The Journal of Animal & Plant Sciences, 25(6): 2015, Page: 1713-1721
ISSN: 1018-7081

MARKET PARTICIPATION BY SUBSISTENCE FARMERS: EVIDENCE FROM THE HIMALAYAS

D. B. Rahut[1], A. Ali[2], I. V. Castellanos[3] and Pravakar Sahoo[4]

[1]Socioeconomics Program, CIMMYT, Mexico, [2]CIMMYT, Islamabad, Pakistan. [3]Bolivia Country Programme Coordinator, Konrad Adenauer Stiftung (KAS), [4]Institute of Economic Growth, New Delhi, India
Corresponding Author-Email: AKHTER.ALI@cgiar.org

ABSTRACT

The importance of market participation for poverty reduction and the wellbeing of the subsistence farmers is proven beyond doubt. Increased market integration and commercialisation of traditional agriculture in the Himalayas is part of a development strategy towards growth and poverty reduction for more than 97% of households who are dependent on agricultural and allied activities for livelihood. This paper examines the roles of physical capital, human capital and the transaction cost in market participation in food crops, cash crops and livestock separately. The results show that the land size, gender of the household head, livestock assets, ethnicity, education, distances to market and location are important determinants of commercialisation. To estimate the impact of market participation on household income and poverty level, this paper uses propensity score matching approach. The results show a positive and significant relationship between the market participation and the household income, and a negative and significant relation between market participation and poverty levels, indicating that market participation can increase the well-being of rural subsistence farmers by increasing income levels and reducing poverty levels considerably.

Keywords: Market participation, small farmers, agricultural production, India, Himalaya

JEL: Q1, I30, R00, O1, D6.

INTRODUCTION

Three out of every four poor people in lower-income countries live in rural areas, and most of them depend directly or indirectly on agriculture for their livelihoods; the eastern Himalayas are no exception. The Himalayas are ecologically fragile and economically underdeveloped with severe limitations on resource productivity. Subsistence agriculture is the main source of livelihood—more than 97% of households participate in agricultural and allied activities (Micevska and Rahut, 2008). Rapid population growth has led to extensive land use changes, mainly through the extension of agricultural land and widespread deforestation. As the World Development Report, 2008 suggests, improving productivity of agriculture and shifting people from agriculture is essential to alleviate extreme poverty and hunger and to achieve the Millennium Development Goals (MDGs). Therefore, creating opportunities in the non-farm sector and improving productivity and value addition in agriculture through market participation is an important measure for poverty reduction. The importance of market participation for improving the wellbeing of subsistence farmers arises from the fact that it provides farmers with a cash income to use to purchase inputs and other goods; thereby enabling them to specialise in the production of useful goods. Promoting market participation by subsistence farmers is crucial for agricultural transformation in developing countries (von Braun and Kennedy, 1994).

Market participation allows increased participation of individuals and poor households in the domestic and international exchange economy, resulting in higher average farm incomes and lower income inequality. The farming sector has a dual structure: subsistence farmers who produce for their own consumption and farmers who sell at least a part of their output in the market. However, most farmers in the eastern Himalayas produce for self-consumption and do not enjoy the benefits of the market economy. Farming in the Himalayas is characterised by small fragmented landholdings, fragile landscape, traditional technology and limited access to the market. There are debates about the future viability of small farms (Hazell *et al.*, 2007) and Himalayan farm households. Despite several hurdles, farmers have managed to participate in markets by delivering fruits, vegetables and livestock products to urban areas as well as the Indian plains.

This paper focuses on the issue of household asset endowments, agricultural diversity and commercialisation. We analyse the determinants of rural households' participation in the market in the eastern Himalayan region of India. The objective is to explore factors determining a Himalayan household's decision to participate in the output market. This paper is based on a comprehensive primary survey. It differs from other studies for the following reasons. First, the study is

conducted in the Himalayan region of eastern India, which has not been studied before and second, it categorises output into agriculture, cash crop, food crops, other crops and livestock. Most importantly, the study estimates the impact of market participation on household income and poverty levels. Although there have been different definitions of commercialisation, we follow von Braun *et al*., 1995 and calculate it as a percentage of the total produce sold from a household or as a percentage of cash crops as compared to all crops cultivated by a household. Thus, this paper also defines the agricultural commercialisation as the degree of participation in the (output) market.

Output market participation by subsistence farmers in the Himalayas: There are differences in access to market and in transaction costs in the Himalayas since households are scattered across the mountains and access to infrastructure differs across households. In addition, the majority of farmers in the Himalayas are subsistent farmers. The rugged terrain, poor and fragile infrastructure, asymmetric information and lack of economy of scale result in high transaction costs. However, farmers with large land assets and higher human capital face lower transaction costs and have easy access to the markets. Farmers produce cash crops like cardamom, oranges, ginger, etc. in large quantities, which reduces the transaction cost, so traders buy from farms and transport the produce to the 'fruits *mandi*" in Siliguri (the major town in West Bengal). For food crops, vegetables and livestock products, farmers usually sell by the roadside or at Sunday markets.

I. Household Asset Endowments, Commercialisation and Agricultural Diversification:

Improving income and food security in the Himalayas requires the governments to articulate policies that encourage and support subsistence farmers to produce over and above their own needs and use the land and labour for high-value crops that can be easily sold in markets. Ellis (2000) provides a theoretical discussion of the motivations for diversification in developing regions where necessity and choice are together responsible for diversification. Rural households may diversify out of necessity and due to vulnerability to unforeseeable crises such as floods, droughts, illness or market price swings to ensure family survival and reproduction. In addition, rural households may diversify on their own initiative and invest in additional enterprises, especially for market-oriented products, to spread risks while generating returns for the sake of some household goals, such as educating children. Some of the recent studies emphasise that farm enlargement is the most important factor to achieve greater commercialisation and diversification (Lerman, 2004; 2005) while study by Mathijs and Noev (2004) found that land is important along with the ownership of machinery, transaction costs and livestock[i].

Kostov and Lingard (2004) claimed that subsistence agriculture could be an advantage under certain conditions in the presence of risk. Further, von Braun and Kennedy (1994) suggest that the subsistence production for home consumption is the best option for small farmers given all constraints. The poor generally lack land, capital and education to respond quickly to technological innovation and agricultural market opportunities (Jayne *et al*., 2003).

The study of commercialisation in this paper starts with whether or not a farm or household sells any of its farm output, and goes a step further to consider the degree of commercialisation as measured by the value of crops sold in relation to the value of crops produced. In this study, we follow Leavy *et al*. (2007) and define the household crop commercialisation index (CCI) as:

$$CCI = \left[\frac{Gross\ value\ of\ all\ crop\ sales_{hh,i,year\,j}}{Gross\ value\ of\ crop\ production_{hh,i,year\,j}}\right] X\ 100$$

This index measures the extent to which household crop production is oriented toward the market. A value of zero would signify a totally subsistence-oriented household and a value closer to 100 implies a higher degree of commercialisation. An important advantage of this approach is that commercialisation is treated as a continuum, thereby avoiding crude distinctions between 'commercialised' and 'non-commercialised' households.[ii]

Following Cragg (1971), Heckman (1979) and Goetz (1992), we go a step further and test whether commercialisation is actually a two-stage decision problem. In the first stage, we estimate whether the households sell any surplus of their agricultural production or not. The equation of the first stage is estimated using a probit analysis. In the second stage, the estimation is made for the quantity of produce sold in the market.

Given the self-sufficiency in food production and stability in distribution of food through the Food Corporation of India, small farmers could concentrate on high-value cash crops. The main purpose of the current paper is to study the subsistence farmers' access to the markets and its impact on the household income and poverty levels. The paper is organized as follows: in Section II, an empirical model is presented; in Section III, data and the description of variables is presented; Section IV presents the empirical results and the paper concludes with some policy recommendations in Section V.

Data and Variables: The study involves careful review and analysis of data and information from both primary and secondary sources.

Household Data: The unit of observation is the rural household, and detailed information was obtained for all household members. Therefore, primary data was collected at the household level based on a structured questionnaire. The primary data source and the data for

the econometric analysis have been drawn from a survey conducted in the second half of 2004. The survey was based in the Himalayan region of India, in the states of Sikkim and West Bengal[iii]. The region is largely agrarian, and agriculture is based on traditional farming methods and terraced slopes. The region does not have large-scale industry because of the hilly terrain and lack of reliable transport infrastructure.

Sample Design: As a first step, the region was divided into two main blocks: rural Darjeeling Gorkha Hill Council in the state of West Bengal[iv] and rural Sikkim. Gram Panchayats were randomly selected in each block.[v] The selected Gram Panchayats were further divided into four to six villages and five to eight households were randomly selected from each village. This sampling procedure yielded a sample of 520 households. The survey provided information on farm and non-farm activities, income sources, income levels, demographic characteristics, employment status, asset holdings and other attributes of the households and household members. A one-year recall period was used and no effort was made to capture seasonality in income patterns.[vi]

The Indian National Sample Survey Organisation (NSS) has been carrying out all-India household surveys in quinquennial rounds. However, the NSS surveys capture only participation in various activities and do not contain quantitative data on household incomes. These surveys are, therefore, not apt for gauging the extent of dependence of the population on particular sources of income. Our survey focused on collecting reliable data on both participation in non-farm activities and the level of income derived from these activities. This allows us to explore the commercialisation of agriculture, cash crops, food crops and livestock as well as to provide a detailed and comprehensive picture of the determinants of commercialisation of rural households in the Himalayas.

Concepts, measures and methods: We begin by constructing the household commercialisation index to measure the effects of crop commercialisation. We add the implicit income from subsistence production imputed at local prices to the value of crops and animal products produced and marketed in the last year. Land holdings play a vital role in determining commercialisation in the Himalayas where over 90% of the population derives its livelihood from agriculture and related activities. As land endowment is an important input for production, we use the household's land assets as the determinants of commercialisation. The number of men and women of prime working age (15–65 years) captures the supply of labour by household. We include adult males and adult females separately because they may have different comparative advantages. Life-cycle effects are captured by age and age squared of the household head.

In the primarily-rural Himalayan region, higher education implies a better awareness of the potential of new agricultural practices toward commercialisation as well as of the possibilities of better and different employment opportunities. Here, we measure the level of education within the household in different ways. In the light of differences in education levels by gender and the diversification of farm tasks by gender, it is important to consider specifications of education that allow for different effects of gender. We use the years of education of the household head, the average education of adult males and females and the highest level of schooling completed by adult males and females[vii]. In addition, to account for the nonlinearity of educational effects, we divide the households into several categories according to the highest level of education attained by adult members: uneducated, less than primary education (less than 5 years of education), completed primary (between 5 and 9 years), matriculation (between 10 and 11 years), completed high school (between 12 and 14 years), and tertiary education (15 or more years of education).

In the Himalayan context, ethnicity has a strong influence on community status relations and may play an important role in determining commercialisation. Since the majority of the households are of Nepali origin and speak Nepali, we control for social status instead.[viii] We divide the households into three groups. The first group consists of households that belong to Scheduled Tribes and Scheduled Castes. These households have preferential treatment in public employment and reserved seats in provincial and central legislatures.[ix] The second group consists of households that belong to other backward classes and have certain preferential treatment in public employment, but to a lesser degree compared to the first group. The rest of the households are classified as a general category.[x]

In our empirical analysis, we control for location characteristics. Ease of access to market is measured by the time required to reach the nearest market. Given the hilly terrain, travel time is a more exact measure than mileage. Inter-regional disparities are captured by classifying the households into two categories according to the regional location: Sikkim and West Bengal. While both regions are largely agrarian, Sikkim has a more dynamic and diverse economy.[xi] A dummy variable for residence in Sikkim accounts for differences in the agricultural potential, institutional arrangements, infrastructure, prices and other unobserved region-specific characteristics.

The total amount of agricultural sales and the value of sold output is calculated by summing the sales value of all the agricultural products.

Descriptive Statistics: It is rare for any rural household in the Himalayan region to receive all its income from a single source. Farm households rely on a variety of

income sources apart from their ownership of a business. Understanding the components of income is important for monitoring the sensitivity of farm household income to economic events and for evaluating the effectiveness of farm policy in supporting income. Farm household income is derived from a variety of sources that ranges from physical assets of both the business and household to various types of assets. In both these Himalayan states, 98% of the households participate in farming and derive more than 30% of their income from it, while 73% of the households take part in non-farm livelihood activities, which contribute to about 57% of their total income (see Table 1).

Table 1. Composition of household income by sector and activity.

	Income (annual)		Share in total income (percent)	Number of households (percent)
	Mean (Rs)	Median (Rs)		
Total farm income	**13,562**	**9,312**	**30.18**	**97.69**
Farm self-employment	11,363	7,204	25.24	97.50
Agricultural wages	6,758	5,040	4.94	32.12
Total non-farm income	**34,482**	**20,160**	**57.55**	**73.27**
Non-agricultural wages	35,939	23,640	47.23	57.69
Skilled labour	57,682	42,000	37.40	28.46
Unskilled labour	13,051	9,150	9.83	33.08
Self-employment	18,123	6,624	10.32	25.19
Small enterprise	28,279	10,390	8.67	13.46
Micro enterprise	5,378	3,240	1.65	13.65
Other income	**12,074**	**1,420**	**12.27**	**44.62**
Remittances	19,378	18,000	5.69	12.88
Pensions	28,332	27,600	6.21	9.62
Other	586	245	0.38	28.27

Source: Adapted from Rahut and Scharf 2012, *Australian Journal of Agriculture and Resource Economics*.
Notes: The mean and median are calculated across households receiving income from the corresponding source. Micro-enterprises involve little or no investment. Enterprises requiring investment of at least Rs 5,000 were classified as small (see Micevska and Rahut, 2008).

Although the share of agriculture in the total income is low, a large section of society is dependent on farming; therefore, agriculture is important for the livelihood of the poor. This calls for poverty reduction policies in the region to focus on commercialisation of small farm holders. Households with adequate land may earn an acceptable income in areas where farming is remunerative, but non-farm activities become an increasingly attractive target where farming cannot fully support household needs. In many studies, diversification (into non-farm activity) is a positive strategy.

Empirical Analysis

V.1 **Market Participation:** We use a probit model to estimate market participation (Table 2) where the dependent variable is whether the household sells any of their agricultural and allied products. In this estimation, we cluster the villages to control for the village effect. The decision to sell agricultural products depends on livestock assets, land per adult, ethnicity and location variables.

Livestock assets represent two important things: (1) they can generate income through the sales of livestock products; and (2) they provide inputs for farms like manure, draught animals, etc. Therefore, households that have more livestock assets can generate income from the sale of animal products and increase productivity from the use of manure and can use them as draught animals (for ploughing and carrying loads). The households belonging to general categories are less likely to sell cash crops, but more likely to sell livestock products because they usually raise cows for milk, cheese and butter production besides raising goats and poultry while Scheduled Castes and Tribes and Other Backward Classes grow oranges and cardamoms. It is not surprising that the education of the household head is significant and positive in the case of cash crops as households with educated heads have access to information on credit, market and government support and extension services, and are able to learn and adopt new technologies. Households can concentrate on producing cash crops, which has a comparative advantage over food crops and depends on food from the market.

Table 2. Probit estimation for market participation (marginal effects).

	Agriculture	Cash Crop	Food Crop	Others Crop	Livestock
Household characteristics and assets					
Age of household head	0.014	0.013	0.002	0.003	0.01
	(0.010)	(0.011)	(0.010)	(0.006)	(0.010)
Age of household head squared	-0.000*	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household head is male[a]	0.031	0.066	-0.007	0.03	0.057
	(0.086)	(0.093)	(0.084)	(0.041)	(0.092)
Number of children <=15 yrs	0.010	-0.006	-0.017	-0.003	-0.003
	(0.018)	(0.020)	(0.018)	(0.010)	(0.018)
Number of working-age men	0.028	0.036	-0.001	0.021	-0.008
	(0.026)	(0.030)	(0.028)	(0.015)	(0.028)
Number of working-age women	-0.014	-0.042	-0.001	-0.016	-0.018
	(0.028)	(0.031)	(0.027)	(0.015)	(0.029)
Engaged in non-farm activities	-0.076	-0.023	-0.048	-0.004	-0.016
	(0.053)	(0.062)	(0.055)	(0.030)	(0.060)
Assets					
Livestock Assets	0.123***	0.114***	0.090***	0.030**	0.194***
	(0.033)	(0.035)	(0.029)	(0.015)	(0.053)
No. of years of education of head	0.002	0.012*	0.002	0.001	-0.005
	(0.006)	(0.007)	(0.007)	(0.004)	(0.007)
Land assets per adult	0.121**	0.070*	-0.009	0.005	-0.008
	(0.053)	(0.050)	(0.018)	(0.008)	(0.017)
Social Categories					
General category	-0.075	-0.161**	-0.071	-0.035	0.185***
	(0.064)	(0.068)	(0.063)	(0.033)	(0.069)
Scheduled caste or tribe	-0.003	-0.032	0.02	-0.021	0.045
	(0.065)	(0.070)	(0.066)	(0.033)	(0.066)
Location characteristics					
Distance to market	0.000	0.000	0.000	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Residence in Sikkim[a,c]	-0.294**	-0.523***	-0.122	-0.222***	-0.266***
	(0.148)	(0.173)	(0.152)	(0.071)	(0.102)
Log-likelihood	-249.1	-257.7	-282.3	-166.5	-246.1
Pseudo *R*-squared	0.252	0.241	0.161	0.094	0.296
Wald chi-squared	146.3	133.2	94.9	53.0	147.2
Prob > chi-squared	0.000	0.000	0.000	0.015	0.000

Source: Author's calculations

Notes: The number of observations in each regression is 520. All regressions include a constant. Village fixed effects included using dummy but not shown. Robust standard errors adjusted in parentheses. [a] dummy variables; [b] excluded category: other backward classes; [c] excluded category: residence in Darjeeling. ***p < 0.001, **p<0.05, *p<0.1 indicate significance at the 1%, 5%, and 10% level.

The probit estimation confirms the findings of other studies that land assets are a critical determinant of a household's position to participate in the market. Larger landholdings not only provide an instrument for mortgage and credit but also enable a household to gain from the economy of scale, the lower transaction cost for traders due to the scale of production. The result shows that household demographic characteristics or distance to market is not a significant determinant of a farm household's participation in the market.

The results of participation in market using probit estimation can be misleading, as they do not distinguish between households who sell a small part of their farm produce and those who sell a large part. Therefore, we estimate the degree or the intensity of commercialisation using Tobit estimation (Table 3).

Table 3. Tobit estimations of the intensity of market participation (degree of participation): Marginal effects.

	Agri. Sales	Cash Crop Sales	Food Crop Sales	Others Sales	Livestock Sales
Household characteristics and assets					
Age of household head	0.002	0.022	-0.001	0.016	0.013
	(0.009)	(0.016)	(0.008)	(0.026)	(0.012)
Age of household head squared	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household head is male[a]	0.032	0.156	0.011	0.116	0.041
	(0.074)	(0.147)	(0.061)	(0.235)	(0.111)
No. of children <=15	-0.013	-0.005	-0.011	-0.041	-0.005
	(0.015)	(0.028)	(0.013)	(0.046)	(0.021)
Number of working-age men	0.026	0.035	0.013	0.115*	-0.011
	(0.022)	(0.043)	(0.022)	(0.066)	(0.031)
Number of working-age women	-0.024	-0.055	-0.003	-0.068	-0.019
	(0.023)	(0.044)	(0.021)	(0.070)	(0.034)
Engaged in non-farm	-0.023	-0.055	-0.006	-0.049	-0.042
	(0.045)	(0.089)	(0.041)	(0.136)	(0.062)
Livestock Assets	0.083***	0.171***	0.062***	0.131**	0.207***
	(0.024)	(0.040)	(0.022)	(0.064)	(0.043)
No. of years of education household head	0.004	0.018*	-0.002	0.006	-0.004
Land assets per adult	(0.005)	(0.010)	(0.005)	(0.017)	(0.008)
	0.043**	0.037*	0.013	0.003	-0.022
General category[a,b]	(0.020)	(0.025)	(0.021)	(0.032)	(0.017)
	-0.059	-0.274***	-0.101*	-0.191	0.192***
Scheduled caste or tribe[a,b]	(0.053)	(0.104)	(0.051)	(0.163)	(0.074)
	0.025	0.001	-0.012	-0.169	0.060
Location characteristics					
Distance to market	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Residence in Sikkim[a,c]	-0.325**	-0.778**	-0.311***	-0.717**	-0.574**
	(0.153)	(0.381)	(0.119)	(0.358)	(0.235)
Log-likelihood	-289.6	-433.1	-207.9	-184.8	-299.4
Pseudo *R*-squared	0.268	0.185	0.278	0.084	0.260
Prob > chi-squared	0.000	0.000	0.000	0.0054	0.000
Wald chi-squared	8.35	7.59	4.54	1.8	7.69

Source: Author's calculations

Notes: The number of observations in each regression is 520. All regressions include a constant. Village fixed effects included using dummy but not shown. Robust standard errors adjusted in parentheses. [a] dummy variables; [b] excluded category: other backward classes; [c] excluded category: residence in Darjeeling. ***p < 0.001, **p<0.05, *p<0.1 indicate significance at the 1%, 5%, and 10% level.

The dependent variable is the share of sale to the total production. The explanatory variables are the same as the ones used in the probit estimation. The Tobit estimation using the share of sales to production supports the earlier findings on the role of land per adult, livestock and the social categories of the household as major determinants of market participation.

The degree of market participation increases with livestock assets because livestock provides manure and draught animals for farming and hence increases farm productivity. The education of the household head is significant in the case of cash crops because educated households are more aware of the commercial value of such crops and grow these crops that fetch more cash income. This study, like other studies, finds that assets are also an important determinant of the intensity of commercialisation and that the land variable is particularly important for cash cropping, which requires more land. General-category households cannot participate in cash and food crop markets as much as Other Backward Classes but they participate more in livestock product markets. The degree of commercialisation is much lower for Sikkimese households than for households in Darjeeling because Sikkimese households have more opportunities to participate in non-farm activities, particularly high-return

non-farm activities, so there are no incentives to participate in the output farm market (Micevska and Rahut, 2008; Rahut and Micevska, 2012). In addition, access to market is better in Darjeeling Gorkha Hill Council.

Impact of Market Participation on Household Income and Poverty Levels using Propensity Score Matching: The impact of market participation on household income and poverty levels is analysed using Propensity Score Matching (Rosenbaum and Rubin, 1983).

The impact of subsistence farmers' market participation was estimated on household income and poverty levels (Table 4). Four different matching algorithms were employed: nearest neighbour matching (NNM), kernel-based matching (KBM), radius matching (RM) and mahalanobis metric matching (MMM. The impact was estimated on household income and poverty levels. The average treatment affect for the treated (i.e. difference in outcomes of the participants and non-participants) indicates that, for all four matching algorithms for income, the ATT results are positive and significant indicating that farmers participating in the market have higher income levels in the range of INR2,000-2,700. Similarly, the results for poverty are negative and significant in all four matching algorithms, indicating that market participation can tend to reduce household poverty levels in the range of 4%-13%. The matching results are in line with previous studies such as Ali and Abdulai (2010) and Ali and Sharif (2011) and Ali *et al*. (2014).

Table 4. ATT estimates regarding household income and poverty levels (propensity score matching estimates).

Matching Algorithm	Outcome	ATT	t-values	Critical level of hidden bias	Number of treated	Number of control
NNM	Income	2371**	2.06	1.20-1.25	280	171
	Poverty	-0.07**	-2.18	1.35-1.40	276	201
KBM	Income	2608***	3.40	1.25-1.30	255	191
	Poverty	-0.13***	-2.96	1.55-1.60	276	214
RM	Income	2095*	1.73	1.10-1.15	234	169
	Poverty	-0.04**	-2.01	1.20-1.25	267	196
MMM	Income	2245***	2.59	1.45-1.50	258	189
	Poverty	-0.08**	-2.17	1.65-1.70	263	204

Note: ATT = average treatment affect for the treated. Four different matching algorithms have been used: NNM = nearest neighbour matching; KBM = kernel-based matching; RM = radius matching and MMM = mahalanobis metric matching. The results are significant at *** 1, ** 5 and * 10 percent levels respectively.

The main purpose of the propensity score matching is to balance the covariates before and after matching; hence, a number of balancing tests are employed like median absolute bias before and after matching (Table 5). The median absolute bias is quite high before matching and is in the rage of 63%-75 %. Another balancing test is the value of R-square before and after matching. The value is quite high before matching and the value is quite low after, indicating that after matching there are not many systematic differences between the participants and non-participants. Similarly, another balancing test is the joint significance of the covariates before and after matching. The joint significance should always be accepted before matching and should always be rejected after matching, indicating that after matching there are not many differences between the participants and non-participants. The results regarding balancing of the covariates are in line with previous studies such as Ali and Sharif (2012) and Ali and Erenstein (2013).

I. Concluding Remarks: In this paper, we have used livelihood survey data from the Eastern Himalayan region of India to investigate the determinants of commercialisation of agriculture by small holders. We wanted to identify factors that help small farm households in the lower Himalayas to participate in the market and escape poverty. This study may help in formulating rural development policies in the hills of Darjeeling and Sikkim.

Result shows that male-headed households earn higher income from the sale of cash crops compared to female-headed households. Therefore, policies should aim at supporting female-headed households by providing inputs and knowledge about high-value crops that need less manpower, etc. The education of households plays a prominent role in commercialisation; thus, policies should aim at keeping children in school and provide for extension education focused on commercialization targeting female farmers. This would go a long way in connecting them to the market. Livestock assets are important determinants of

commercialisation, which calls for enhancing livestock assets of households as these assets provide manure for the farm and enable farmers to sell livestock products in the market. Land assets are an important determinant of commercialisation as more land means that the farmers are able to produce surplus, which can be sold in the market. Although land size cannot be increased, policies should improve the functioning of the land lease market, development of the land sales market and consolidation of fragmented farm structures. Policies should promote the development of non-farm activities, as this would help to transfer labour from farm to non-farm activities, thereby increasing the availability of land for farming.

Table 5. Indicators of covariates balancing before and after matching.

Matching Algorithms	Outcome	Median absolute bias before matching	Median absolute bias after matching	Percentage bias reduction	Value of R-square before matching	Value of R-square after matching	P-value of joint significance of covariates before matching	P-value of joint significance of covariates after matching
NNM	Income	21.50	6.40	70	22.34	0.05	0.005	0.325
	Poverty	18.67	5.32	72	19.61	0.03	0.001	0.467
KBM	Income	19.38	7.14	63	18.63	0.02	0.006	0.311
	Poverty	17.59	5.15	71	17.44	0.00	0.003	0.470
RM	Income	22.94	8.50	63	16.10	0.01	0.002	0.523
	Poverty	24.34	6.12	75	15.26	0.02	0.001	0.614
MMM	Income	20.47	6.43	69	14.38	0.03	0.005	0.510
	Poverty	18.39	7.16	61	12.55	0.000	0.004	0.362

Note: NNM = nearest neighbour matching; KBM = kernel-based matching; RM = radius matching; MMM = mahalanobis metric matching.

The study finds that the general categories of households are disadvantaged in participating in cash and food crop markets compared to Other Backward Classes and Scheduled Castes and Tribes because the latter has preference in government employment, and hence labour is shifted from farm to non-farm activities. Some of them migrate to other Indian cities for employment in government jobs. A small household size has positive effects on commercialisation as it means fewer family members to feed and hence there is more surplus available for sale. The general categories of household are able to participate more in the livestock market because households belonging to general categories are mostly farmers who rear cows and sell butter, milk and curd. Therefore, rural development policies should support general categories of households in enhancing their farm productivity and livestock production.

Location plays an important role in commercialisation. The analysis shows that the rural households located in Darjeeling are able to produce and sell more livestock products. This is because Himul, a milk processing company, operates there, supports the farmers and collects the milk from them. Further, if agriculture is to contribute to poverty reduction and growth in the region, the commercialisation of small holders should be given more importance in the national-, state-, district- and Panchayat-level planning and policies as subsistence farmers are disconnected from the markets and do not respond to them.

The encouraging policy findings from the current study are that subsistence farmers having access to markets have higher income levels and have lower poverty levels. Improving the market linkages can lead to an increase in household income and can considerably reduce rural poverty. Agricultural policy should aim at removing the entry barriers to agricultural markets that discourage sales by smallholders. Policy should aim to enhance education and asset endowments of the resource-poor farm household.

REFERENCES

Ali, A. and A. Abdulai (2010). The adoption of genetically modified cotton and poverty reduction in Pakistan. J. Agri. Econ. 61(1):175-192.

Ali, A., and M. Sharif (2012). Impact of farmer field schools on adoption of integrated pest management practices among cotton farmers in Pakistan. J. Asia Pacific Economy, 17(3): 498-513.

Ali, A., and M. Sharif (2011). Impact of integrated weed management on cotton producers ‘earnings in Pakistan. Asian Economic J. 25(4): 413-428.

Ali, A., and O. Erenstein (2013). Impact of zero tillage adoption on household welfare in Pakistan. J. Agri. Technology. 9(7), 1715-1729.

Ali, A., O. Erenstein and D.B. Rahut (2014). Gender contribution in production of high value crops: Empirical Evidence from Pakistan. J. Anim. Plant Sci., 24(3), 936-944.

Cragg, L.G. (1971). Some Statistical Model for Limited Dependent Variables with Application to the Demand for Durable Goods, Econometrics 39, pp. 829-844.

Ellis, F. (2000). Rural livelihoods and diversity in developing countries. Oxford University Press, Oxford, UK.

Goetz, S.J. (1992). A Selectivity Model of Household Food Marketing Behavior in Sub-Saharan Africa. American J. Agricultural Economics 74(2), pp. 444-452.

Hazell P., Poulton, C. Wiggins and S. A. Dorward, (2007). The Future of Small Farms for Poverty Reduction and Growth. IFPRI 2020 Discussion Paper 42, May 2007. Washington DC: International Food Policy Research Institute.

Heckman, J. (1979). Sample Selection Bias as a Specification Error. Econometrica 47(1), pp. 153-1961.

Kostov, P. and J. Lingard (2004). Subsistence Farming in Transitional Economies: Lessons from Bulgaria. J. Rural Studies 18, pp. 83-94.

J Leavy, C Poulton and C Poulton (2007). Commercialisations In Agriculture. Ethiopian J. Economics Vol. 16 (1) 2007: pp. 3-42

Lerman, Z. (2004). Institutions and Technologies for Subsistence Agriculture: How to Increase Commercialization. Paper presented at the IAMO-Seminar *Subsistence* Agriculture in Central and Eastern Europe: How to Break the Vicious Circle?', Halle (Saale), Germany, May 6-8, 2001.

Lerman, Z. (2005). Agriculture in Transition Economies: From Common Heritage to Divergence. Agricultural Economics 26(2), pp. 95-114.

Mathijs, E. and N. Noev (2004). Commercialization and Subsistence in Transition Agriculture: Empirical Evidence from Albania, Bulgaria, Hungary and Romania Contributed paper, 10th EAAE Congress: 'Exploring diversity in the European Agri-food System' Zaragoza, Spain, August 28-31, 2002.

Micevska, M. and D. Rahut (2008). Rural Non-Farm Employment and Income in Eastern Himalayas, Economic Development and Cultural Change, 57:163–193, October 2008.

Rahut B, Dil and Maja Micevska Scharf (2012), Livelihood diversification strategies in the Himalayas, Australian J. Agricultural and Resource Economics, 56(4), 558-582.

Rosenbaum, P. R. and D. B. Rubin (1983). The Central Role of Propensity Score in Observational Studies for Causal Effects. Biometrika, Vol. 70,pp. 41-50.

Smith, L. E. D., M. Stockbridge, , and H. R. Lohano (1999). Facilitating the provision of farm credit: The Role of interlocking transactions between traders and zamindars in crop marketing systems in Sindh. *World Development*, 27(2), 403-418.

Von Braun, J. and E. Kennedy, (eds). (1994). Commercialization of Agriculture, Economic Development and Nutrition, Baltimore, MD: John Hopkins Press.

Von Braun, J. (1995). Agricultural Commercialization: impacts on income, nutrition and implications for policy. Food Policy 20(3): 87–202.

World Bank (2008). World Development Report. Agriculture for Development. Washington DC.

Notes

[i] The interlocking of input supply, credit and crop marketing is a common feature of marketing in many developing countries in Asia (Smith *et al*. 1999).

[ii] The drawback of this approach is that it makes no meaningful distinction between a farmer who produces just a bag of maize and sells the entire bag and one who grows 50 bags and sells 30 of those.

[iii] The survey was carried out within a large-scale project designed to examine the livelihood of rural households. The project was financed by the GiZ, which was formally known as German Corporation for Technical Cooperation (GTZ).

[iv] We have taken into consideration only the highland areas of the Darjeeling Gorkha Hill Council. Villages involved in the production of Darjeeling tea were excluded from the analysis. A few politically unstable rural areas were also avoided.

[v] Gram Panchayats are local government bodies in India. In Sikkim, Gram Panchayats were selected from all four districts (North, South, East and West).

[vi] It should be mentioned that, as in most studies, recall errors are likely to have affected reported income.

[vii] Children's education is ignored because it is less likely to affect activity choices, but more likely to be influenced by them through income.

[viii] Other languages spoken in the region include Bhutia, Dzongkha, Groma, Gurung, Lepcha, Limbu, Magar, Majhi, Majhwar, Newari, Rai, Sherpa, Sunuwar, Tamang, Thulung, Tibetan and Yakha.

[ix] For a detailed description of the social system and caste-based preferential policies in India, see Gallanter (1984) and Osborne (2001).

[x] As noted by Borooah, Dubey and Iyer (2007), if one were to establish a hierarchy of communities in terms of the 'desirability' of the economic status, scheduled castes/scheduled tribes would lie at the bottom, the general category Hindus would be at the top, and the other backward classes would be in the middle.

[xi] Sikkim has had an impressive growth rate of 8.3 %, which is the second highest in the country after Delhi.