distance to Primary School	-0.071	0.025	-2.809	0.005	-0.074	0.025	-2.926	0.004
Distance to Health Post	-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	0.03	-2.99	0.003	-0.097	0.03	-3.254	0.001
Log Land	0.115	0.012	9.516	<0.001				
R2	0.370				0.373			

Source: NLSS (2003).

In terms of the empirical results, it is seen that 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. This is as expected because educational disparity is 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 Intermediate (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 with these education levels make, as compared to households in which no household member has attained such educational levels.

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%) for the OLS (GAM). The key difference seems to be between those who then go on and get the Intermediate as well. Here the increase is an expected 19% for consumption or 23% for income from both OLS and GAM. The more adults, and the more educated the adults, the less likely that a household will be poor.

Distance to the road, primary school, and health-post or hospital was included as measurements of infrastructure. The supposition is that as the distance increases, the costs to the household rise and consumption levels decrease. 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 would 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 result that consumption as well as income is higher in the mountain region than those in the Terai is also not expected but the result is not statistically significant. These results support the conclusion that a mere increase in land holding without complementary income sources does not guarantee poverty alleviation.

As Tables 2 and 3 show, the OLS coefficients for log land for income and consumption are 0.115 and 0.09 respectively. We can estimate the change in income and consumption in case of an increase in land by 50% (*i.e.*, s takes the value 1.5). The results show that the change in income and consumption from a 50% increase in land are 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 GAM results of change in consumption and income due to a 50% increase in the land for small, medium and large farm households. This shows that whilst income may rise as land is increased, consumption tends to go up more slowly. The results imply that a household's ability to generate a sufficient economic livelihood also depends on the environment. The general expectation is that due to credit constraints and other unfavourable conditions, households with small land holdings may have a lower marginal value of land with respect to consumption and income. Larger farms have better access to credit, so that an increase in landholding will increase the use of variable inputs and reduce the distortion in the input markets (Eswaran & Kotwal, 1986). As land endowments increase, access to credit improves and the household can allocate labour more efficiently. Hence, the marginal value of land increases.

Table 4 GAM estimation of marginal value of land for income and 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

The resulting estimate of the consumption value of land, *g(X)*, is plotted in Figure 1, where consumption appears as an increasing function of land. This indicates that the relationship between consumption and land is not linear and suggests that a linear specification would be a poor approximation. The thin line shows the GAM, which is not constrained to be linear. The thick 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 Figure 2 and gives a similar shape.

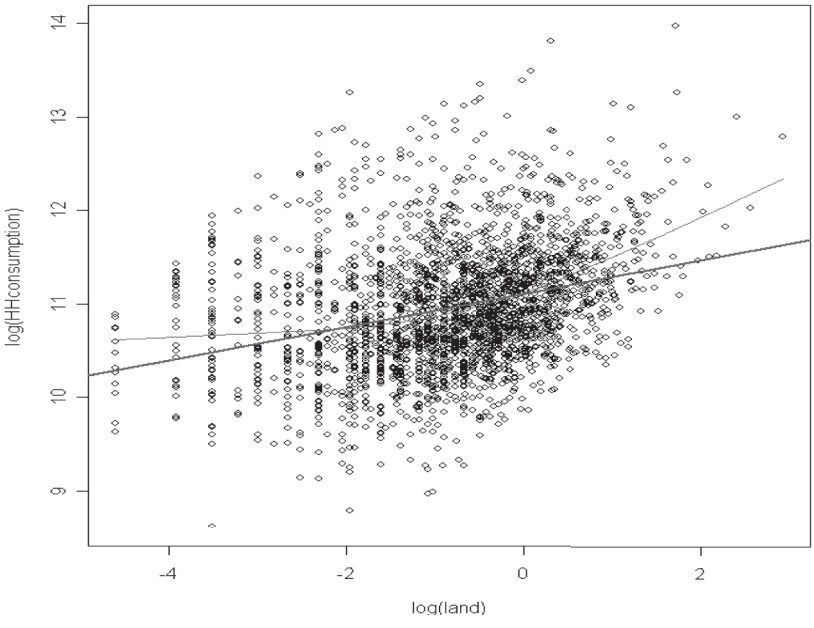

Figure 1 OLS and GAM trends for consumption

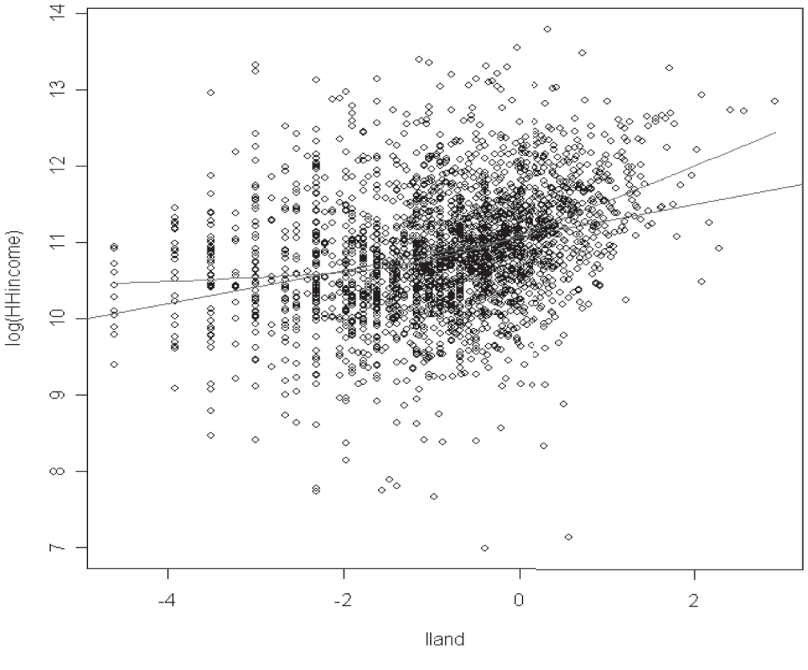

Figure 2 OLS and GAM trends for income

The shape of in Figure 1, as well as 2, will reflect our theoretical prediction of the impact of a credit market constraint on return to land. This may capture our understanding that for small farmers, additional land produces a return that is lower than the simple production value of the extra plot of land. 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 a 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 have a lower return to land. Thus, 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 (such as roads, hospitals, and schools) needed for people to make effective use of land. This suggests that land access programmes be packaged as elements of a more comprehensive programme in order to secure the poverty reduction potential of land.

However, the fact is that only a limited amount of land can be allocated even if a judicious ceiling on land is imposed (CBS, 2004a). This limits the possibilities of economic development and poverty alleviation by greater access to farmland for the poor under the provision of any land reform. If the poverty reduction agenda is to operate properly, one option is that some people who are under the land ownership ceiling but cannot use their land efficiently will have to leave their land 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 (Adhikari, 2009). 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 land reform 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 similar results in eight Latin American countries. 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 had difficulty in establishing a link does not mean the link does not exist.

Our results imply the importance of careful consideration of the link between land access and poverty. We employed cluster analysis to consider how many subgroups are within our data set using explanatory variables in our models. Table 5 shows that there are three groups that explain most of the variation in our data set[5] . These include one younger well educated group with the smallest amount of land 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 far from local amenities. The analysis shows that land policies 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. So it seems wisest to formulate policies targeting separate groups rather than a 'one size fits all' policy.

Table 5 Average and Groupwise Mean Value of Cluster Analysis

Variable	Average	Group A (n=1325)	Group B (n=1146)	Group C (n=114)
Land	0.44	0.38	0.51	0.44
HH Size	5.27	5.34	5.69	4.78
HH Head Age	44.92	35.78	58.59	40.4
HH Head Education	2.4	3.99	1.5	1.7
Education less than 10 years	0.89	0.98	1.05	0.65
SLC	0.1	0.12	0.14	0.04
Intermediate	0.03	0.04	0.05	0.02
BA and more	0.01	0.02	0.02	0
HH Members less than 10 years	1.44	1.66	1.29	1.38
HH Members 10-18 years	0.88	1.02	1.03	0.58
HH Members 18-60 years	2.6	2.4	2.81	2.59
HH Members more than 60 years	0.32	0.19	0.54	0.23
Distance to Road	24.07	4.44	5.6	62.16
Distance to Primary School	0.36	0.32	0.34	0.42
Distance to Health Post	1.28	0.84	0.87	2.13

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

Table 5 (Continued)

Variable	Average	Group A (n=1325)	Group B (n=1146)	Group C (n=114)
Mountain	9.73	2.38	2.39	24.41
Terai	0.07	0.12	0.09	0.01

Conclusions

This study investigates the impact of land on poverty in Nepal where land is the main source of income and consumption. The results demonstrate that greater access to land increases income and consumption and thereby reduces poverty. The significant marginal value of land for both consumption and income implies that an effective access to land policy could well be the most effective approach to alleviate rural poverty. However, land access programmes must come as part of a larger overhaul of policy that includes targeting the appropriate subgroups within the community and applying appropriate strategies to each one. 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. 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 such as location 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. Because of credit constraints and other unfavourable conditions, households with small land holdings have a lower 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. This underlines the importance of not

considering access to land as an exclusive measure to alleviate poverty.

Cluster analysis indicates 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. 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 such as industry and services.

Access to land for the poor is an effective approach to tackle poverty, but needs to be part of a larger, carefully constructed reform procedure. Whilst the analysis pertains to Nepal, the results may apply to other developing countries with similar issues and conditions.

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