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Do Non-farm Jobs Affect Soil Conservation Decisions? A ten-year (1996-2006) study in Bukidnon, Philippines[1]

By:

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Abstract

Using time series data of an upland community in the Philippines, this paper aims to understand whether soil conservation practices by upland farmers is affected by opportunities for non-farm jobs. The paper first analyzes the national trends in economic growth and the structural change in employment by industry origin as a result of wage trends in both farm and non farm jobs. Municipal trends in the study site on agricultural and non agricultural wages, farm and non farm employment are also presented. The factors that affect the propensity to participate in non farm jobs are identified through a logit model. A logit model is also estimated to establish relationship between the propensity to practice soil conservation and the participation in non farm employment.

The Philippine economic trends showed a decline in agriculture value added, a stable industry sector, and an increasing share of the service sector from 1970 to 2006.Agricultural employment share in total employment has consistently declined in the same period; while agricultural wage rates were also lower than the non agriculture wages. At the town level, data showed more employment in the non farm sector; with higher wages in that sector. Age and tenure status were significant factors in the participation in non farm jobs during the drought years; age, education and dependency ratio were significant for the subsequent years.

Upland farmers usually do soil conservation measures, especially for those cultivating the steep slopes. The participation in non farm jobs has lowered this propensity to do soil conservation during the drought years; but during the normal years (2000-2006), the non farm work was not a determinant of soil conservation practices. Descriptive data also showed that despite intensification especially of vegetable production, vegetable farmers were practicing soil conservation measures. This finding is encouraging, that even as agriculture intensifies, environmental measures are being taken up by farmers, which could be a result of the high knowledge about sustainable agriculture.

I. INTRODUCTION

Using time series data of an upland community in the Philippines, this paper aims to understand whether soil conservation practices by upland farmers is affected by

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opportunities for non-farm jobs. This notion counters the common perception by policy makers and development workers that "upland farmers are subsistence-oriented, and thus exists beyond the reach of market-based policies".

This paper updates the work found in Rola and Coxhead (2001, 2002). In these two papers, it was argued that non-farm economic conditions influences soil conservation decisions. The data in Rola and Coxhead (2001) was from 1996 to 1999. In the 2002 paper, the data was up to 2000. During 1997-98 period captured in the first paper, the El Nino climatic aberration has forced some of the members of the population to migrate to seek for non farm jobs. Some farms have recovered their production losses in 2000, especially so that prices of upland crops were in the uptrend. In this paper, we analyze the longer term impact (up to 2006) of the structural change (from farm to non-farm employment) and the implications in the decision to do soil conservation, having in mind the effect of the La Nina (floods and rains) that characterize the country during early 2006.

As has been argued previously in the two papers, the use of indirect policy tools for soil conservation in the uplands is not widespread. However, the evidence shows that many upland farmers are commercially oriented, and respond to output price incentives (Coxhead, Shively and Shuai 2002); Coxhead, Rola and Kim, 2001). In adoption decisions on land clearing or soil-conserving actions, where long-term land productivity and sustainable resource management are issues of concern, the repercussions of a land use change due to external shocks such as market price or policy changes will also affect technology decision and agricultural labor demand. One type of shock that could have a significant impact on labor allocation decisions in upland agriculture is the emergence of rural non-farm employment opportunities.

There is a need to explain the link between non-farm economic conditions and farmers' choice of techniques. In general, the availability of farm household labor is an important determinant of production and land management decisions, including those affecting soil conservation. The capacity of a farm household to establish and maintain hedgerow system, for example, depends in part on the availability of labor and management skills for the purpose. However, the number of household member's available on-farm, and the amount of time they are willing to devote to farm labor and management, could be influenced by conditions in the non-farm labor market. In general, greater earning opportunities in non-farm employment cause the supply of family labor on-farm to diminish.

In this paper we hypothesize that non-farm opportunities will reduce family labor input in farm operations, even in a relatively remote upland area. This will occur because rising wages or earnings opportunities make farm work less remunerative relative to non-farm. Households will respond by cultivating less land, mechanizing some tasks, or shifting to crops or techniques that are less management and labor-intensive. In wealthy countries, rising non-farm wages have historically been associated with mechanization and the adoption of less labor-intensive cropping patterns (Hayami and Ruttan 1985; Binswanger et al.1978). In the uplands of a developing country like the Philippines, rising wages may

under some circumstances signal a shift from relatively labor-intensive annual crops to perennial crops or to less intensive farming systems, including agroforestry. Depending on its exact nature, such a shift might be characterized as a move towards more environment-friendly agricultural development.[3]

We use the case of the upland community of the SANREM project site in Lantapan, Bukidnon, to analyze farmer behavior in terms of soil conservation technologies in the presence of an emerging rural non-farm labor market.[4] This paper makes use of both primary and secondary data. Secondary data are taken from published reports and municipal (Lantapan) and provincial (Bukidnon) statistics. Farm and household level data are from farm surveys conducted in the study site during the dry seasons 1996, 1998, 1999, 2000, 2002 and 2006. The sampling and survey methodology are described in Coxhead (1995). Other demographic statistics and human capital data have been taken from earlier benchmark surveys (Rola, et al.1995). Data that characterize labor supply consists of the gender of labor market participants, educational attainment, place of residence, and nature (whether on-farm, off-farm and non-farm) of labor participation.

This paper consists of five parts. In part II, we discuss structural changes in the Philippine labor market from the perspective of national, regional and local trends. In part III, we analyze the factors that influence the participation of upland households in non-farm jobs through a logit regression. In part IV, we also use the logit model to present an empirical analysis of the determinants of propensity to adopt soil conserving practices. Part 5 contains a brief conclusion.

II. ECONOMIC GROWTH AND THE LABOR SUPPLY TRENDS

II.1 National and Regional Economic Trends

Economic growth and employment trends

The Gross Domestic Product (GDP) of the country has steadily increased during the past four decades. Percent share of agriculture in GDP has decreased by half from 28% in 1970 to about 14% in 2006 (Table 1). On the other hand, share of the service sector has risen to over 54% in 2006 from only 38% in 1970 while proportion of the industrial sector remained steady at 35% on the average during the period 1970-2006.

Table 1. Shares in the real gross domestic product by major industry (in percent), Philippines, 1970-2006 (1985=100).

Major Industry Group	1970	1980	1990	1998	2006
Agriculture, Fisheries					

[3] *A number of studies conducted in the Philippines and elsewhere in the sloping uplands of the humid tropics identify the expansion and intensification of annual crop cultivation (primarily corn and upland rice) as the primary sources of agricultural land degradation, soil erosion, and (in areas where commercial forestry is no longer dominant) deforestation. Unit erosion rates are far higher under annual crops than under agroforestry and other perennial-based land use systems (David 1988), and the area covered by upland food crops is very large in relation to total upland agricultural area.*

[4] *"Rural" here also includes surrounding towns in the province such as Malaybalay and Valencia, which are densely populated.*

and Forestry	28	23	22	20	14
Industrial Sector	34	41	36	35	32
Services Sector	38	36	42	45	54
Gross Domestic Product (in million pesos)	343,162	609,768	720,690	888,000	1,508,156

Source: Philippine Statistical Yearbook, 2006
National Statistical Coordination Board, 2007

At the national level, data trends further showed that share of agricultural employment is declining, a characteristic of a growing service-industry based economy (Fig.1). Reduction in share of agricultural employment was also experienced in Region 10, which is basically an agricultural area. This was distinctly observed after the 2000 period. The high figures in 1997-1999 seem artificial and could be an increase in agricultural employment in other areas of the region which was favorable to agriculture despite the

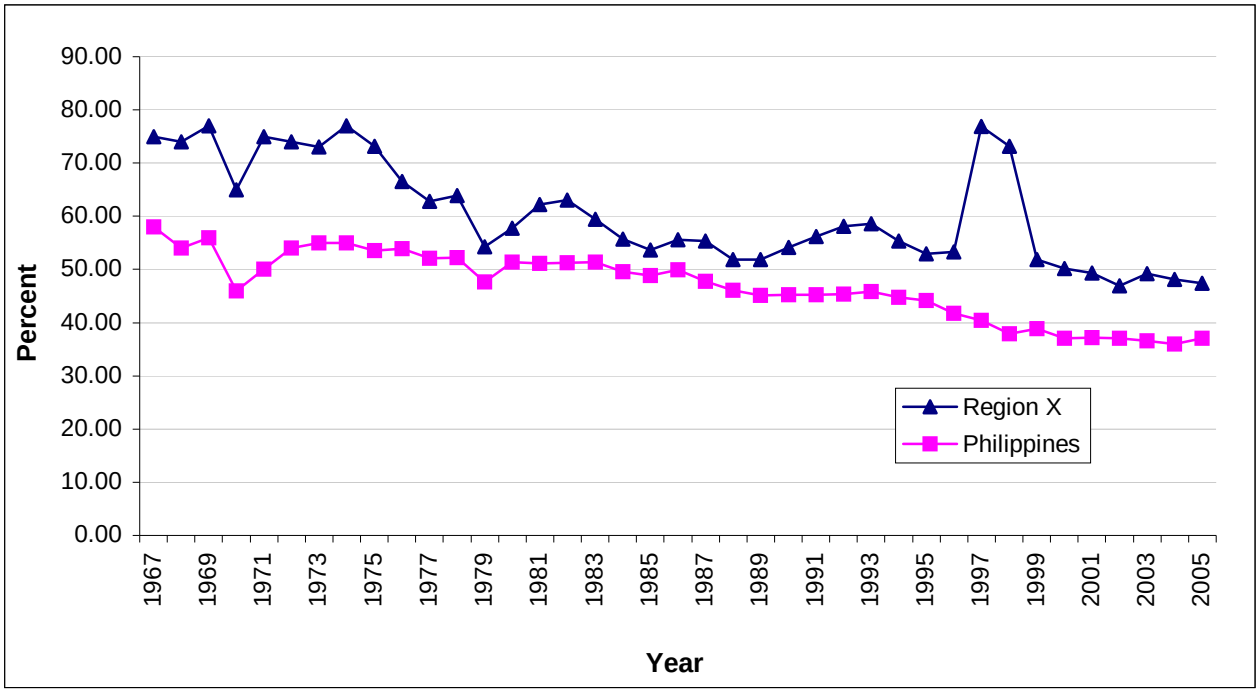

Fig. 1. Percent share of agricultural employment to total employment.

drought. Labor requirement of the industrial sector remained stable over the past 40 years although it suffers continuous decline from 1990 to 2006. The service sector's greater demand for labor altered the labor structure considerably (Table 2).

Table 2. Proportion of employed persons in major industry, Philippines, 1970-2006.

Major Industry Group	1970	1980	1990	1998	2006
Agriculture, Fisheries and Forestry	54	51	45	38	36
Industrial Sector	21	20	20	17	15
Services Sector	25	29	35	45	49
Total (1,000)	11,775	16,434	22,532	26,631	32,963

Source: Philippine Statistical Yearbook, 2006
National Statistical Coordination Board, 2007

Wage Trends

Slow growth of economy and rapid growing population of the country has huge impact in real wages. Generally, there is a stable increase in nominal wages of agricultural and non-agricultural sectors. But real wages in both the agricultural and non-agriculture sectors have a declining trend after 2002 (Figure 2). There was no wage increase during the later period, despite increasing commodity prices.

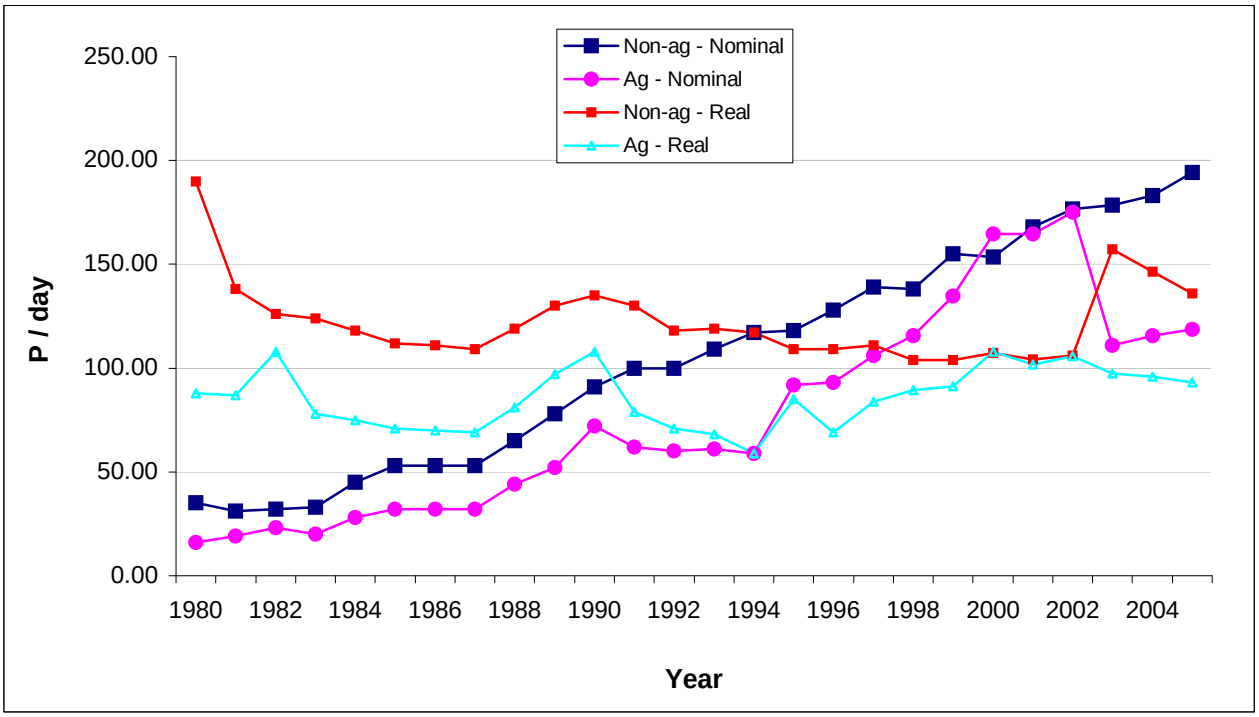

Fig. 2. Real and nominal wages by type of employment, Philippines, 1980-2005. (1994=100).

II. 2. Provincial trends of labor supply and impact of migration

Within Region 10, Bukidnon had consistently had the highest population of 15 years old and over (Table 3). Until 2000, it had a high labor force participation rate though this has declined slightly in 2003. Employment rate in Bukidnon is higher than the regional average. However, Bukidnon has also the highest visible underemployment rate, i.e. those employed are not necessarily fully employed. This may reflect in-migration by workers hoping to find full-time work, and willing to endure a period of unemployment or underemployment in the course of their search—a provincial version of the well-known Harris-Todaro migration model (Harris and Todaro 1970).

Migration and Agricultural Expansion in Upland and Forestlands

Data also show that labor force growth in Bukidnon province is strongly influenced by in-migration. In the 1995 Philippine Census projections of inter-regional

and inter-provincial migration patterns, Bukidnon was projected to have positive net migration rates (NMR), for both males and females (Table 4).[5]

Table 3. Total population 15 years old and over and employment status, Region 10, selected provinces, 1996-2003.

City/ Provinces	Total 15 years old and over (1,000)				Labor Force Participation Rate (LFPR)[1]				Employment Rate[2]				Visible Underemployment Rate[3]			
	1996	1998	2000	2003	1996	1998	2000	2003	1996	1998	2000	2003	1996	1998	2000	2003
Region 10	2602	1709	1711	2390	70	73	76	75	93	94	94	92	15	16	21	19
Bukidnon	588	623	630	756	79	88	85	73	95	97	96	95	22	25	27	22
Camiguin	42	43	47	48	50	58	76	77	95	96	99	97	5	5	7	3
Misamis Occidental	323	340	320	319	64	64	70	80	94	92	94	91	3	6	12	19
Misamis Oriental	701	743	714	675	65	65	71	74	94	92	91	86	20	11	20	17
Cagayan de Oro	274	295	318	494	60	63	65	79	92	90	90	97	3	4	9	8

Source: Philippine Countryside in Figures, NSCB, 2005
Integrated Survey of Households Bulletin, 1998
[1]LFPR - Percent of people in the labor force population over 15 years old. People in the labor force are those people who are working plus people who are looking for work during the reference period.
[2]Number of people employed / number of people in the labor force.
[3]Visible under-employment rate - working for less than 8 hours a day.

Table 4. Net migration rates (NMR), by gender, selected provinces, 1975-2010.

Province	Male				Female		
	1985 - 1990	1975 - 1980	2005 - 2010[1]		1985 – 1990	1975 - 1980	2005 - 2010[1]
Bukidnon	0.017	0.015	0.020		0.008	0.011	0.005
Misamis Occidental	-0.015	-0.023	-0.010		-0.018	-0.032	-0.010
Mountain Province	-0.028	-0.056	-0.014		-0.034	-0.064	-0.017
Cavite	0.057	0.061	0.118		0.059	0.059	0.075
Laguna	0.042	0.022	0.121		0.046	0.025	0.123
Nueva Ecija	-0.011	-0.019	-0.005		-0.015	-0.019	-0.003

Source: 1995 Census-based National Region and Provincial Population Projection, NSO, Manila.
[1]Projection by NSO

Motivations for migration to the uplands according to Cruz and Francisco (1993) were "more by lack of other livelihood options than by the attractiveness of destination lands"; therefore increases in lowland incomes, and better definition and enforcement of property rights over forest lands could both constitute major deterrents to migration.

[5] The migration projection assumptions include the differentials in the levels of development of the provinces as well as the presence or absence of a growth center. The basic indicator of change in the level and direction of net migration was the percentage change over the two migration intervals (1975-1980 and 1985-1990). In both periods, the computed NMR for Bukidnon is positive. This is in contrast with other upland areas in the Philippines like Misamis Occidental and Mountain province, which have negative NMRs, meaning, out migration trends.

Why has Bukidnon been such an attractive area for migrants? Surveys and local history show that migrants came from other parts of the country to cultivate temperate crops in the cool highlands attracted by the opportunity to colonize land and convert it to intensive agricultural production. In recent years, the high migration rate also reflects strong job growth in the province, compared with other provinces in Northern Mindanao. Non-farm employment opportunities have increased rapidly in the urban areas of Bukidnon's major towns, Malaybalay and Valencia, and province-wide data show nominal and real non-agricultural wages to be slightly higher than plantation wages, but significantly higher than the non-plantation (i.e. farm) wages since the mid-1990s.

Rapid growth of the provincial economy also affects the labor supply decisions of long-term Bukidnon residents. For many farm families in the province, distances and travel times to urban areas are now small enough to allow for daily (or at least weekly) commuting. Because of the proximity to alternative employment opportunities, rural household members can decide whether to seek farm, off-farm or non-farm jobs. Naturally non-agricultural labor demand favors workers with more education or experience, so the degree of intersectoral labor mobility is likely to be influenced by factors on both the demand and supply side of the market as well as the transactions costs of moving between markets.

II.3 Municipal Level Trends in Labor Supply Decisions

Compared with other Philippine upland communities, Lantapan farmers practice highly commercialized agriculture, thus providing for year-round agricultural employment. A number of farm activities have remuneration on a daily wage rate basis.[6] From a 1996 survey of 120 households, 66% of all labor is mainly on own-farm, 7% mainly in off-farm, and 27% mainly in non-farm activities. Eighty six percent of the non-farm workers were females.[7] In the 2006 survey of households in the town, only 50% of the household members worked mainly on-farm, 26% mainly in off-farm and 24% mainly in non-farm activities.

In addition to this, household members earned higher wage rate per day from non-farm and off-farm jobs than farm work (Table 5). In general, non-farm income exceeded the wage rate given by banana plantations in 2006. This was in contrast with the 1999 and

[6] *Agricultural wage labor is usually called upon in times of plowing, planting, weeding and harvesting. Farm labor remuneration in Lantapan includes both cash and non-cash payments. Cash payment may be daily per individual, or on a contractual basis, i.e. per hectare of land worked, per bag of fertilizer applied or per unit of crop harvested. Non-cash payments are observed in the harvesting of some crops, when harvesters get a share of output as payment. Exchange labor agreements (hunglos) among farmers are sometimes observed, specifically for planting and weeding. Daily wage rates vary depending on location, type of farm operation, sex and age of the laborer. Gender discrepancies are not distinct in corn areas, although some farmers have reported paying higher female wages in vegetable cultivation (Rola et al. 1995).*

[7] *The reason for the high proportion of females engaged in non-farm work is that better-educated members of the population do more non-farm work, and more females than males complete high school and college degrees (Rola, et al.1995).*

2000 survey results where income from banana plantation was higher than from non-farm jobs.

In the 1996 survey, 70% of residents in own village worked in farm jobs; and about 5% in non farm work. Fifty percent of those who go out of their villages but still in the same town also do farm work. Among those who go out of Lantapan, 50% still farm in 1996.

Table 5. Average Daily Wages by Occupation and Location (P/day), 1998-2006.

Type of Employment	Upper Watershed Villages					Lower Watershed Villages				
	1998	1999	2000	2002	2006	1998	1999	2000	2002	2006
Nonfarm work										
Office Employment	141	136	-	177	364	148	182	182	257	682
Small-scale enterprise	94	110	96	86	241	32	93	111	282	210
Construction work	150	60	40	50	110	175	69	-	150	200
Household help	55	50	53	55	65	62	45	74	80	84
Sales lady/helper	70	61	63	48		137	114	136	90	
Nonfarm Average	102	83	63	83	257	111	101	125	172	269
Off-farm Average	-	128	148	91	168		128	148	149	221
Farm Average	59	78	68	73	87	49	79	94	83	113

Source: SANREM survey data.

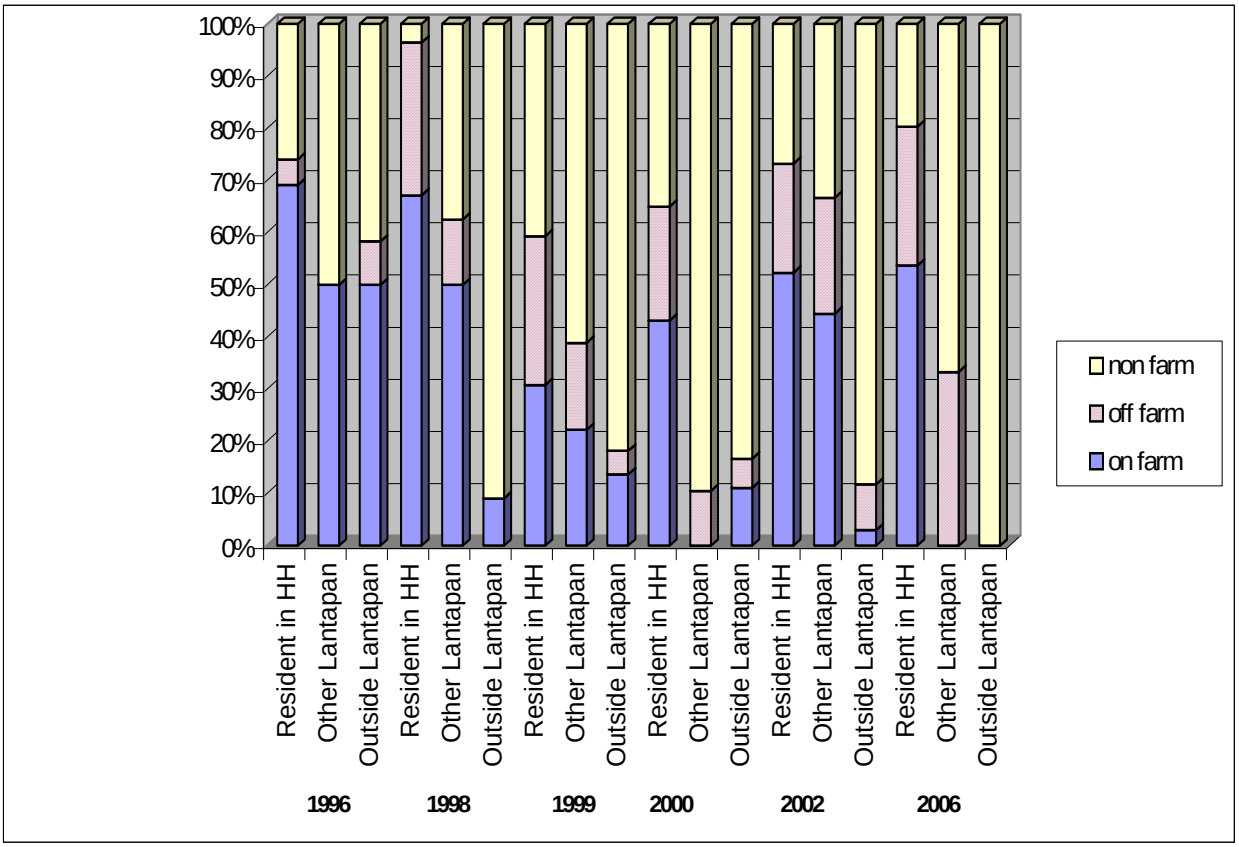

Fig. 3. Distribution of residence of household members over 15 years old, by type of employment, Lantapan, 1996-2006.

This trend has considerably changed in 2006. In 2006 survey, 50% of household members residing in their own place worked on the farm. Those who live in other places in Lantapan worked either in an off-farm or non-farm job, none in farm jobs. Household members who were in other areas outside Lantapan worked exclusively in a non-farm jobs (Figure 3). Some of them were in private and government offices while others worked as household helpers in the urban centers. Our data further showed that the climate aberration in the 1990s induced farm households to seek non farm and off farm work even in the village confines, but these residents went back to farming when weather was favorable.

III. PARTICIPATION IN NON-FARM EMPLOYMENT

III. 1 Non-farm Job Opportunities in Lantapan

Through the years, increased participation of household farm members in off-farm and non-farm job was observed. Shift from farm to off-farm and non-farm jobs were heavily felt during 1999. The El Ñiño drought of 1998 saw a big increase in non-farm employment shares as upland crops failed. In general, our data showed that corn areas have higher proportion of non-farm employment than vegetable areas (Figure 4). Movements to off farm work in 1999 and 2000, was a consequence of the establishment of two large banana plantations in the study area. But interestingly, percentage of household members working on farm suddenly increased its share after year 2000. As evidence, the 2006 survey revealed that the biggest proportion of household members in vegetable and upper watershed corn areas worked on farm. This shift suggests that household members still considered farm job as a more stable source of income since off-farm and non-farm employment required skilled work. The long term data also showed the resilience of the upland households to climate shocks; they can shift to non farm jobs during drought; but go back to farm work in better times.

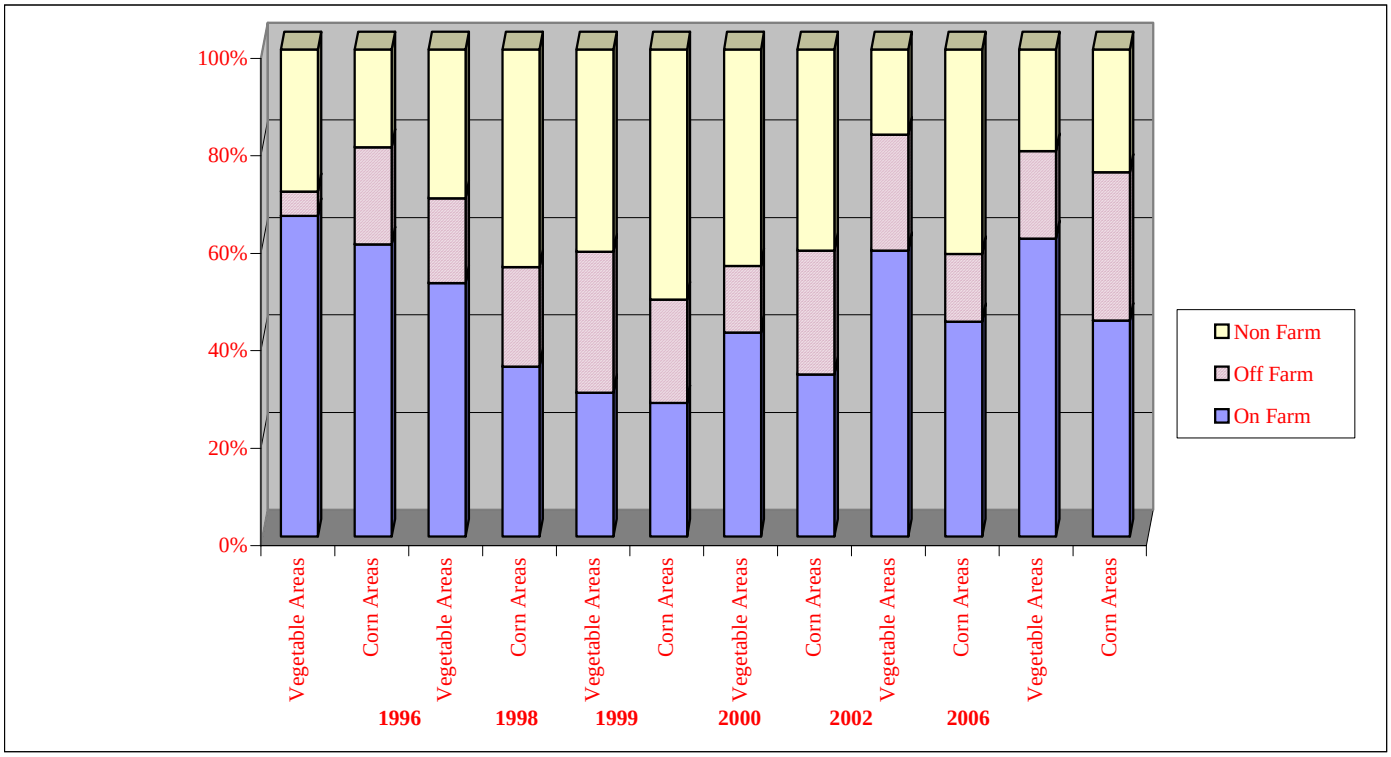

Fig. 4. Distribution of source of employment of household members over 15 years old, in vegetable and corn growing area, Lantapan, 1996-2006.

III. 2.Propensity to participate in non farm employment

The Empirical Model

Logit estimation was used to determine the factors that affect the propensity to participate in non farm and off farm activities. Two regression equations were estimated representing the 1996-98 period and the 2000-2006 period, respectively. Patterns of employment were different during the two periods thus this division. The drought during the period 1997-98 created a different condition than the later normal years. We have earlier observed that migration out of the farm became distinct during the drought period (Rola and Coxhead 2001). Employment opportunities were also more varied in the later period thus, models representing the two periods are specified differently.

The dependent variable used was assigned a value of 1 for households with non farm and off farm labor and 0 for farm employment only. Farmer characteristics determined the propensity to participate in non farm employment. In the earlier period, it was hypothesized that number of adult females will have higher propensity to be in the non farm labor. The participation would be negatively influenced by the area of vegetable farmed as vegetable production is farm labor intensive. The interaction of the area of vegetable planted and the number of adult female members is expected to be positive and that this will have a negative effect on the propensity to participate in the non farm labor.

In the equation for the 2000-2006 period, variables added were the dependency ratio where this will have negative effect on the dependent variable; dummy for households

who rented out parcels, assumed to have positive coefficient; and the gender of the household head, where 1 is female headed households and 0 is male headed households, and positively related to the dependent variable. The year dummy was assigned a value of 1 for 2006 and 0 for 2000 and 2002 to differentiate the somewhat different economic conditions between these years.

Results of the Descriptive Statistics 1996-2006.

Demographic characteristics of our farmer household respondents have certainly changed during the past ten years (Table 6). Mean age of household head has not unilaterally increased by 10 years, some of our respondents have dropped out and sought non-farm jobs and were part of the survey. The older ones have also passed away. Educational attainment has increased through time, though just slightly. The proportion of adult members of the households also increased from 1996 to 2002, but declined in 2006. This may imply that those getting out of our samples have more female adult members who have sought for non farm jobs. The status of the tenure of the largest plot became more secured through time. The proportion of vegetable area to total area planted to annual crops have also increased in 2006 from 2002, revealing the increasing intensity in vegetable production in the area, that could be a result of the profitability of vegetables in the economy. Proportion of female headed households has increased tremendously; while dependency ratio has declined from .71 in 1996 to .54 in 2006. It also seems that rental of parcels had slowed down in 2006 compared to 2002.

Table 6. Descriptive Statistics for variables in the logit model, 1996 to 2006.

	1996	1998	2000	2002	2006
Mean age of HH	44.00	45.24	47.63	47.97	51.93
Mean education of adult household members	2.45	2.63	2.70	2.46	2.87
% of adult females in the household	42.45	43.56	46.08	48.1	43.88
% distribution of tenure of largest plot					
Most secured	24.49	47.25	47.62	47.57	61.33
Moderately secured	73.47	27.47	33.33	37.86	22.67
Least secured	2.04	25.27	19.05	14.56	16.00
% of vegetable area to total area planted to annual crops	7.13	13.05	3.25	27.78	41.78
% of female headed household	15.45	2.15	2.38	9.26	31.25
Dependency ratio	0.71	0.76	0.75	0.69	0.54
% of households with rented out parcels	-	-	7.14	17.59	7.50

Econometric results and discussions

Results of the 1996-98 regression showed that age and tenure were the significant factors in the decision to be in non farm employment (Table 7). Younger household members go to non farm employment more and this rate is declining as one gets older, as expected. Tenure was positive and significant, i.e. owners of land go into non farm employment more. This could also capture the education effect, which in this regression result is positive but not significant. Except for the proportion of vegetable area to total annual

area, all the other variables were found to have the right sign as hypothesized, though not statistically significant. As vegetable production intensifies, non farm employment declines, but our computed coefficient is positive. As area of vegetable planted increases in proportion to other annual crops, there ought to be lower propensity to be in the non farm sector. This is so because vegetable production is labor intensive. But vegetable households with adult female members have lower propensity to join the non farm job market that supports earlier findings. This also indicates that with climate shock during this period (1997-98), wealth and skills (as represented by the younger population) were significant factors in the household survival.

Table 7. Logit estimates on the propensity to participate in off-farm and non-farm[1] activities, (1=participating; 0=not participating) 1996-1998.

Variables	Estimates		Elasticities	
	Coefficient	Standard Error	Coefficient of Elasticity	Standard Error
Constant	-6.18	2.83	-	-
1. Age of household head	0.21*	0.12	2.35*	1.36
2. Age squared	-0.002*	0.001	-1.15*	0.66
3. Mean education of adult HH members	0.2	0.18	0.13	0.11
4. # of adult females in the HH	0.57	0.37	0.24	0.15
5. Tenure of largest parcel (3-most secured, 2-moderately secured, 1-least secured)	0.52**	0.27	0.26**	0.13
6. Proportion of vegetable area to total area planted to annual crops	0.24	0.85	0.02	0.07
7. Area of vegetable planted X number of adult female member	-0.22	0.51	-0.03	0.08
Log-likelihood	-.85.72			

* Significant at $p \leq 0.10$
** Significant at $p \leq 0.05$
*** Significant at $p \leq 0.01$

In the subsequent period (2000-2006), normalcy in the climate was observed. There were more significant variables in the list of household characteristics (Table 8.). The age variable is significant and positive; age squared is significant and negative, which conforms to expectation. Tenure variable is positive and insignificant, while education is highly significant. Educated land owners go into non farm activities. Female headed households and female adults in general have lower propensity to be in non farm employment, which was not the case in the earlier year regression. Adding the dependency ratio as a variable generated a negative and significant coefficient. The younger the children are or the more old persons (65 years and above) in the household, the lesser is the propensity for the adult members to be in the non farm jobs. Coefficient of the dummy for plot rented out was positive, though not significant. This shows that households with rented out plot had more propensity to do non farm jobs. Mostly, our

data showed that households who rented out their plots have family members as employees of the banana company in this later period. Higher proportion of vegetable area to total annual crops area also had positive but insignificant coefficient. The year dummy coefficient also showed distinct differences in the decisions between the two periods, 2000-2002 and 2006, having significant but negative coefficient. Households were more prone to be in the non farm jobs in 2000- 2002 than in 2006. Economic conditions may have improved and farm households may have recovered from the effects of the drought. Banana plantations may also have stabilized their employment levels and were not hiring anymore in this later year, thus this observation. In addition, small farmers also planted bananas, that is now considered as farm work.

This analysis proves that non farm employment by upland households are sensitive to their particular socio-demographic characteristics (age, education, dependency ratio) and indirectly, the economic context that they experienced.

Table 8. Logit estimates on the propensity to participate in off-farm and non-farm[1] activities, (1=participating; 0=not participating), 2000-2006.

Variables	Estimates		Elasticities	
	Coefficient	Standard Error	Coefficient of Elasticity	Standard Error
Constant	-5.11*	3.15	-	-
Mean age of adult members	0.30*	0.16	3.31*	1.77*
Mean age squared	-0.004**	0.002	-1.55**	0.79
Mean education of adult members	0.44***	0.15	0.38***	0.13
Gender of household head (1=female; 0=male)	-0.06	0.46	0.00	0.02
# of adult females in the HH	-0.11	0.19	-0.07	0.12
Tenure of largest parcel (3=most secured; 2=moderately secured; 1=least secured)	0.06	0.21	0.04	0.15
Dependency ratio	-0.68**	0.23	-0.13**	0.04
Dummy for household with rented out parcel (1=rented out;0=none)	0.002	0.59	0.0001	0.02
Proportion of vegetable area to total area planted to annual crops	0.10	0.60 [a]	0.01 [a]	0.08
Area of vegetables planted X number of adult female member	0.10	0.29	0.02	0.07
Year dummy: 1=2006 0=2000&2002	-1.59***	0.36	-0.16***	0.04
Log-likelihood	-132.81	-	-	-

[1] For parcels with slope greater than 0

IV. PROPENSITY TO PRACTICE SOIL CONSERVATION

IV.1 Soil Conservation Practices in the Uplands

Less labor on the farm may discourage labor-using soil conservation technologies, the promotion of which has been a focus of efforts to encourage environmentally

sustainable upland agricultural practices. At the plot level, our data do not show a clear pattern of adoption rates of both labor-intensive (hedgerows and contour farming) and labor-saving technologies (fallow and agro-forestry). The percentage of sample plots with labor-intensive conservation methods such as contour plowing and hedgerows declined from 16% in 1996 to barely 10% in 1999, but grew to 36% in dry season of 2006. On the other hand, the proportion of plots with trees and fallow is constant at about 25%; the increase in this category would be due to the number of plots being fallowed for the year (Table 9).

The details on soil conservation measures of specific crops like corn and cabbage revealed that more plots have labor-using technologies (Table 10). This occurrence was seen during the drought year and consequent year. In 2006, no plots were fallowed in the upper watershed. Cabbage plots with conservation measures commonly have contour hedgerows rather than trees and fallow.

Table 9. Number of plots with soil conservation measures, Dry Season Lantapan, Bukidnon, 1996-2006.

Year	Total Plots (n=)	Percent of Plots with Contours/ Hedgerows		Percent of Plots with Trees / Fallow	
		n	%	n	%
1996-1	224	37	16.52	56	25.00
1998-1	132	38	28.79	32	24.24
1999-1	123	13	10.57	42	34.15
2000-1	116	39	33.62	34	29.31
2001-1	91	28	30.77	33	36.26
2002-1	167	31	18.56	54	32.34
2006-1	97	35	36.08	24	24.74

On the other hand, upper watershed has larger number of corn plots with contours and hedgerows as soil conservation measures than corn plots in the lower watershed areas. Farmers with steep plots normally practice soil conservation measures, as an indigenous technology.

Table 10. Number of plots with soil conservation measures by crop, dry season, Lantapan, Bukidnon, 1996-2006.

Year	Cabbage			Corn (lower watershed)			Corn (upper watershed)		
	% of plots with soil conservation	% of plots with contours/ hedgerows	% of plots with trees/ fallow	% of plots with soil conservation	% of plots with contours/ hedgerows	% of plots with trees / fallow	% of plots with soil conservation	% of parcels with contours / hedgerows	% of parcels practicing trees / fallow
1996-1	58	50	8	53	22	31	42	16	26
1998-1	67	67	0	52	40	12	60	33	27
1999-1	0	0	0	39	15	24	54	11	43
2000-1	0	0	0	74	54	20	51	34	17
2001-1	60	20	40	65	50	15	82	26	56
2002-1	67	42	25	70	35	35	50	30	20
2006-1	80	80	0	41	33	8	57	57	0

IV.2 Employment of household members doing soil conservation

Trends of sources of employment in relation to the practice of soil conserving measures indicate that households are indifferent to the type of soil conserving measures practiced as they go to non farm and off farm employment (Figure 5). Households who practice trees and fallow and hedgerows and contour were seeking off and non farm employment especially during the drought years. During 2006, when the climate was considered normal, those practicing trees and fallow had a higher proportion of non farm and off farm employment, while those practicing contours and hedgerows had more proportion of farm employment. We earlier noted that cabbage farmers and upper watershed corn farmers only used contours and hedgerows. However, in general, we also saw that proportion of farmers doing conservation measures in annual crops in the upper watershed have increased in 2006 (Table 10).

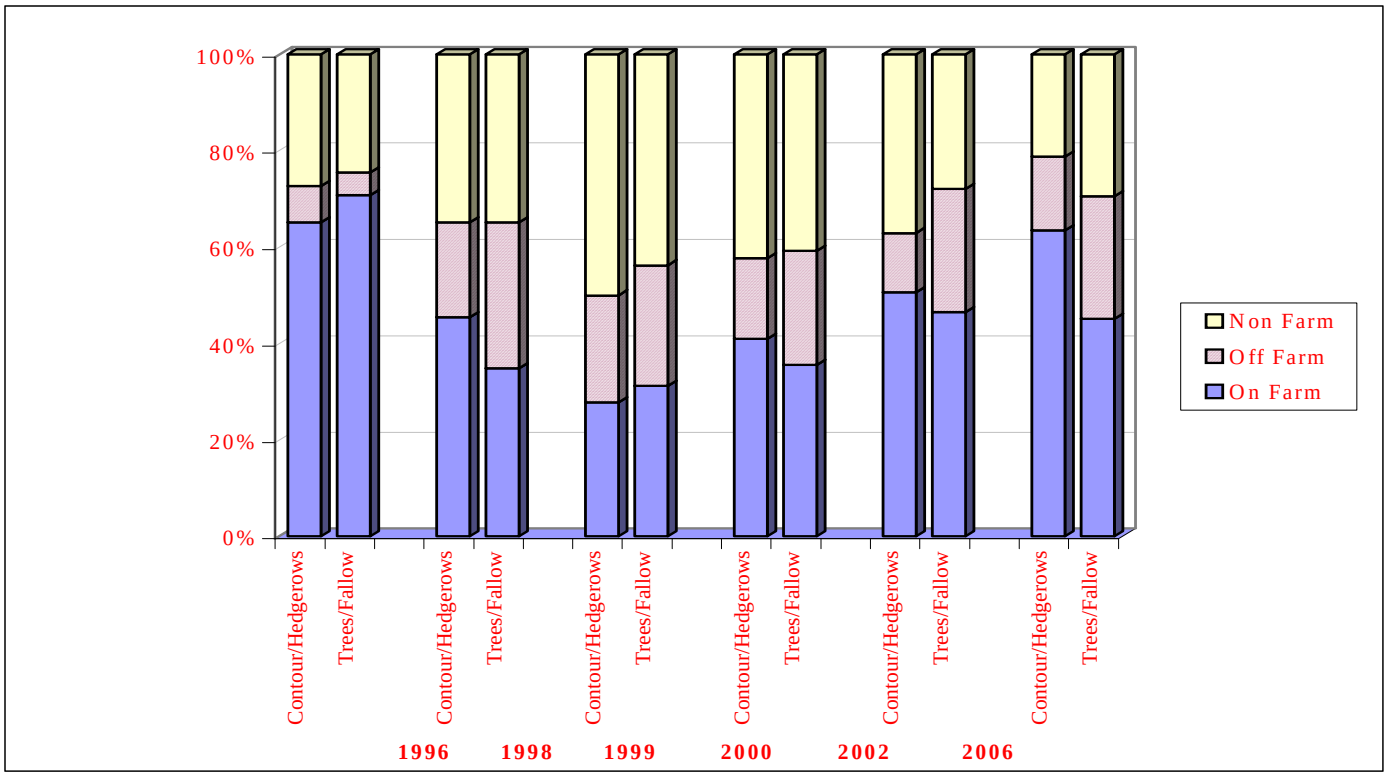

Fig. 5. Distribution of sources of employment of household members over 15 years old, practicing soil conservation measures, 1996-2006.

IV. 3 Propensity to Practice Soil Conservation

The Econometric Model

Following the model used by Rola and Coxhead (2002), we model the probability that a farmer will adopt soil conservation measures on a given plot (parcel). Define a binary variable C, taking a value of 1 if the largest parcel has a soil conservation measure, and 0 otherwise. The adoption decision is modeled in two alternate ways:

$$C = f(W, P, Z') \quad (1)$$

and

$$C = f(E, P, Z') \quad (2)$$

where $Z' = Z$ is the vector of household characteristics including farm size and a variable representing the slope of the parcel.[11], E is the non farm employment dummy, W is the non farm income and P is the price expectation. E is the dependent variable in the logit equations discussed in Tables 9 and 10. The theory presented in Rola and Coxhead (2002) indicates that land use and conservation decisions are functions of nonagricultural wages (proxied by non farm incomes), among other variables, as in equation (1). When non-farm wages are high, there is a tendency to get out of the farm and the scarcity of the farm workers will now diminish the propensity to adopt soil conservation measures. Equation (2) is intended to compensate for imperfect observation of non farm wage data; the propensity to participate in non farm employment.

For each parcel, higher slope and more secure tenure are both expected to have a positive association with the adoption of conservation practices (Rola and Coxhead 2002). In addition, expected output price was defined as a variable in the model. If one expects higher output price in the future, then there is an incentive to adopt soil conservation measures where these promise higher yields. The demographic variables in Z' are intended to capture what we have referred to as the 'match' between the characteristics of family labor and those demanded by the off-farm and nonfarm labor markets, particularly age and education. We hypothesize that earnings potential rises with each of these; however, as age captures both experience and capacity, we expect also that earning potential increases with age at a declining rate. Therefore, we include a term for the square of age as well.

Two sets of regression equations were estimated to represent the 1996-98 period and the 2000-2006 period. In the second period, a dummy for year is included, with a value of 0 for 2000-2006 and 1 for 2006. This is to capture the varying climatic and economic conditions during these periods. With the availability of non farm and off farm jobs in the uplands during the recent times, farmers may not practice soil conservation measures as much as they did when these other employment opportunities were not available.

Two specification of the model was used to estimate equations (1) and (2): Model I included the dummy for non farm participation, while Model II included non farm incomes in absolute values.

Results and discussion

In the earlier period, the econometric results for both models showed negative though barely significant coefficients for the dummy of non farm employment participation and non farm income (Table 11). Model I revealed a positive and significant coefficient for slope, which supported the earlier results, that it is the farmers' practice to do soil conservation in steep slopes. The coefficient of the age variable was not in conformity to the expectation. Coefficient of age of household head is positive while that of age

squared is negative and both were not significant. This result was consistent with the earlier study (Rola and Coxhead 2002). Education coefficient is negative though not significant which seems to suggest that the less educated persons are the ones left on the farm and thus do soil conservation measures.

In Model II, non farm income did not yield a significant coefficient but was negative, which is as expected. Output price expectation coefficient was slightly significant and negative, which was as hypothesized. Education coefficient was seen to have positive sign though not significant, and not consistent with our earlier observation. This effect can be influenced by the tenure variable which is positive and significant. Educated land owners will have higher propensity to practice soil conservation measures, even if they go to non farm jobs.

Table 11_. Propensity to practice soil conservation measures[1], 1996-1998.

Variables	Model I		Model II	
	Coefficient	Standard Error	Coefficient	Standard Error
Constant	-5.38 [a]	4.28	-2.89	4.65
Slope	1.85***	0.59	0.47***	0.44
Tenure	0.9 [a]	0.59	1.71	0.69
Age of HH	0.1	0.18	0.09	0.19
Age Squared	-0.001	2	-0.001	0.002
Dummy for non-farm income participation	-0.89 [a]	0.62	-	-
Non-farm income, in pesos	-	-	-0.04 [a]	0.02
Price Expectation	-	-	-0.48	0.43
Mean education of HH	-0.18	0.26	0.09	0.27
Log likelihood	-88.0		-37.75	

[1] For parcels with slope greater than 0
[a] Significant at 20%
*** Significant at $p \leq 0.01$

Table 12. Propensity to practice soil conservation measures[1], 2000-2006.

Variables	Model I		Model II	
	Coefficient	Standard Error	Coefficient	Standard Error
Constant	2.6	5.34	1.52	7.47
Slope	0.49 [a]	0.38	1.19	0.66
Age of HH	-0.15	0.21	-0.22	0.29
Age Squared	0.002	0.002	0.003	0.003
Dummy for non-farm income participation(1 for participating; 0 otherwise	-0.13	0.53	-	-
Non-farm income, in pesos	-	-	-0.005	0.01
Price Expectation	-	-	0.38	0.41
Mean education of HH	0.03	0.19	0.05	0.28
Dummy for year (1 for 2006, 0 for	-1.3***	0.51	-1.64***	0.76

2000 and 2002)		
Log likelihood	-116.89	-95.15

[1] For parcels with slope greater than 0
[a] Significant at 20%
*** Significant at $p \leq 0.01$

Moreover, in the earlier article (Rola and Coxhead 2002) we found negative sign though not statistically significant coefficient of the expected non farm wage. In this longer data set, we also found a negative though insignificant coefficient for non farm income. The result still supports our earlier conclusion that so long as land is not to be taken out of production altogether, the growth of nonfarm employment opportunities should perhaps be matched by incentives for farmers to adopt soil-conserving strategies to reduce family labor on-farm, rather than alternatives that might worsen erosion. For example, subsidies or tax breaks for farmers reallocating their labor to nonfarm employment and wishing to convert their farms to agroforestry or other perennial crops might be justified on the grounds that by doing so, the offsite effects of soil erosion are diminished.

In the 2000-2006 period, almost all coefficients were not significant except for the year dummy and slightly on the slope (Table 12). The age variable though has now the correct expected sign which supports the theory that younger farmers may not adopt soil conservation techniques, but would do so as they get older. As mentioned in the earlier article, "on the farm, it is often observed that older persons know more about soil conservation and that their indigenous knowledge leads to more sustainable practices. It could also be that younger farmers have more non-farm opportunities through higher educational attainment, and thus tend less readily to adopt labor-using practices. Our data indicate that farmers adopting no conservation practices at all have an average age of about 30, while those adopting have average age of about 35 years"(Rola and Coxhead 2002).

In this model, tenure was not included in the model as education may have captured its effect. The year dummy coefficient also shows that propensity to do soil conservation measure was higher during 2000-2002 than during the later period. This could be the outcome of the non fallowing of plots of our respondents in 2006. Coefficients of dummy for non farm job participation and for non farm income are both negative and insignificant as compared to the earlier period where this was slightly significant at 20% level. The longer data set seems to show that even with non farm jobs in the area, farmers still do soil conserving techniques, as also supported by the descriptive statistics, especially in the upper watershed.

V. CONCLUSIONS

The Philippine economic trends showed a decline in agriculture value added, a stable industry sector, and an increasing share of the service sector from 1970 to 2006.Agricultural employment share in total employment has consistently declined in the same period; while agricultural wage rates were also lower than the non agriculture wages. At the town level, data showed more employment in the non farm sector; with higher wages in that sector. Age and tenure status were significant factors in the

participation in non farm jobs during the drought years; age, education and dependency ratio were significant for the subsequent years.

Upland farmers usually do soil conservation measures, especially for those cultivating the steep slopes. This long term data analysis showed that the participation in non farm jobs has lowered this propensity to do soil conservation during the drought years as also seen in the earlier studies; but during the normal years (2000-2006), the non farm work was not a determinant of soil conservation practices. Participation in non farm employment has affected practice of soil conservation measure, but this impact has lessened as agriculture again becomes a more popular source of income.

Descriptive data also showed that despite intensification especially of vegetable production, vegetable farmers were practicing labor intensive soil conservation measures. This finding is encouraging, that even as agriculture intensifies, environmental measures are being taken up by farmers in the area. This could be a result of the high knowledge about sustainable agriculture of our respondents. This area has been the study site of various projects, and results in this analysis may be attributed to the impact of these, especially land care projects.

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