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Policy schemes for the transition to sustainable agriculture—Farmer preferences and spatial heterogeneity in northern Thailand

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ABSTRACT

Thailand has become one of the biggest exporters of agricultural products and the majority of the poor households rely on agriculture as their main source of income. Recent droughts and flooding have affected the agricultural farms especially in the upland areas of northern Thailand. Incentive based policies can play an important role in conservation and protection of agroecosystems. Hence, this paper applies a Choice Experiment approach to elicit small scale farmers' preferences for a potential payment policy scheme. Latent class models were used to analyse the farmers' responses to investigate their preferences, heterogeneity in preferences and the willingness to accept compensations. The results reveal that farmers are willing to participate in the proposed payment for ecosystem services (PES) scheme; however, overall the farmers show an aversion to drastic changes in their farming activities. The analysis suggests that majority of the farmers prefer schemes which require moderate reduction in chemical use and have shorter contract lengths. Furthermore, the study also provides cost comparisons of various policy combinations and variation in spatial patterns of the welfare estimates, which are useful for identifying the target areas for effective implementation of policy schemes.

1. Introduction

Natural landscapes in the past century have been transformed into human managed lands. The agricultural expansion and intensification has primarily been for food production along with food security concerns due to desertification, fodder maize and conservation projects (Bruun et al., 2017). However, agricultural practices not only determine the level of food production but also to a large extent the state of the environment through agriculture's ability of providing various ecosystem services (regulating, supporting, provisioning and cultural services). Agricultural intensification and unsustainable land uses affect the provision of services negatively (Albert et al., 2017) for example, high applications of fertilizers and pesticides can increase the nutrients and toxins in ground and surface water; intensive farming activities such as ploughing and mono-cropping can degrade the soil quality and its ability of water retention, which leads to increased water runoff, loss of topsoil and nutrient leaching into the water systems.

Environmental concerns along with concerns for sustained food production gave rise to interest in the sustainability of agricultural and food systems, where technologies and practices that do not have negative impacts on the environment, are adoptable and effective for farmers and can improve the provision of the ecosystem services. Sustainable agriculture involves efficient production of agricultural products, resource conservation, protection of farm biodiversity, protection and improvement of the natural environment along with safeguarding the social and economic conditions of the farming communities (Lee, 2005). It also helps in the provision of a range of public goods & services, such as, clean water, biodiversity conservation, carbon sequestration, flood protection, improved landscapes (Pretty et al., 2003).

Agricultural sustainability integrates natural processes such as nutrient recycling, soil regeneration, carbon storage and pest control into food production processes in order to enhance the provision of ecosystem services provided by the agroecosystems. It also minimises the use of pesticides and inorganic fertilizers and makes better use of knowledge and skills of the farming community (Pretty et al., 2003; Pretty, 2008). Hence, it involves not only field level sustainability, increased food production and income generation through farm diversification, but also ensures social sustainability linked with agriculture (Gypmanyasiri et al., 1997).

Thailand has become one of the biggest exporters of agricultural products for many years. The majority of poor households depend on agriculture as their main source of income. However, they are still in debts and many of them have to work in the non-agricultural sector as

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well, as only agricultural income is not enough to improve their quality of life and pay off the farm debts (Office of agricultural economics, 2010). The total agricultural area in Thailand is around 114.6 million rai.[1] About 26% of the Thai households own agricultural land, which is about 19.4 rai each (Office of National Statistics, 2013). 80% of the agricultural land is not in the irrigation areas (Office of agricultural economics, 2012). The expansion in agriculture in Thailand, in order to support food security and the Thai economy, is also associated with various problems; such as soil degradation from intensive land use, high chemical uses in agriculture, health problems from chemical uses, conflicts in water uses between different stakeholders and low production price. There have also been protests for compensations or price guarantee policy for some agricultural products. These issues raise the need to design effective agricultural policies in the area.

Though the concept of sustainability has been in Thailand since the fifth national plan (1982–1986), it was not implemented properly until the eighth national economic and social development plan (1997–2001). However, till present this implementation has not been very effective which can be attributed to constraints such as lack of cooperation between governmental organizations, lack of property right over agricultural areas, complications in the process of certificate scheme for organic agriculture for small-scale farmers, lack of participation from grass root people from planning process. All these constraints and problems reveal inefficiency in agricultural policy implementation. Including farmers' preferences when assessing the scope of sustainable policy can prove useful for effective implementation of these policies (Schiavone, 2010).

Monetary and financial incentive policies (Payments for Ecosystem Services (PES)) combined with agricultural policy are increasingly being promoted as a potential tool to attract farmers to change their land use and land management practices (Engel et al., 2008; Pagiola, 2008; Wunder, 2008). They represent a useful approach not only for enhancing sustainable management of ecosystems but also for supporting rural development (Ingram et al., 2014). These payment programmes such as national scale programmes in Costa Rica and Mexico, agri-environment programmes in the US and agri-environment schemes in Europe are being used to enhance the efficiency of supply of associated ecosystem services (Sauer and Wossink, 2010); however, such programmes are still not widespread in Thailand (Sangakapitux et al., 2009).

Effective implementation of these schemes has been attributed to farmers' decision to participate (Wilson, 1996). Rate of participation, compensation requirements and the characteristics of participating farms are considered as determinants of successful implementation of schemes (Crabtree et al., 1998; Zandersen et al., 2016). Hence, it is important to have an understanding of farmers' motivation to participate. Studies have used the Willingness to Accept (WTA) for research towards PES schemes' effectiveness as it provides an estimate of the lowest level of compensation farmers expect for adopting changes in farming activities according to the scheme designs (e.g. Broch and Vedel, 2012; Beharry-Borg et al., 2013; Zandersen et al., 2016). Most of the recent studies have focused on identifying the factors affecting the farmers' participation decision by investigating potential scheme attributes (e.g. Wilson, 1997; Ruto and Garrod, 2009; Espinosa-Goded et al., 2010; Broch and Vedel, 2012) and by exploring the heterogeneity in farmers behaviour based on both farm and farmer characteristics (see Wilson and Hart, 2000; Vanslembrouck et al., 2002; Hudson and Lusk, 2004; Ruto and Garrod, 2009; Aslam et al., 2017).

Various methods have been used to evaluate farmer responses such as contingent valuation survey method (Purvis et al., 1989), a dynamic mathematical programming model (Varela-Ortega et al., 1998), however, Choice Experiments (CE) are particularly suited for hypothetical policy scenarios, where no real data is available. Studies have used CE to address improvements in PES scheme designs by concentrating on farmers' preferences for scheme attributes (Ruto and Garrod, 2009; Broch and Vedel, 2012; Beharry-Borg et al., 2013; Zandersen et al., 2016).

However, there is not much relevant literature available in the context of Thailand. Given the heavy dependence of Thai culture on agriculture, it is important to assess the feasibility of such schemes in the country. Therefore, this paper proposes to provide policy recommendations regarding potential changes in land use activities that can help to enhance sustainable agriculture specifically in the northern regions of Thailand. It also addresses the effective design and implementation of policies by providing an understanding of the impact of various factors (farm and farmer) on the decisions of small scale farm holders. The current study employs a CE approach to (i) investigate farmers' preferences towards various scheme attributes, (ii) quantify farmers' WTA requirements for changes in farming practices, and (iii) explore farmers' heterogeneity in land use decisions and whether it is associated with particular farm and farmer characteristics.

2. Methods

2.1. CE theoretical framework

CE is based on the Lancastrian Economic Theory of Value (Lancaster, 1966) and Random Utility theory (McFadden, 1974). The conditional Logit Model (CLM) is the most commonly used and simplest of all the choice models. It assumes that a farmer 'n' will choose to participate in a scheme alternative 'i' from a specific choice, C_n, given that the indirect utility 'U_{ni}' from doing so, is greater than the indirect utility of other alternatives. The utility for CLM, including a constant term to capture the effect of unobserved influences exert over the selection of the 'business as usual' or 'do not want to participate' option, becomes:

$$U_{ni} = ASC_{BAU}.\ BAU + \beta_1 X_{1ni} + \beta_2 X_{2ni} + \ldots + \beta_k X_{kni} + \varepsilon_{ni} \quad (1)$$

The ASC_{BAU} is a dummy variable that takes a value of 0 if one of the hypothetical payment programmes is selected by a respondent on a particular choice card or 1 if the 'do not want to participate' option is selected. β_k is the utility coefficient and X_{kni} is the level of attribute k for alternative i for a farmer n.

The CLM assumes that unobservable components are identically, independently distributed and follow a Gumbel distribution (Train, 2003; Hensher et al., 2005). Therefore, the probability of selecting the alternative i will be:

$$P_{ni} = \frac{\exp(\beta_1 X_{1ni} + \beta_2 X_{2nI} + \ldots + \beta_k X_{kni})}{\sum_{j=1}^{i} \exp(\beta_1 X_{1nj} + \beta_2 X_{2nj} + \ldots + \beta_k X_{kni})} \quad (2)$$

The simple CLM imposes homogenous preferences across respondents, which is considered as a limitation, since preferences can be heterogeneous (Milon and Scrogin, 2006). The heterogeneity can be based on the varying socioeconomic and spatial charactersitics and attitudes of the respondents which effect the decision making. In order to identify this preference heterogeneity the Latent Class Model (LCM) was used.

2.2. Latent Class Model (LCM)

The Latent Class model (LCM) is a more flexible method which captures taste heterogeneity by classifying the respondents into segments and predicts their choice behaviour according to the segment they belong to. Each segment is unique and accounts for taste variation across the population and are determined endogenously by the data (Milon and Scrogin, 2006).

The LCM is specified as a random utility model where farmer n belongs to latent class s = (1, 2,…, S). The utility function can now be

[1] 1 rai is equal to 0.16 ha or 1600 square meters.