Ecological Economics 93 (2013) 1–10

Contents lists available at SciVerse ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Analysis

Traditional vs. modern production systems: Price and nonmarket considerations of cacao producers in Northern Ecuador

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ARTICLE INFO

Article history:
Received 10 August 2012
Received in revised form 6 March 2013
Accepted 10 March 2013
Available online 23 May 2013

Keywords:
Agroforestry
Farm–household model
Cacao production
Labor productivity
Shadow wage
Planned biodiversity

ABSTRACT

Many factors besides profit maximization, such as nonmarket ecological and social benefits, influence smallholder households to adopt a specific agricultural production system or sell in a particular market. Thus, different analytical techniques are needed that take into consideration more than monetary income to fully capture these additional benefits to better understand the production decisions of smallholder farmers. We build on previous work on the household model and shadow wage estimation to develop a shadow wage for Ecuadorian cacao producers that includes these nonmarket benefits. We found that the shadow wage correctly indicated that, on average, these households would prefer to use an agroforestry production system instead of the more profitable modern system because of the nonmarket benefits received from the former system.

Published by Elsevier B.V.

1. Introduction

The link between the price premiums paid by affluent consumers in the North and the sustainability of the production practices of farmers in the South has been tightened during the last decades. Increasing awareness of environmental degradation and socioeconomic inequality has impacted consumers throughout the world who desire to confront these challenges through their purchasing behavior. The demand for environmentally and socially differentiated products has led to the creation of organic and fair trade (FT) commodities (LeClair, 2002; Smith, 2009). Indeed, great complementarities of the social and environmental objectives linked to these markets has led to a growing integration of FT and other eco-labels through multiple-certification providers, which verify that a good is fair trade and meets strict environmental standards (de Janvry et al., 2010).

In the regions where alternative markets operate, smallholder producers have found renewed incentives to invest their time and effort in using sustainable production systems, which include many traditional farming practices, such as agroforestry systems. These production systems provide farmers with economic and non-economic benefits, such as food, medicine, and cultural rewards. Yet, the need for cash, education, and other investments benefits the adoption of modern, more productive and genetically uniform, high-yielding crops (Brush et al., 1992; Harlan, 1975). The perspective of selling in alternative markets may provide incentives to move away from modern production systems, yet the smallholders' decision about what type of system to prioritize goes beyond a plain comparison of economic benefits. Especially in areas with pervasive market imperfections, household preferences and endowments have a strong influence on production decisions (Benjamin et al., 1993; Carter and Yao, 2002; Eswaran and Kotwal, 1984; Key et al., 2000).

While many studies have tried to quantify the impact of participation in alternative markets on farmers' welfare, most of the focus has been on examining the price premium or additional income received by farmers, compared to income in regular markets (Calo and Wise, 2005; de Janvry et al., 2010; Giovannucci et al., 2010; Ronchi, 2006; Ruben et al., 2009; Wollni and Zeller, 2007). These studies ignore the environmental attributes associated with the production of these specialty products and their interaction with farm–households' decisions. A few authors have looked at a wider notion of living standards (Bacon, 2005) and the non-market benefits of participation (Becchetti and Costantino, 2008), but these works have been mostly descriptive and do not integrate their analyses into a broader conceptual framework of farmer decision making.

In this study, we develop a farm–household model to explain how environmental factors, such as biodiversity, interact with price premiums received in specialty markets to impact the allocation of labor of smallholder households across different productive activities. Building on the seminal work of Jacoby (1993) and Skoufias (1994), we develop a link between the marginal benefits that households receive from planned biodiversity (Vandermeer and Perfecto, 1995) and the effective remuneration that their members receive for their work. This leads to a nuanced explanation of why farmers may prefer to work on farm and not participate in the labor market—environmental

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0921-8009/$ – see front matter. Published by Elsevier B.V.
http://dx.doi.org/10.1016/j.ecolecon.2013.03.010

non-market benefits—which goes beyond the standard logic of transaction costs and typical market imperfections. It also shows how farmers' valuation of environmental benefits influences their economic behavior and widens the spectrum of reasons for the strong influence of factor endowments on small producers' decisions (known in the development literature as lack of separability or recursivity of household models). We also find that the identification strategy proposed by Jacoby (1993) and Skoufias (1994) to enable estimation of the shadow wage for household members does not deliver point identification in a setting with positive environmental benefits derived from farm labor. However, the implications of the effect of these ecological and social nonmarket goods on producer behavior can be derived.

The issue is inherently a crosscutting one that thematically falls in the growing body of research that integrates development economics with environmental economics. Our effort to formally integrate a micro-household model with environmental questions contributes to two major fields of applied economics: (1) to the recent research in environmental and ecological economics that has put considerable emphasis on valuing biodiversity, but has not tended to root it in a deeper portrayal of the household's full resource allocation problem (Nijkamp et al., 2008; Nunes and van den Bergh, 2001) and (2) to the slowly growing body of work in development economics that addresses environmental questions. This work blends both lines of work in the context of biodiversity effects on household behavior. As such, it also provides the groundwork for analyzing other dimensions related to smallholder participation in alternative commodity markets than has previously been available in the literature.

We apply this framework to the Ecuadorian case of cacao production, where two different farming systems for the production of cacao are utilized. One method raises a traditional variety of cacao, known locally as cacao Nacional, in an agroforestry system that can be sold in specialty markets for a premium because of its flavor characteristics that are demanded by gourmet chocolate makers. This cacao is often certified with FT, shade-grown, organic, and origin certifications in order to access these markets. The other method raises a modern, hybrid variety, referred to in Ecuador by the name CCN-51, in a shade-less, less diverse system. The latter is advertised as being more productive and profitable than the former. Yet, many smallholder producers continue to raise the former (Bentley et al., 2004; Coporación de Promoción de Exportaciones e Inversiones, 2009; El Cacao Volvió Ser la Pepa de Oro, 2009). This study found that the benefit of a diverse production system is an important component of the opportunity cost of time that families consider when they make decisions about how to allocate their labor to different production activities.

2. Agroforestry Systems and Farmers' Decisions

Traditional production systems in high biodiversity areas, such as the cacao agroforestry system in Ecuador, provide households economic, social, and cultural benefits (Beer et al., 1998; Bentley et al., 2004). These traditional cropping systems are more biodiverse than commercial systems and may reduce the need to apply agrochemicals, as they control the spread of pathogens (plagues that affect one crop are buffered from affecting other crops). The agroforestry system often mimics the planting structure of a native forest whose structure naturally prevents the spread of diseases through the spacing and random arrangement of diverse species (Reitsma et al., 2001). In addition, these intensive cropping systems provide shading that inhibits the growth of weeds and provide an abundance of organic matter that enhances the quality of the soil (Beer et al., 1998). Indeed, in many agroforestry systems, several varieties of leguminous plants are included in this system, which provides natural nitrogen to the system as well (Duguma, 2001).

There are two distinct components of biodiversity which can be recognized in agroecosystems (Vandermeer and Perfecto, 1995). The first component, planned biodiversity, is the biodiversity that is associated with the crops in the agroecosystem and varies depending on farmer management. The second component, associated biodiversity, includes all soil floras and faunas, as well as other living organisms that colonize the agroecosystem from surrounding environments. Planned biodiversity is managed by the farmers and has a dual function in the system. It directly promotes ecosystem functions, such as pest regulation and nutrient cycling, and indirectly creates conditions for the survival of associated biodiversity, such as insects and birds that are attracted to shade trees. Thus, cacao agroforestry systems create a synergy with the planned biodiversity, creating an environment welcoming to additional species.

In contrast, a principal cause of genetic erosion has been found to be the replacement by farmers of multiple local varieties and landraces for genetically uniform, high-yielding varieties (Brush et al., 1992; Harlan, 1975). While the adoption of these modern varieties has increased short-term crop productivity for some farmers, the consequent loss of genetic resources has increased the vulnerability of farmers to environmental changes, pests, and pathogens. These problems have exacerbated poverty and increased the level of food insecurity (Dasgupta, 1995). This phenomenon is also present in Ecuador, where farmers had been encouraged to replace their traditional agroforestry cacao fields with high yielding monoculture systems (Bentley et al., 2004). Indeed, the loss of diversity is an acute problem in Ecuador, which is one of the world's biodiversity hot spots due to its high concentration of threatened/endangered plants and species (Myers et al., 2000).

The additional food source provided by the intercropping of cash crops, such as cacao, with subsistence crops encourages the planting of various crops and agroforestry production systems as occurs in the traditional Ecuadorian cacao production system. In addition to food safety and environmental benefits, social and cultural benefits have shown to be important in the planting decisions of smallholder farmers (Becchetti and Costantino, 2008). Farmers recognize these benefits when choosing to invest in these cropping systems to maximize economic, social, and environmental benefits. This is the type of decision framework faced by Ecuadorian cacao farmers and other smallholder producers throughout the world.

Barnum and Squire (1979) developed the household model to show how all decisions of smallholder families are interrelated. Production and consumption decisions are not made independently. Agricultural production, education, migration, and household food allocation are thought to depend upon current or future opportunity costs of time (Jacoby, 1993; Le, 2009; Rosenzweig and Evenson, 1977; Rosenzweig and Schultz, 1982; Skoufias, 1994).

The opportunity cost of time or shadow wage is a key articulating variable that is able to capture both the market and non-market benefits of productive activities because it is a measure defined in terms of utility, not economic profits. This is relevant because smallholders' decisions in developing countries are equally affected by market and non-market factors. For example, Arslan and Taylor (2009) discovered that Mexican families choose to plant traditional maize instead of the hybrid variety because of the extra utility received from the taste of traditional maize, even though the hybrid variety was more productive and profitable. Furthermore, Indonesian farmers were found to be willing to accept a price lower than full compensation for lost profits when growing cacao in a traditional agroforestry system instead of the more productive modern system because of the additional nonmarket ecological services provided in agroforests (Steffan-Dewenter et al., 2007). Even in the United States, some Floridian ranchers also prefer agroforestry practices in spite of lower returns, compared to more intensive agriculture systems (Shrestha and Alavalapati, 2003). Thus, to truly understand smallholder farmers' production decisions, nonmarket as well as market values must be integrated into the analysis.