

# Commercialization of agriculture in the Himalayas

著者	Rahut Dil Bahadur, Velasquez Castellanos Ivan, Sahoo Pravakar
権利	Copyrights 日本貿易振興機構 (ジェトロ) アジア経済研究所 / Institute of Developing Economies, Japan External Trade Organization (IDE-JETRO) <a href="http://www.ide.go.jp">http://www.ide.go.jp</a>
journal or publication title	IDE Discussion Paper
volume	265
year	2010-12
URL	<a href="http://doi.org/10.20561/00037902">http://doi.org/10.20561/00037902</a>

IDE Discussion Papers are preliminary materials circulated to stimulate discussions and critical comments

**IDE DISCUSSION PAPER No. 265**

**COMMERCIALIZATION OF  
AGRICULTURE IN THE HIMALAYAS**

*Dil Bahadur Rahut\**  
*Iván Velásquez Castellanos\*\**  
*Pravakar Sahoo\*\*\**  
**December 2010**

**Abstract**

*Increased market integration and commercialization of traditional agriculture in the Himalayas is part of a development strategy towards growth and better standard of living. More than 97 percent households depend upon agricultural and allied activities for livelihood which constitutes 30 percent of the household income. Given the importance of commercialization of agriculture to improve the productivity, per capita income and thereby the standard of living in the Himalayas, we examine the factors affecting the commercialization of agriculture on the basis of primary survey data. The results reveal that the land size, gender of the household head, livestock assets, ethnicity, education and location are important determinants of commercialization. Although commercialization of agriculture is considered as stimulated private-sector activity, public policy is essential to facilitate driving forces viz., trade and market reforms, rural infrastructure, and the institutional framework for legal and contractual arrangements between farmers and processors.*

**Key Words:** Rural, Poverty, Agriculture, Market, Production, India, Himalaya

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

---

*\*Chief, Research, Planning and Monitoring Department, Bank of Bhutan, Bhutan. Email: dilbhutan@yahoo.com*

*\*\*Bolivia Country Programme Coordinator, Konrad Adenauer Stiftung (KAS). Email: velasquezivanomar@yahoo.com*

*\*\*\*Associate Professor, Institute of Economic Growth, New Delhi, India and Visiting Researcher, Institute of Developing Economies, Japan. Email: pravakarfirst@gmail.com*

The Institute of Developing Economies (IDE) is a semigovernmental, nonpartisan, nonprofit research institute, founded in 1958. The Institute merged with the Japan External Trade Organization (JETRO) on July 1, 1998. The Institute conducts basic and comprehensive studies on economic and related affairs in all developing countries and regions, including Asia, the Middle East, Africa, Latin America, Oceania, and Eastern Europe.

---

The views expressed in this publication are those of the author(s). Publication does not imply endorsement by the Institute of Developing Economies of any of the views expressed within.

---

**INSTITUTE OF DEVELOPING ECONOMIES (IDE), JETRO**  
**3-2-2, WAKABA, MIHAMA-KU, CHIBA-SHI**  
**CHIBA 261-8545, JAPAN**

©2010 by Institute of Developing Economies, JETRO

No part of this publication may be reproduced without the prior permission of the IDE-JETRO.

# COMMERCIALIZATION OF AGRICULTURE IN THE HIMALAYAS

## 1. 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 and eastern Himalaya is no exception. The Himalayas are ecologically fragile and economically underdeveloped with severe limitations on resource productivity. Subsistence agriculture is the main source of livelihood as more than 97 percent of the household participates in agricultural and allied activities for their livelihood (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 World Development Report, 2008, suggests improving productivity agriculture and shifting people from agriculture is essential for taking out people from extreme poverty and hunger and achieving Millennium Development Goals. Therefore, creating opportunities in non-farm sector and improving productivity and value addition in agriculture through commercialization is important.

Commercialization allows increased participation of individuals and poor households in the domestic and international exchange economy and results in higher average farm incomes and lower farm income inequality. The farming sector has a dual structure with subsistence farmers, who produce for their own consumption and farmers, who sell at least a part of their output in the market. However, a majority of the farmers in the Eastern Himalayas produce for self consumption and do not enjoy the benefits of the market economy. Farming in Himalayas is characterized 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 so are the farm households of the Himalayas. Despite several hurdles, the farmers have managed to participate in the markets by delivering fruits, vegetables and livestock products to the urban areas as well as the Indian plains.

This paper focuses on the issue of household asset endowments, agricultural diversity and commercialization. So, we analyze the determinants of participation in market by rural

households in the Eastern Himalayan region of India. The objective is to explore factors determining the Himalayan household's decision to participate in the output market. The paper is comprehensive based on the primary survey and differs from other literatures because firstly, the study is conducted in the Himalayan region of Eastern India, which is unexplored and secondly, it categorizes output into agriculture, cash crop, food crops, other crops and livestock. Though there has been different definitions of commercialization, we follow Von Braun *et al*, 1994 and calculate it as 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 commercialization as the degree of participation in the (output) market.

## **2. Household Asset Endowments, commercialization and agricultural diversification**

Improving the income and food security in the Himalayas require the governments to articulate policies that encourage and support the subsistence farmers to produce over and above their own needs and use the land and labor for high value crops that can easily be sold in the markets. Ellis (2000) provides a theoretical discussion of the motivations for diversification in developing regions where necessity and choice combine are 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, with the goal of ensuring family survival and reproduction. In addition, rural households may diversify on their own initiative, investing in additional enterprises, especially for market-oriented products, in order to spread risks while generating returns for the sake of some household goals, such as educating children.

The household assets endowments along with connecting infrastructures are important determinants of commercialization of agriculture. Asset endowments refer to production factor endowments (land, labor, and capital) as well as local infrastructure (roads, communications, etc.). Household asset endowments shape household asset strategies to invest its resources for household livelihood diversity and welfare goals. Inequalities in asset endowments along with other factors such as seasonality, markets, credit and labour markets, generate different asset strategies among households and yield differences in agricultural diversity at household level (Ellis, 2000). Some of the recent studies emphasize that farm enlargement is the most important

factor to achieve greater commercialization and diversification (Lerman, 2004; 2005) while studies by Mathijs and Noev (2004) and Balint and Wobst (2006) find that size of the land along with the ownership of machinery, transaction costs and livestock are important.

Commercialization is usually thought in large scale and the economists usually tend to ignore the fact that even the small farmers and poor farm households participate in the market either because they produce a little surplus or sell to earn cash income to meet other family necessities<sup>1</sup>. Desperation amongst some of the poor households is such that they sell their crops even before it is being harvested. This is particularly the case when food is being sold and then the households are forced to buy back the same (or indeed a greater) quantity of food later in the year when the price is much higher. However, Kostov and Lingard (2004), claim that subsistence agriculture could be an advantage under certain conditions, in the presence of risk. Von Braun and Kennedy (1994) write 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). Therefore, the landholding is the key determinant of commercialization as the land allows the farmers to cultivate more than what is required for self consumption and use some plots for production of commercial cash crops. At any given yield level, a household with lower land per capita has to devote a higher proportion of its land to food production if it is to achieve a given level of self-sufficiency and hence there is less land available, if any at all, for production of higher value crops for market.

The study of commercialization in this paper starts with the question whether a farm or household sells any of its farm output and goes a step further to consider the degree of commercialization as measured by the amount of value of crops sold in relation to the value of crops produced. In this study, we follow Strasberg *et al.* (1999) and Leavy *et al* (2007) and define the household crop commercialization index (CCI) as:

---

<sup>1</sup> Many papers including ours fail to capture the “distress” sales, i.e. crop sales by poor household’s straight after harvest because they are desperate for cash.

$$CCI = [\text{gross value of all crop sales}_{hh\ i, \text{ year } j} / \text{gross value of all crop production}_{hh\ i, \text{ year } j}] * 100$$

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 where a value closer to 100 implies the higher degree of commercialization. An important advantage of this approach is that commercialization is treated as a continuum, thereby avoiding crude distinctions between “commercialized” and “non-commercialized” household<sup>2</sup>.

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

The existing literature in commercialization use both the participation in the output market as well as participation in the input market to measure the commercialization of agriculture (see, von Braun and Kennedy, 1994). Since the majority of the farm households in the Himalayas are poor and reluctant to use inorganic manures and seeds from the market, the participation in the input market will not be able to provide any indication about the commercialization. We, therefore, do not consider this dimension in this paper.

The diversification in market-oriented crop (and livestock) enterprises is important way to spread market-related risks but the small and fragmented land holding is not suitable. The initial production of crops for market especially non-food crops represents diversification away from production of basic foods meant for consumption. As Heltberg (2001) observes, “small holders produce market-destined crops *in addition to* the subsistence food crops they are growing anyway...” and according to him (2001), the tendency to add cash crops to existing food production activities can be attributed to the “urge for food self-sufficiency in environments of

---

<sup>2</sup> 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 growing fifty bags and sells thirty of them.

large transaction costs and high risks found in many sub-Saharan African (SSA) countries”<sup>3</sup>. Therefore, commercialization is important as a livelihood strategy, source of cash income to farmers, and export revenue to the country, and worth promoting on those grounds.

The gains from smallholder agricultural commercialization do not come from the realization of economies of scale but from growing high value crops and freeing itself from producing food for self consumption. The communities can harness the economies of scale in terms of production as well as marketing through cooperative farming.

Given the self sufficiency in food production and stability in distribution of food through Food Corporation of India, the small farmers could concentrate on high value cash crops. The Mozambique study by Heltberg and Tarp (2002) also highlights the importance of availability staple food production to agricultural commercialization. Pandey *et al.* (2006) show that higher upland rice yields are associated with a lower proportion of total area planted to upland rice and a higher proportion planted to cash crops.

### **3. Data and variables**

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

#### **3.1. Household Data**

The unit of observation is the rural household and detailed information was obtained for all members of the household. Primary data was, therefore, collected at a household level based on a structured questionnaire. The primary data source and the data for the econometric analysis come 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<sup>4</sup>. The region is largely agrarian, based

---

<sup>3</sup> This contrasts with the belief of economic historians that “gains from specialization are a key driving force in economic growth” (see North 1991)

<sup>4</sup> The survey was carried out within a large-scale project designed to examine the livelihood of rural households. The project was financed by the German Corporation for Technical Cooperation (GTZ).



on traditional farming methods and terraced slopes. The region does not have large-scale industries because of the hilly terrain and lack of reliable transportation infrastructure.

### **3.2. 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<sup>5</sup> and rural Sikkim. Gram Panchayats were randomly selected in each block<sup>6</sup>. The selected Gram Panchayats were further divided into 4-6 villages and 5-8 households were randomly selected from each village. This sampling procedure yielded a sample of 520 households. The survey provided information on farm and nonfarm activities, income sources, income levels, demographic characteristics, employment status, asset holdings, as well as other attributes of the households and of the household members. A one-year recall period was used and no effort was made to capture seasonality in income patterns<sup>7</sup>.

The Indian National Sample Survey Organization (NSS) has been carrying out all-India household surveys in quinquennial rounds. However, the NSS surveys capture just the participation in various activities and do not contain quantitative data on household incomes.

These surveys are thus inapt for gauging the extent of dependence of the population on particular sources of income. Our survey focused on collecting reliable data on both the participation in nonfarm activities and the level of incomes derived from these activities. This allows us to explore the commercialization of agriculture, cash crops, food crops and livestock as well as to provide a detailed and comprehensive picture of the determinants of commercialization of rural households in the Himalayas.

### **3.3. Concepts, measures and methods**

We begin by constructing the household commercialization index to measure the effects of crop commercialization. To the value of crops and animal products produced and marketed in the last

---

<sup>5</sup> 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.

<sup>6</sup> Gram Panchayats are local government bodies in India. In Sikkim, Gram Panchayats were selected from all four districts (North, South, East, and West).

<sup>7</sup> It should be mentioned that, as most Studies, recall errors are likely to have affected reported income.

year, we add the implicit income from subsistence production imputed at local prices. Landholding plays a vital role in determining commercialization in the region (Himalayas) where over 90 per cent of the population derives its livelihood from agriculture and related activities. As the land endowment is important input for production, we use the land assets of the household as the determinants of commercialization. The supply of labour by households is captured by the number of men and women of prime-working age (15-65 years old). We include adult males and adult females separately because they might have different comparative advantages. Life-cycle effects are captured by age and age squared of the household head.

In Himalayan region, which is primarily rural in nature, higher education implies a better awareness of the potential of new agricultural practices toward commercialization as well as possibilities of better and different employment opportunities. Here, we measure 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 also 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<sup>8</sup>. In addition, to account for 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 also play an important role in determining commercialization. Since the majority of the households are of Nepali origin and speak Nepali, we control for social status instead<sup>9</sup>. 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

---

<sup>8</sup> Children education is ignored because it is less likely to affect activity choices, but more likely to be influenced by them through income.

<sup>9</sup> 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.

employment and reservation of seats in provincial and central legislatures<sup>10</sup>. 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<sup>11</sup>.

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 the 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<sup>12</sup>. A dummy variable for residence in Sikkim also 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.

#### **4. Descriptive Statistics**

In the Himalayan region, it is rare for any rural household to receive all of its income from a single source. Farm households, aside from their ownership of a business, also rely on a variety of income sources. Understanding the components of income is also important for monitoring the sensitivity of farm household income to economic events and evaluating the effectiveness of farm policy in supporting income. Farm household's income is also 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 percent of the households participate in farming and derive more than 30 percent of their income while 73 percent of the households take part in non-

---

<sup>10</sup> For a detailed description of the social system and caste-based preferential policies in India, see Gallanter (1984) and Osborne (2001).

<sup>11</sup> As noted by Boroah, 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.

<sup>12</sup> Sikkim has had an impressive growth rate of 8.3 percent, which is the second highest in the country after Delhi.

farm livelihood activities, which contributes to about 57 percent of the total income (see Table-1). 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 livelihood of the poor. This calls for poverty reduction policies in the region to focus on commercialization of small farm holders. In areas where farming is remunerative, households with adequate land may earn an acceptable income. But where farming cannot fully support household needs, non-farm activities become an increasingly attractive target. In many studies, diversification (into non-farm activity) is a positive strategy.

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

	Income (annual)			Share in total income (per cent)	Number of households (per cent)
	Mean (Rupees)	Median (Rupees)	Std. dev. (Rupees)		
<b>I. Farm vs. nonfarm composition</b>					
<b>Total farm income</b>	<b>13,562</b>	<b>9,312</b>	<b>17,887</b>	<b>30.18</b>	<b>97.69</b>
Farm self-employment	11,363	7,204	17,545	25.24	97.50
Agricultural wages	6,758	5,040	6,475	4.94	32.12
<b>Total nonfarm income</b>	<b>34,482</b>	<b>20,160</b>	<b>42,453</b>	<b>57.55</b>	<b>73.27</b>
Nonagricultural wages	35,939	23,640	40,126	47.23	57.69
Skilled labor	57,682	42,000	45,859	37.40	28.46
Unskilled labor	13,051	9,150	12,259	9.83	33.08
Self-employment	18,123	6,624	36,497	10.32	25.19
Small enterprise	28,279	10,390	47,117	8.67	13.46
Micro enterprise	5,378	3,240	5,799	1.65	13.65
Other income	12,074	1,420	19,177	12.27	44.62
Remittances	19,378	18,000	21,163	5.69	12.88
Pensions	28,332	27,600	15,662	6.21	9.62
Other	586	245	999	0.38	28.27

**Source:** Author's calculations. (Figures are annual)

**Notes:** The mean, median, and standard deviation are calculated across households receiving income from the corresponding source. Micro enterprises involve little or no investment. Enterprises requiring investment of at least 5,000 Rupees were classified as small. (see Micevska and Rahut, 2008)

**Table-2: Market Participation by the Household**

	<b>Total agriculture</b>	<b>Cash crops</b>	<b>Food Crops</b>	<b>Other Crops</b>	<b>Livestock product</b>
Values of products sold in Rupee	6,442.80	5,393.20	1,017.80	31.7	1,848.30
Sales to Production Ratio	0.31	0.47	0.10	0.06	0.23
Percent of household that sold	64	50	39	12	40

**Source:** Author's calculations. (Figures are annual)

It is known that market participation is both a cause and a consequence of economic development. Markets offer households the opportunity to specialize according to comparative advantage and thereby enjoy welfare gains from trade. On an average 64 percent of the household sold some of their agricultural and livestock products and earned average cash income of Rs. 6,442.80. On an average household sells 31 percent of the total agricultural production of which cash crop and livestock products were the major items. About 39 percent of the household sold 10 percent of the food crops and earned cash income of Rs 1,017.80 (see Table-2).

**Table-3. Sales of agricultural produce by quintile (Volume of commercialization)**

	<b>Income Quintile</b>				
	<b>Quintile</b>	<b>Quintile</b>	<b>Quintile</b>	<b>Quintile</b>	<b>Quintile</b>
Total agriculture (Rs)	1,394.0 (1.7)	3,493.2 (1.4)	2,859.7 (1.9)	5,814.9 (2.1)	18,652.2 (2.2)
Cash crops (Rs)	1,159.1 (1.9)	3,044.1 (1.6)	2,532.7 (2.1)	4,608.2 (2.1)	15,622.0 (2.5)
Food Crops (Rs)	225.7 (2.5)	433.9 (2.1)	302.9 (4.9)	1,190.3 (4.3)	2,936.4 (3.2)
Other Crops (Rs)	9.2 (3.4)	15.2 (5.0)	24.1 (3.7)	16.4 (4.2)	93.7 (5.6)
Livestock product (Rs)	1,336.7 (1.9)	1,477.5 (2.3)	2,051.1 (1.5)	2,487.1 (1.8)	1,889.0 (1.9)

**Source:** Author's calculations. (Figures are annual)

**Notes:** Coefficient of Variation in parenthesis. Rs = Rupees

The table 3 shows that the market participation in agriculture by the rural household increases across quintiles, which means that richer household are able to sell more than the poor households. Across all the categories of agricultural products (cash, food, other and livestock), the participation in market increases across quintile. The average sales of agricultural products

for the household in quintile 5 is 13 times the average sales of agricultural products of the household in quintile 1 and 3 times the average sales of agricultural products of the household in quintile 5. This indicates that richer households tend to participate much more than the poorer ones.

**Table-4. Sales of agricultural produce by level of education  
(Volume of commercialization)**

	Years of education of household head					
	Uneducated	1-4	5-9	10-11	12-14	>14
Total agriculture (Rs)	4,983.8 (3.6)	5,573.5 (2.1)	7,073.0 (3.3)	13,042.3 (2.2)	3,317.4 (2.8)	5,532.6 (2.2)
Cash crops (Rs)	4,478.3 (3.9)	3,601.7 (2.1)	6,363.2 (3.7)	9,804.3 (2.6)	3,138.8 (2.9)	4,687.5 (2.2)
Food Crops (Rs)	467.0 (3.4)	1,947.3 (3.8)	692.2 (4.2)	3,156.7 (3.5)	166.4 (2.2)	835.8 (2.2)
Other Crops (Rs)	38.4 (8.8)	24.4 (3.6)	17.7 (4.0)	81.3 (5.0)	12.3 (3.7)	9.4 (2.8)
Livestock product (Rs)	1,316.8 (2.1)	2,552.4 (1.9)	2,254.3 (1.6)	1,521.1 (1.9)	1,727.4 (2.5)	506.3 (2.3)

**Source:** Author's calculations. (Figures are annual)

**Notes:** Coefficient of Variation in parenthesis. Rs = Rupees

The analysis on the commercialization by the level of education (see table-4) of the household head shows that with the increase in the level of education, the average sale of agricultural products by the household increases up to 10-11 years of education and it decreases thereafter.

This is because the households tend to participate in market until they attend high school, but upon completion of high school, they either drop agriculture and depend on non-agriculture or engage only on a small scale. So, in the Himalayan context higher education implies a better awareness of the potentials of new agricultural practices toward commercialization as well as possibilities of better and different employment opportunities.

**Table-5. Sales of agricultural produce by farm size (Volume of commercialization)**

	Farm Size in Acres					
	Landless	<0.5	0.5-1.5	1.5-2.5	2.5-3.5	>3.5
Total agriculture (Rs)	1,458.2 (3.4)	1,915.5	5,431.9 (3.7)	9,761.4 (2.3)	11,171.8 (1.4)	26,439.7 (1.7)
Cash crops (Rs)	1,211.5 (3.8)	1,713.5	4,435.9 (4.4)	8,728.4 (2.4)	8,540.3 (1.5)	22,013.4 (2.0)
Food Crops (Rs)	227.2 (3.4)	182.7	968.4 (4.6)	1,009.7 (3.6)	2,598.5 (3.1)	4,302.5 (2.7)

Other Crops (Rs)	19.6 (4.3)	19.2	27.7 (8.5)	23.3 (3.2)	33.1 (3.1)	123.8 (5.7)
Livestock product (Rs)	1,665.1 (2.2)	2,092.0	1,750.5 (2.0)	2,008.4 (2.0)	1,100.3 (1.8)	2,156.3 (1.8)

**Source:** Author's calculations. (Figure are annual)

**Notes:** Coefficient of Variation in parenthesis. Rs = Rupees

The analysis by the farm size (Table-5) shows that the household with large land holding per adult members are able to sell a larger volume of their produce as compared to those with lower land holdings. This is true for all the agricultural products except for the livestock, which is obviously independent of landholdings. The landless farmers are able to sell agricultural product worth Rs. 1,458.2 while households with less than 0.5 acres per adult are able to sell Rs. 1,915.5 on an average. Similarly, households with landholding between 0.5 to 1.5 acres and, 1.5 to 2.5 acres sell agriculture produces worth Rs. 5,431.9, Rs. 9,761.4 respectively. Bigger landholding families such as 2.5 to 3.5 acres sell worth Rs. 11,171.8 and more than 3.5 acres sell agriculture product worth Rs. 26,439.7. This clearly supports the other research works that establish the relationship between the land assets and the commercialization (Table-5).

**Table-6. Ratio of Sales and Production  
(Degree of Commercialization by land size)**

	Farm Size in Acres					
	Landless	<0.5	0.5-1.5	1.5-2.5	2.5-3.5	>3.5
Total agriculture (%)	0.13	0.27	0.33	0.40	0.42	0.56
Cash crops (%)	0.20	0.40	0.50	0.63	0.64	0.75
Food Crops (%)	0.05	0.08	0.11	0.12	0.15	0.20
Other Crops (%)	0.03	0.06	0.05	0.11	0.05	0.08
Livestock product (%)	0.20	0.25	0.23	0.22	0.21	0.22

**Source:** Author's calculations. (Figures are annual). Landless farmers also sells agricultural product because some of them take land on rent or lease while other do share cropping.

The degree of commercialization as measured by the ratio of sales to production also shows the increasing trend with the increase in landholdings. This is simply an indication that the household with larger farm size are able to sell larger share of their production as compared to the household with smaller farm size. The landless households sell 13 percent, the households with less than 0.5 acres sell 27 percent, the households with 0.5 to 1.5 acres of land sell 33 percent, those with 1.5 to 2.5 acres sells 40 percent, those with 2.5 to 3.5 acre sell 42 percent and

those households with greater than 3.5 acres sell 56 percent of the farm produce. The relationship between the degree of commercialization and farm size is more pronounced in cash crops and the degree of commercialization in livestock is not affected by the farm size.

**Table-7. Percentage of house engaged in market  
(Degree of commercialization)**

	Farm Size in Acres					
	Landless	<0.5	0.5-1.5	1.5-2.5	2.5-3.5	>3.5
Household selling agricultural products (%)	0.41	0.60	0.67	0.78	0.78	0.81
Household selling cash crops (%)	0.24	0.43	0.53	0.67	0.67	0.77
Household selling food crops (%)	0.28	0.37	0.44	0.42	0.50	0.40
Household selling other crops (%)	0.10	0.12	0.08	0.17	0.14	0.16
Household selling livestock products (%)	0.34	0.45	0.38	0.38	0.44	0.44

**Source:** Author's calculations. (Figures are annual)

The percentage of households selling agricultural products increases with the increase in the farm size, which means that farm size is correlated with the commercialization. However, such trend is not observed for livestock products. 41 percent of the landless households sells agricultural and allied products, 60 percent of the households with less than 0.5 acre of land sells the farm produce, 67 percent of the households with 0.5 to 1.5 acres sells their farm produce, 78 percent of the household with 0.5 to 1.5 acres and 1.5 to 2.5 acres of land sells their farm produce and 81 percent of households with more than 3.5 acres of land sells their agriculture products. This trend on percentage of household selling the farm produce is steeper for cash crop followed by food crop and other crops.

## **5. Empirical Analysis**

### **5.1. Market Participation**

We use probit model to estimate market participation (Table No 8) where the dependent variable is whether the household sells any of their agricultural and allied products. In this estimation, to control for the village effect, we cluster the villages. The decision to sell the agricultural products depends on livestock assets, land per adult, ethnicity and the location variables.



The livestock assets also represent the two important things:

- i) It can generate income through the sales of livestock products
- ii) It also provides inputs for the farms like manures, draught etc

Therefore, the household that has more livestock assets are able to generate income from sales of the animal products and increased productivity from the use of manures and are used as draught animals. The households belonging to general categories is less likely to sell cash crops, but more likely to sell livestock products. The education of the household head is significant and positive only in the case of cash crops. The probit estimation confirms the findings of the other studies that the land asset is critical determinants of household's position to participate in the market.

**Table-8 Probit estimation for Market Participation  
(Marginal Effects)**

	<b>Agricultur e</b>	<b>Cash Crop</b>	<b>Food Crop</b>	<b>Others crop</b>	<b>Livestoc k</b>
<i>Household characteristics and assets</i>					
Age of household head	0.014 (0.010)	0.013 (0.011)	0.002 (0.010)	0.003 (0.006)	0.01 (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 <sup>a</sup>	0.031 (0.086)	0.066 (0.093)	-0.007 (0.084)	0.03 (0.041)	0.057 (0.092)
Number of children<=15 yrs	0.010 (0.018)	-0.006 (0.020)	-0.017 (0.018)	-0.003 (0.010)	-0.003 (0.018)
Number of working-age men	0.028 (0.026)	0.036 (0.030)	-0.001 (0.028)	0.021 (0.015)	-0.008 (0.028)
Number of working-age women	-0.014 (0.028)	-0.042 (0.031)	-0.001 (0.027)	-0.016 (0.015)	-0.018 (0.029)
Engaged in non-farm activities	-0.076 (0.053)	-0.023 (0.062)	-0.048 (0.055)	-0.004 (0.030)	-0.016 (0.060)
<i>Assets</i>					
Livestock Assets	0.123*** (0.033)	0.114*** (0.035)	0.090*** (0.029)	0.030** (0.015)	0.194*** (0.053)
Nos. of years of education of head	0.002 (0.006)	0.012* (0.007)	0.002 (0.007)	0.001 (0.004)	-0.005 (0.007)
Land assets per adult	0.121** (0.045)	0.070* (0.035)	-0.009 (0.035)	0.005 (0.035)	-0.008 (0.035)

	(0.053)	(0.050)	(0.018)	(0.008)	(0.017)
<b><i>Social Categories</i></b>					
General category	-0.075 (0.064)	-0.161** (0.068)	-0.071 (0.063)	-0.035 (0.033)	0.185*** (0.069)
Scheduled caste or tribe	-0.003 (0.065)	-0.032 (0.070)	0.02 (0.066)	-0.021 (0.033)	0.045 (0.066)
<b><i>Location characteristics</i></b>					
Distance to market	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.000)	0.001 (0.001)
Residence in Sikkim <sup>a,c</sup>	-0.294** (0.148)	-0.523*** (0.173)	-0.122 (0.152)	-0.222*** (0.071)	-0.266*** (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:** a. Village fixed effects included using dummy but not shown.

b. \*\*\*p < 0.001, \*\*p<0.05, \*p<0.1 indicate significance at the 1%, 5%, and 10% level.

c. Robust standard errors adjusted in parentheses. All regressions include a constant.

d. The number of observations in each regression is 520.

e. <sup>a</sup> dummy variables; <sup>b</sup> excluded category: other backward classes.

f. <sup>c</sup> excluded category: residence in Darjeeling.

**Table-9. Tobit estimations of the intensity of market participation  
( Degree of participation): marginal effects**

	<b>Agri. Sales</b>	<b>Cash Crop Sales</b>	<b>Food Crop Sales</b>	<b>Others Sales</b>	<b>Livestock Sales</b>
<b><i>Household characteristics and assets</i></b>					
Age of household head	0.002 (0.009)	0.022 (0.016)	-0.001 (0.008)	0.016 (0.026)	0.013 (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 <sup>a</sup>	0.032 (0.074)	0.156 (0.147)	0.011 (0.061)	0.116 (0.235)	0.041 (0.111)
No. of children<=15	-0.013 (0.015)	-0.005 (0.028)	-0.011 (0.013)	-0.041 (0.046)	-0.005 (0.021)
Number of working-age men	0.026 (0.022)	0.035 (0.043)	0.013 (0.022)	0.115* (0.066)	-0.011 (0.031)
Number of working-age women	-0.024 (0.023)	-0.055 (0.044)	-0.003 (0.021)	-0.068 (0.070)	-0.019 (0.034)
Engaged in non-farm	-0.023 (0.045)	-0.055 (0.089)	-0.006 (0.041)	-0.049 (0.136)	-0.042 (0.062)

Livestock Assets	0.083 <sup>***</sup> (0.024)	0.171 <sup>***</sup> (0.040)	0.062 <sup>***</sup> (0.022)	0.131 <sup>**</sup> (0.064)	0.207 <sup>***</sup> (0.043)
No. of years of education household head	0.004 (0.005)	0.018 <sup>*</sup> (0.010)	-0.002 (0.005)	0.006 (0.017)	-0.004 (0.008)
Land assets per adult	0.043 <sup>**</sup> (0.020)	0.037 <sup>*</sup> (0.025)	0.013 (0.021)	0.003 (0.032)	-0.022 (0.017)
General category <sup>a,b</sup>	-0.059 (0.053)	-0.274 <sup>***</sup> (0.104)	-0.101 <sup>*</sup> (0.051)	-0.191 (0.163)	0.192 <sup>***</sup> (0.074)
Scheduled caste or tribe <sup>a,b</sup>	0.025 (0.049)	0.001 (0.093)	-0.012 (0.051)	-0.169 (0.158)	0.060 (0.074)
<b>Location characteristics</b>					
Distance to market	0.000 (0.001)	0.000 (0.001)	0.000 (0.000)	0.000 (0.001)	0.000 (0.001)
Residence in Sikkim <sup>a,c</sup>	-0.325 <sup>**</sup> (0.153)	-0.778 <sup>***</sup> (0.381)	-0.311 <sup>***</sup> (0.119)	-0.717 <sup>**</sup> (0.358)	-0.574 <sup>**</sup> (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:** a. Village fixed effects included using dummy but not shown.

b. \*\*\*p < 0.001, \*\*p < 0.05, \*p < 0.1 indicate significance at the 1%, 5%, and 10% level.

c. Robust standard errors adjusted in parentheses. All regressions include a constant.

d. The number of observations in each regression is 520.

e. <sup>a</sup> dummy variables; <sup>b</sup> excluded category: other backward classes.

f. <sup>c</sup> excluded category: residence in Darjeeling.

The results on participation in market using Probit estimation can be misleading as it fails to distinguish between those households, which sell small and large part of their farm produce. Therefore, we estimate the degree or the intensity of commercialization using tobit estimation. The dependent variable is the share of sale to the total production and the explanatory variables are same as the one used in Probit estimation. The Tobit estimation using the share of sales to production also supports the earlier finding on the role of land per adult, livestock and the social categories of the household as major determinants of market participation.

The degree of commercialization increases with the livestock assets because the livestock provides manures and drought for farming and hence increases farm productivity. The education of the household head is significant in case of cash crops because educated households are more

aware of the commercial values of such crops and grow these crops that fetch higher cash income. This study, like other studies, finds that the asset is also important determinants of intensity of commercialization and the land variable is particularly important for the cash cropping which needs larger land area. The general categories of the households are not able to participate as much as the other backward class in cash and food crop market, but the degree of participation in livestock product is higher for the general categories of households. The degree of commercialization is much lower for the Sikkimish household as compared to a household in Darjeeling.

## **5.2. Income from sale of farm product**

Degree of participation as measured by using the share of sales of farm product to the total farm produce is not able to distinguish between those households that produce a bag of rice and sells the entire bag as against those households that produce 50 bags of rice and sell 25 bags. In order to take care of the shortfall of the probit and tobit estimation, we need to run the OLS with income from sale of farm produce as the dependent variable.

Since running the simple OLS will impose the problem of selectivity bias, we therefore run heckman two stage least square regression using the same probit estimation as the first stage equation and in the second stage we use the log of sale of farm output as the dependent variable.

However, the income from the sales of agricultural after controlling for the selectivity bias using heckman indicates households with the male head earns more income from sales of agriculture products ,particularly the cash crops. The education of the household head is significant and positive only in the case of livestock product sales. The land per adult is significant and positive in the case of agriculture and cash crop.

The male headed households are more likely to earn more from the sale of farm produce and it is more pronounced and significant in cash crops. The number of children under 15 years reduces the household ability to earn higher income from sale of farm produce. The education level of the head is positive and significant at 5 percent in sale of livestock products. The cash income from land per adult is significant and positive for cash and food crops. The scheduled castes and

tribes earn small amount from the sale of livestock products. The residents of Sikkim sell less livestock products than those households in Darjeeling. This is because of the presence of Himul Milk Agency in Darjeeling.

**Table-10 Estimations of (log) sales income with selection correction: marginal effects**

	<b>Agri Sales</b>	<b>Cash crop</b>	<b>Food Crop</b>	<b>Other Crops</b>	<b>Livestock</b>
<b>Household i.e. individual characteristic</b>					
Age of household head	-0.036 (0.041)	-0.008 (0.040)	0.004 (0.049)	-0.013 (0.074)	0.022 (0.035)
Age of household head squared (x100)	0.001 (0.000)	0.000 (0.000)	0.000 (0.001)	0.000 (0.001)	0.000 (0.000)
Household head is male <sup>a</sup>	0.596* (0.374)	0.924** (0.382)	0.406 (0.439)	-0.637 (0.624)	0.177 (0.293)
Number of Children under 15 yrs	-0.130* (0.076)	-0.127** (0.070)	0.072 (0.093)	-0.158 (0.114)	0.054 (0.062)
Number of working age male	0.023 (0.116)	-0.010 (0.107)	0.175 (0.150)	0.067 (0.188)	-0.021 (0.091)
Number of working age female	0.111 (0.123)	0.061 (0.114)	0.228* (0.140)	0.253 (0.217)	0.019 (0.101)
No of years of schooling of head	0.038 (0.027)	0.020 (0.026)	0.006 (0.032)	-0.025 (0.042)	0.042** (0.022)
Land per adult	0.176*** (0.066)	0.169*** (0.055)	0.338*** (0.090)	0.008 (0.126)	0.018 (0.070)
Livestock Assets	0.144 (0.122)	0.143 (0.109)	0.077 (0.144)	0.276 (0.183)	0.178 (0.127)
General category <sup>a,b</sup>	-0.150 (0.259)	0.121 (0.257)	-0.122 (0.300)	-0.260 (0.343)	0.184 (0.204)
Scheduled caste or tribe <sup>a,b</sup>	0.177 (0.245)	0.081 (0.222)	-0.108 (0.284)	-0.370 (0.398)	-0.447** (0.205)
<b>Locational characteristic</b>					
Distance to market (x100)	-0.002 (0.003)	-0.001 (0.003)	0.000 (0.003)	-0.006 (0.008)	0.000 (0.002)
Residence in Sikkim <sup>a,c</sup>	0.177 (0.225)	0.243 (0.210)	-0.093 (0.317)	-0.090 (0.393)	-1.902*** (0.297)
Lambda	-1.722** (0.329)	-0.603** (0.293)	-1.510*** (0.404)	-0.361 (0.803)	-0.247 (0.289)
Wald chi2(26)	73.450	77.370	69.680	52.510	151.890
Prob > chi2	0.000	0.000	0.000	0.002	0.000

**Source:** Author's calculations

**Notes:** a. Village fixed effects included using dummy but not shown.

b. In columns 1-4, 6, and 7, the unit of observation is the household; in the first stage, the probabilities of participation in nonfarm activities are estimated at the household level as in Table 3. In columns 5, 8, and 9, the unit of observation is the household head; in the first stage, the probabilities of participation in nonfarm activities are estimated for the household head; the identifying restrictions are the inherited land and parental occupation.

c. \*\*\* $p < 0.001$ , \*\* $p < 0.05$ , \* $p < 0.1$  indicate significance at the 1%, 5%, and 10% level.

d. Robust standard errors adjusted in parentheses. All regressions include a constant.

e. The number of observations in each regression is 520.

f. <sup>a</sup> dummy variables; <sup>b</sup> excluded category: other backward classes.

g. <sup>c</sup> excluded category: residence in Darjeeling.

## 6. Concluding Remarks

In this paper, we have used livelihood survey data from the Eastern Himalayan region of India to investigate the determinants of commercialization of agriculture by small farmers. In other words, we wanted to identify those factors that help the small farm households in the lower Himalayas to participate in the market and escape from subsistence. This study will help in formulating the rural development policies in the Hills of Darjeeling and Sikkim. The results of our econometric analysis show that the asset endowments contribute to explaining why farmers stay in subsistence farming. The findings indicate that family farming systems in lower Himalayas exhibit variation in household asset endowments and agricultural production and income diversity, and that assets exert important effects on commercialization.

Gender of the head plays an important role in participation in the market. Male headed household seems to earn higher income from sale of cash crops. Therefore, the policies should aim at supporting the female headed households by way of providing inputs, knowledge about the high value crops that need less manpower, etc. The education of the households also plays a prominent role in commercialization; thus the policies should aim keeping children at school. The livestock assets are also important determinants of commercialization, which calls for enhancing the livestock assets of the household as it provides manures for the farm and also the farmers are able to sell the livestock products at the market. The land asset is important determinants of commercialization as the more land means that the farmers are able to produce surplus, which can be sold in the market. Although the land size cannot be increased, the policies should improve the functioning of the land lease market and development of the land sales market and consolidation of

fragmented farm structures. Policies should also promote the development of non-farm activities, as this would help in transfer of labour from farm to non-farm thereby increasing the availability of land for farming.

The social categories also influence the commercialization. The analysis finds that the general categories of households are disadvantaged in participating in cash and food crop market as compared to the other backward classes. This is because of the fact that the other backward classes and scheduled castes and tribes have reservation in the government jobs and hence the labour are shifted from farm to non-farm and some of them migrate to other Indian cities for employment in government jobs. Small household size also has positive effects in commercialization as it means less family to feed and hence more surpluses available for sale. The general categories of household are able to participate more in the livestock market because the households belonging to the general categories are mostly farmers and rear cows and sells butter, milk and curd. Therefore, the rural development policies should support the general categories of household in enhancing their farm productivity and livestock production.

The location also plays an important role in commercialization. The analysis shows that the rural households located in Darjeeling are able to produce and sell more livestock products. This is because in Darjeeling the Himul, is a milk processing company, is in operation and supports and collects the milk from the farmers. Further, if agriculture has to contribute to poverty reduction and growth of the region, commercialization of small holders should be given due 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 the markets.

Livelihood diversity in the Himalayan context could be the major factor affecting the success and relevance of many agricultural programmes. Although it may be argued that such diversity is nothing new, there is considerable evidence that it is assuming an ever greater role. Public policy has to protect farms choices to facilitate access to

commercialization options at low risks. Policy responsibility arises where commercialization generates new food security risks with which small farmers are not able to cope.



## References

- Abbott, J. C. 1988. *Agricultural Processing for Development*. Aldershot, England: Gower.
- Alderman, Harold; Merges, George; and Slade, Roger. 1987. *Cooperative Dairy Development in India: Evolution, Debate, and Evidence*. Working Paper on Commercialization of Agriculture and Nutrition 2. Washington, D.C.: International Food Policy Research Institute.
- Borbala, Balint. 2004. Determinants of commercial orientation of the individual farms in Romania. *Deutscher Tropentag*. Berlin, October 5-7, 2004. Conference on International Agricultural Research for Development.
- Braun, J. Von. Lohlein, D. 2001. Policy Options to Overcome Subsistence Agriculture in the CEECs. 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.
- Brüntrup, M. Heidhues, F. 2002. Subsistence Agriculture in Development: Its Role in Processes of Structural Change. Discussion Paper No. 1/2002, Institute of Agricultural Economics and Social Sciences in the Tropics and Subtropics, University of Hohenheim.
- Cragg, L.G. 1971. Some Statistical Model for Limited Dependent Variables with Application to the Demand for Durable Goods, *Econometrics* 39, pp. 829-844.
- Dorsey, B. 1999. Agricultural intensification, diversification, and commercial production among smallholder coffee growers in central Kenya. *Economic Geography* 75: 178–195.
- Ellis, F. 1993. *Peasant economics: farm households and agrarian development*. Cambridge University Press, Cambridge, UK.
- Ellis, F. 2000. *Rural livelihoods and diversity in developing countries*. Oxford University Press, Oxford, UK.
- Evans, H.E. Ngau, P. 1991. Rural-urban relations, household income diversification and agricultural productivity. *Development and Change* 22: 519–545.
- Gibbs, J.P. Poston, D.L. 1975. The division of labor: Conceptualization and related measures. *Social Forces* 53: 468–476.
- Goetz, S.J., 1992. A Selectivity Model of Household Food Marketing Behavior in Sub-Saharan Africa. *American Journal of Agricultural Economics* 74(2), pp. 444-452.

- Haggblade S., Hazell P. Brown J. 1989. Farm/ non-farm linkages in rural Sub-Saharan Africa. *World Development* 17: 1173–1201.
- Hazell P., Poulton, C. Wiggins, S. Dorward, A. 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.
- Heltberg, R. 2001. Commercialization and specialization in Mozambican Agriculture, mimeo, Institute of Economics, University of Copenhagen. January.
- Jayne, T., et al. 2003. Smallholder Income and Land Distribution in Africa: Implications for Poverty Reduction Strategies. *Food Policy* 28(3): 253-275.
- Kimhi, A. Lerman, Z. Haifa, K. 2004. Farm output, non-farm income and commercialization in rural Georgia. The Hebrew University.
- Kostov, P. Lingard, J. 2002. Subsistence Farming in Transitional Economies: Lessons from Bulgaria. *Journal of Rural Studies* 18, pp. 83-94.
- J Leavy, C Poulton, C Poulton 2007. Commercialisations In Agriculture. *Ethiopian Journal of Economics* Vol. 16 (1) 2007: pp. 3-42
- Lerman, Z., 2001a. 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., 2001b. Agriculture in Transition Economies: From Common Heritage to Divergence. *Agricultural Economics* 26(2), pp. 95-114.
- Mathijs, E. Noev, N. 2002. 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. Rahut, D. 2008. Rural Non-Farm Employment and Income in Eastern Himalayas, *Economic Development and Cultural Change*, 57:163–193, October 2008.
- Pandey, S., Khiem, N. Waibel, H. Thien, T. 2006. Upland Rice, Household Food Security and Commercialization of Upland Agriculture in Vietnam, Los Banos, Philippines: International Rice Research Institute.

- Paul J. Strasberg, T. S. Jayne, Takashi Yamano, James Nyoro, Daniel Karanja, and John Strauss. (1999). Effects of agricultural commercialization on food crop input use and productivity in Kenya. POLICY SYNTHESIS for USAID - Africa Bureau Office of Sustainable Development Number 41 February 1999.
- Perez G. Stephen. 2005. The Effects of Household Asset Endowments on Agricultural Diversity among Frontier Colonists in the Amazon. *Agroforestry Forum*, 2005 63: 263–279. Springer 2005.
- Von Braun, J. Kennedy, E. (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.
- Wharton, C.R. (ed.). 1969. *Subsistence Agriculture and Economic Development*, Aldine Publishing Company, Chicago.
- World Bank. 2008. *World Development Report. Agriculture for Development*. Washington DC.