Can we get better information by any alternative to conventional statistical approaches for analysing land allocation decision problems? A case study on lowland rice varieties

Bhubaneswor Dhakal

Support for Development, Christchurch 7608, New Zealand

ARTICLE INFO

ABSTRACT

This study conducted a social survey on 300 representatives of Nepali farming households to demonstrate robustness of a structural modelling approach for examining and explaining complex land allocation decision problems of managers. It tested the approach specifically for investigating drivers and barriers of farmers' decisions for allocating lowland under three kinds (hybrid, conventionally improved and local) of rice varieties. The study required working on both irrelevant choice and disutility choice decision problems besides land allocation problems of all individual varieties. It formulated the research problems on a multiportfolios allocation framework and the empirical model in the structural equations modelling setup. The model was estimated in Full Information Maximum Likelihood (FIML) method. The findings of the model were compared with the results of the standard Tobit model (a conventional method). The estimates of the FIML are found better than the Tobit in terms of satisfying the assumptions of the allocation model, properties of standard errors and theoretical expectations of the variables under investigation. The improvements in the estimates make a noticeable change in prediction impacts and policy weightages of the explanatory factors which potentially alter the policy priorities of decision makers. The study identified many interesting factors determining the farmers' decisions of allocating lowland between the varieties, and resulting discriminatory benefit distribution between social groups. The study with the comprehensive information provides policy makers an avenue to compare and understand managers' decision problems of allocating lands in politically preferred and not preferred uses, and contributes in making effective policy decisions. This study discussed on the roles of crop research and community support policies and practices for emerging new problems of seed supply and exacerbating social exclusion in the farming communities. Some policy solutions are also discussed in line with the findings of the study.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

Land is a scarce resource with difference in suitability for many productive uses. Decision making for appropriate use of the resource is often a complicated subject. External supports can help managers to increase allocation of the valuable resource for better uses which can bring additional benefits in societies (Knowler and Bradshaw, 2007; Rogers, 2003; Stephenson, 2003). Many studies have been conducted to explain drivers and barriers to the resource allocation decisions of managers and assist to government and other support agencies for policy decisions (Bemabas et al., 2016; Fezzi and Bateman, 2011; Knowler and Bradshaw, 2007;

Doss, 2006; Amacher et al., 2003). However, the previous studies have still many weaknesses to examine and explain some complex land allocation decision problems and provide robust information for policy making.

Using of scientifically better methods in the study is one of the approaches to get better information. The scope of the approach is high in many land use decision cases such as lowland area allocation to different varieties of rice crop, forest land allocation to produce special characteristics of plant species and participation of landholders for agri-environment conservation. Social surveys in such characteristics of populations show that a significant number of respondents report zeros for their land allocation on various uses (Fezzi and Bateman, 2011; Doss, 2006). According to Humphreys (2013) the zero values can be reported mainly for two different reasons: irrelevant choice and disutility choice. Previous studies poorly recognised the implication of mixing or omitting of information of

E-mail address: Bhubaneswordhakal@gmail.com

the zeros resulted from the two different sources. Some of the studies discarded the samples with irrelevant choice observations for analytical simplicity (Yen and Huang, 2002). Others considered all sources of zeros carry same meaning irrespective of representing different problems and implication in results (Gauchan and Panday, 2012; Gauchan et al., 2012). The results of the studies can poorly meet the assumptions of allocation model. Details of the methodological problems in previous studies are discussed in next section. Investigating the land allocation decision problems with scientifically better approach would increase both quality and quantity of information for policy decisions. The motivation of this study was to demonstrate a scientifically better approach for addressing the analytical problem. The study focused especially to address the question whether the land allocation decision problems could be better explained on an alternative model over conventional ones.

This study considers that farmers have multiple decisions problems of land allocation. One decision might affect others. The conditions guided the study to set up the research problem in a multi-portfolio allocation framework. The observations of dependent variables could be measured in binary values in some cases and mixed of zeros and continuous values in others. The analytical problem is, therefore, formulated on a structural equation model and analysed in Full Information Maximum Likelihood (FIML) estimation method. The term FIML, here, refers a maximum likelihood estimation technique which simultaneously solves all equations of structural model and incorporates interrelationship effects of the system. The method allows estimation of equations with both latent and observed values in dependent variables (Westland, 2010; Kaplan, 2009). In the study the latent equations in the structural model are two kinds. One represents irrelevant choice and the other to disutility choice decision. This kind of disaggregation, to the best of our knowledge, has not been practiced previously in investigating land allocation decision problems. The study, therefore, contribute in advancement of both knowledge and method in land use decision study.

This empirical study focuses on investigating drivers and barriers of lowland allocation to different kinds of rice crop varieties of wet season (post monsoon harvest). The crop requires plain and safe field to hold water for puddling at seedling transplanting time and maintaining plant growth. Some of the farmers in the communities do not hold farm land suitable for lowland rice cropping. It is often termed a brute force boundary condition. The choices on the crop varieties are irrelevant to the farmers and the land allocation responses would be zeros.

This study included three kinds of varieties: hybrid, conventionally improved and local. The term local variety refers to all traditionally grown varieties that, to the best of the farmers' knowledge, were not introduced and improved by development agencies. Farmers manage the seeds of the local variety by using traditional methods of growing, and seed selection. The term conventionally improved variety refers to all high yielding varieties other than the hybrid variety that was bred and introduced by development organizations. Farmers can produce seed of the conventionally improved variety but replacement by fresh seed is needed after growing some years to ensure that it retains yield at original level. The hybrid variety is also an introduced one but farmers must buy its seed from seed providers every production season. In term of grain production the hybrid followed by improved variety gives higher yield than the local one. However, it is not necessary the varieties with high grain yield are economically beneficial than local one to the farmers.

The historical land allocation to a particular variety is assumed to make little difference to current lowland area holding of the farmers. Following other studies (e.g. Carletto et al., 2013; Gauchan et al., 2012), the factors determining land allocation are examined against the share of lowland used by farmers for each of the rice

varieties available in local communities. The benefit of each variety could be arguably better measured on the share of farmland used than the dichotomous choice (allocated or not allocated), although there were possibilities of some level of incorrect reporting of the farm area used in each variety (Carletto et al., 2013). The results of univariate Tobit method (the most common approach to analyse farmers' land allocation decisions) were considered appropriate to verify the results of the new approach.

The rest part of this article is organised as follows. The following section provides literature review focusing on theoretical model and analytical methods. Next two sections describe the research model and empirical method applied in this study. The results section presents output of empirical analysis. The results are discussed and concluded in the last section.

2. Literature review

Low level of resource allocation to or adoption of any technology is considered a problem of user side. The factors resulting the problem are believed to be minimised by policy interventions or other supports. The understanding on user side problems can make some reflections of supplier side problems but it has secondary importance. The literature review, therefore, focuses on decision goals, practices and problems of user side in explaining strengths and weaknesses of existing theories and study practices. The review is divided in three parts: theoretical model, decision influencing factors and analytical models.

2.1. Theoretical model

Many studies applied modified rational choice theory (based on utility maximization principle) in explaining land allocation decision problems (Doss, 2006; Sunding and Zilberman, 2001).[1] The key drawbacks in the original rational choice theory are assumptions of perfect information access and equal competency (no bounded rational problem) between decision makers. The assumptions made the theory inappropriate to study problems in land allocation decisions. The modified theory relaxes the perfect information assumption and considers the bounded rational problem of land managers. The theory posits that expected payoff of land allocation differs between available options, and an economically rational individual allocates the land area in his or her disposal to a variety or many varieties for maximizing expected benefit subject to his or her constraints. The individual prefers one portfolio or combination of portfolios which results higher benefit over others (e.g. Sunding and Zilberman, 2001). However, the decision of whether or not allocate their land to a particular option and if they decide to allocate how much to allocate is a function of many factors related to the land holders (e.g. Kalinda et al., 2014; Chibwana et al., 2012; Shapiro et al., 2002). When the landholder faces problem of making decision on multiple options, the decision of allocating resources on one portfolio also affects the decision of others in varying degrees. Resource allocation between the options is, therefore a joint decision problem and can be called a multi-portfolio-allocation decision problem.

Previous studies, however, have not adequately recognised the joint decision problem of land allocation and rarely explained in

---

[1] Studies on practicing politically preferred land use decision problems and particularly of crop varieties have broadly examined on economic (e.g. random utility and modified ration choice theories) and social (e.g. decision step theory and diffusion process theory) theoretical frameworks. The first theory deals the research problem from utility, cost, or benefit perspective whereas the later one deals the problem with process of practicing (Aldana et al., 2011; Rogers, 2003; Sunding and Zilberman, 2001).