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Forest-based livelihoods, income, and poverty: Empirical evidence from the Himalayan region of rural Pakistan

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ABSTRACT

Using a comprehensive primary dataset collected from 500 farmers of the seven major districts of Gilgit-Baltistan Province in Pakistan (i.e., Ghizer, Gilgit, Astore, Diamer, Ghanche, Hunza-Nagar, and Skardu), this study estimates the determinants of dependence on forest resources and their impact on household income and poverty levels. The determinants of choice of forest-based livelihood and its impact on income and poverty was estimated using a multivariate probit and a propensity score matching (PSM) approach. The aim is to contribute to the literature on forest-based livelihoods using primary data and a propensity score matching approach to establish the link between forest resources, household income, and poverty in the Himalayan region of Pakistan. The male labour force, the age of the household head, female-headed households and households with a literate head are more likely to adopt forest-based livelihoods. The results show that households with forest-based livelihoods have higher income levels, lower poverty levels and consume more forest-based products. Government policy should focus on promoting the guided use of forest resources to promote sustainability on the one hand and to augment rural livelihoods and income on the other hand.

1. Introduction

Despite rapid economic and agricultural development, forest resources continue to play an important role in rural livelihoods and in ensuring food security among rural households in developing countries (Angelsen et al., 2014; Das, 2010; Hogarth et al., 2013; Kar and Jacobson, 2012). In the developing world, a large section of small-holder farmers still derives a substantial part of their income from forest-based livelihoods (Wunder et al., 2014). Forests supply a wide range of goods and services to the households located in and around forests and are the major source of livelihood for people in developing countries (Behera, 2009; Dash et al., 2016). In these countries, forests play a significant role in poverty alleviation and reducing income inequality among forest-dependent people. Studies from around the globe find that forest and non-forest environmental incomes make significant contributions to rural livelihoods (Babulo et al., 2009; Jagger et al., 2014; Pouliot and Treue, 2013; Shackleton et al., 2007).

As in any developing country, the forest food plays an important role in food security in Pakistan, particularly for the rural households in the Himalayas. In times of emergency, when transferring food to remote rural areas is challenging, or when families do not have money to purchase food, forest products provide a safety net to households in remote rural areas. The majority of the literature on forests and their derivative livelihoods highlights the importance of forestry resources to rural households for averting a fall into greater poverty due to unexpected shocks such as flood, drought, death of family members and livestock, family illness, etc. (McSweeney, 2004, 2005; Pattanayak and Sills, 2001). Forestry resources provide food and income to rural communities during lean seasons (Angelsen and Wunder, 2003; De Beer and Mcdermott, 1996).

The forest area of Pakistan is 5% of its total area (Government of Pakistan, 2010) while the global average forest coverage is 30.3% (FAO, 2007), which is very low. The percentage of land under forest coverage is low compared to other South-Asian countries like

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Bhutan (68%), Sri Lanka (30%), Nepal (25.4%), India (22.8%) and Bangladesh (6.7%) (FAO, 2007). Further, Pakistan has witnessed rapid deforestation, and about 170,684 ha of forest have disappeared between 1990 and 2010, (Qamer et al., 2016).

Across Pakistan, forests are not dispersed evenly: the majority of the forests are in Khyber Pakhtunkhwa (KPK) Province (40%) and Gilgit-Baltistan (15.8%). The Himalayan forests in Pakistan play a vital role in the livelihood of the rural communities of both mountainous as well as lowland regions (Kala, 2005). Rural households derive a range of products from the forest: wood, medicinal plants, fruits, and vegetables as well as fodder (Bussmann and Sharon, 2006; Jabbar et al., 2006). In these regions, the forests are used for multiple purposes like timber and wood for construction, fuel wood, grazing, medicinal and aromatic plants, fishing, honey bee keeping, etc. (FAO, 2009). A vast majority of households in Gilgit-Baltistan are dependent on forests for their livelihood (Government of Pakistan, 2010; Poffenberger, 2000).

Like many developing countries, the relation between the local population and department handling the forestry resources has been hostile in Pakistan. Local communities are regarded as rivals and are forced to meet their needs for forest resources illegitimately, largely resulting in over-exploitation, depletion and degradation of forest resources. Exclusive management of the forests (both state-owned and communal) by public sector organizations has been unsuccessful in controlling deforestation and degradation; hence community-based forest management is being experimented with for managing the forest resources in Pakistan as an alternative option (FAO, 2009). Numerous studies in Asia have found a positive impact of community-based forest management on controlling deforestation (Rahut et al., 2015). As in other studies (Pattanayak and Sills, 2001), the current paper is based on rural households because rural families are more dependent on the forest for their livelihoods.

The current paper makes a significant contribution to the existing literature bringing in two specific novel aspects. First, it uses a primary dataset from the Himalayan region of Pakistan to explore the relationship between forests and poverty. This present research is an endeavor to explore the nexus between forest resources, family income, and poverty alleviation. Another novel aspect of the current study is that a propensity score matching approach has been employed to analyze the impact of forest resources on poverty, as few studies in the past have employed this approach to analyze the forest resources and welfare of the population (Jumbe and Angelsen, 2006). Section 2 describes the methodology and conceptual framework; Section 3 deals with the description of the data and variables used in the empirical section; in Section 4, the econometric results on determinants are presented; in Section 5, the impact assessment results from PSM are provided, and the paper's conclusion and policy recommendations are included in Section 6.

2. Conceptual framework and methodology

2.1. Conceptual framework

We consider a typical rural household in the Himalayas. There are two main types of households: those deriving a livelihood from the forests represented as $H(F)$ and those not deriving a livelihood from the forests, represented by $H(F_n)$

It is assumed that the households deriving livelihood from the forests $H(F)$ have higher utility levels compared to households not deriving livelihood from the forests.

$$U(H(F) > U(H(F_n) \tag{1}$$

Rural households in the Himalayas use a number of products from the forests like honey (ψ), wax (ζ), wood (ξ), fruits and vegetables (ς), animals and birds (χ) as well as medicinal plants (ρ) and fodder (λ).

Collecting these goods from the forests may lead to growth in family income and decline in poverty levels. This conceptual framework is validated by using the propensity score matching methodology.

2.2. Multivariate probit model

Households can use multiple types of forest products like wood, wax, honey, fodder, birds, animals, medicines, fruits and vegetables at the same time, which are correlated. As the farm households use more than one forest product, we use a multivariate probit model to capture the multiple types of forest product used by the farm households. In the multivariate probit model, different types of forest product used are considered dependent variables and the explanatory variables include household demographics, household labour supply, human and social capital, wealth and locational dummies. Unlike single equation probit and logit models, the multivariate probit model concurrently examines the choice of goods from the forest in their livelihood strategy.

This paper follows (Lin et al., 2005) in framing the multivariate model which has seven dependent variables, $y_1 \ldots y_7$ such that:

$$y_i = 1 \; if \; \beta_i X' + \varepsilon_i > 0 \tag{2}$$

and

$$y_i = 0 \;\; if \;\; \beta_i X' + \varepsilon_i \leq 0, \; i = 1, 2, \ldots, 7 \tag{3}$$

where x is a vector of the explanatory variables; $\beta_1, \beta_2, \beta_3, \beta_4$ *and* β_5 are conformable parameter vectors and $\varepsilon_1, \varepsilon_2, \varepsilon_3, \varepsilon_4$ *and* ε_5 are random errors distributed as a multivariate normal distribution with zero mean, unitary variance and an n X n.

2.3. Propensity score matching estimates

The propensity score matching (PSM) is the conditional odds that a household participates in forestry resources for their livelihood, given pre-participation characteristics (Rosenbaum and Rubin, 1983). A PSM method is used to correct for the possible sample selection biases that might arise from systematic differences among the families reliant on forest resources and those not reliant on forest resources, particularly when the experimental data is not available (Dehejia and Wahba, 2002). To generate the condition of a randomized experiment, the PSM uses the conditional independence assumption (CIA); hence the forest-based livelihood adoption is random and uncorrelated with the outcome variables.

Unlike the parametric methods, it is not necessary to provide an assumption about functional form in specifying the relationship between outcomes and the predictors of the outcome. However, this assumption of unconfoundness is the limitation of the PSM. There may exist systematic differences between outcomes of adopters and non-adopters of forest-based livelihoods even with conditioning as the selection is dependent on unmeasured characteristics (Smith and Todd, 2005). However (Jalan and Ravallion, 2003), mention that the assumption is not more restrictive than that of the instrumental variable approach used in cross-sectional data analysis. Finally, it may be concluded that the PSM is the most accurate method to estimate the impact when experimental data is missing (Michalopoulos et al., 2004) because it eliminates biases much more than the average. The result does not always improve while using the fixed effect models. The average treatment