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Shocks, Income and Wealth: Do They Affect the Extraction of Natural Resources by Rural Households?

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Summary. — This paper examines the effects of household- and village-level characteristics on environmental reliance and participation in resource extraction decisions. Unlike previous analyses that used case studies or regional samples, I use a nationally representative sample of rural households: rounds I and II of the Mexico National Rural Household Survey (ENHRUM). Econometric results show that participation in resource extraction follows an inverted U-shaped relationship with income and that environmental reliance decreases with income. Beyond income, results show that relatively wealthy households in rural Mexico are less likely to participate in resource extraction and have lower reliance than those with less wealth. There is also clear evidence that natural resources provide some sort of insurance for households that are subjected to negative agricultural shocks.
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Key words — Agricultural shocks, Environmental income, Environmental reliance, Inequality, Mexico, Poverty

1. INTRODUCTION

Poverty tends to be concentrated in rural areas; rural households, particularly in developing countries, rely on the environment for at least some of their income (Angelsen, Overgaard, Friis, Smith-Hall, & Wunder, 2011; Cavendish, 2000; World Bank, 2002; WRI, 2005). Nevertheless, the relationship between environment and poverty is complex, as environmental goods and services can play different roles in rural households' livelihood strategies (WRI, 2005). In a detailed account of the links between poverty and forests, Angelsen and Wunder (2003) argue that forest resources can play different roles in a household's livelihood strategy; they can act as "safety nets" or "gap fillers," but they might just as easily become poverty traps. Furthermore, households' resource-use behavior can be quite diverse both within and across communities, implying that while extraction from the environment can be the main source of income for some households others in the same village might not extract at all (Coomes & Barham, 1997; Fisher, Shively, & Buccola, 2005).

So far, the emphasis in the literature has been on the relationship between environmental income or reliance and total income, and relatively little empirical research has explained inter-village variations or differences across socio-economic groups (Mamo, Sjaastad, & Vedeld, 2007). This paper sheds light on the reasons behind households' heterogeneous behavior by incorporating variables that capture wealth as well as the occurrence of shocks (idiosyncratic and covariate). It also looks at differences due to village level heterogeneity in terms of access to markets.

Many studies have followed the approach of estimating poverty and inequality with and without including income from environmental sources as a way to underscore the importance of this income source for the rural poor. Jodha's (1986) seminal paper was arguably the first to do so. His results show that the Gini coefficient increases by as much as 36% in dry regions of India when income from common property resources is not considered. Using a data set from Zimbabwe, Cavendish (1999) shows the relevance of including natural resources and environmental services when estimating poverty and inequality. By calculating these measures with and without considering the income derived from natural resources, he shows that rural poverty and inequality can be overstated using conventional household surveys. In India, Reddy and Chakravarty (1999) find that if income from forestry was set to zero (under the scenario of restricting access to common property areas), poverty would increase by as much as 28%; the reduction in inequality due to forest-related income was found to be negligible (−0.1%). Fisher (2004) shows that forest income reduces income inequality in southern Malawi. Mahapatra, Albers, and Robinson (2005) use an Indian data set to estimate how sales of nontimber forest products can decrease income inequality. Babulo *et al.* (2009) show that poverty and inequality increase when forest income of rural households in Northern Ethiopia is not accounted for.

All of these analyses were based on case studies or on regional samples. López-Feldman, Mora, and Taylor (2007) present one of the first efforts to estimate the influence of natural resource income on poverty and inequality using a household data set that is representative of the rural population of a whole country (Mexico). They show that the number of poor individuals increases by 4.2% and inequality by 2.4% when natural resource income is not taken into consideration. A 10% increase in income from natural resources, other things being equal, reduces the Gini coefficient of total income inequality by 0.2% in rural Mexico and by 0.36% in the South-Southeast Region of the country.

These studies have established the importance of including income from environmental sources when measuring rural poverty, inequality or livelihoods, although this practice has

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yet to be widely assimilated in rural development circles and poverty alleviation strategies (Angelsen *et al.*, 2011; Sunderlin *et al.*, 2005). A related thread of the literature analyzes how environmental income and reliance on environmental resources (measured as the share of environmental income in overall income) vary with different socioeconomic characteristics (Narain, Gupta, & van't Veld, 2008b). However, very few of these studies have used an econometric approach.

One of these exceptions is Fisher (2004), who shows that asset-poor households in a region of Malawi are more dependent on natural resources than more affluent households. Similarly, Escobal and Aldana (2003) study a small sample of Brazil nut harvesters in Peru and conclude that the poor rely more heavily on natural resources than the wealthy. Contrary to the negative relationship that Cavendish (2000) finds for Zimbabwe, Narain, Gupta, and van't Veld (2008a, 2008b) find that, for rural Indian households that participate in the collection of natural resources, reliance exhibits a U-shaped relationship with income. They also find that the poorest and the richest households are the least likely to collect natural resources. These results are in line with the findings of other studies: even when poor households exhibit greater reliance on natural resources, the wealthy derive greater absolute values from the resources they exploit (Cavendish, 1998, 2000; Mamo *et al.*, 2007).

The present work uses a country-wide sample of rural Mexican households to show that both participation in resource extraction and environmental reliance are correlated with poverty (in terms of both income and wealth (measured by an index of durable goods and dwelling characteristics)). More importantly, there is clear evidence that environmental income provides some form of insurance to rural households; households considerably increase their probability of participation in resource extraction after the occurrence of a negative shock. Finally, it is shown that households in more isolated communities present higher participation and higher levels of environmental reliance.

The remainder of the paper is organized as follows. Section 2 discusses the data set and shows the importance of environmental income in the livelihoods of rural Mexican households using poverty and inequality measures. Section 3 presents the empirical strategy and results of the estimation of the factors that shape decisions to participate in resource extraction and the degree of environmental reliance. Conclusions and final remarks are presented in Section 4.

2. DATA DESCRIPTION AND EMPIRICAL EVIDENCE ON THE RELEVANCE OF ENVIRONMENTAL INCOME

Data for this research were obtained from rounds I and II of the Mexico National Rural Household Survey (Encuesta Nacional a Hogares Rurales de México, or ENHRUM). The survey consisted of both village and household questionnaires. The village survey was administered to key informants (teachers, doctors, leaders of local cooperatives, etc.) and collected information on the basic characteristics of the village (infrastructure, access to markets, etc.). The household survey was administered to a random sample of 22 households in each of 80 communities located in 14 states. INEGI (Mexico's national information and census office) designed the sampling framework to provide a statistically reliable characterization of Mexico's rural population (i.e., communities with fewer than 2,500 inhabitants). For reasons of cost and tractability, individuals in hamlets or disperse populations with fewer than 500 inhabitants were not included in the survey. The result is a sample that is representative of more than 80% of the population that the Mexican government considers rural. The exclusion of very small communities from the sample is unfortunate for the objectives of this work, as one could argue that natural resources might be more available in less populated areas. The first round of surveys was administered in 2003 (the information collected is for 2002) to more than 1,700 households. The second round re-interviewed almost 1,600 of these households in 2008.

Both rounds of ENHRUM provide detailed data on assets, socio-demographic characteristics, production, labor allocation, and income (cash and in-kind) from all sources. Therefore, it is possible to quantify environmental income (e.g., firewood, timber, wild fruits, wild animals, wild plants, etc.) as well as total income at the household level. [1] For the purposes of this paper total income is defined as the sum of value added from five sources: family production (crops, livestock, nonagricultural goods and services, and rent of land), environmental income, wage labor (agricultural and nonagricultural), migrant remittances (both internal and international), and public transfers.

Value added from household production activities was estimated as the gross value of production minus purchased inputs. [2] Production includes not only commercial production but also output consumed at home and given to other households as gifts. In order to obtain the gross value of commercial production, households were asked the price at which they sold their product. For output consumed at home or given as gifts, households were asked the price they would have received by selling the product. Firewood and other goods produced for home consumption were valued by asking what price they would have had to pay to purchase these goods. Salary and wage income were aggregated across all household members and jobs. Migrant remittances were aggregated across all remitters and government transfers were aggregated across all household members that received them. All the results in this paper refer to per capita income.

Prior to the second round of ENHRUM, the household questionnaire was modified to better capture all the potential sources of environmental income, e.g., the first round did not include specific questions to capture the use of medicinal plants. Questions about the occurrence of both idiosyncratic and covariate agricultural and nonagricultural shocks were also included. [3] Therefore, I decided to analyze the environmental income and environmental reliance using data from the second round of ENHRUM (the information collected is for 2007). One major limitation of the ENHRUM survey is that annual recall was used to obtain information for all income activities. This can result in considerable underreporting of environmental income because the use of natural resources is often casual (hence forgettable) and highly seasonal (Angelsen & Friis, 2011; Cavendish, 2002). Considering this, and the exclusion of communities with less than 500 inhabitants from the sample, one could argue that the results presented in this work underestimate the importance of environmental income for Mexican rural households.

The first column of Table 1 shows that environmental income represents 6% of total income (if only the households that participate in resource extraction are considered this number increases to 12%). Wage income is the most important income source, followed by family production. There is high inequality in the distribution of every one of the income sources; wage income is the least unequally distributed. [4] Inequality of total income is also relatively high, as shown by a Gini coefficient of 0.563.

Following Cavendish (1999) and Reddy and Chakravarty (1999), among others, I estimate again inequality (and pov-

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