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Eliciting citizen preferences for multifunctional agriculture in the watershed areas of northern Thailand through choice experiment and latent class models

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ABSTRACT

Multifunctional agriculture is increasingly discussed as an alternative to conventional, mono-functional farming and its negative environmental impacts. This study aims at determining Thai society's demand for agri-environmental services offered by a multifunctional agricultural system using two models, i.e. a Choice Experiment Model and a Latent Class Choice Model. The Choice Experiment Model (CEM) is employed to assess citizens' willingness to pay for various attributes of multifunctional outputs. Extending from the CEM, the heterogeneity of citizens' preferences across environmental attitudes and knowledge is captured through the Latent Class Choice Model (LCCM). Survey data was obtained from structured interviews with 373 respondents in the country's two largest cities, namely Bangkok and Chiang Mai. The results of the CEM suggest that urban Thai citizens are willing to pay for changes toward multifunctional agriculture, as expressed in an increase of their monthly food expenses. Among the attributes of agri-environmental practices, "organic agriculture in combination with agro-biodiversity conservation" garnered the highest preference, followed by "organic farming as single practice" and "Good Agricultural Practice combined with agro-biodiversity conservation". Income, gender, agri-environmental knowledge and environment-conscious attitude are important factors determining urban citizens' support of multifunctionality. Findings of the LCCM revealed a strong heterogeneity in attribute valuation across three different classes of respondents, suggesting that policy-makers need to be aware of diverse preference patterns among Thai citizens with regard to specific attributes of multifunctional agriculture. We further conclude that enhancing environmental literacy and consciousness is a key determinant in gaining citizens' support for multifunctional agriculture.

1. Introduction

Until recently, highland agriculture in the watershed areas of northern Thailand has primarily focused on the mono-functional role of producing food (mainly subtropical and temperate fruit and vegetables) to serve domestic and export demand. The emphasis on intensive, high-value and high-output agricultural systems was induced by national and international organizations to promote economically attractive alternatives to opium poppy which had been the dominant cash crop among highland dwellers with various ethnic backgrounds until the 1970s (Neef, 2012). Intensive farming practices associated with high agrochemical usage have shown adverse on- and off-site effects in various forms, such as soil and water degradation, loss of agro-biodiversity, and chemical residues in water and agricultural produce (Schreinemachers et al., 2012). Parallel to this high-intensity form of agriculture, more conservation-oriented government agencies, such as the Department of National Parks and the Department of Land Development declared certain sensitive areas as off-limits for agricultural expansion and delineated a wide system of national parks, wildlife sanctuaries, forest reserves, and watershed protection zones (Neef et al., 2003). Yet the policy of partitioning Thailand's highland watersheds into agricultural areas and conservation zones has been criticized by many scientists and development practitioners as ineffective in terms of promoting sustainable resource use, environmental conservation and viable rural livelihoods (e.g. Vandergeest, 1996).

While multifunctional agriculture has been widely discussed as an

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alternative to reverse the negative effects of conventional, monofunctional farming in many OECD countries, this concept is still nascent in the context of Thailand. Agricultural multifunctionality conceptually refers to the environmental, ethical and social dimensions of farming and production technology. The underlying principle is that farming does not only produce marketable goods, but also secures a range of environmental services, such as landscape conservation, flood protection or water purification, as well as fostering sustainable rural communities as public non-marketable goods and services to the society (see Section 2.1). Recognizing and estimating citizens' demand for such functions is crucial for an optimal agricultural policy design from a societal perspective. This study aims at determining Thai society's demand for agri-environmental goods and services offered by a multifunctional agricultural system. A Choice Experiment Model (CEM) is employed to assess citizens' willingness to pay for various attributes of multifunctional outputs. Extending from the CEM, the heterogeneity of citizens' preferences across socioeconomic characteristics, as well as environmental attitudes and knowledge is captured through the Latent Class Choice Model (LCCM).

After this introductory part, the remainder of this paper is organized as follows. Section 2 describes the concept of multifunctional agriculture, discusses the theoretical framework and briefly introduces the body of literature. Section 3 presents the various levels and attributes as a basis for the choice experiments, depicts the choice sets and introduces the specific research design and methodology. Section 4 presents and discusses the findings from the choice experiment model and the latent class choice model. Section 5 draws the conclusions.

2. Concepts, theoretical framework and literature review

2.1. Multifunctional agriculture: concept and values

It has long been acknowledged that agriculture is not just an economic activity that produces food, feed and fiber, but that it also provides a range of non-market, non-commodity outputs. These encompass the contribution of agriculture to fostering viable rural areas, to sustaining the local cultural heritage, to providing opportunities for agro-tourism, and to securing a number of ecological services, such as soil protection, flood control, landscape diversity, and agro-biodiversity conservation. Some of these ecological services may have a direct use value both for farmers and for society as a whole, while others may be of non-use value (e.g. existence and bequest values). Taken together, the multiple services that agriculture provides in terms of food security and safety, socio-economic development of rural areas, and ecosystem and watershed functions are enshrined in the concept of "multifunctional agriculture" (see Van Huylenbroeck et al. (2007) for a comprehensive review of definitions). Multifunctionality in agriculture has gained currency in academic and policy circles, particularly in the United States, Australia, the EU and Japan, as a means to redefine the agricultural sector's role in the 21st century (e.g. Bennett et al., 2004; Yrjölä and Kola, 2004; Hyytiä and Kola, 2006; Kallas et al., 2007; Arriaza et al., 2008). OECD agricultural ministers adopted the concept of multifunctional agriculture recognizing that "beyond its primary function of supplying food and fibre, agricultural activity can also shape the landscape, provide environmental benefits such as land conservation, the sustainable management of renewable natural resources and the preservation of biodiversity, and contribute to the socio-economic viability of many rural areas" (OECD, 2001). Yet the concept of multifunctionality in the agricultural sector has been interpreted in different ways. From an economic point of view, the challenge is to determine those values that are non-marketable in a conventional way, i.e. the positive externalities that are often taken for granted by other economic sectors and by non-farming citizens and whose contributions to overall social welfare may be substantial, while not being adequately reflected in conventional economic assessments. The concept of multifunctionality has also been increasingly used as an argument for including non-trade issues in WTO negotiations (cf. Vatn, 2002). Controversies have arisen on the question whether government intervention is justified to promote the concept of multifunctionality and – if yes – which policy measures are most suitable to address the challenge of multifunctional agriculture.

Groenfeldt (2009) argues that the concept of multifunctional agriculture should not be confined to wealthy, industrialized countries in the Global North, but is also relevant for emerging economies and developing countries in the Global South. Referring to evidence from various studies, he suggests that small-scale, agro-ecologically diverse farming systems in Monsoon Asia have the capacity to contribute to national and local food security, while protecting crucial ecosystem services, socio-cultural heritage and local knowledge systems under a changing climate. Dasgupta et al. (2015) hold that integrated farming systems with their diversified agro-ecological practices provide multiple benefits to farm households and have desirable socio-economic and ecological outcomes in the context of developing countries (see also Bowman and Zilberman, 2013). For the case of Thailand, Tipraqsa et al. (2007) adopted the framework of multifunctional agriculture to assess the performance of integrated farming systems as compared to non-integrated (commercial) farming systems. Drawing on farm-level research in Northeast Thailand, they found that integrated farming outperformed non-integrated farming in terms of four major elements of multifunctionality, i.e. food security, environmental functions, economic functions, and social functions. Zheng and Liu (2013) used a hybrid methodology to assess the multifunctional agriculture in Liaoning province (China), looking at economic, ecological, residential, and leisure functions. They suggest that agro-ecotourism is becoming an increasingly important element of multifunctionality in rural areas. While these studies have mainly looked at the 'production' side of multifunctional agriculture, our study focuses on the demand side, i.e. urban citizens' willingness-to-pay for the range of services provided by more diverse, multifunctional farming systems in ecologically fragile watershed areas.

2.2. Theoretical framework

2.2.1. Choice experiment approach

Grounded in Lancaster's model of consumer choice and the Random Utility model, the choice experiment approach proposes that consumers' utilities are derived not from the goods themselves, but rather from attributes constituted of such goods (Lancaster, 1966; Luce, 1959; McFadden, 1974; Birol et al., 2012). Under the Random Utility Model, the utility obtained from choice comprises both an observable deterministic component and an unobservable error component that is independent of the deterministic part. The error component – which implies that predictions cannot be made with absolute certainty – follows a predetermined distribution. Choices made among various alternatives express the perception of the respondent that the utility associated with a particular option is higher than that associated with other alternatives (Hensher et al., 2005; Birol et al., 2012). Assuming a similar preference pattern for all consumers, an econometric model, such as a conditional logit (CL) model is widely employed to deliver the value of each attribute. In addition, consumers' socioeconomic characteristics can also be included as interaction in the choice experiment model. The utility function can be written as

$$U_{ij} = V_{ij}\,(Z_j, E_i) + \varepsilon_{ij} \quad (1)$$

where U_{ji} is the utility the respondent i obtains from choice j. V is the deterministic part consisting of the vector of attributes of alternative j, Z_j and the vector of socio-economic characteristics of the respondents, E_i. ε_{ji} represents the error term or random unobservable term. The linear functional form of Vji can be written as follows (Arriaza et al., 2008);

$$V_{ji} = ASC_j + \Sigma\,\alpha_m\,X_{mj} + \Sigma\,\beta_e\,(ASC_j \times E_{ei}) \quad (2)$$