CHAPTER IV

NON-TIMBER FOREST PRODUCTS DEPENDENCE, PROPERTY RIGHTS AND LOCAL LEVEL INSTITUTIONS: EMPIRICAL EVIDENCE FROM ETHIOPIA

Abstract

This study examines the role of local level institutions and property right regimes on the forest-poverty link, with respect to non-wood forest products, using data from a random sample of rural households in Ethiopia. Households in the sample derive approximately 8.7% of their income from these products. The determinants of forest dependency were examined separately for different types of forest property right regimes. The findings suggest that forestry management devolution enhances resource use by the poor, while reducing dependency among the rich. Our estimation results, which are consistent across the different measures of forest dependency, also suggest that local level institutions are not significant factors in determining the use of non-wood forest products, a result that differs from the analysis of timber and other woody materials. From the study results, we conclude that generalizations of the forest-poverty link are not possible, as the link depends on the type of forest management and the specific characteristics that prevail in the area.

1. INTRODUCTION

Empirical evidence from developing countries indicates that forest products play a significant role in rural livelihoods, particularly for the rural poor. Almost a quarter of a billion people live in or around the dry forests of Sub-Saharan Africa (CIFOR, 2008), and most of them depend on the forests for building materials, food, cropland, fuel wood, non-wood products and many other things. Forest product extraction and the extent of natural resource degradation in developing countries is often attributed to rapid population growth, rural poverty and the open access nature of those resources, especially forests (Dayal, 2006; Bluffstone, 1998).

Rural households in Ethiopia are able to access forest products from a variety of sources, including: participatory forestry management (PFM) forests, or community forests; state forests, which are *de facto* open access forests; and private sources, such as on-farm forests and trees around the homestead. Experiences in many settings are consistent with Hardin (1968):open access resources tend to be overexploited and depleted. Recognizing this fact, Ethiopia, a decade ago, began to transfer the management of state forests to the local communities living near the forests. As part of its efforts, PFM, initiated by non-governmental organizations, such as FARM Africa and GTZ, has devolved to Oromiya and the Southern Nations, Nationalities and Peoples' (SNNP) regions of the country. It is believed that the new management style has improved environmental outcomes and contributed economic benefits to the local people. There is, however, little quantitative empirical evidence related to the effect of these institutional changes on the forest-poverty link. As argued by Shyamsundar et al. (2005), understanding the impacts of these institutional changes is important both for governments and for other stakeholders.

It is widely argued that devolution – the transfer of rights and responsibilities to local level user groups – of natural resource management is the most viable option for ecological and economic sustainability of natural resources. According to Dayal (2006), the transfer of the rights of state managed forests to local people is the primary forestry policy goal in many developing countries, including Ethiopia. As a result, donors, practitioners and governments are advocating a change in the management of forest at the local level. However, the success of common property resource management depends, to a great extent, on the rules and regulations applied and practiced in the management of natural resources (Ostrom, 1990,

cited in Mekonnen, 2000). Besides household and village characteristics, institutional factors at the local level – such asthe clarity of rules for accessing the forests, the degree of village level forest monitoring and village level participation in forest management –are found to be important in the analysis of the poverty-environment nexus, in general, (Wunder, 2001; Reddy and Chakravarty, 1999) and the forest-poverty link, in particular (Adhikari et al., 2004).

Many researchers have documented the role of environmental resources and non-timber forest products (NTFP) in the economic development of local communities and sustainable forest management.[45]Available evidence from developing countries (Arnold and Bird, 1999; Cavendish, 1999a and 1999b; Adhikari, 2005; Reddy and Chakravarty, 1999; Narain et al., 2008b) focuses on quantifying the contribution of natural resources or forest products to rural income and analysing the socioeconomic factors that affect forest dependence. Recent studies tracking household income conclude that NTFPs contribute between 10% and 60% of income (Cavendish, 2000; Reddy and Chakravarty, 1999; Fisher, 2004; Mamo et al., 2006), and that this contribution varies substantially across households. Similarly, Neumann and Hirsch (2000) argue that, while NTFPs contribute to household income in many places, the contribution is geographically uneven, varies across social groups and is highly differentiated by gender, class and ethnicity. Though many studies find a strong positive link between poverty and NTFP dependence, Pattanayak and Sills (2001) find that relatively wealthier households depend on NTFP to reduce risk and smooth both consumption and income. In other words, many complex factors affect the forest product use and dependence in rural areas of developing countries.

As explained in the preceding paragraph, the contribution of forest resources to rural livelihoods varies across studies, depending on the nature of forest products included in the study, the methods employed in the valuation of products, and the type and management of forests prevailing in the study area. However, despite the importance of understanding the role of local level institutions and property right regimes on rural household forest product use and dependence, the empirical evidence is still limited (Edmonds, 2002). Therefore, there

[45]Different definitions are used in the NTFP literature. Various authors interchange minor forest products, non-wood forest products, and secondary forest products. In this paper, the term NTFPs and NWFPs are used, interchangeably, to refer to all forest products except for fuel wood and other woody materials, which can be derived from forests, wooded land and trees outside of forests.

is a need to evaluate and analyse the forest-poverty link at the local level, in order to more appropriately design policies and programs aimed at improving rural livelihoods, reducing forest degradation and increasing forest resources (Gutman, 2001).

The main objective of this research is to examine the factors that affect NTFP dependence, with a particular emphasis on the role of property right regimes and local level institutions. Moreover, the study assesses the contribution that forest products, especially NTFPs, make to rural livelihoods, by examining time allocation – to the collection of NTFPs – and the share of income derived from the forest. The study contributes to the existing literature by including institutional variables and property right regimes with in the forest-poverty nexus. This study also complements the limited literature related to the forest-poverty link in Africa, in general, and Ethiopia, in particular.

In this study, we find that forestry management devolution enhances forest resource use by the poor, while reducing dependency among rich households. There is no evidence that richer households influence either the formal or informal access restrictions on access in their favour, when the forest belongs to the community. However, our findings also suggest that the relatively richer households exploit forest resources from OA more than the poor suggesting that there is a need to expand the current practice of PFM to other OA areas. We also find that local institutions do not have any significant effects on forest dependency in a community forest. This might be because institutional conditions are well understood by the PFM participants, meaning that households are fully aware of the forest use rules, regulations and management policies of the community forest. The policy implications is that improving property rights, either through community forestry or private ownership, is likely to reduce the exploitation of forest resources, and may provide equity benefits for the rural population.

The structure of this paper is as follows: Section 2 discusses the methodology, including the conceptual framework and empirical strategies employed in the analysis. Section 3 presents the study area, describes the nature of the data and presents descriptive statistics for the survey data. The results of the empirical analysis are presented and discussed in Section 4. The final section, Section 5, concludes and discusses policy implications.

2. METHODOLOGY

2.1. Analytical framework

Generally, farm households in developing countries are both producers and consumers of agricultural and forest products; the study area examined here is no different. Furthermore, in our study areas, factor markets and agricultural output markets are either weak or absent, due to high transaction costs and limited information, as well as poor infrastructural networks (transportation and communication). Thus, insight into the highly heterogeneous role of forest products in rural household economies can be obtained through microeconometric modelling within the non-separable agricultural household production framework (Sills et al., 2003).[46]

The basic theory assumes a household that maximizes its utility, typically a unitary measure of utility, subject to a set of production, budget, and time constraints. The major implication derived from this model is that household-specific implicit prices are needed whenever key markets are either missing or incomplete. Moreover, the optimal decisions are such that households allocate their labour between various activities (such as agriculture, NTFP collection, and off-farm activities) by equating the marginal utility of leisure to the value of the marginal product of labour in each activity. Households allocate their time such that the shadow value of NTFP collection time is equal to the marginal utility of NTFPs obtained by allocating more time to collecting, which is the familiar proposition that marginal cost equals marginal benefit, applied, in this case to NTFP collection. The optimal conditions yield a set of production, consumption and labour allocation equations, which are functions of prices and wages, household preferences and technologies, which can be empirically examined.

2.2. Empirical Strategies

As previously stated, the main objective of the analysis is to understand NTFP dependence, with a particular emphasis on property rights and local level institutions. In order to examine the NTFP dependence across the different property right regimes and institutional settings, separate regression models were specified for PFM (or community) forests, private sources and open access forests. From the theoretical framework the dependent variable could be NTFP production, NTFP consumption or labour allocation to NTFP collection. As the model

[46]Amacher et al. (1996), Cooke (1998), Mekonnen (1999), Köhlin and Parks (2001), and Heltberg et al. (2000) develop and apply such models in the examination of fuels, especially fuel wood.

is non-separable, the functional form of the reduced-form equations cannot be derived analytically (Singh et al., 1986). Therefore, researchers have relied on numerous methodologies, including: descriptive and multiple regression methods, such as OLS (Adhikari, 2005); discrete choice models, such as Tobit (Fischer, 2004; Dayal, 2006); instrumental variable models, and panel data analysis (Cooke, 1998).

2.2.1. Time Allocation

Due to the variety of sources available to the household, it is likely that only a subset of households make use of any one particular source, such that resource use is censored at zero. Censoring could be random or non-random. If censoring is random, an independent hurdle model, such as the standard Tobit model or a more general two-part model could be applied. If censoring is not random, a dependent hurdle model is, instead, required to mitigate the effect of non-random censoring, more commonly referred to as selection bias. In this analysis, only a subset of households participate in the PFM, and, given the name, it is reasonable to assume that households choose to participate, such that censoring is non-random. Note also that only members of the PFM are allowed to collect resources from the community forest. Non-members or non-participants, on the other hand, are required to either use their own sources or use open access forests. Thus, only considering members of the community forest will yield inconsistent estimation results.

On the assumption that rural households decide where to collect the non-timber forest resources, based on their access, as well as the measure of income related to collection, Heckman's (1979) sample selection methodology is followed. The participation, or selection function, follows a probit specification.

$$y_1 = \mathbb{I}(Z\gamma - \varepsilon_1 > 0) = \Phi(Z\gamma) \quad (1)$$

In (1), $\mathbb{I}$ is an indicator function yielding a one when the expression in brackets is true, such that $y_1 = \{0,1\}$, $Z$is a set of observable controls, which are assumed to be uncorrelated with the observed controls, γ is vector of parameters to be estimated, ε_1 represents unobserved determinants, and Φ represents the cumulative normal distribution. The outcome equation follows a standard linear regression format.

$$y_2 = X\beta + \varepsilon_2 \quad (2)$$

In (2), X is a set of exogenous controls assumed to affect time allocated to collection of forest products and the measure of forest resource income (share of income and total income) used in the analysis, ε_2 represents the unobserved determinants of resource collection, which are assumed uncorrelated with observed determinants, and β is a vector of parameters to be estimated. The system (1) and (2) are estimated via full information maximum likelihood, correcting for heteroscedasticity following White (1980), and further assuming a bivariate normal distribution.

$$\begin{bmatrix}\varepsilon_1\\ \varepsilon_2\end{bmatrix} \sim N\left(\begin{bmatrix}0\\ 0\end{bmatrix}, \begin{bmatrix}1 & \rho\\ \rho & \sigma^2\end{bmatrix}\right) \tag{3}$$

The key to identification in the system is finding exogenous variation in participation that does not affect collection time, allowing for identification of the correlation between the unobserved determinants of participation and resource use, as measured by ρ.In this analysis, the household's distance to the forest is used for identification.

In order to check the robustness of the results, the share of income and total income derived from each type of property rights regime were considered as income measures related to NTFP dependence, while time spent collecting was also considered as a different measure of NTFP dependence. The estimation strategy, described by (1) – (3), is used for both the share of income and total annual income derived from NWFPs. However, further estimates of time spent, share of income and total income derived from all sources, were derived from OLS specifications, although it was applied only for households involved in the collection of NWFPs from at least one source.

2.2.2 Local Level Institutions

As the analysis is concerned with broad measures forest dependency, in relation to NTFP, and there is a PFM policy in place, the analysis also considers the effect of local level institutional effects on forest dependency. Recent literature, though, has emphasized the endogeneity of forest management institutions. In the presence of endogenous explanatory variables, the instrumental variable regression is the preferred approach. However, in this analysis, the Durbin–Wu–Hausman test was used to test for endogeneity. Initially, 'enforcement strength' was regressed on other independent variables. Residuals from the initial regression were included in an augmented resource regression. The same test procedure was implemented for institutional characteristics. The hypothesis of no

endogeneity was rejected in both cases, and, therefore, OLS corrected for heteroscedasticity was employed, since endogeneity was not statistically relevant in this sample.

The necessary data for measuring institutional strength in the area were collected, as part of the survey, although data is only available for PFM members. The institutional variables focus on forest management, forest monitoring, household participation and household perception related to forest use and status. Forest user group members were asked to indicate their agreement or disagreement, on a Likert-type of scale (i.e., strongly agree=1, agree=2, no opinion=3, disagree=4 and strongly disagree=5), to a wide range of statements. Given the large number of statements, and the limited number of observations in the sample, it is practically very difficult to include all the variables in the analysis. Therefore, an index was constructed combining, and, thus, reducing the number of closely related variables.[47]Two such indexes were constructed, one relating to enforcement strength, "ENFORINDEX", the other related to institutional characteristics, "INSTINDEX".[48] All the questions related to monitoring, penalties and social sanctions are grouped under enforcement strength, while other variables, such as the clarity of rules and regulations, fairness in the distribution of benefits and participation in forest management are grouped under institutional characteristics.

2.2.3. Valuation and Estimation of Share of Income from NWFPs

The values of NWFPs derived from different sources are based on the different approaches found in the literature. First, the value of tradable products was calculated from the quantity collected and the local market price. Second, the value of some non-marketed forest products was calculated from the collection time and the current market wage rate in the area, i.e, through an opportunity cost approach. See for example, Chopra (1993) and Adhikari (2005), who note that if labour time is the major input required in the accrual of a good or service, its opportunity cost can be treated as an approximation of the product's value in use. However, this latter method underestimates the true value of some forest products in the study area.

[47] Although, principle components regression is one possibility, a simpler index related to the UNDP's human development index was, instead, used. The calculated index is based on the average of the N indices, and rescaled to lie in the unit simplex. That is, $Index_i = N^{-1}\sum_{j=1}^{N}(\max(I_j) - I_j)/(\max(I_j) - \min(I_j))$, when max and min are the lowest and highest values in the sample, N is the number of institutional components included under the index. The result is, therefore, unit free and represents a simple average of the institutional variables. Bluffstone et al. (2008) applied a similar formula to calculate their index. Principal components analysis was also applied, but led to results that were difficult to interpret.

[48]The correlation coefficient between the two indices is 0.12, suggesting that the variables are not strongly correlated measures of institutional conditions.

Instead, a unit of time spent (including travel time) in collection of marketed forest products was multiplied by the total time spent to collect other similar non-marketed products. Extreme observations and unclear reported values or quantity units were removed from the analysis. Furthermore, the contributions of forests to major environmental services, such as soil conservation and carbon sequestration, as well as general aesthetic and spiritual values are not considered in this study.[49] In general, the values reflect the gross economic value of NWFPs. Unfortunately NTFPs (NWFPs) have often been undervalued in previous studies, since previous studies have only considered them in terms of their direct-use values (Shackleton et al., 2001).

The share of income derived from NWFPs, as implied by the moniker, is obtained as the ratio of income derived from NWFPs to the total annual expenditure of the household.[50] As opposed to most other studies, expenditure is used, rather than income, since expenditures are less variable and more closely related to expected lifetime income.[51]

3. STUDY AREA, DATA COLLECTION AND DESCRIPTIVE STATITICS

3.1 Study Area and Survey

The survey was conducted in Gimbo Woreda[52] in the SNNP region of Ethiopia. Gimbo Woreda is part of the southwestern Ethiopian highlands and is found in Kaffa Zone, about 450 km of southwest of Addis Ababa, the capital city of Ethiopia. The total population of the Woreda is estimated to be 147,905, 78% of which are located in rural areas. The population density of the Woreda is estimated to be 116.5 people per square kilometer. Most of the population is Kaffa, although there are also small numbers of people from the Menja and Mana tribes. Major crops grown in the area include: cereals, pulses, *enset* (a large, thick, single-stemmed banana plant), sugarcane, coffee and spices. Livestock is also important to the farm economy.

[49]To measure such environmental services of this nature, specialized valuation techniques (contingent valuation, travel costs methods, hedonic pricing, or production function approaches) are preferred (Cavendish, 2000). However, data to perform such valuations was not collected, as part of the survey.
[50]There is little agreement on the appropriate approach to including durable goods expenditure; however, in this analysis, a percentage of expenditure on the good is allocated to the year in question. Although this may minimize the underestimation of annual total household expenditure,it is subject to the assumption used.
[51]Recognizing the problem of current income in measuring forest dependency, Narain et al. (2008) introduce the concept of permanent income in their analysis of resource dependence in rural India.
[52] A *Woreda* is an administrative division of Ethiopia managed by local governments, which is equivalent to a district.

The largest proportion of today's Ethiopian coffee forests is situated in the southwestern part of the country (SNNP and Oromyia Regional States). However, as in other parts of the country, the forest areas in this region are declining rapidly, primarily due to the conversion of forests into agricultural land (Bekele, 2003). In an attempt to mitigate or even reverse the rapid decline, the FARM Africa-SOS Sahel PFM project was established in our study area to foster and promote sustainable forest resource use and management in the study area (Bekele, 2003). The PFM project was first introduced in the area by FARM-Africa in 1996. PFM is a system of management, whereby members of the local community manage the local forest. The traditional role of local government from one of owner and regulator has been altered to include facilitation, capacity building, advising, analysing and generating new technologies (Jirane et al., 2008).The objective of the project is the improvement of forest cover, by slowing down deforestation and forest degradation, and the improvement of the economic livelihoods of the local rural populations. PFM is a partnership between the government's Department Forestry and Community Forest Management Groups. That partnership is contractual, as the community forest managers and government sign an agreement specifying the rights, obligations and duties of both parties, as well as specifying current use rights, future use rights and forest product revenue sharing for the local communities.

Table 4.1: List of sample sites and their respective sample sizes.

List of Kebeles	Number of focus groups	Name of Focus Group	
		PFM	NPFM
Yebito (88)	2	Agama (58)	Mula and Hindata (30)
Bita Chega (49)	1	Dara (49)	--
Mitchiti (80)	3	Beka (32), Matapha (24)	Chira and Botera (24)
Woka Araba (50)	1	---	Woka Araba (50)
Keja Araba (47)	1	---	Keja Araba (47)
Maligawa (63)	2	Sheka (37)	Sheka (26)
TOTAL	10	200	177

*The numbers in brackets refer to sample sizes. NPFM denotes non PFM groups.

Research villages were purposively selected, in order to evaluate the impact of the participatory forestry program (PFM) on rural livelihoods. A total of 10 focus groups, five under the PFM and five operating outside of the PFM, were selected. Household selection into the focus groups was based on the list of community forest users and non-users; a systematic random sampling method across the lists was adopted to ensure the sample was representative of the area. Accordingly, a total of 377 rural households were interviewed. The questionnaire was prepared in both English and Amharic, which is the local language. Data

was collected on household and individual characteristics, forest management institutions, the consumption and purchase of various goods and services, the quantity of labour allocated to forest resource collection and the collection, purchase and sale of NTFPs. Additional data on community level variables related to population size, village location and perceptions of forest status were also collected. Table 4.1 lists the kebeles, the focus group names, the number of focus groups and focus group sample sizes, based on PFM participation; 200 households are part of the PFM; the remaining 177 households do not participate in the PFM.

3.2. Descriptive Statistics

The definitions of the explanatory variables used in the analysis, together with descriptive statistics, are presented in Table 4.2. Since there is little variation in wages, the education level of the household head is included to account for unobserved labour market opportunities (Heltberg et al., 2000). Education is expected to be negatively correlated with forest resource use; as the opportunity costs of time rise, less time is devoted to resource collection and use. Similarly, because there is missing markets for NWFPs, forest product prices were not included in the empirical specification, and, therefore it is assumed that the impacts of these prices can be captured indirectly through household and village characteristics.

Table 4.2: Description of variables and descriptive statistics

Variable*	Description of variable names	Mean	S.D	Min	Max
AGE	Age of the household head in years	43.54	14.13	18	90
SEX	Sex of the household head (male=1, female=0)	0.94	0.25	0	1
DEDUCAN	Education of head (read and write=1, none=0)	0.42	0.49	0	1
LANDSIZE	Size of land owned by the household in ha	2.34	1.57	0	10
LIVESTLU	Livestock ownership in TLU	4.32	2.64	0	19.9
DISTTOWN	Distance of household from the nearest town in kms	6.84	3.83	0.01	20
ADUFEM10	Number of female members age greater or equal to 10	1.87	1.07	0	7
ADUMAL10	Number of male members age greater or equal to 10	1.96	1.11	0	6
OFFFARM	Dummy whether any member from the family is participating in off farm activities (yes=1, No=0)	0.11	0.31	0	1
DISMARKET	Distance of the village from the nearest market (walking distance in minutes)	79.68	32.46	35	140
DISFOREST	Distance of the household from the community forest (walking distance in minutes)	45.35	57.78	1	500
FAMSIZEeqv	Family size in adult equivalent	5.07	1.9	1.97	12.4
DENSITY**	Number of households per hectare of forest	0.47	0.28	0.1	0.96

* The variables are in level form, while some of the variables in the regression analysis are logarithmic
** DENSITY refers to the PFM groups only, as data for non-PFM is incomplete.

The theoretical model suggests that technology matters, and, thus, the state of the forest also matters. Unfortunately, the data does not include an objective measure of the state of the forest. Instead, forest-level population density (the number of households per hectare of forest) is used as a proxy for the state of forest. Low density is expected to increase the marginal product of labour, and, hence, reduce the time required to collect a unit of forest product. Unfortunately, it is only available for PFM groups, so is only included in PFM-specific regressions.

In terms of the expected effects of the household characteristics, larger families are expected to demand more forest products, and tend to extract more forest resources. Furthermore, larger families are expected to have more labour that can be made available for extraction activities. As noted previously, expenditure is used, instead of income; however, wealth is also included in the models. Edmonds (2002) and Dayal (2006), for example, include livestock and house type, respectively, in their analyses. In line with these authors, this analysis includes livestock ownership (in tropical livestock units; 1TLU=250kg) and landholdings. Cavendish (1999a, 1999b) and Sills et al. (2003) find a negative correlation between wealth and the collection of NTFPs, which they associate with changing preferences, the opportunity cost of time, or effective risk. On the other hand, Adhikari (2005) finds that the rich are more dependent on natural resources than the relatively poor in Nepalese community forests.

Infrastructural proxies, such as access to markets and the distance to town, are expected to negatively impact forest resource use and, hence, reduce the time devoted to forest resource collection. Infrastructural access is expected to promote off-farm activities, reducing the time available for forestry activities. However, improved transportation networks may increase forest product demand; improved roads increase access to other, potentially, bigger markets.

Table 4.3 presents summary statistics of household and community level variables used in the study; they are presented by forest property right regime type. As can be seen in the table, household characteristics are rather similar across the regimes. However, and as is needed for potential identification of PFM participation, PFM households are closer to community forests than are those households depending on either their own sources or open access forests.

Table 4.3: Descriptive statistics by source of forest products.

Community (N=198)			Open Access (N=129)		Private (N=182)	
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.
AGE	43.65	13.56	43.82	13.93	43.41	13.95
SEX	0.92	0.27	0.95	0.21	0.94	0.24
DEDUCAN	0.41	0.49	0.43	0.50	0.42	0.50
LANDSIZE	2.27	1.47	2.60	1.55	2.32	1.47
LIVESTLU	4.21	2.48	4.66	2.87	4.52	2.60
ADUFEM10	1.88	1.11	1.90	1.03	1.90	1.02
ADUMAL10	1.97	1.10	1.89	1.09	2.04	1.07
DISTTOWN	6.34	3.90	7.57	3.58	7.16	3.94
DISFOREST	23.15	27.58	70.83	74.31	52.04	54.27
DISMARKET	75.86	32.62	81.24	29.42	82.14	32.41
FAMSIZEeqv	5.15	1.92	4.99	1.85	5.15	1.90
OFFFARM	0.13	0.34	0.07	0.26	0.10	0.31
DENSITY	0.47	0.28	0.60	0.36	0.49	0.28

Table 4.4 presents a descriptive analysis of time allocation, the share of income and total income derived from NWFPs from the different forest property right regimes. The mean annual NWFP income obtained from community forests is Birr 655, meaning that an average household derives 5.4 % of their total income from NWFPs. Furthermore, 95% of the PFM households earn up to 18% of their total income from NTFPs, while the range for the upper tail is between 19 and 41%. Given the income ranges, and the fact that government lacks the institutional capacity to control access to their own forests, it is not surprising that, on average, households spend more time in open access forests than in either private or community forests.

Table 4.4: Mean values of time allocated, share and total income from NWFPs by sources.

Sources	No.	TIME (Hr/Month)	SHARE (%)	TOTAL INOCME (Birr/Year)[53]
COMMUNTIY	198	2.379	5.4	655.24
OPEN ACESS	129	3.233	6.4	750.92
PRIVATE	182	3.091	7.2	873.29
TOTAL	373	3.975	8.7	1042.54

[53] The exchange rate was 1 USD ≈ Birr 12.615 during the survey period.

Finally, Table 4.5 outlines the descriptive statistics for the two institutional variables for each community forest; recall that there are five PFM forests in the data set. The index, described in footnote 43, was based on the answers to a series of questions related to the PFM program. The information contained in Table 4.5 suggests that enforcement and management is strong within all of the PFM forests. However, the similarity of these indexes suggests that there is not enough independent variation to provide empirical traction, which will result in insignificant estimates.

Table 4.5: The mean values of the institutional indices for each community forest

Name of community Forest(PFM Groups)	ENFORINDEX				INSTINDEX			
	Mean	S.D	Min	Max	Mean	S.D	Min	Max
Agama(58)	0.80	0.15	0.29	1	0.80	0.22	0.08	1
Beka(31)	0.76	0.21	0.17	1	0.87	0.17	0.25	1
Dara(48)	0.82	0.15	0.54	1	0.87	0.14	0.42	1
Matapa(24)	0.81	0.15	0.50	1	0.91	0.15	0.33	1
Sheka(37)	0.80	0.17	0.25	1	0.81	0.18	0.42	1

4. RESULTS AND DISCUSSION

4.1. Results

4.1.1 Time Allocation

Table 4.6 presents the estimates of equations (1) – (3) for the quantity of household time allocated to the collection NTFPs from community, private and OA forests, separately. The probit parameter estimates are presented in the first three columns, while the outcome equation estimates are presented in the last four columns; the non-selection estimates of total time for all households is presented in the last column of the regression section.

Table 4.6: Estimates of Time Allocation to NWFPs collection

	SELECTION			REGRESSION			
Variables	COM	O. A	PR	COM	O.A	PR	TOTAL[a]
AGE	0.089**	-0.000	-0.113***	-0.315**	-0.585**	0.113	-0.284**
	(0.04)	(0.04)	(0.04)	(0.15)	(0.23)	(0.20)	(0.13)
AGESQUARE	-0.001**	0.000	0.001***				
	(0.00)	(0.00)	(0.00)				
SEX	0.156	-0.103	-0.250	0.267*	0.362**	0.237	0.223*
	(0.38)	(0.35)	(0.43)	(0.16)	(0.17)	(0.21)	(0.12)
DEDUCAN	-0.257	0.208	0.468**	0.099	-0.192	0.124	0.074
	(0.21)	(0.20)	(0.23)	(0.11)	(0.16)	(0.12)	(0.09)
LANDSIZE	0.034	0.545**	-0.570**	-0.008	0.414***	0.267*	0.273***
	(0.22)	(0.24)	(0.24)	(0.12)	(0.14)	(0.15)	(0.10)
LIVESTLU	-0.031	-0.051	0.062	-0.165*	0.069	0.018	-0.055
	(0.20)	(0.17)	(0.19)	(0.09)	(0.13)	(0.12)	(0.08)
ADUMAL10	-0.074	-0.190**	0.248**	0.050	0.017	0.056	0.041
	(0.10)	(0.08)	(0.10)	(0.04)	(0.07)	(0.07)	(0.04)
ADUFEM10	-0.030	-0.042	-0.018	-0.013	-0.050	0.066	0.013
	(0.08)	(0.08)	(0.09)	(0.04)	(0.07)	(0.06)	(0.04)
DISTTOWN	-0.731***	0.671***	0.071	0.162*	0.123	-0.035	0.229***
	(0.18)	(0.17)	(0.18)	(0.09)	(0.15)	(0.10)	(0.08)
DISFOREST	-0.875***	0.401***	0.425***				
	(0.10)	(0.09)	(0.09)				
Access to private sources by community users	9.240***			-0.418***			
	(0.37)			(0.12)			
Access to private sources by OA users		2.624***			-0.906***		
		(0.34)			(0.18)		
Access to Openacess			8.621***			0.195	
			(0.94)			(0.28)	
Access to community			9.668***			0.517*	
			(0.71)			(0.28)	
Access from two sources							0.011
							(0.08)
_cons	2.097**	-3.697***	0.090	1.819***	2.75***	-0.437*	1.34
	(0.95)	(1.08)	(1.03)	(0.61)	(0.92)	(0.72)	(0.51)
Rho	0.154	-0.365***	0.508				
	(0.16)	(0.12)	(0.26)				
N	373	373	373	198	129	182	365

[a] Estimation is by using OLS, corrected for heteroskedasticity. *, **and *** represent 10, 5, and 1% level of significance. DCOMM_private, DOACESS_private, DPRIVATE_Openacess, DPRIVATE_community and Dtwo_sources are all dummy variables referring to whether community forest members are collecting resources from private source, OA users are also collecting from private source, private users are collecting from OA forest , private users are also collecting resource from community forest , and whether the household is collecting NWFPs from two or more than two sources, respectively. They can be considered as indicators of availability of substitutes.

With the exception of collection time within community forests, collection activities are selective. According to the selection results, unobserved factors that increase the probability of collection from open access forests, tend to decrease the collected quantity, while unobserved determinants associated with an increased probability of private forest collection, tend to increase the collected quantity.[54] One potentially important unobserved determinant is the price of NTFPs, while another is true forest productivity. Intuitively, increased prices would tend to raise both participation probabilities and collection time. On the other hand, increased forest productivity could increase the probability of participation, while simultaneously reducing collection times, and vice versa. In the context of this research, the unobserved price effect appears to dominate the unobserved productivity effect for privately produced NTFPs, while the opposite appears to be true for open access collectors.

In terms of participating in the collection of NTFPs from community forests, the probability is a concave function of age of the household head, and is also higher for users that are also able to access their own sources; however, the probability is decreasing in both the distance to town and the distance to the community forest. Collecting from open access forests, on the other hand, is more likely for households located farther from town and from the community forest. Furthermore, open access collection is more likely for households with larger landholdings, as well as access to private sources, but is less likely for households with a larger number of males aged 10 years and older. Finally, the probability of collection from private sources is a convex function of the age of the household head, and is decreasing in landholdings; however, the probability is higher for households also able to access both open access forests and community forests, as well as for households located farther from community forests. It is also higher for households with a more educated head, and for households with a greater number of adult males.

In terms of collection time, results of which are presented in the rightmost columns of Table 4.6, total collection time is a convex function of the age of the household head across all sources, except for own sources. Collection time is also larger for male-headed households, again, with the exception of own sources. With the exception of community forests, collection time is also increasing in landholdings. Livestock holdings, on the other hand, are

[54]Although one might argue that collection times are likely to be affected by distance to forest, the exclusion restriction, in an OLS regression of collection times including all the factors in the right-hand columns of Table 6, as well as distance to forest, was found to be statistically independent of collection time.

associated with reduced collection times in community forests, while total collection time in community forests, and in total across all forest sources, is larger for households located farther from town. Access to private sources reduces both community forest and open access collection times, although access to community forests increases private source collection times.

4.1.2. Share of Income and Total Income Derived from NTFPs

Equations (1) – (3) were also examined in the context of the share of income derived from NTFPs, as well as total income derived from NTFPs. The results are presented in Tables 4.7 and 4.8, respectively. As should be expected, the determinants of participation in the collection of NTFPs from various sources are qualitatively, and nearly quantitatively, identical to those presented in Table 4.6. The only real difference is the correlation between the unobserved determinants for the share of income derived from NTFPs collected from own sources, where it is insignificant. If prices are an important unobserved determinant to collection, it is reasonable to expect that prices will have the same effect on both the numerator and the denominator, in the income share, and, therefore, it is reasonable to expect that prices will not strongly influence the correlation between the unobserved determinants.

Regarding the outcomes related to the share of income regressions by collection source, that share tends to be lower for households with older household heads, greater landholdings and access to additional private sources. Total income derived from community forests is larger for households with a greater number of adult males, and is lower for households also accessing their own private sources. The share of income derived from NTFPs collected in open access forests is higher for households with greater landholdings, but lower for households with an older head and with access to additional sources. The results for total income follow a similar pattern, although the parameter estimates are larger, due to the fact that there is greater variability in total income than in the share of income. Finally, the share of income derived from NWFP collection from own sources is higher for households with greater landholdings, as is total income derived from NWFP collection from own sources.

Table 4.7. Determinants of Share of income from NWFPs by source of NWFPs

	SELECTION			REGRESSION			
Variables	COM	O.A	PR	COM	O.A	PR	TOT
AGE	0.091**	0.006	-0.093**	- 0.035**	-0.041*	0.026	-0.023
	(0.04)	(0.04)	(0.04)	(0.01)	(0.02)	(0.02)	(0.02)
AGESQUARE	-0.001**	0.000	0.001**				
	(0.00)	(0.00)	(0.00)				
SEX	0.167	-0.066	0.184	0.018	0.013	0.003	0.015
	(0.38)	(0.35)	(0.57)	(0.02)	(0.03)	(0.02)	(0.02)
DEDUCAN	-0.233	0.179	0.415*	0.012	-0.018	0.015	0.008
	(0.21)	(0.20)	(0.21)	(0.01)	(0.02)	(0.01)	(0.01)
LANDSIZE	0.043	0.551**	-0.488**	-0.009	0.051***	0.044**	0.041***
	(0.23)	(0.23)	(0.24)	(0.01)	(0.02)	(0.02)	(0.01)
LIVESTLU	-0.047	-0.046	0.091	-0.023**	-0.000	0.001	-0.007
	(0.20)	(0.17)	(0.19)	(0.01)	(0.01)	(0.01)	(0.01)
ADUMAL10	-0.077	-0.200**	0.205**	0.001	-0.001	-0.008	-0.005
	(0.10)	(0.08)	(0.09)	(0.00)	(0.01)	(0.01)	(0.00)
ADUFEM10	-0.035	-0.035	-0.024	-0.004	-0.008	-0.001	-0.004
	(0.08)	(0.08)	(0.09)	(0.00)	(0.01)	(0.01)	(0.00)
DISTTOWN	-0.722***	0.665***	0.027	0.005	0.001	-0.003	0.013
	(0.18)	(0.17)	(0.18)	(0.01)	(0.02)	(0.01)	(0.01)
DISFOREST	-0.878***	0.396***	0.363***				
	(0.10)	(0.087)	(0.09)				
Access to private sources by Community users	9.031***			-0.033***			
	(0.46)			(0.01)			
Access to private sources by OA users		2.628***			-0.083***		
		(0.35)			(0.02)		
Aaccess to openacess			8.427***			0.017	
			(0.47)			(0.09)	
Access to community			3.578***			0.012	
			(0.47)			(0.04)	
Access from two sources							-0.005
							(0.01)
_cons	2.071**	-3.818***	-0.499	0.217***	0.23**	- 0.066	0.116*
	(0.97)	(1.10)	(1.14)	(0.06)	(0.10)	(0.08)	(0.06)
Rho	-0.065	-0.332**	0.256				
	(0.13)	(0.13)	(0.37)				
N	373	373	373	198	129	182	365

Table 4.8. Determinants of total income obtained from NWFPs by source of NWFPs /Heckman Sample Selection/

	SELECTION			REGRESSION			
Variables	COM	OA	PR	COM	OA	PR	ALL
AGE	0.083**	0.005	-0.107***	-0.489	-0.785**	0.007	-0.450*
	(0.04)	(0.04)	(0.03)	(0.43)	(0.42)	(0.33)	(0.24)
AGESQUARE	-0.001**	0.000	0.001***				
	(0.00)	(0.00)	(0.00)				
SEX	0.171	-0.062	0.29	1.049	-0.159	0.41	0.419
	(0.37)	(0.34)	(0.54)	(0.69)	(0.46)	(0.55)	(0.36)
DEDUCAN	-0.237	0.203	0.459***	0.014	-0.315	0.269	0.199
	(0.21)	(0.19)	(0.19)	(0.29)	(0.27)	(0.21)	(0.17)
LANDSIZE	0.062	0.526**	-0.514**	0.108	0.781**	0.864***	0.696***
	(0.22)	(0.23)	(0.21)	(0.32)	(0.31)	(0.25)	(0.19)
LIVESTLU	-0.038	-0.044	0.108	-0.046	0.099	0.094	0.054
	(0.20)	(0.17)	(0.19)	(0.25)	(0.23)	(0.20)	(0.14)
ADUMAL10	-0.066	-0.189**	0.208**	0.191*	0.038	0.034	0.024
	(0.10)	(0.08)	(0.09)	(0.11)	(0.15)	(0.09)	(0.09)
ADUFEM10	-0.021	-0.039	-0.026	0.099	-0.082	0.073	0.007
	(0.08)	(0.08)	(0.08)	(0.11)	(0.14)	(0.10)	(0.07)
DISTTOWN	-0.735***	0.664***	0.068	-0.087	0.087	-0.24	0.083
	(0.18)	(0.17)	(0.15)	(0.37)	(0.28)	(0.19)	(0.14)
DISFOREST	-0.858***	0.364***	0.352***				
	(0.12)	(0.08)	(0.09)				
DAccess to Private by comm	9.385***			-1.062**			
	(0.67)			(0.54)			
DAccess to private		2.665***			-1.264***		
		(0.34)			(0.44)		
Access to Openacess			6.663***			1.36***	
			(1.95)			(0.43)	
Acces to community			3.995***			1.25***	
			(0.43)			(0.41)	
Access to two sources							-0.032
							(0.14)
_cons	2.12**	-3.70***	-0.048	6.02***	8.63***	3.25**	6.37***
	(0.94)	(1.08)	(0.85)	(1.98)	(1.67)	(1.41)	(0.92)
Rho	0.303	-0.325	0.908**				
	(0.35)	(0.23)	(0.12)				
N	373	373	373	198	129	182	365

4.1.3. Dependency within Community Forests

The final analysis was based on collection time, share of income and total income collected in PFM forests. The analysis was based on OLS regressions, since all households included in the analysis are members of the PFM, and, therefore, selection issues do not arise. The results are available in Table 4.9. The focus for the analysis was on the institutional effects across the various forest programs. In all regressions, livestock holdings and the age of the household (although both were insignificant in the total income regression), the off-farm wage, forest density, and access to separate private sources were associated with a reduction in the outcome variable of interest. However, although expected given the limited variation in institutional conditions across the programs outlined in Table 4.5, neither enforcement strength nor institutional characteristics are associated with total collection time, the share of income derived from NTFPs or total income derived from NWFPs.

4.2 Discussion

4.2.1 Time Allocation

In contrast to Adhikari (2005), who argues that richer households collect more forest products from community forests in Nepal, this analysis found that wealth is negatively correlated to forest product collection from community forests. According to the results presented for outcomes in Table 4.6, a 10% increase in livestock holdings is associated with a 1.65% reduction in the amount of time spent in community forest collection activities. Clearly, richer households have resources, other than livestock, such as land, enabling them to easily substitute community forest products for products from private sources. However, our results, suggest that landholdings do not influence community forest collection times, although they do influence open access and private source collection times; a 10% increase in landholdings increases the amount of time spent collecting from open access forests by 4.1%, while only increasing time spent collecting from private sources by 2.7%.

On the other hand, in rural India, Heltberg et al. (2000) find that landowners substitute private fuels generated on the farm for forest fuel wood, which is consistent with a subset of our findings. We find that community forest collection time is lower, by 41.8%, for households with access to their own sources, while open access collection time is 90.6% lower for households with access to private sources. Possibly, properly managed community forests are yielding equity gains. Similarly, community forestry management that takes into

account access to private sources will help reduce household dependence on the commons, and, hence improve the ecological balance and biodiversity.

Table 4.9:Regression results for forest dependency on community forests

Variables	SHARE NWFPS	COLLECTION TIME	Total income NWFPs
AGE	-0.001***	-0.007**	-0.006
	(0.00)	(0.00)	(0.01)
SEX	0.023	0.378**	1.26*
	(0.02)	(0.17)	(0.69)
DEDUCAN	0.010	0.077	-0.005
	(0.01)	(0.11)	(0.30)
FAMSIZEeqv	0.000	0.038	0.188***
	(0.00)	(0.02)	(0.07)
OFFFARM	-0.033***	-0.327***	-0.968**
	(0.01)	(0.12)	(0.44)
LIVESTLU	-0.025**	-0.173*	-0.138
	(0.01)	(0.09)	(0.25)
DISTTOWN	0.011	0.223**	0.129
	(0.01)	(0.10)	(0.33)
DISMARKET	0.020	0.305	0.676
	(0.02)	(0.19)	(0.60)
DISFOREST	-0.001	0.052	0.008
	(0.00)	(0.05)	(0.15)
DENSITY	-0.061***	-0.673**	-1.454*
	0.02	(0.27)	(0.84)
ENFORINDEX	0.020	-0.153	1.268
	(0.03)	(0.30)	(1.01)
INSTINDEX	0.005	0.204	0.639
	(0.03)	(0.27)	(0.82)
Dummy access to private sources	- 0.033***	-0.514***	-1.503***
	(0.01)	(0.09)	(0.30)
_cons	0.030	-0.404	0.462***
	(0.09)	(0.76)	(2.46)
N	198	198	198

The numbers in the brackets are the White-robust standard errors. The dependent variables (collection time and total income), livestock ownership (LIVESTLU), distance to town (DISTTOWN), distance to market (DISMARKET) and distance to forest (DISFOREST) are also in log form. There was no serious multicollinearity problem as the Variance inflation factor (vif) was less that 5 for all variables. *, **, and *** represent 10%, 5% and 1 % significance level, respectively.

4.2.2. Income Share and Total Income

The results of the analysis further suggest that the relationship between forests and poverty depends on the type of property right regime. Although poverty is not directly analysed, both

the share of income and total income derived from NWFPs is lower for households with their own sources, and tend to be larger for households with greater landholdings. The share of income collected in community forests is 3.3% lower for households also collecting from private sources, while total income from community forests is 106% lower. Similarly, the share of income from open access forests is 8.3% lower for households collecting from their own sources, while total income is 126% lower. In terms of land holdings, however, the income share from NWFPs ranges from 4.1% to 5.1% higher, depending upon the collection sources, while total income from NWFPs increases between 69.6% and 86.4%, depending upon the source. As Cavendish (1999a, 1999b) notes, it is difficult to make broad generalizations about the relationship between income and environmental changes, in part, because this relationship is varied, and, in part, because there are many other environmental demand determinants.

4.2.3. Dependence within Community Forests

Previously, little attention has been given to the impact of local level institutions on the poverty-environment hypothesis, particularly in areas where the community participates in the management and use of resources. In many developing countries, on-the-ground management can often correspond poorly with stated policies. Perceptions, therefore, have the potential to better reflect reality (Bluffstone et al., 2008). Unfortunately, as already noted, institutional conditions are not related to any of the resource outcomes. The results, however, should be interpreted with caution. The lack of significance does not necessarily mean that local level institutions are not important in natural resource management. As indicated in the descriptive statistics, members of the PFM groups are well acquainted with the rules, regulations and management of the community forest. Therefore, one explanation for the insignificance of these variables is the limited variation in the perception of households regarding the various local rules and institutions governing the community forest. Another possible explanation is that institutional conditions may not be specified for NTFPs. The various rules and regulations may be applied and practiced in the case of major forest products such as timber or other woody materials like fuel wood.

The important determinants in the regressions reported in Table 4.9 include, forest-level population density, access to own sources and off-farm labour opportunities. The last results, consistent with Bluffstone (1995), suggest that the presence of an off-farm labour market

helps stabilize forest stocks, despite open access to resources, while the absence of off-farm opportunities may lead to further degradation and deforestation.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This research examined the role of property rights regimes and local level institutions on forest resource use in southwest Ethiopia, using a household survey conducted in the region. The primary purpose of the analysis was to examine the link between forests and poverty under different property right regimes, although forest dependency was considered through proxies related to time allocation, the share of income derived from NWFPs and total income derived from NTFPs. The findings suggest that forestry management devolution enhances forest resource use by the poor, while reducing dependency among rich households. There is no evidence that richer households influence either the formal or informal access restrictions on access in their favour, when the forest belongs to the community. However, our findings also suggest that richer households, as measured by land holdings, exploit forest resources from OA more than the poor suggesting that there is a need to expand the current practice of PFM to other OA areas.

We have also observed that the contribution of NWFPs to household income cannot be ignored. On average, households derive 8.7% of their total income from NWFPs from all sources; PFM participants derive 5.4% of their total income from NWFPs, while open access and private sources yield 6.4% and 7.2% income shares, respectively. However, there is some substitution present, NTFP collection from private sources is negatively correlated with collection from other sources, suggesting that development agents and government organizations should encourage households to develop, maintain and use their private sources to ease the pressure on open access and community forests.

Although the role of local institutions was also considered in the analysis, no significant results could be identified. However, we cannot conclude that local level institutions are not important for proper natural resource management. Importantly, institutional conditions are well understood by the PFM participants, meaning that households are fully aware of the forest use rules, regulations and management policies of the community forest.

These results are suggestive for policy. Improving property rights, either through community forestry or private ownership, is likely to reduce the exploitation of forest resources, and may provide equity benefits for the rural population. Moreover, with such measures, it is possible to maintain, or even improve, the environmental and ecological services provided by forests. In this regard, the distribution of seedlings and provision of technical assistance to rural households could also be beneficial, although such activities could not be addressed in this study.