FARMERS' PREFERENCES FOR AGRI-ENVIRONMENTAL SCHEME DESIGN: A CHOICE EXPERIMENT APPROACH

PREFERENCIAS DE AGRICULTORES PARA AGRI-DISEÑO DEL ESQUEMA AMBIENTAL: UN ENFOQUE DE EXPERIMENTO DE ELECCIÓN

PREFERÊNCIAS DOS AGRICULTORES PARA AGRO PROJETO DE ESQUEMA AMBIENTAL: UMA ABORDAGEM DE EXPERIÊNCIA DE ESCOLHA

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Abstract

Agri-environmental schemes are the main political tool in the world to maintain the relationship between agriculture and environment. The voluntary nature of these schemes is such that farmers' cooperation is considered the focal point of achieving policy goals. The aim of this article is to investigate farmers' preferences for agri-environmental schemes of water-related ecosystem services improvement. A choice experiment is used to elicit farmers' preferences for different attributes of these schemes. Seven attributes of cropping pattern, IPM program, individual or collective action, scheme length, option of cancelling, monitoring and financial support are investigated. Choice data was gathered through a survey of 376 farmers of Mashhad (northeast of Iran) and modelled by applying conditional logit and random parameters logit models. It is concluded that the explanatory power of RPL model compared to CL model is more appropriate. There are heterogeneities among farmers considering IPM, scheme length and level of monitoring and it is probable that the estimated parameter sign changes for some farmers. Results, also, show that there is a significant preference for the status quo option. In addition, the option of cancelling the scheme has the most marginal rate of substitution. The second and third places of marginal substitution rates are dedicated to collective action and Implementing proposed cropping pattern attributes. The findings show that credit-based payment for ecosystem services (CB-PES) is appropriate for this scheme in this region.
Key words: ecosystem services, credit-based payment, Heterogeneity, Random parameters logit, Mashhad

Resumen

Los esquemas agroambientales son la principal herramienta política en el mundo para mantener la relación entre la agricultura y el medio ambiente. La naturaleza voluntaria de estos esquemas es tal que la cooperación de los agricultores se considera el punto focal para lograr los objetivos de las políticas. El objetivo de este artículo es investigar las preferencias de los agricultores por los esquemas agroambientales de mejora de los servicios ecosistémicos relacionados con el agua. Se utiliza un experimento de elección para obtener las preferencias de los agricultores por los diferentes atributos de estos esquemas. Se investigan siete atributos del patrón de cultivo, programa de MIP, acción individual o colectiva, duración del esquema, opción de cancelación, monitoreo y apoyo financiero. Los datos de elección se recopilaron a través de una encuesta a 376 agricultores de Mashhad (noreste de Irán) y se modelaron aplicando logit condicional y modelos de logit de parámetros aleatorios. Se concluye que el poder explicativo del modelo RPL en comparación con el modelo CL es más apropiado. Hay heterogeneidades entre los agricultores que consideran el MIP, la duración del esquema y el nivel de monitoreo y es probable que los parámetros estimados cambien para algunos agricultores. Los resultados también muestran que existe una preferencia significativa por la opción de status quo. Además, la opción de cancelar el esquema tiene la tasa de sustitución más marginal. El segundo y tercer lugar de las tasas de sustitución marginal están dedicados a la acción colectiva y la implementación de los atributos propuestos del patrón de cultivo. Los hallazgos muestran que el pago basado en el crédito por servicios ecosistémicos (CB-PES) es apropiado para este esquema en esta región.

Palabras clave: servicios ecosistémicos, pagos basados en crédito, heterogeneidad, parámetros aleatorios logit, Mashhad

Abstrato

AEsquemas agro-ambientais são a principal ferramenta política no mundo para manter a relação entre agricultura e meio ambiente. A natureza voluntária desses esquemas é tal que a cooperação dos agricultores é considerada o ponto focal para atingir as metas políticas. O objetivo deste artigo é investigar as preferências dos agricultores por esquemas agroambientais de melhoria dos serviços ecossistêmicos relacionados à água. Um experimento de escolha é usado para extrair as preferências dos agricultores por diferentes atributos desses esquemas. Sete atributos de padrão de cultivo, programa de MIP, ação individual ou coletiva, duração do esquema, opção de cancelamento, monitoramento e apoio financeiro são investigados. Os dados escolhidos foram coletados por meio de uma pesquisa com 376 agricultores de Mashhad (nordeste do Irã) e modelados com a aplicação de modelos logit condicionais e logit de parâmetros aleatórios. Conclui-se que o poder explicativo do modelo RPL comparado ao modelo CL é mais adequado. Existem heterogeneidades entre os agricultores, considerando o IPM, o comprimento do esquema e o nível de monitoramento, e é provável que o sinal de parâmetro estimado mude para alguns agricultores. Os resultados também mostram que há uma preferência significativa pela opção status quo. Além disso, a opção de cancelar o esquema tem a taxa mais marginal de substituição. O segundo e o terceiro lugar das taxas de substituição marginal são dedicados à ação coletiva e à implementação dos atributos do padrão de cultivo proposto. Os resultados mostram que o pagamento baseado em crédito para serviços ecossistêmicos (CB-PES) é apropriado para este esquema nesta região.

Palavras-chave: serviços ecossistêmicos, pagamento baseado em crédito, Heterogeneidade, parâmetros aleatórios logit, Mashhad

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1. Introduction

In order to preserve ecosystems and their related services, from 1960s, natural balance of environment and sustainable development gradually became the focus of scientific and executive circles. From then on, several committees and meetings were held about this subject, including conference on the ecological aspects and international development (Warrenton, 1968), United Nations human environment conference (Stockholm, 1972) which led to establishment of United Nations Environment Program (UNEP), global strategy of environment preservation presented by UNEP in 1980, international union of conservation nature and natural resources (IUCN), world wide fund for nature (WWF), and Brundtland Commission (Geneva,1987) that published "our common future" report. Moreover, in Agenda 21 that is the result of the international environment and development conference in Rio de Janeiro in 1992, countries are required to act regionally and internationally in fields of biodiversity, climate change, desertification, forest management and other renewable resources so that in the 21st century, development will be replaced by sustainable development in all countries.

From the mid-1980s, in order to specify agriculture related damages to the environment and associated services and also to properly manage the relation between agriculture and ecosystem services, agri-environmental schemes (AES) were introduced and presented (OECD, 2003). Agri-environmental schemes are currently the main political tool in the world to maintain the relationship between agriculture and environment. Reduction of environmental risks, preservation of biodiversity, ecosystem development and improvement, increasing countryside recreational opportunity and protecting historical elements are among

1. Introducción

A fim de preservar os ecossistemas e seus serviços relacionados, a partir dos anos 1960, o equilíbrio natural do meio ambiente e o desenvolvimento sustentável gradualmente se tornaram o foco dos círculos científicos e executivos. A partir de então, várias comissões e reuniões foram realizadas sobre este assunto, incluindo conferência sobre aspectos ecológicos e desenvolvimento internacional (Warrenton, 1968), conferência sobre ambiente humano das Nações Unidas (Estocolmo, 1972) que levou ao estabelecimento do Programa das Nações Unidas para o Meio Ambiente (UNEP).), estratégia global de preservação ambiental apresentada pelo PNUMA em 1980, união internacional de natureza conservacionista e recursos naturais (IUCN), fundo mundial para a natureza (WWF) e Comissão Brundtland (Genebra, 1987) que publicou o relatório "nosso futuro comum" . Além disso, na Agenda 21, resultado da conferência internacional sobre meio ambiente e desenvolvimento no Rio de Janeiro em 1992, os países devem agir regional e internacionalmente nos campos da biodiversidade, mudança climática, desertificação, manejo florestal e outros recursos renováveis para que No século 21, o desenvolvimento será substituído pelo desenvolvimento sustentável em todos os países.

A partir de meados da década de 1980, para especificar os danos relacionados à agricultura ao meio ambiente e serviços associados e também para gerenciar adequadamente a relação entre a agricultura e os serviços ecossistêmicos, os esquemas agroambientais (AES) foram introduzidos e apresentados (OCDE, 2003). Esquemas agro-ambientais são atualmente a principal ferramenta política no mundo para manter a relação entre agricultura e meio ambiente. Redução dos riscos ambientais, preservação da biodiversidade, desenvolvimento e melhoria dos ecossistemas, aumento das oportunidades de lazer no campo e proteção dos elementos históricos.n

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AES goals. Agri-environmental schemes present a political response to environmental issues associated with intensive farming practices (Feehan and O'connor, 2009). Environmental damages resulting from output oriented agriculture include quality and quantity reduction of water resources, soil pollution, reduction of vegetative and animal biodiversity due to degradation of their habitats located in farmlands and etc.

Although priorities differ with countries, the main object of AES is to support environmentally beneficial agricultural activities, including sustainable agriculture and preserving existing low intensity systems (European Commission, 1997). In Denmark, for instance, the introduced AES include decreasing pollution of Nitrate, organic agriculture encouragement and extensive grassland management. In Portugal, programmers struggle for preserving non-intensive agriculture and reduction in inputs. In England, encouraging organic agriculture and developing special ecosystems through reduction of cultivated lands and pastures were objectives of AES. In fact, until now, a wide range of agri-environmental schemes and policies based on environmental rules and standards, taxes, payments and salable permits have been proposed in order to overcome market failure caused by public goods and external effects related to agriculture. Different studies show that there is no single tool for complete protection of environment and in many cases political combinations are needed to bring together these tools.

Agri-environmental schemes usually work by providing financial incentives for farmers who are trying to protect the fragile environment and even improve it. Effective implementation and application of environment protecting policies and programs greatly depends on accep

tMetas da AES. Esquemas agroambientais apresentam uma resposta política às questões ambientais associadas às práticas agrícolas intensivas (Feehan e O'connor, 2009). Os danos ambientais resultantes da agricultura orientada para a produção incluem a redução da qualidade e da quantidade dos recursos hídricos, a poluição do solo, a redução da biodiversidade vegetal e animal devido à degradação de seus habitats localizados em fazendas e etc.

Embora as prioridades sejam diferentes dos países, o principal objetivo da AES é apoiar atividades agrícolas benéficas para o meio ambiente, incluindo a agricultura sustentável e a preservação dos sistemas existentes de baixa intensidade (Comissão Européia, 1997). Na Dinamarca, por exemplo, o AES introduzido inclui a diminuição da poluição do Nitrato, encorajamento da agricultura orgânica e gestão extensiva de pastagens. Em Portugal, os programadores lutam por preservar a agricultura não intensiva e reduzir os insumos. Na Inglaterra, incentivar a agricultura orgânica e desenvolver ecossistemas especiais através da redução de terras cultivadas e pastagens eram objetivos da AES. De fato, até agora, uma ampla gama de esquemas e políticas agroambientais baseados em regras e padrões ambientais, impostos, pagamentos e permissões vendáveis têm sido propostos para superar a falha de mercado causada por bens públicos e efeitos externos relacionados à agricultura. Diferentes estudos mostram que não há uma ferramenta única para a proteção completa do meio ambiente e, em muitos casos, são necessárias combinações políticas para reunir essas ferramentas.

Os esquemas agro-ambientais geralmente funcionam fornecendo incentivos financeiros para os agricultores que estão tentando proteger o ambiente f

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tation of these policies by farmers. Experiences have proved that when policies are designed and applied in a top-down way without considering target population, they are less successful as the role of target population in designing the policies is denied and policymakers are not aware of their current condition. In fact, we could say that the voluntary nature of agri-environmental schemes is such that farmers' cooperation is considered the focal point of achieving policy goals (Wilson, 1997). However, the current framework of agricultural policies administration is not compatible with correct basics of design and administration of policies and a large part of agricultural policy design structure is developed by experts based on inefficient management in a one-way top-down process. This type of management is usually far from harmony and cooperation with ecological and environmental society. For the most part, beneficiaries are not involved in decision-making, but in fact, they must have a say in social and economic decisions affecting the environment. Several researches on influential factors on farmers' cooperation in these schemes have been conducted (for instance, Vanslembrouck et al., 2002). Brotherton (1991 and 1989) claimed that when we try to understand farmers' cooperation with AES, we need to consider farmer and scheme factors. Farmer factors include different individual features of farmer and farm such as age, education and farm size. Scheme factors are those that influence economic attractiveness of a special scheme and include proposed financial incentives and a ray of other designing factors like length of an AES scheme (Ruto and Garrod, 2009).

Following Brotherton (1989), literature related to farmers cooperation in AES (called adoption studies) has concentrated on farmer factors influencing cooperative

rágil e até mesmo melhorá-lo. A implementação e aplicação efetivas de políticas e programas de proteção ambiental dependem muito da aceitação As evidências provaram que, quando as políticas são projetadas e aplicadas de forma descendente sem considerar a população-alvo, elas são menos bem-sucedidas, pois o papel da população-alvo na elaboração das políticas é negado e os formuladores de políticas não estão cientes de sua condição atual. De fato, poderíamos dizer que a natureza voluntária dos esquemas agroambientais é tal que a cooperação dos agricultores é considerada o ponto focal para atingir as metas políticas (Wilson, 1997). No entanto, o atual quadro de administração de políticas agrícolas não é compatível com os conceitos básicos corretos de projeto e administração de políticas e uma grande parte da estrutura de projeto de políticas agrícolas é desenvolvida por especialistas baseados em gerenciamento ineficiente em um processo unidirecional de cima para baixo. Este tipo de gestão é geralmente longe de harmonia e cooperação com a sociedade ecológica e ambiental. Na maior parte dos casos, os beneficiários não estão envolvidos na tomada de decisões, mas, na verdade, eles devem ter voz nas decisões sociais e econômicas que afetam o meio ambiente. Várias pesquisas sobre fatores influentes na cooperação dos agricultores nesses esquemas foram realizadas (por exemplo, Vanslembrouck et al., 2002). Brotherton (1991 e 1989) afirmou que, quando tentamos entender a cooperação dos agricultores com a AES, precisamos considerar os fatores do agricultor e do esquema. Os fatores do agricultor incluem diferentes características individuais do agricultor e da fazenda, como idade, escolaridade e tamanho da propriedade. Fatores de esquema são

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behaviors (for example Morris and Potter, 1995; Wilson, 1997; Wilson and Hart, 2000; Vanslembrouck et al.,
2002; Siebert et al., 2006; Wossink and Wenum, 2003; Wynn et al., 2001). It seems that cooperation with agri-environmental schemes has positive correlation with farm size, farmer's education and farmer's interest in protective schemes and is negatively correlated with farmer's age. Although these innate factors might be influential on cooperative decisions, they limit policymakers because they are not changeable. Falconer (2000) stated that a lot of focus on farmer factors is not very beneficial (Ruto and Garrod, 2008).

In this regard and in order to reduce bad effects of such a designing and implementing policy system which bounds the policymaker and administrator to a great extent (due to unchangeable nature of farmer factors and lack of attention to scheme factors), in recent years, policy making has changed from top-down to bottom-up system and acts upon contributive comments of stakeholders to design agri-environmental schemes. In such conditions where individual farmers are the target of these measures, ideal environmental products are only achieved if farmers of that area collectively work in that field, because in most cases, preparing environmental products is only possible when local beneficiaries in rural areas accept coordinated adoption approach for environment management. This necessitates a different approach in the field of innovative intervention forms that takes agri-environmental aspect into account in order to prepare public products in regional scale. In fact, this approach can provide higher quality products which wouldn't be achievable through individual

aqueles que influenciam a atratividade econômica de um esquema especial e incluem incentivos financeiros propostos e uma série de outros fatores de projeto, como o comprimento de um esquema AES (Ruto e Garrod, 2009).

Seguindo Brotherton (1989), a literatura relacionada à cooperação de agricultores na AES (chamada estudos de adoção) concentrou-se nos fatores do agricultor que influenciam as cooperativasbehaviors (for example Morris and Potter, 1995; Wilson, 1997; Wilson and Hart, 2000; Vanslembrouck et al.,
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farmers' actions. This feature is specifically related to environmental goals that improve public environmental products such as biodiversity, landscape and water quality (ENRD, 2010).

It is not clear to what extent collective action is considered a valuable option for increasing farmers' cooperation in producing agriculture related public environmental products or to what extent design and implementation of agricultural policies can fulfill co-operational and social approaches among different beneficiaries of a rural region. One of the main goals of this study is to analyze farmers' collective action toward designing and implementing agri-environmental schemes (in addition to prevalent individual actions). Collective action is a number of farmers' activities interacting with other people and organizations for keeping local agri-environmental problems under control. Collective actions happen when more than one person has to cooperate with each other to reach an ideal result (Ostrom, 2004) or when optional actions to reach a common goal is undertaken within a group (Meinzen-Dick et al., 2002; Ostrom, 2008). Marshal (1998) defines collective action as an action that is the result of understanding shared preferences of members within a group (either directly or on its behalf through an organization). As raised by Meinzen-Dick et al. (2004), common features of all collective action definitions are inclusion of a group of people, shared preferences and common and optional actions to achieve common tendencies.

Several studies on improvement of classification understanding of ecosystem services and its financial valuation have been conducted among which we can point to Costanza et al., 1997; Costanza and Farber, 2002; de Groot et al., 2002; Boyd and Banzhaf,2007; Fisher and Kerry Turner,2008; Ojea et al., 2012). So f

Innovative intervention forms that takes agri-environmental aspect into account in order to prepare public products in regional scale. In fact, this approach can provide higher quality products which wouldn't be achievable through individual

ações dos agricultores. Esse recurso está especificamente relacionado a metas ambientais que melhoram os produtos ambientais públicos, como biodiversidade, paisagem e qualidade da água (ENRD, 2010).

Não está claro em que medida a ação coletiva é considerada uma opção valiosa para aumentar a cooperação dos agricultores na produção de produtos ambientais públicos relacionados à agricultura ou até que ponto a formulação e implementação de políticas agrícolas podem cumprir abordagens co-operacionais e sociais entre diferentes beneficiários de uma agricultura rural. região. Um dos principais objetivos deste estudo é analisar a ação coletiva dos agricultores para projetar e implementar esquemas agroambientais (além das ações individuais predominantes). A ação coletiva é uma série de atividades dos agricultores interagindo com outras pessoas e organizações para manter os problemas agroambientais locais sob controle. Ações coletivas acontecem quando mais de uma pessoa tem que cooperar entre si para alcançar um resultado ideal (Ostrom, 2004) ou quando ações opcionais para alcançar um objetivo comum são empreendidas dentro de um grupo (Meinzen-Dick et al., 2002; Ostrom, 2008). Marshal (1998) define a ação coletiva como uma ação que é o resultado da compreensão das preferências compartilhadas dos membros dentro de um grupo (diretamente ou em seu nome através de uma organização). Conforme levantado por Meinzen-Dick et al. (

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ar, the definition of ecosystem services has been the foundation of environmental policies and measures (Costanza and Farber, 2002; Millennium Ecosystem Assessment, 2005). In the last two decades, using financial incentives for provisioning, cultural and regulatory ecosystem services as a motivation all around the world even in developing countries has been on the rise. Payment for Ecosystem Services (PES) is the latest political tool being used in both developed and developing countries (Schomers and Matzdorf, 2013) and according to the World Bank and the World Resources Institute, it is expanding in developing countries in order to support and monitor agricultural environment (World Bank, 2004; World resources Institute, 2005). The most important goal of PES programs in developing countries is to diversify existing livelihood strategies as well as developing ecosystem services (Bulte et al., 2008; Milder et al., 2010).

In the beginning, it was supposed that this was the most cost-effective technique (Ferraro and Kiss, 2002; Ferraro and Simpson, 2002; Cranford and Mourato, 2014), but where market constrains exist, the preferred technique of ruling organizations and custodians was indirect intervention (Groom and Palmer, 2010), therefore, the alternative technique is interventions that reduces market constraints. A related study in Ecuador examined demand for credit in case the required environmental conditions were met. In this study, if the borrower showed environmentally friendly behavior, the cost of bank facilities would be reduced for him. This was a new motivating technique named credit-based payment for ecosystem services (CB-PES) (Cranford and Mourato, 2014). Also, in this study, due to limited budget of custodians of this subject, CB-PES was

2004), características comuns de todas as definições de ação coletiva são a inclusão de um grupo de pessoas, preferências compartilhadas e ações comuns e opcionais para alcançar tendências comuns.

Vários estudos sobre a melhoria da compreensão da classificação de serviços ecossistêmicos e sua avaliação financeira foram realizados, entre os quais podemos apontar para Costanza et al., 1997; Costanza e Farber, 2002; de Groot et al., 2002; Boyd e Banzhaf, 2007; Fisher e Kerry Turner, 2008; Ojea et al., 2012). assim

ar, a definição de serviços ecossistêmicos tem sido a base de políticas e medidas ambientais (Costanza e Farber, 2002; Millennium Ecosystem Assessment, 2005). Nas últimas duas décadas, o uso de incentivos financeiros para o fornecimento de serviços ecossistêmicos culturais e regulatórios como motivação em todo o mundo, mesmo nos países em desenvolvimento, tem aumentado. O Pagamento por Serviços Ecossistêmicos (PSA) é a mais recente ferramenta política usada tanto em países desenvolvidos quanto em desenvolvimento (Schomers e Matzdorf, 2013) e, de acordo com o Banco Mundial e o World Resources Institute, está expandindo nos países em desenvolvimento para apoiar e monitorar o ambiente agrícola (Banco Mundial, 2004; World resources Institute, 2005). O objetivo mais importante dos programas de PSA nos países em desenvolvimento é diversificar as estratégias de subsistência existentes, bem como desenvolver serviços ecossistêmicos (Bulte et al., 2008; Milder et al., 2010).

No início, supunha-se que esta era a técnica com melhor relação custo-benefício (Ferraro e Kiss, 2002; Ferraro e Simpson, 2002; Cranford e Mourato,

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presented to reduce market constraints.

Payment for Ecosystem Services is designed to create economic motivations in line with adjusting individual and collective actions for protecting, guaranteeing or supporting human access to benefits from natural system (Fisher et al., 2010, Muradian et al., 2010). Interventions for PES programs include both individual and collective actions. Common property regimes are normally managed by collective actions whereas private property regimes are usually related to individual actions (Dietz et al., 2002). A number of attempts to execute payment for ecosystem services programs in developing countries were done, but market based approaches were not tested at a sufficient level (Jones, 2006; Turpie et al., 2008; Jack, 2009; Fisher et al., 2010). Similarly, according to our surveys, no related study in Iran has been done based on this approach. Therefore this research aims to investigate Mashhad farmers' behavior regarding their participation in agri-environmental schemes of water-related ecosystem services considering collective action and credit-based payment for ecosystem services.

w2014), mas onde existem restrições de mercado, a técnica preferida de governar organizações e custodiantes foi a intervenção indireta (Groom e Palmer, 2010), portanto, a técnica alternativa é a intervenção que reduz as restrições do mercado. Um estudo relacionado no Equador examinou a demanda por crédito, caso as condições ambientais exigidas fossem atendidas. Neste estudo, se o mutuário demonstrasse um comportamento ecologicamente correto, o custo das instalações bancárias seria reduzido para ele. Essa foi uma nova técnica de motivação chamada pagamento baseado em crédito para serviços ecossistêmicos (CB-PES) (Cranford e Mourato, 2014). Além disso, neste estudo, devido ao orçamento limitado de custodiantes deste assunto, o CB-PES

apresentado para reduzir as restrições do mercado.

O Pagamento por Serviços Ecossistêmicos é projetado para criar motivações econômicas de acordo com o ajuste de ações individuais e coletivas para proteger, garantir ou apoiar o acesso humano aos benefícios do sistema natural (Fisher et al., 2010, Muradian et al., 2010). Intervenções para programas de PSA incluem ações individuais e coletivas. Regimes de propriedade comum são normalmente administrados por ações coletivas, e). Uma série de tentativas de executar m um nível suficiente (Jones, 2006; Turpie et al., 2008; Jack, 2009; Fisher et al., 2010). Da mesma forma, de acordo com nossas pesquisas, nenhum estudo relacionado no Irã foi feito com base nessa abordagem. Portanto, esta pesquisa tem como objetivo investigar o comportamento dos agricultores de Mashhad em relação à sua participação em esquemas agro-ambientais de serviços ecossistêmicos relacionados à água, considerando a ação coletiva e o pagamento baseado em crédito para serviços ecossistêmicos.

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Study site
Mashhad plain which is among the most important plains of Khorasan-e-Razavi province in northeast of Iran, is bound to Neyshabour and Yengije on the west, Kalat and quchan plains on the north, Fariman and Kalat plains on the east and Fariman, Sangbast and Neyshabour on the south (Fig. 1).
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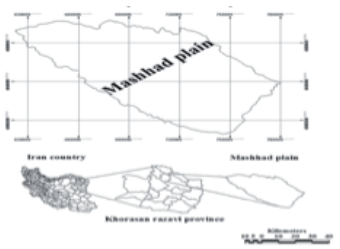

Figure 1. Situation of Mashhad plain in Khorasan-e-Razavi province
In general, we can divide Mashhad water supplies into four groups: underground water resources, regulated surface water (runoff) resources, irregulated surface water resources and re use of waste water. This plain was listed under prohibited plain and utilization and allocation of that should follow the rules of prohibited plains and be in accordance with fair water distribution law. The hydrograph of Mashhad plain shows a sharp drop (23 meters drop in 29 years) in aquifers and it is predicted that in near future (10 to 50 years), it will face a critical and irrecoverable problem in supplying drinking water and water for industrial and agricultural uses (Shahnooshi, 2014). According to statistics provided by comprehensive system of agricultural beneficiaries of Jahad-e-Keshavarzi office in Mashhad (2016), 8800 agricultural beneficiaries in cultivation subsection in Tabadkan, Darzab, Sarjam, Toos, Kardeh, Kenevist, Miami and Mian-Velayat rural districts are active. It is to be mentioned that according to the administrative division map of Iran in 2015, these 8 rural districts include 328 villages.
Designing discrete choice experiments
The discrete choice experiments (DCE) method is based on Lancaster's consumer choice theory which assumes that the utility from a good (or service) comes from the value of the attributes of the good (or service) (Lancaster, 1966). According to Lancaster (1966), attributes are defined as characteristics of a product or service which, in recent years, has covered political design aspect (Colombo et al., 2005), agri-environmental scheme design (Ruto and Garrod, 2009; Christensen et al., 2011; Broch and Vedel, 2012; Le Coent et al., 2017), community forestry design (Gelo and Koch, 2012) and land management contract design (Tesfaye and Brouwer, 2011) (Abebe et al., 2013; Le Coent et al., 2017). It can be assumed that farmers are actually making choices among specific scheme attributes, and then selecting their most preferred attributes package, in order to value different agri-environmental schemes. CE is also based on the random utility theory according to which observation of utility can only be made imperfectly, so the utility from a good consists of deterministic component (based on observed choices) and stochastic error component (McFadden, 1973). A growing literature about use of DCE to measure farmers' preferences for different technical specifications of agri-environmental schemes exists. These experiments are used when a choice problem has two or more discrete alternatives. The quality of a choice experiment mostly depends on the attributes used and the combination of these attributes (Street et al., 2005)

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In these schemes, usually, two groups of attributes are studied. The first group is attributes that directly influence farmers' acceptance cost (different types of agri-environmental measures and their levels) and the second group is related to scheme design (scheme length, option of cancelling the scheme, kind of cooperation in scheme (collective or individual action), level of monitoring and etc.). Developing the set of attributes from the first group in choice experiment requires two main processes. First, a comprehensive review of political documents and related rules, researches and expert agricultural and environmental viewpoints. Second, using focus groups and cognitive interviews with farmers, university instructors, active agriculture and environment experts in Mashhad and Khorasan-e-Razavi province. After defining water-related ecosystem services and agri-environmental measures of improving these services, prioritized services and proceedings of prioritized agri-environmental services were defined using FANP technique. Results of FANP (table 1) provided us with a more limited range of attributes to enter the discrete choice experiment.

Table 1. Chang's priority weights and rankings of agri-environmental measures of water-related ecosystem services improvement

Measures	Priority weights	Ranking
proposed cropping pattern (PCP)	0.207	2
Low irrigation (LIR)	0.037	6
Conservative tillage (COT)	0.162	3
Integrated pests management (IPM)	0.422	1
pressurized irrigation (PIR)	0.081	5

In this regard, two measures of implementing proposed cropping pattern and integrated pests management (IPM) as the two prioritized proceedings of water-related agri-environmental services improvement In Mashhad (as the attributes used in choice experiment) were selected. In addition to prioritized agri-environmental proceedings in designing each scheme, other attributes that could be influential on farmers' decision on accepting or rejecting of the scheme were selected as scheme factors in the choice experiment design. On this base, one of the attributes entered the scheme design is individual and collective action attribute that can be very critical in farmers' decision in accepting or rejecting the scheme. Also, scheme length is another important attribute of farmers' cooperation with agri-environmental schemes. Measure of monitoring on the scheme by trusted organizations can be mentioned as another important factor impacting farmers' cooperation.

One of the attributes mentioned before in several researches and requested by farmers in face to face interviews conducted before the scheme design was the option of cancelling the scheme. Compensated payments attribute (financial support) aimed at reducing market constraints designed in the form of credit-based payment for ecosystem services (CB-PES) with rate of interest equal to zero and four year repayment period was included in the scheme in order to motivate the farmers. On this account and to calculate net financial supprt to farmers, first a pilot study with 42 farmers was conducted in the study area and using contingent valuation technique, a least willingness to accept of the two proceedings was calculated. Also, after interviewing experts of Jihad-e-Keshavari department of Mashhad and Khorasan-e- Razavi's

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Jihad-e-Keshavarzi organization and Mashhad phytopathology clinic authorities as well as selected farmers, beside benefiting from a study by Alizadeh et al. (2012) who undertook dynamic mathematical programming to calculate the benefits in case they adopted the proposed cropping pattern of research Center Of Jihad-e-Keshavarzi of Khorasan-e-Razavi, the average annual financial support was determined as 38.46$/ha/year of cultivated land. On this base, the required bank credits for each scheme was calculated considering net present value (NPV) and discount rate calculation. Table 2 presents above mentioned scheme attributes along with levels of each attribute.

Table 2. Description of choice experiment attributes of agri-environmental schemes

	description	levels	coding
proposed cropping pattern (PCP)	Proportion of cultivated land allocated to (PCP)	$\frac{1}{3}, \frac{2}{3}, \frac{3}{3}$	Continuous
IPM program	Proportion of cultivated land under IPM program	$\frac{1}{2}, \frac{2}{2}$	Continuous
Collective action	Implementation of scheme measures in groups of 4 or 5	Individual Collective	dummy
Scheme length	The duration of the scheme is accepted	2 years 4 years	Continuous
Option of cancelling	Possibility of cancelling the scheme at least three months before the new crop year!	Yes No	dummy
Monitoring	Number of monitoring times on the scheme by trusted organizations	3, 4, 5, 6	Continuous
Financial support	Amount of credit the farmer receives as a one-time loan with interest rate of 0% (per hectare per year)	19, 38, 57, 76$	Continuous

As it is seen in table 2, experiment design includes one attribute with three levels, four attribute with two levels and two attributes with four levels (4^2×2^4×3^1) That were combined in D-efficient fractional factorial main effects choice experi and finally 24 choice sets were presented. Choice sets were structured according to the proposed approach by Street et al. (2005) and were blocked into 12 balanced blocks with two choice sets. To this end, SAS software was used for mentioned designs. In order to assure absence of sequence impact on respondents' preferences and to reach more changes in preferred sets, each respondent was randomly assigned to answer one of the 12 balanced blocks. Each choice set includes three alternatives which the third alternative always being the status quo. This means that each farmer (respondent), in each choice set, has to choose between water-related ecosystem services improvement (alternatives 1 and 2) and status quo (alternative 3). The status quo alternative is included in the choice sets in order to acquire welfare measures that are consistent with demand theory (Bennett and Blamey, 2001). Usually, the status quo alternative is entered in choice experiments in order to find farmers preference for agri-environmental schemes when he is completely free to accept or reject these schemes (Espinosa-Goded et al., 2010; Broch and Vedel, 2012; Christensen et al., 2011; Kuhfuss et al., 2014; Ruto and Garrod, 2009).

The status quo alternative is included to free the farmer from being imposed by a force alternative (Dhar and Simonson, 2003; Dhar, 1997; Tversky and Shafir, 1992; Kontoleon and Yabe, 2003; Le Coent et al., 2017). In this study, in

Integrated Pest Management (IPM) is an ecosystem approach to crop production and protection that combines different management strategies and practices to grow healthy crops and minimize the use of pesticides. FAO promotes IPM as the preferred approach to crop protection and regards it as a pillar of both sustainable intensification of crop production and pesticide risk reduction. As such, IPM is being mainstreamed in FAO activities involving crop production and protection. IPM aims to suppress pest populations below the economic injury level (EIL). FAO defines IPM as the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms (FAO, 2012).

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order to examine the respondents' utility difference when he chooses one of the agri-environmental schemes compared to when his preference is status quo, an alternative specific constant (ASC), for current state, is added to the model which assigns a value of 1 for two non-status quo alternatives and zero value for the status quo. If the coefficient of this variable is negative, it shows the preference of status quo alternative (no change) (Vermeulen et al., 2008) or a minimal WTA for accepting an agri-environmental scheme (Le Coent et al., 2017).

The questionnaire of this research includes three main parts. The first part deals with farmers' personal, economic, social and cultural information. The designed questions in the second part look at farmers' viewpoint on environment and environmental policies associated with agriculture. Finally, the third part of the questionnaire includes agri-environmental choice sets of water-related ecosystem services improvement in Mashhad. The purpose of first and second parts is to consider preference heterogeneity that cannot be considered by choice set attributes. Materials and methods

Econometric model

In the choice experiment technique, farmers are asked to choose an alternative from many choice sets, which are defined according to their attributes and levels. Conditional logit (CL) model is among the most commonly used models in analyzing the choice experiments. We can define an underlying latent variable which indicates the value function related with farmer i choosing alternative n, in choice situation Ct. Under a fixed budget constraint, farmer i choose alternative n among all m alternatives in choice situation Ct, if , for any n m (Pan et al., 2016). The researcher does not directly observe

U^*_{nit}, but instead directly observes U_{nit}, where:

$$U_{nit} = \begin{cases} 1 & if \quad U^*_{nit} = Max(U^*_{1it}, U^*_{2it}, ..., U^*_{Jit}) \\ 0 & otherwise \end{cases} \quad (1)$$

According to the random utility theory, the utility related with a choice is comprised of a deterministic component V_{nit}, which includes of factors observable by the researcher, and a stochastic error component ε_{nit}, which is independent of the deterministic part and follows a predetermined distribution. This error component implies that predictions cannot be made with certainty. Thus, the utility U^*_{nit} related with farmer i whose choice is alternative n in choice situation C, is given by:

$$U^*_{nit} = V^*_{nit} + \varepsilon_{nit} \quad (2)$$

Under the assumption that ε_{nit} $for\, n = 1,2,...,n$ are identically and independently distributed and follow the Gumbel distribution with scale parameter μ, the probability of any particular agri-environmental scheme n being chosen can be expressed in terms of a logistic distribution. Equation (2) can be estimated with a CL model (Greene, 2011; Mcfadden, 1974) which takes the general form:

$$P_{nit} = \frac{e^{\mu V^*_{nit}}}{\sum_{n=1}^{m} e^{\mu V^*_{nit}}} \quad (3)$$

In this model, the utility that farmer i derives from choosing alternative n, in choice situation C, (t=1, …, T) is given by:

$$U_{nit} = \beta_i X_{nit} + \varepsilon_{nit} \quad (4)$$

Where are the attributes of alternative n and the coefficient vector indicates the vector of farmer tastes (Le Coent et al., 2017).

But the CL model requires two strong assumptions which are independence of irrelevant alternatives (IIA) and preference homogeneity among respondents (Hausman and McFadden, 1984). The IIA presumes that relative odds of chosen alternative in comparison to other choices is independent of absence or presence of the unchosen third alternative (McFadden, 1974). This condition is not probably met in this study, as a third alternative of status quo is fitted in each choice set and the farmer may prefer it when there is no dominant alternative in the choice set (Le Coent et al., 2017).

Moreover, this model assumes homogeneous preferences across farmers. It is probable that behavioral factors mentioned before heterogeneously affect farmers' preference in accepting or rejecting the scheme. Preferences are unobservable to the researcher

If the scheme is cancelled, the financial support has to be paid back and the farmer is then free to return to his past behavior.

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are unobservable to the researcher and at least some variability would be expected in farmers' preference patterns due to individual-specific decision rules engaged by the farmers to analyze choice tasks, even if they tend to have similar socio-demographic characteristics (Pan et al., 2016). Farmers are heterogeneous and their preferences for agri-environmental schemes attributes may also be heterogeneous. Heterogeneities amongst farmers play a crucial role in the evolution of cooperation (Perc, 2011). Imposing an assumption of preference and response homogeneity when, in fact, there is heterogeneity, results in biased and inconsistent parameters and choice probability estimates (Otieno et al., 2011(. On this account, in order to analyze data in this study, it is preferred to use random parameters logit (RPL) model along with CL model. This allows preferences to vary randomly and continuously among people and doesn't require IIA assumption (McFadden and Train, 2000). A common method of evaluating preference heterogeneity is estimation of RPL model (Pan et al., 2016). Among the studies that are evidence of strength of RPL model, Brownstone and Train (1999), Ruto and Garrod (2009), Upton et al. (2012), Cranford and Mourato (2014), Classen et al. (2014) and Santos et al. (2015) could be mentioned.

The probability of RPL is the weighted mean of the logit formula, which is measured and evaluated in different values of β and given weights of the density f (β). In literature review, the weighted mean of different functions is called mixed function and the providing density for these weights is called mixing distribution. RPL is a mixture of evaluated logit in different β's with f(β) as the mixing distribution. In fact, random parameters logit probabilities are the ves in choice situation Ct is presented by:

integral of standard logit probabilities over a density of parameters. In this model, the probability that farmer i chooses scheme n among all m alternati

$$P_{nit} = \int \left(\prod_{t=1}^{T} \frac{e^{\beta i' x_{nit}}}{\sum_{m \in C_t} e^{\beta i' x_{mit}}} \right) f(\beta|\theta)\, d(\beta)) \qquad (5)$$

Where is a vector of parameters specific to farmer i (representing the farmer's tastes, which vary over people), are parameters that describe the density of the distribution of the individual-specific parameters , is the probability density function for (Le Coent et al., 2017). In RPL model, f(β) is continuously defined and specified. For instance, the density of β can be specified normally with mean b and covariance W (Train, 2009). According to Train (2009) the researcher should specify a distribution for the coefficients and estimates the parameters of that distribution (Train, 2009). Considering the fact that it is expected from the farmers to select both positive and negative values for different scheme attributes, normal distribution is an appropriate distribution for absorbing heteroskedasticity in population of this study. Simulated maximum likelihood is applied in order to estimate RPL model. In this study 1000 Halton draws is used to carry out the simulation.

The marginal rate of substitution between attributes and the compensating payments attribute can be calculated as:

$$MRS = -\frac{\beta_a}{\beta_{cp}} \qquad (6)$$

Where is the coefficient of each scheme attribute and is the coefficient of financial support attribute. Through this marginal rate of substitution, we can

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infer how the scheme attributes would be accepted by farmers in return to receiving a financial support.

Data

based on the amount of outlet water, were identified and by using Neyman allocation method, sample size in each stratum is determined. After that by applying simple random sampling method, farmers were selected from each well list of beneficiaries.

Results

Descriptive statistics of farmers who attended in discrete choice experiments of this study are presented in table 3. According to the information of this table, the average age of farmers of the surveyed sample is about 53 years of which more than 60% are above 50 years old which suggests the relative old age of farmers in the surveyed area. Also, according to the presented information, almost 80% of farmers have less than 9 years of schooling and the average level of education among farmers is about 5 years that suggests a low level of education among the target community under study. Furthermore, according to findings of table 3, average number of farmers' family members is about 4 people. About 75% of farmers of the surveyed sample earn less than $3846 per year and the average annual income of all farmers is nearly 3359$ that is considered very low. Information about willingness to modernity index in agricultural production (which is calculated a number between 0 and 7) indicates an average willingness of farmers toward using new crop patterns, irrigation methods and pesticides and fertilizers.

Table 3. Summary of sample socio-demographic characteristics

Variable	Description (variable format in models)	Group	Sample size	Percent sample (%)	Mean	S.D
age	Number of living years (continues)	18-30 years old	36	9.00	52.90	15.03
		31-40 years old	52	13.80		
		41-50 years old	62	16.50		
		51-60 years old	107	28.50		
		61 years old or older	121	32.20		
education	Number of education years (continues)	less than 6 years	104	27.70	5.21	3.74
		6-less than 9 years	198	52.70		
		9-less than 12 years	48	12.80		
		12 years and more	26	6.90		
Family size	Number of family members (continues)	1 and 2	67	17.80	4.09	1.79
		3 people	93	24.70		
		4 people	82	21.80		
		5 people	70	18.60		
		6 and more	64	17.00		
Income	Amount of annual income (continues)	Less than 10 million Rials	22	5.9	130.98	420.84
		10- less than 50 million Rials	126	33.5		
		50- less than 150 million Rials	162	43.1		
		150 million Rials and more	66	17.6		
Willingness to modernity in production	Calculated index (new crop patterns, irrigation methods and pesticides and fertilizers) (continues)	0-3	48	12.80	4.68	1.29
		More than 3- 4.5	130	34.60		
		More than 4.5- 7	198	52.70		
Farm size	Total area of farmland (continues)	0-5 hectare	232	61.70	12.55	30.26
		More than 5- 20 hectare	98	26.10		
		More than 20 hectare	46	12.20		
Risk assessment	0= medium; 1=high (dummy)	medium	266	70.70	-	-
		high	110	29.30		
Belief in positive impact of jihad-e-keshavarzi	Calculated index (reliability and playing a positive role) (continues)	0-2	110	29.30	2.61	1.06
		More than 2- 3.5	240	63.80		
		More than 3.5- 5.5	26	6.90		
Irrigated area under cultivation	Total area of irrigated cultivated land (continues)	0-5 hectare	258	68.60	9.61	20.94
		More than 5- 20 hectare	78	20.70		
		More than 20 hectare	40	10.60		
Willingness to accept the scheme	1= scheme A; 2= scheme B; 3= status quo	scheme A	148	19.68	-	-
		scheme B	212	28.19		
		status quo	392	52.13		

An investigation on the farm size shows that only about 12% of farmers have a cultivated land of about 20 hectares, and about 61% of them, with a cultivated land less than 5 hectares are considered among short-scale farmers. According to information presented in table 3, almost 71% of farmers assessed a medium agricultural activities risk in their irrigated under cultivation land and none of them had a low estimation of the risk. The presented information about the index of Belief in positive impact of jihad-e- keshavarzi which is a number between 0 and 5.50, suggests a downward medium value (2.61) in positive effect of Jihad-e-Keshavarzi on their agricultural activities. Also, nearly 70% of the farmers have an irrigated cultivated land of less than 5 hectares.

As shown in table 3 almost 52% of farmers do not have the willingness to accept proposed schemes and only 42% are willing to accept one scheme, which

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suggests a relatively low willingness among farmers toward proposed schemes.

Estimation results

The estimates of logit models are presented in Table 4. Results of CL model shows that all main variables from the CE are significant at least at the 1% level. According to the estimated regression measure of goodness of fit which equals 0.38, explanatory power of model is high (Hensher et al., 2005). Based on this, Hensher et al. (2005) stated that in discrete dependant variable models, values of measure of goodness of fit between 0.2 and 0.4 indicates extremely good fits of model.

Table 4. Estimates of logit models

Variable	Conditional logit	Random parameters logit		
	Coef. (std. err.)	Coef. (std. err.)	S.D (std. err.)	Probability of negative coef.(%)
ASC	-11.400*** (0.503)	-4.070** (1.920)	-	-
proposed cropping pattern	-4.140*** (0.125)	-2.190** (0.936)	-0.0056 (0.018)	100
Integrated production management (IPM)	-2.490*** (0.193)	-0.665* (0.347)	1.170 (0.668)	71
Collective action	6.110*** (0.179)	2.320** (0.866)	0.0524 (0.034)	0
scheme length	-1.480*** (0.099)	-0.926* (0.489)	1.910 (0.756)	68
Option of cancelling	-8.100*** (0.136)	-4.490** (1.850)	0.123 (0.102)	100
Monitoring	-0.340*** (0.090)	-0.492* (0.287)	-0.281 (0.158)	96
Compensation	0.0103*** (0.001)	0.0104* (0.005)	-	-
Respondents	376	376		
Observations	752	752		
Log likelihood	-509.746	-485.342		
Pseudo-R2	0.385	0.415		
Adjusted Pseudo-R2	0.373	0.396		

* $P < 0.1$

** $P < 0.05$

*** $P < 0.1$; (*robust*)*standard errors are given in parentheses*

As it is seen in table 4, coefficient of alternative-specific constant (ASC) variable is negative and significant which suggests that moving away from the current state to proposed choices will have a negative utility effect on farmers (Adamowicz et al., 1998); this result suggests that in current situations, farmers, in general, are not willing to change their crop pattern or poisons and chemical fertilizer utilization management to the crop pattern proposed by Reasearch Center of Jihad-e-Keshavarzi or IPM program. Coefficients of the attributes proposed cropping pattern, IPM program, scheme length, option of cancelling the scheme and level of monitoring are negative and statistically significant which suggests that these attributes have negative effect on farmers' choice behavior. In other words, if farmers are asked to dedicate a higher proportion of their cultivated land to the proposed crop pattern of Jihad-e-Keshavarzi, it is highly probable that farmers will not choose it. Also, if they are asked to dedicate a higher proportion of their cultivated land to IPM program, it is highly probable they will not choose it. The same is true about scheme length and with lengthy schemes farmers' behavior leads to refuse the scheme. According to information in this table, farmers are less willing to choose schemes in which they do not have option of cancelling the scheme (and if they quit the scheme, they will be penalized). In addition to this, the more the level of monitoring, it is more likely farmers will not choose such a scheme. Significant positive coefficient of collective action with financial support suggests that when the amount of governments' financial support increases or a scheme is proposed to farmers in which they need to do the required measures of the scheme in groups of 4 or 5 (compared to the situation they are asked to do these activities individually), it will have a positive utility impact and farmers will most probably choose them. The reason for more financial support is clear because everyone likes to receive the most financial support possible, but for collective action and farmers' willingness to choose schemes in which collective action is possible, after interviewing farmers, it was found that in addition to an increase in their power to track their requests, farmers believed that individual approach to ecosystem services improvement measures is useless. In other words, a typical farmer believes that if he undertakes IPM program individually or

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implements proposed crop pattern of Agricultural Research Center, this scheme is neither technically (due to excessive use of poison and fertilizers by other farmers and use of water resources for plants that are not suitable to cultivate in that area in current situation) nor financially successful (because other farmers who have not accepted this scheme will hamper the realization of economic goals and the costs will increase for implementing the IPM program).

As explained above, conditional logit (CL) model requires independence of irrelevant assumption and to examine this assumption, McFadden and Hausman test was used (Hausman and Mcfadden, 1984). Result of IIA test shows that IIA is rejected at the level of 1% and therefore, CL model may not be an appropriate specification for this estimation. Therefore, data was again estimated by Random Parameters Logit (RPL) model which was both free from IIA assumption and accounted for unconditional unobserved heterogeneity. RPL model results with 1000 Random Halton draws are, also, presented in table 4. In this model, ASC and government's financial support are assumed fixed. Also, to ensure the possibility of sign change of standard deviations throughout the full range of model, other attributes were entered to the model with normal distribution (Pan, 2016; Train, 2009). Comparing measures of goodness of fits for CL and RPL models, we conclude that the explanatory power of RPL model compared to CL model with respect to calculated pseudo-R2 is more appropriate. Therefore, aside from all the advantages above, RPL model provides better fits for this survey compared to CL model.

Standard deviations in table 4 shows that there are heterogeneities among farmers considering IPM, scheme length and level of monitoring and it is likely that the estimated parameter sign changes for some farmers. In other words, resulted standard deviations of distribution of parameters suggest the existence of heterogeneity in preferences among farmers for the main effects of attributes of IPM program, scheme length and level of monitoring. On this basis, we can say that farmers show homogeneous behavior toward attributes of Agricultural Research Center's proposed cropping pattern, collective action and possibility of cancelling the scheme, in a way that with higher proportion of field dedicated to proposed crop pattern, individual action and impossibility of cancelling the scheme, farmers' willingness to accept the scheme will decrease and in other words, all farmers show similar behaviors facing these changes. In contrast, for IPM program, scheme length and level of monitoring attributes, mean coefficients and standard deviations are all significant which suggests heterogeneity in farmers' behavior in choice behavior of agri-environmental schemes of water-related ecosystem services improvement. Therefore, it could be said that farmers in the surveyed area prefer to dedicate lower proportions of their farmland to IPM program, short scheme length and less level of monitoring, although, some farmers prefer schemes that require higher proportion of cultivated land dedicated to IPM program, lengthier scheme and with a higher level of monitoring of government institutions.

Interacting with farmers' socio-economic characteristics

Although invisible heterogeneity is included in RPL model, this model is unable to explain sources of heterogeneity. Mostly,

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this heterogeneity is a reflection of socio-economic dissimilarities of respondents (Boxall and Adamowicz, 2002; Pan et al., 2016).

In order to access the information about sources of heterogeneity in preferences, and to understand socio-economic characteristics of the root of these heterogeneities, CL and RPL models are estimated, considering the interaction of financial support with socio-economic characteristics, some of which are direct variables and some results of SEM-PLS process (table 5).

Table 5. Estimates of logit models with interactions

Variable	Conditional logit	Random parameters logit		
	Coef. (std. err.)	Coef. (std. err.)	S.D (std. err.)	Prob. of negative coef.(%)
ASC	-11.500*** (0.371)	-6.360 (0.701)		-
proposed cropping pattern	-4.130*** (0.092)	-2.290 (0.144)	0.0071 (0.022)	100
Integrated production management (IPM)	-2.450*** (0.142)	-0.368 (0.215)	-2.660 (0.509)	56
Collective action	5.940*** (0.149)	1.570 (0.239)	0.0168 (0.0287)	0
scheme length	-1.480*** (0.074)	-0.405 (0.0944)	0.0069 (0.0107)	100
Option of cancelling	-8.120*** (0.114)	-4.570 (0.351)	-0.0522 (0.0709)	100
Monitoring	-0.339*** (0.064)	-0.647 (0.114)	-0.0324 (0.0200)	100
Compensation	0.014*** (0.002)	0.0187 (0.0028)	-	-
Age	-0.00009*** (0.00002)	-0.0001 (0.00002)		
Family size	0.0002* (0.0001)	0.000004 (0.0001)		
Education	0.019* (0.011)	0.0179 (0.0105)		
Income	-0.000000***(0.00001)	-0.00004 (0.00001)		
Willingness to modernity	0.0005** (0.0002)	0.0007 (0.0003)		
Farm size	0.00004* (0.00002)	0.000029 (0.000015)		
Risk assessment	-0.002*** (0.0005)	-0.0025 (0.0007)		
Believing in positive impact of jihad-e-keshavarzi	0.001*** (0.0003)	0.0013 (0.00037)		
Irrigated area under cultivation	-0.000002 (0.00004)	-0.000003 (0.00004)		
Respondents	376	376		
Observations	752	752		
Log likelihood	-490.362	-477.061		
Pseudo-R2	0.406	0.423		
Adjusted Pseudo-R2	0.386	0.396		

* $P < 0.1$

** $P < 0.05$

*** $P < 0.1$; *(robust)standard errors are given in parentheses; VIF – uncentered*: 1.701

In this survey, different socio-economic characteristics of interactions are included, that according to the literature in several surveys in different times and places around the world, only some of them are recognized as effective factors on farmers' behavior in accepting agri-environmental schemes. Socio-economic characteristics used in interaction process of this survey are age, family size, education, annual income, willingness to modernity, farm size, risk assessment, belief in positive i

mpact of Jihad-e-Keshavarzi in farmers' success and irrigated cultivated land. Results of CL and RPL models with interaction are presented in table 5. These interactions show the effect of these variables on farmers' requested financial support for accepting the scheme (in case of education, its effect on accepting collective action is investigated). A positive partial coefficient from interaction between financial support and a variable indicates that this variable causes farmers' requesting for more financial support from government institutions and in contrast, negative partial coefficient indicates that mentioned variable decreases farmers' amount of required financial support from government institutions.

In CL model, coefficients of interactions with age, income and risk assessment variables are negative and statistically significant. Negative sign of age means as a farmer grows older, he asks for less financial support from government to accept agri-environmental schemes of water-related ecosystem service improvement. In other words, older farmers are more willing to accept schemes with less financial support in comparison to younger ones. The reason lies in their experience. Interview with farmers in the surveyed area showed that most of experienced farmers in the area have kept record of changes in environment and water resources and believe that if current resources management and exploitation and production method in the agricultural sector goes on, agricultural activities will not be possible in the coming years and transferring this career to their children will be hampered due to extinction of resources and inappropriate environmental conditions

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of the agricultural sector in the area (partly due to improper management of the beneficiaries), therefore, they are willing to request for less financial support, to accept these schemes. Another reason can be found in cultural differences between different generations. One obvious thing to be mentioned here is that the previous generation and older people are more content and will implement proposed agri-environmental schemes with less financial support. Coefficient of interaction with income variable suggests that with income increase, farmers ask for less financial support for accepting agri-environmental schemes. In other words, the more money a farmer earns, the less money they are going to ask from government institutions in order to accept agri-environmental schemes of water-related ecosystem services improvement. One of the reasons of this behavior is as a result of type of financial support which is considered in this research. As mentioned before, in this project we have applied CB-PES method which clearly shows that farmers with more income are less willing to take these credits for accepting some agri-environmental measures. Also, aside from the method of financial support in this project, it could be said that the richer a farmer is, the less financial support he is expected to request. About the risk assessment variable, we can observe that coefficient of interaction with government financial support variable is negative which indicates that a farmer who assess a high risk of his agriculture activity asks for less financial support from the government for accepting these agri-environmental measures. The reason could be explained by the fact that in analyzing his activity risk, each farmer logically considers several risks, among which the most important one can be lack of water resources in near future in surveyed area. Also, another activity risk considered by farmers is the damages caused by natural disasters like drought, pests and insects and etc. Since these risks play a dominant role in farmers' point of view, it is expected that farmers take action for reducing and controlling them in order to be safe from their harmful effects in future. Therefore, they are convinced to ask for less financial support from government institutions to accept proposed agri-environmental schemes (which are expected to be considered in designing the crop pattern by Research Center of Jihad-e-Keshavarzi and IPM program).

Also, according to information on table 5, in this model, coefficients of interaction of financial support with family size, willingness to modernity, farm size and belief in positive effect of Jihad-e-Keshavarzi variables and also coefficient of interaction of collective action with education, are positive and significant. Negative sign of family size variable means that the bigger the size of the family, the more financial support a farmer is going to request for accepting proposed agri-environmental schemes. In other words, in order to convince farmers with larger families to accept agri-environmental schemes, you need to provide them with more financial support. It is logical to say that the reason for this type of farmers' behavior is their concern about unpredictable outcome of these schemes on their agricultural production and income which is the supplier of the life of the household and the more family members a farmer has, the more concerned he is about supplying their needs and therefore asks for more financial support from government institutions in compensation for these concerns.

Coefficient of interaction of willingness to modernity with financial support indicates that farmers who are more inclined to modernity in agricultural

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activities, ask for more financial support for accepting agri-environmental schemes, because they believe that their freedom of action to move toward modern techniques will be limited and they will have to act in the framework assigned by the proposing institution, so, it is obvious that they are going to ask for more financial support from government institutions to accept those schemes. Coefficient of interaction of financial support with farm size suggests that with increase in the size of the farm, farmers ask for more financial support to accept agri-environmental schemes and the reason can be explained in the fact that in many cases, farmers who own large farmland, cannot cultivate the whole land due to financial and other resources limitations, therefore, to compensate for this shortcoming, are inclined to receive more financial support to accept agri-environmental schemes. It seems that this behavior indicates the more effective elasticity of financial resources limitation in comparison to other resources, from farmer's point of view. Coefficient of interactions of Belief in positive effect of Jihad-e-Keshavarzi on farmers' success is positive and significant. These farmers who think highly of Jihad-e-Keshavarzi , believe that it has enough organizational and governance power, therefore, ready to fund and pay more if it insists on a scheme and so, farmers will be less under financial pressure. Therefore with this belief, it is obvious that farmers request Jihad-e-Keshavarzi to play a key role in accepting costs caused by implementation of these schemes.

Information in table 5 also suggests that coefficient of interaction of level of education with collective action variable is positive and significant which shows the positive effect of education on accepting agri-environmental schemes in a collective action. In other words, on this basis we can say that those farmers who have higher levels of education are more willing to run these schemes with other farmers in groups of 4 or 5 compared to other farmers. The reason lies in the fact that higher education for these farmers leads to a better understanding of collective action advantages in technical, financial and legislative aspects and removes the mental barriers which are mostly legislative and social issues.

Negative distribution of preferences

Mean and standard deviation of coefficients with normal distribution provide information about the proportion of farmers who consider a negative value for an attribute compared to those who consider that value positive. Information in table 5 suggests that farmers' probability distribution of preferences for proposed crop pattern of Agricultural Research Center is negative and 100% of farmers have negative preferences for these attributes meaning that they are not willing to accept this pattern. However, according to this table, farmers' probability distribution of preferences for IPM attribute is also negative, but for this attribute, 29% of farmers have positive preferences. In other words, for this attribute, 71% of farmers have negative and 29% of them have positive preferences and the estimated parameter of this attribute for this group of farmers is positive. Distribution of preferences for collective action attribute is positive and 100% of them have positive preferences for this attribute. As we can see about the length of the scheme, 68% of farmers have negative and 32% positive preferences. For the option of cancelling the scheme, as we can see, 100% of farmers have negative preferences for impossibility of cancelling and based on this,

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we can say that all farmers prefer to option of cancelling in their chosen scheme. Considering the variable of level of monitoring on the scheme by supervisory authorities, as we can see in table 5, 96% of farmers have negative and only 4% of them have positive preference toward monitoring the scheme.

Marginal rates of substitution

Values considered by farmers for each attribute of agri-environmental schemes of water-related ecosystem services improvement can be calculated by marginal rates of substitution between that attribute and financial support of government attribute by applying equation 6. Marginal substitution rates in this survey indicate farmers' willingness to accept (WTA) for measures and attributes of each scheme. With consideration of consistency, in this survey marginal substitution rates are calculated at mean and for RPL with interactions model. The justification for using results of RPL with interactions model compared to three other models is that this model provides more appropriate fits and includes heterogeneity of farmers' preferences and their resources, and secondly is that CL model violates IIA assumption which may lead to biased results. Results of final marginal substitution rates are presented in table 6.

Variable	Conditional logit		Random parameters logit	
	without interaction	with interaction	without interaction	with interaction
ASC	283.79	210.62	100.35	87.21
proposed cropping pattern	103.10	75.64	53.99	31.40
IPM	62.00	44.87	16.40	5.05
Collective action	-152.10	-108.80	-57.20	-21.53
scheme length	36.84	27.10	22.83	5.55
Option of cancelling	201.64	148.72	110.70	62.66
Monitoring	8.46	6.21	12.13	8.87

The marginal rate of substitution result of RPL without interactions is explained here. There is a significant preference for the status quo option. This result is also obtained by other researchers like Le Coent, et al., 2017. The estimation of the WTA for the ASC is 100.35 $/ha/year. This preference corresponds to the average minimal payment required to accept an average scheme (i.e. independently of the level of the other attributes). This minimal WTA entails the opportunity and psychological costs of entering in a contract (Le Coent, et al., 2017). Results, also, show that the option of cancelling the scheme has the most marginal substitution rate (110.8 $/ha/year) . Broch and Vedel (2012) also achieved a similar result in their study. In current situation, farmers are free to do their agricultural activities in the way they want and do their activities with their own responsibility and decisions, but after accepting the scheme, they are required to do or not to do certain measures; therefore, it is clear that this limitation reduces the farmers' utility and he tries to compensate this feeling with asking for financial support from the government. If this restriction is added to impossibility of cancelling the scheme, it is clear that this issue will have more negative effects on farmers' utility and it is expected that he asks for more financial support in order to eliminate possible bad effects of scheme measures. Therefore, as he is banned from cancelling the scheme he is accepted, the farmer, due to concerns caused by

Rial is converted to dollar using 1$ equals 39000 Rial.

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changes required by each scheme, considers this scheme more costly for his agricultural activities and tries to compensate the risk of benefit reduction. However, when there is option of cancelling the scheme, the farmer asks for less financial support because he can manage his risks by cancelling the scheme and is not after compensating for probable risk of cancelling the scheme, which may have negative financial effects on benefits. The second place of marginal substitution rates is dedicated to collective action attribute. The important point is that unlike other attributes which have positive value, marginal substitution rate of this attribute has negative value which proves positive effect of collective action on farmers' utility. The reason for importance and the second rank of this attribute can be farmers' experience and understanding of socio-cultural status and technical issues of agricultural productions and inputs use. Based on this and with appropriate information about their area under activity, farmers believe that this measure is effective and useful only when it is done with collective cooperation and contribution of farmers and if some farmers try this measure individually, not only will their measure be unsuccessful, but also experience has proved that due to unchanged behavioral pattern of other famers, will press more charges on farmers who accept this scheme and will not be physically and technically effective, because other farmers will not try to save the resources or change inappropriate Input consumption pattern and therefore the result is nothing but waste of resources. Implementing proposed cropping pattern of Jihad-e-Keshavarzi

attribute- which is designed to develop water consumption and gain maximum benefit- sits in the third place (almost 54.1 $/ha/year). By accepting the scheme, the farmer accepts to plant crops which might be different from his decision for cultivation. It is obvious that when a farmer decides for the type of crop to cultivate, he considers all resources and facilities he has and his needs and thinks to himself that with a change in crop pattern, he might lose what he predicted and therefore tries to compensate for this loss by asking for more financial support from government institutions – Alizadeh et al. (2012) also confirm the possible reduction in income by accepting proposed crop pattern of Research Center in starting years. But for IPM program acceptance, it is different. After explanations by Jihad-e-keshavarzi experts to farmers and ensuring them that IPM program does not ban the use of fertilizers, but its only aim is for the farmers to closely monitor their field and cooperate with experts and phytopathology clinics in order to select the best type of pests control and type and amount of chemical fertilizers and pesticides in a logical way, believe that this method will not have negative meaningful effect on the product of area under cultivation (the view point of Jihad-e-Keshavarzi of Khorasan, Mashhad and phytopathologists also confirms this) and even by getting related certificates and good marketing, they can sell their products at a higher price. Therefore, to accept this program, farmers ask for less financial support compared to the proposed crop pattern and even as results of RPL model show, coefficient of this attribute for some farmers is positive which seems logical

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according to above explanations. Scheme length as another attribute of agri-environmental schemes of water-related ecosystem services improvement that influences farmers' preferences in choosing or refusing the scheme. Based on this, marginal substitution rate related to this attribute is calculated about 22.8 $/ha/year for each hectare which indicates that with lengthier schemes, farmers ask for more financial support to accept them. Also, with more frequent monitoring of their cultivated land, farmers ask for more financial support. On this basis, farmers ask about 12.1 $/ha/year from responsible institutions for each more time of monitoring. Conclusion

According to the economic analysis on collected data from 376 farmers of Mashhad located in Mashhad plain using choice experiment approach and conditional logit and random parameters logit models, farmers' preferences about agri-environmental schemes of water-related ecosystem services improvement was surveyed.

From the results of this survey, we come to seven general conclusions. First, if in a two way top-down and bottom-up management process, agri-environmental schemes of water-related ecosystem services improvement are designed to meet farmers' needs, they are willing to cooperate with these schemes. In other words, by designing schemes that are both financially and technically possible and supplier of farmers' needs and concerns, an effective step toward improvement of ecosystem services in Mashhad has been taken. The second conclusion is that each and every measures and attributes of schemes is significant in farmers' preferences. In other words, in addition to scheme measures drawn from FANP process, other attributes such as scheme length, individual or collective action, level of monitoring on the scheme implementation and option of cancelling the scheme are influential attributes on farmers' preferences. Third, in the process of choosing the scheme by farmers, it was seen that option of cancelling the scheme is a key attribute in choosing or rejecting the scheme and it works as a safety valve for the farmer in risk management for entering an unknown scheme. Therefore, if policymakers and scheme designers' goal is to enhance level of participation in such environmental schemes, it is advised that to the extent possible, these attributes be included in the scheme so that farmers confidently choose them. The fourth conclusion from the results of this survey is that with respect to novelty of these schemes to farmers in surveyed area and considering the risks of accepting these schemes, it is advise that if possible, in presenting the schemes to farmers (with considering technical subjects), different levels of commitment to agri-environmental measures are presented so that they can select the appropriate level of each political measure, based on their level of risk taking. Making this arrangement can improve the farmers' level of participation. The fifth conclusion is about collective action. According to the previously mentioned information in this research, farmers prefer to accept the AES proposing collective action as it is, also, emphasized by Dietz et al. (2002). Therefore, paying attention to this issue is a key point in schemes success.

The sixth conclusion drawn from the results of this survey can be specified to financial support tool included in each scheme. The results of this survey showed that credit-based payment for ecosystem

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services (CB-PES) has been considered by two sides to be appropriate for this scheme. First the scheme is therefore deemed appropriate by custodians and policymakers who will bear less financial pressure, and thus the policy maker can overcome market failures of public goods. Second the farmers also receive much more than direct payments, and thus can use it in the quantitative and qualitative development of his agricultural activities, resulting in reduction of accepting the scheme risk. The seventh conclusion drawn from this survey is as a result of the model we used which clearly showed heterogeneity of farmers' preferences in selecting different schemes. In other words, it became clear that farmers of Mashhad, in selecting three attributes of IPM program, scheme length and level of monitoring on the scheme implementation show significant heterogeneity, in a way that some of them have positive and other have negative preferences in respect to these attributes which need to be focused on in presenting the scheme and contracting with farmers so that the efficiency of the scheme increases. Based on this, it is recommended that schemes be presented according to age, level of education, family size, farm size, annual income and other effective factors. Applying choice experiment approach in this survey may partially solve the problem of formulating agri-environmental schemes of water-related ecosystem services improvement, but further research on this survey can greatly contribute to development and improvement of this context. It is then recommended that researches focus on hypothetical bias problem management in choice experiment approach. Considering the fact that respondents in this survey have selected the schemes in a hypothetical environment (with no real exchange), it is possible that due to lack of economic motivations to reveal the true value, they overstated their true behavior. Using cheap talk method and doing experiment in real-life situation can be a better reflection of farmers' true preferences. Also, if cost-benefit analysis is used to estimate cost and benefits of these schemes, we can design agri-environmental schemes with better efficiency. In addition, it is recommended that farmers' spatial distribution impact on their choice behaviors be investigated.

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