



The socioeconomic determinants of legal and illegal smallholder logging: Evidence from the Ecuadorian Amazon



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ABSTRACT

Using data from a household survey covering colonists and indigenous communities in the Ecuadorian Amazon, this paper analyzes the socioeconomic determinants of legal and illegal smallholder timber harvesting. The results of a multinomial probit model reveal that non-harvesting households are statistically likely to be poor, to receive nonfarm income, to have smaller areas in primary forest and to reside nearer population centers. Illegal logging is more likely to be carried out by poor households that do not have nonfarm income, have larger areas in forest and reside farther away from urban areas. Legal loggers, in contrast, are likely to come from wealthier households that have legal property rights to the land they possess or control but do not take part in nonfarm employment. Ethnicity has no effect on the likelihood of harvesting timber (either legally or illegally) and has only a marginally significant effect on non-harvesting households. The implications of these findings for policy are explored in the conclusions.

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1. Introduction

Timber is one of the main sources of income for people living in or near tropical forests (Angelsen et al., 2014; Wunder et al., 2014). Nevertheless, smallholder logging often occurs at unsustainable levels leading to high rates of deforestation and environmental degradation (Geist and Lambin, 2002; Lambin et al., 2001). Timber overexploitation is closely linked to illegal logging which in turn is associated with a number of negative environmental, economic and social effects. Illegal logging often leads to high rates of deforestation, forest degradation and biodiversity loss, threatening not only the rich biodiversity and stability of tropical forests but also the welfare of those who depend on forest resources for their survival (Bowles et al., 1998; Curran et al., 2004). In terms of its economic impacts, illegal logging deprives governments of million dollars in tax revenues and discourages investments in the formal timber sector due to unfair competition from illegal operators (Contreras-Hermosilla, 2001; Hansen et al., 2012; Kaimowitz, 2003).

Smallholder decisions on whether to comply with the law or not, depend not only on smallholder characteristics but also on access to timber markets and institutional factors, mainly regulations (Molnar

et al., 2007). Many countries have implemented forestry regulations to organize and control timber exploitation aiming at reducing illegal logging activities and its pernicious effects, nevertheless, a substantial part of smallholder logging still occurs outside the law (Cano-Cardona et al., 2015; FAO, 2012; Pacheco et al., 2008). Understanding the nature and drivers of both illegal and legal logging is important for designing policies favoring the latter while achieving simultaneously environmental and livelihood benefits from tropical forests use.

Relatively scarce empirical research has examined smallholder decisions concerning timber harvest. Amacher et al. (2009) examined the determinants of timber sale – mostly illegal according to the authors – in the Brazilian Amazon. The authors determined that the likelihood of selling wood is higher for formally settled wealthy households that have received credit. Gray et al. (2015) examined the drivers of forest resource use among indigenous populations in the Ecuadorian Amazon. They found that households that have off-farm income, own large farms and reside farther away from urban centers are more likely to sell timber. In the Peruvian Amazon, Escobal and Aldana (2003) found that the probability of harvesting timber is strongly influenced by education, with the likelihood of harvesting timber increasing with schooling up to a level of incomplete secondary education and then decreasing at higher levels of formal instruction. Prior quantitative research, however, has not made a distinction between legal and illegal timber harvest.

With data from a household survey conducted in January–September 2012 in the Napo province, Northern Ecuadorian Amazon, this

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paper aims at answering the following research question: do legal and illegal loggers differ in terms of their socioeconomic characteristics? This study distinguishes itself from previous research in at least two ways: 1) it uses an unusual data set covering both indigenous and migrant-colonist populations, which allows us to assess the role of ethnicity on logging patterns, and 2) to the best of our knowledge, this is the first quantitative study treating legal and illegal logging as two different categories of analysis. Apart from this introduction, this paper is structured as follows: the next section presents the theoretical framework, followed by a description of the study area, the data source and the statistical methods. The subsequent section presents and discusses the results while the final section pulls together the main conclusions.

2. Theoretical framework

In this study, we take the livelihood model (Ellis, 2000b) as the theoretical framework of smallholder decisions concerning timber harvesting. In the livelihood framework, the rural household is the decision-making unit which makes livelihood decisions subject to different endowments of natural capital (land, water, forest resources), social capital (interpersonal networks, membership in groups and associations), human capital (education, skills, health), physical capital (irrigation canals, implements, roads), and financial capital or its substitutes (cash, savings and cattle). Access to these capitals and the way in which they are combined shape a household's livelihood strategies and the relationship it has with the environment (Bebbington, 1999; Scoones, 1998). For instance, households with high endowments of education but low endowments of natural capital (land and forest) are more likely to earn their livelihood from nonfarm work as a way of both coping with natural resource scarcity and maximizing the returns to education. On the other hand, households with low endowments of education and wealth, and high endowments natural capital (forest) are more likely to obtain their livelihood from timber and non-timber forest products as they lack the qualification and resources to diversify their income sources (Vasco and Bilsborrow, 2016).

Livelihood decisions are also determined by a number of contextual factors including institutional factors (functioning of markets, land tenure schemes, common property regimes), cultural factors (gender roles, spiritual connection to land), economic factors (local and international demand for locally produced goods) and environmental changes (climate change) (Sherbinin et al., 2008).

Amacher et al. (2009) focus on smallholder decisions concerning timber sale. According to the authors, smallholder logging decisions are shaped by a number of factors including household demographic characteristics, preference factors, opportunity cost of time and access to forest resources. In this context, logging is more likely to occur if the opportunity cost of labor time is high, the lost utility of non-timber labor is low or the marginal utility of income is high. A higher opportunity cost of labor time reduces the likelihood of selling timber since household utility can be met more easily through other means (i.e., agricultural and nonfarm income).

Smallholders must also make the decision on whether exploiting timber in compliance with forest regulations or doing it outside the law. Forest regulations are a set of rules designed to protect forests from private actors who, in absence of such regulations, may overexploit and deplete forest resources (Agrawal, 2005). Literature presents two main views to explain smallholder participation in illegal forest operations.

The first is related to the high transaction costs of exploiting timber legally. Forest regulations typically define the resources that can be harvested, the processes for obtaining transportation permits as well as payment levels and tax criteria. However, obtaining an exploitation permit and selling timber involves the formulation of management plans and the payment of fees and taxes, the cost of which prevent many smallholders from entering the formal sector and, at the same time, push them to participate in illegal logging (Mejía et al., 2015). In this

context, wealthier smallholders are in a better position to pay for the high transaction costs that obtaining a permit for forestry operations entails (Pacheco et al., 2008). In the second view, smallholders voluntarily choose to exploit timber outside the law based on an internal cost-benefit analysis where the trade-offs of selling timber illegally are found to be higher than the risk of being caught and criminalized (Amacher et al., 2009; Perry et al., 2007).

With this theoretical framework, we develop a multivariate regression model to establish the determinants of legal/illegal timber harvest decisions among smallholders in the Northern Ecuadorian Amazon. The implications of this broad theoretical framework regarding the specific effects of sets of household and community characteristics on smallholder logging decisions are presented in the section of results.

3. Methodology

3.1. The study area

The research was carried out in the Sumaco Biosphere Reserve buffer and transition zone in the Napo province, in the Central Ecuadorian Amazon (see Fig. 1), one of the world's biodiversity hotspots (Bass et al., 2010; Myers et al., 2000). Since the late 1960s - when roads were opened to exploit oil reserves - the Amazon region has received continuous migratory waves of poor peasants with little or no land who came from the Highlands and the Coast regions. Colonist communities do not belong to conglomerate territories (which is common for indigenous populations) so farm limits are symmetrical, mostly imposed by two laws of agrarian reform and colonization in 1964 and 1973 (Izurieta et al., 2014). Napo is also home of two indigenous groups, the Waorani and the Kichwa or "*Napo Runa*" (Izurieta et al., 2014).

The migrant-colonists number approximately 44,000 individuals and account for 43% of the province population (INEC, 2010). Traditionally, colonists engage in commercial agriculture including crops such as coffee, cocoa and maize, in addition to considerable cattle ranching (Barbieri et al., 2005). The high rates of population growth in colonist territories has resulted in an accelerated process of land fragmentation and stronger pressure on natural resources. Another effect of the high rates of population growth is the growing share of colonists engaging in nonfarm employment including self-employment (e.g., running a grocery store, cooking meals, selling handicrafts) and wage employment (e.g., public employee, soldier, driver, bricklayer, domestic servant) (Bilsborrow et al., 2004). Although most of the commercially valuable timber in colonist farms has already been harvested, earnings from timber sales account for 19–23% of colonist households' total income (Mejía et al., 2015; Torres et al., 2014; Vasco et al., 2015). This principally occurs in communities where timber still exists and roads have been recently opened.

The Kichwa of Napo or "*Napo Runa*" are the traditional inhabitants of the Northern Ecuadorian Amazon. They are the most numerous ethnic group in Napo with an approximate population of 53,000 individuals (52% of the province total population). While some descriptions account that the Kichwa obtain their livelihood principally from subsistence farming (cassava, plantain and maize), and the collection of forest products, hunting and fishing for self-consumption (Uzendoski, 2004), others report that, when in direct contact with the market economy, they also adopt colonist livelihood strategies including commercial agriculture, cattle ranching and timber logging (Gray et al., 2008). Although indigenous peoples normally control extensive areas of land under common property regimes, population growth and land fragmentation may also be an issue in Kichwa communities (Muzo et al., 2013). In terms of timber logging, prior research (Muzo et al., 2013; Vasco et al., 2015) determined that it accounts for about 10% of total income of Kichwa households already integrated into timber markets. Nevertheless, this share may grow in the future because, in distinction from colonists and other indigenous groups in the Amazon (e.g., the Shuar), the Kichwa still have valuable timber in their lands (Loaiza et al., 2015).

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