Factors affecting farmers' likelihood to use advisory and extension services

STEFANO PASCUCCI*; TIZIANA DE-MAGISTRIS**

Jel Classification Codes: Q12, Q16

Acknowledgements

The authors gratefully acknowledge the Marche Regional Administration for allowing them to use the information presented in the Evaluation Report on the effects of Extension Services in Agro-food Systems funded by Regional Law 37/99 and R.T.I. E-coter – Resco – Unicab who compiled the report.

Stefano Pascucci benefited from the support of the European Commission through the Marie Curie Actions Intra-European Fellowships (IEF), Call: FP7-PEOPLE-IEF-2008, project title "Institutional Compatibility Analysis of Resource Use Sustainability" (ICARUS).

Tiziana de-Magistris is benefitting from the support of the European Commission through the Marie Curie Actions Outgoing International Fellowships at Arkansas University.

Abstract

Privatization and decentralization of public advisory and extension services (AES) are raising increasing concerns worldwide. However, the way farmers re-act to this reform, and how they select the most appropriate AES still remain puzzling and relatively under-explored. Accordingly, the aim of this paper is to analyze the factors affecting the likelihood of farmers to use different types of AES. We analyze the decisions to use three different types of AES made by a sample of famers (443) in Italy (Marche region). This decision-making mechanism is related to the use of AES introduced by Marche Regional Administration (MRA) in a policy reform in 2005. By adopting this approach, we highlight the relevance of social capital and local networks in driving the decision to use services more related to information, knowledge sharing and diffusion, while the agricultural specialization remains the main factor affecting farmers` likelihood to use specialized and targeted services.

Key word: *extension services, Marche region, modeling farmer's decision, Multivariate Probit Model.*

Rèsumé

La privatisation et la décentralisation des services de vulgarisation et de conseil agricoles suscitent actuellement une préoccupation grandissante dans le monde entier. Cependant, les réactions des producteurs à cette réforme et la façon dont ils sélectionnent les services les plus appropriés restent encore peu claires et relativement peu analysées. Par conséquent, le but de ce travail est de passer en revue les facteurs qui influent sur la probabilité que les producteurs aient recours à différents types de services de vulgarisation et de conseil agricoles. Nous allons donc évaluer comment un échantillon (443) de producteurs italiens (dans la région des Marches) ont décidé d'utiliser trois différents types de services. Ce mécanisme de prise de décision est lié aux dispositifs d'utilisation des services introduits en 2005 par l'Autorité régionale des Marches dans le cadre d'une réforme politique. En suivant cette approche, nous allons mettre en évidence dans quelle mesure le capital social et les réseaux locaux contribuent à déterminer la décision d'utiliser des services plus liés à l'information, au partage et à la dissémination des connaissances alors que la spécialisation agricole reste le principal facteur qui intervient dans la probabilité que les producteurs utilisent des services spécialisés et ciblés.

Mots clés: services de vulgarisation, région de Marches, modélisation de la décision des agriculteurs, Multivariate Probit Model

1. Introduction

In industrialized countries one of the most important motivations leading farmers to use advisory and extension services (AES) is the expectation of direct or indirect improvement in the performance of their business. Prior papers have underlined the role of advisory services in enhancing the financial performance of farmers and managing market risk (Pennings et al., 2005; Isengildina et al., 2006). Other approaches also analyzed the links between the use of AES and farmers' overall features and strategies (Kidd et al., 2000; Santucci et al., 2002; Snapp et al., 2003; Brunori et al., 2008; Klerkx and Leeuwis, 2008; Knickel et al., 2009). In this respect the potential demand for AES is seen to be driven by both business and non-business related issues. But the effective use of AES is also a matter of availability and organization of their provision (supply side). In the past decades AES provision has been mainly due to public organizations and agencies. More recently several policy interventions have tried to reform public AES provision introducing elements of privatization and decentralization (Rivera, 2008). This has been particularly evident in the European context (Laurent and Labarthe, 2006; Labarthe, 2009). Some of the privatized-type of AES are more and more related to farmers' business objectives, while more public-oriented ones still remain in the domain of direct policy support and provision. The way farmers react to this change and how they select the most appropriate services still remain puzzling and not completely addressed in this research domain (Snapp et al., 2003).

Accordingly the aim of this paper is to cover this gap by analyzing the factors that affect the likelihood of farmers to use different types of AES and the relation between these decisions.

We decide to evaluate this mechanism via a case study. We analyze the choice of three different stylized-types of

* Management Studies Group (MST), Wageningen, The Netherlands.

** Agro-Food Economics Unit, Center for Agro-Food Research and Technology (CITA), Zaragoza, Spain.

AES made by a sample of famers (443) in Italy (Marche region). This decision-making mechanism is related to the use of AES which Marche Regional Administration (MRA) introduced after an innovative policy reform in the domain of advisory and extension services (MRA, 1999; 2003). A first type of service refers to farm-targeted assistantship and consultancy provided by both public-organized and semi-private organizations such as farmers' unions or associations, cooperatives, consultancy firms, regional extension agents. The second type of service is collectively provided and non-targeted in nature (i.e. group actions). They refer to information and animation activities (innovation diffusion) and they rely extensively on regional extension agents who act as intermediaries. Finally a demand-led, privatized and highly de-centralized type of service is also considered. This refers mainly to veterinary and risk-management type of AES which are provided by private entities.

The paper starts with a brief presentation of the conceptual framework and highlights the main factors that theoretically influence the decision-making process on AES use at farm level. In section 3 we present the model of farmers' decision making. In section 4 we describe the econometric strategy we follow. The field survey and the data gathering procedure are presented in section 5, while in section 6 and 7 we show both the descriptive statistics and the results of the econometric model. In the final section a discussion on the role of AES and some concluding remarks are provided.

2. Conceptual framework

In this paper we describe how Marche Regional Administration (MRA) introduced an institutional reform in the domain of public AES in central Italy. We think this reform represents a useful case-study for analyzing the transition from a more traditional to an innovative system of AES provision.

Traditional approaches tend to explain farmers' choice to use AES within a so-called "linear model" of information and knowledge transfer. This is often described as a system in which public agencies are almost the only providers (Godin, 2006; Knickel et al., 2009). In this model the role of AES is to facilitate technological changes which is often described as innovation adoption. In a traditional model the choice set of farmers is limited by the supply side. If a certain type of AES is not offered by the providers then the farmers cannot use it, even though they can potentially benefit from its usage. Moreover in the traditional model private costs have little impact on farmers choice since costs are mainly externalized to the society (taxpayers) (Brunori et al., 2008).

In the European context the traditional model has been progressively substituted by a new approach where the information and knowledge transfer has become more complex. For example it implies systemic rather than linear relationships between farmers and service providers (Knickel et al., 2009; Labarthe, 2009). In this model farmers' benefits are not limited to the capacity of improving the production efficiency of standardized foods and fibers. Benefits also depend on the capacity to generate profit from a larger number of activities. In this approach differentiate rather than specialize is a central element (Brunori et al., 2008). In this sense farmers become more and more sensitive to innovation opportunities not only related to technology changes but also related to marketing, organization and management (Labarthe, 2009). Furthermore, many "new" actors started to have a role within the innovation adoption mechanisms (Labarthe, 2009; Brunori et al., 2008).

3. Modeling farmers' decisions

To depict this new system of AES provision we model farmers' choice in a more contractual-type of decision-making process. The choice of a specific AES corresponds to choose a contractual solution in order to carry out a transaction between an information and knowledge provider (AES supplier) and the farmer. Farmer assesses the use of certain type of AES by comparing the expected benefits deriving from the information and knowledge provided and the relative costs.

We formalize the decision making on using (Y_1) or not (Y_0) an advisory and extension service in this way:

$$Y^* = \begin{matrix} Y_0, \ if \ U(R^0) \geq U(R^1) \\ Y_1, \ if \ U(R^0) < U(R^1) \end{matrix} \quad (1)$$

where R^0 and R^1 represent the (expected) benefits associated with the corresponding decision (Masten and Saussier, 2002). Equation (1) shows that a certain type of AES is chosen if the benefits from using it exceed the benefits from not using it. AES can provide a different type of information and knowledge which impact on farmer's benefits such as marketing and risk-reduction performances (Pennings et al., 2005). It can also provide benefits in the area of farmer's non-agricultural activities, such as *agroturismo*, product quality management, provision of leisure services, or off-farm businesses. Typical costs of AES use include transaction and opportunity costs deriving from service use.

In the context of this paper we are interested in systemic interaction and therefore the farmers' decision to use simultaneously different typologies of AES from different types of providers. As showed in table 1 we consider three stylized alternative types of AES (Tab. 1).

We classify different types of AES first according to the content and/or type of activities they should promote (*content-wise dimension*). Then we consider the level of decision making they mainly work at (*decision-making dimension*). Finally, we indicate the type of participation they required from the involved stakeholders, namely whether they are based on single-farm participation, group or collective action, mixed (*participatory-dimension*).

Content-wise, we distinguish between three types of ES pointed out in the literature with different names but that we

Table 1 - *Description of the main types of AES.*

Contents and activities of Advisory and Extension Services	Decision making level	Participation	Potential effects on farmers strategies
***Assistance and consultancy services* (ACS)**			
Process innovation (quality management, collective and or private labeling, technological innovation transfer, sustainable practices management, animal welfare management)	Mid and long term actions	Mainly single farm based	Increase the capacity of value creation from food productions
Supply planning and management (marketing, food chain networking, non-farm activities networking, legal assistantship)	Long and midterm actions	Mainly single farm based	Increase profitability of farming activities (animal and crop productions) and compatibility with environmental cross-compliance rules
Re-orientation towards multifunctional activities and multiple tasks	Long term actions	Mainly single farm based	Enlarging farmers interests and capacities to non-agricultural based activities
Management of public support schemes (Rural Development Measures, National/Regional supports, etc.)	Mid and long term actions	Mixed	Enhancing financial capacities of the business, introducing non-agricultural activities and promote local linkages between farmers and rural communities
***Dissemination, information and animation services* (DIAS)**			
Information and knowledge dissemination (best-practices, field examples, courses)	Short, mid and long term actions	Mainly collective	Increase the capacity of farmers to replicate best practices, share information and knowledge, build-up informal ties and networks
Rural animation (meetings, exhibitions, happenings, farmers-non farmers associations)	Short, mid and long term actions	Mainly collective	Enhancing the relationship between farmers and non-farmers, rural community interactions, urban-rural relations (i.e. via touristic activities)
***Specialized Services* (SAS)**			
Veterinary services (Animal breeding improvement, genealogy)	Short term actions	Mainly single farm based	Contribute to enhance ongoing agricultural oriented activities
Agro-meteorology and crop-management (genetic improvement, pest-management)			
Accountancy (business management)			

Source: our elaboration on different sources.

can generally define as (i) *Assistance and Consultancy Sservices* (ACS), (ii) *Dissemination, Information and Animation Services* (DIAS) and (iii) *Specialized Advisory Services* (SAS).

A typical ACS is a service oriented towards (a) process innovation (e.g. quality management, collective and/or private labeling, technological innovation transfer, sustainable practices management, animal welfare management), (b) supply planning and management (marketing, food chain networking, non-farm activities networking, legal assistance), (c) orientation towards multifunctional activities and multiple tasking and (d) increasing the management of public support opportunities (e.g. rural development measures, national/regional supports). In our perspective ACS refer to a type of AES which is mainly provided to each farm singularly, and focuses on specific user needs and goals (problem-solving and on demand).

By contrast, DIAS describe a type of service mainly organized as collective action, providing general information, aiming to coordinate farmers in their activities without specific focus on each user's features. This type of AES corresponds to the more traditional public-organized extension service. Examples are services like information and knowledge dissemination (i.e. best-practice sharing, field examples, courses, etc.) and rural animation (i.e. meetings, exhibitions, happenings, farmers' and non-farmers' associations). DIAS are usually seen to impact certain farmers' activities and attitudes. For example, they increase farmers' capacity to replicate best practices, share information and knowledge, and build-up informal ties and networks. They may also enhance the relationship between farmers and non-farmers, promoting rural community interactions and urban-rural relations for example via touristic activities.

SAS are the third type of AES. They are considered as highly related to specific fields of knowledge transfer and/or technology adoption, with a special focus on limited and specialized competencies that are mainly agriculture-oriented. Typical SAS are (i) veterinary services (i.e. livestock breeding, genealogy), (ii) agro-meteorology and crop management (i.e. genetic improvement, pest management) and (iii) accountancy (business management).

4. Econometric strategy

Because we are interested in testing whether the choice of different AES could be interrelated, a Multivariate Probit Model (MVP) is the natural econometric approach to be implemented (Maddala, 1993). The use of such an econometric model to investigate farmers' decisions between potential joint alternatives is a consolidated technique within the agricultural economics literature in the field of information and knowledge transfer (Velandia et al., 2009), in/off farm labour allocation (Kimhi, 1996), market strategies (Lowell and Kau, 1973; Fletcher and Terza, 1986; Velandia et al., 2009), and investment and planning decisions (Oude Lansink et al., 2003).

Following equation (1) the empirical specification of MVP takes the form:

$$Y_i^* = \beta_i' X_i + \varepsilon_i \qquad \text{with i=1,…,3} \tag{2}$$

$$Y_i = 1 \text{ if } Y_i^* > 0 \text{ and } 0 \text{ otherwise} \tag{3}$$

where is an unobservable latent variable denoting the probability of choosing *i* type of AES. Thus, the final specification of the MVP for *i*= 1 (ACS), 2 (DIAS) and 3 (SAS) is as follows:

$$Y_{1(ACS)} = \alpha_O + \alpha_{ff} X_{ff} + \alpha_{sf} X_{sf} + \alpha_{loc} X_{loc} + \varepsilon \quad (4)$$

$$Y_{2(DIAS)} = \alpha_O + \alpha_{ff} X_{ff} + \alpha_{sf} X_{sf} + \alpha_{loc} X_{loc} + \partial \quad (5)$$

$$Y_{3(SAS)} = \alpha_O + \alpha_{ff} X_{ff} + \alpha_{sf} X_{sf} + \alpha_{loc} X_{loc} + \zeta \quad (6)$$

where X_{ff} represents the set of factors related to farmer and farm characteristics, X_{sf} the service features, and X_{loc} the location and context features.

To estimate the three equations (4), (5), and (6), we assume that the error terms (ε, δ and ζ) may be correlated. Then, instead of independently estimating them, they are considered to be a multivariate limited-dependent-variable model, in which the three error terms (ε, δ and ζ) follow a multivariate normal distribution with mean zero and variance and covariance matrix W.

5. Survey design and data-gathering procedure

We empirically test our model using information deriving from the MRA reform in Italy. In 2006 the MRA assigned to a consortium of consultancy agencies[1] the assessment of the first (short-run) outcomes of the AES reform. The assessment procedure was organized in order to analyze the farmers' perception of the institutional change by using a field survey with a sample of beneficiaries and focus groups to discuss and interpret the results. The field survey was carried out via a telephone interview to collect data from a selected sample of beneficiaries of the new AES during the period 2003-2005. The interviewees were selected from the list of beneficiaries of 2004 as provided directly by the MRA. More specifically, the interviews involved the beneficiaries of the service in 2004 (the second year of the reform's implementation), because 2003 was considered by the MRA as a start-up period with a huge transitional bias. The sample was stratified in order to respect representativeness criteria among beneficiaries such as size, farm specialization and location (province). A semi-structured questionnaire was submitted to a restrict sample of beneficiaries for pre-testing and it passed two major rounds of revisions by the task-force of experts enrolled by the consortium and the MRA[2].

In 2004, 5,867 farmers benefited from AES, using in total 10,022 services. In all, 443 interviews were conducted successfully (85% response rate), covering 7.5% of the universe of total ES users. The non-response rate is assumed as physiological in this type of survey design (Curtin et al., 2005). Non-respondents were mainly farmers who stated they were not available for this type of interview because they had been recently interviewed for other research or statistical purposes. The standard procedure was to have a first call to the potential interviewee to explain to him/her the purpose of the survey and to arrange an appointment for a second interview to fill in the questionnaire. When necessary, a copy of the questionnaire was sent by fax or e-mail and extra calls were made as well to explain its content and the meaning of the key questions.

6. Descreptive statistics

The main descriptive statistics are reported in Table 2 and 3. We use the official data available from the National Census Data (ISTAT, 2000) and the regional FADN (INEA, 2003) in order to benchmark the main sample features with the farm characteristics at regional level. In terms of location, 29.6% of all the farms surveyed are in the province of Ancona (the regional capital), followed by Macerata (25.7%), Pesaro-Urbino (23%) and Ascoli Piceno (22%). About 31% of the farms are located in mountain areas and 16% in less favoured areas. The location split of the sample matches the overall regional split quite closely (ISTAT, 2000). The average age of farm managers in the sample is 55 years, a little below the regional (61) and national average (59) (ISTAT, 2000). Young farmers make up about 20% of the sample while about 23.5% are over 65. At the regional level the farmers within this category are much more numerous than those in the sample (ISTAT, 2000). As regards the size distribution of the sample, medium-sized farms constitute the larger group while in the regional context the small farms constitute the larger one. Arable crops are the main specialization in the sample (85%) in line with the general condition at regional level (80%) (ISTAT, 2000), while about 157 farms have cattle (35% of sample).

Table 3 shows the main types of AES used by the interviewees. About 67% of AES falls into the ACS category, while the ``traditional`` type of AES (DIAS) accounted for 24%. The most commonly used AES was that concerning the dissemination of information which could be classified as traditional extension services. Of the total AES, 19.2% entailed consultancy for managing and improving the capacity to use state financial support. By contrast, many of the most specialized services were less widely used by farmers: this is the case of marketing assistance (1.1% used), supply planning and strategy assistance (0.2%), and non-agricultural activities consultancy (0.1%).

In all, 72% of the farmers surveyed used assistance and consultancy services (ACS), while about 53% diffusion, information and animation services (DIAS) and 19% specialized services (SAS) (table 4). According to the relative literature review, we take into consideration both the farm(er) characteristics and needs (Godin, 2006; Knickel et al., 2009; Labarthe, 2009), specific service characteristics and

[1] The A.T.I. Resco – Ecoter – Unicab.

[2] One of the two authors was directly enrolled as an expert in the evaluation process. He also acted as moderator in all of the focus groups and expert interviews that the consortium and MRA carried out.

Table 2 - *Description of the main features of the sample.*

Variable	Sample		Marche (regional context)	
	N.	%	N.	%
Location: province [a,b]				
Ancona (AN)	131	29.6	15,354	23.07
Ascoli Piceno (AP)	97	21.9	20,452	30.73
Macerata (MC)	114	25.7	15,439	23.19
Pesaro Urbino (PU)	101	22.8	15,318	23.01
Total	443	100	66,563	100
Location: type of area [a,b]				
Mountain area	137	30.9	18,569	27.9
Less favoured area	70	15.8	10,867	16.32
Normal area	236	53.3	37,127	55.78
Total	443	100	66,563	100
Farmer education [a,b]				
No education (< 5 years)	15	3.5	5,207	8.1
Primary school (5 years)	183	42.7	34,136	53.3
Secondary school (8 years)	134	31.2	11,856	18.5
High school (13 years)	76	17.7	10,326	16.1
Graduate (Master equivalent) (18 years)	14	3.3	2,575	4
Other professional education (11-12 years)	7	1.6	0	0
Total	429	100,0	64,100	100%
Size distribution (UAA) [a,b]				
< 1 ha	2	0.5	16,916	25.9
1 - 2 ha	8	1.8	10,753	16.5
2 - 5 ha	50	11.3	16,848	25.8
5 - 10 ha	98	22.2	9,897	15.2
10 - 20 ha	97	22	5,919	9.1
20 - 50 ha	125	28.3	3452	5.3
50 - 100 ha	38	8.6	934	1.4
> 100 ha	23	5.2	474	0.7
Total	441	100	65,193	100
Size distribution (AWU) [a,c]				
1 UL	158	35.9	418	52.8
1 - 3 UL	219	49.8	336	42.5
> 3 UL	63	14.3	37	4.7
Total	440	100	791	100
Agricultural specialization [a,c]				
Arable crop	234	53.4	427	54
Horticulture	10	2.3	6	0.8
Vineyard	23	5.3	28	3.5
Olives tree cultivation	4	0.9	18	2.3
Other permanent crops	1	0.2	6	0.8
Cattle breeding	157	35.8	31	4.0
Other breeding activities	0	0.0	66	8.3
Mix	9	2.1	209	26.4
Total	438	100	791	100
Non-agricultural activities [a,d]				
Farmers with non-agricultural activities (i.e. agro-tourism, on farm processing, etc.)	120	27.1	14.507	26.1

Source: a. field survey; b. ISTAT, Census Data 2000; e. INEA, 2003; d. ISTAT, 2003.

the way they were provided and/or organized (Rivera and Gary, 2004; Rivera et al., 2005; Pennings et al., 2005), and the socio-economic and geographical context (Brunori et al., 2008).

Average farm size of the sample in terms of agricultural land is about 41 hectares (2.38 AWU in terms of labour units) which is above the regional average size of 8 ha (ISTAT, 2000) and 0.54 AWU (FADN, 2003). The average number of animals is about 2 livestock units (LU) per farm which is above the regional average (20.08 LU per farm) (INEA, 2003). Another block of this set of variables refers to specific interviewee needs for the use of AES and their participation in regional rural development measures related to the period 2000 – 2006. About 34% of the farmers showed a specific need for ACS, 19.4% for DIAS and about 11% for SAS. The proportion of farmers receiving support from at least one RRD measure was about 39%.

The second set of variables refers to AES characteristics and the way they were provided and/or organized. About 73.6% of the AES used by the farmers were provided by a state-run organization (directly funded and/or organized by the MRA). Local networks were used by 64.3% of the farmers as a source of information and technology transfer, 48.1% participated in periodical (at least one per month) meetings with other rural actors and experts, 49.2% used specialized newspapers and periodicals as sources of information while 42% of the interviewees formally belonged to a network or association providing him/her with relevant information.

Finally, we consider the location of farms. Only farms located in the provinces of Ancona and Ascoli Piceno were relevant to the model. Although these two provinces are classified as intermediate rural according to OECD criteria (OECD, 1994), the former is the most urbanized province in the region, while the latter still has scant urban pressure.

7. Econometric results

The MVP defined by equations (4) (5) and (6) was simultaneously estimated using Stata 10. Table 5 presents the estimated parameters, their t-values and the correlation coefficient between the three equations.

The estimated model is evaluated according to the log-likelihood function. The likelihood ratio is greater than the corresponding value for the χ^2 for 15 degrees of freedom, indicating the rejection of the null hypothesis that all the exogenous variables finally included in the model are not jointly significant. The goodness of fit of the MVP is assessed using McFadden's R^2 for the system of equations. McFadden's R^2 values in the range of 0.2–0.4 are typical for logit models (Sonka et al., 1989). However, a value of 0.12 is found, indicating that the explanatory power of the variables in the model is relatively low. Factors that are not observed in this study, such as personal goals or the financial situation, may account for the unexplained variation of the model (Oude Lansink et al., 2003). Moreover, more than 72% of observations were correctly predicted.

(i) The first result concerns the correlations between the three different types of AES. The correlation coefficient be-

Table 3 - *Type of AES used by interviewed farmers.*

Types of ES	Used services	
	N.	%
Type 1) Specialist advice and assistantship	626	57,4
Action 1) Management consultancy	*352*	*32,3*
Production factors optimization	20	1,8
Improving capacity to use public funding schemes	209	19,2
Re-orientation of production and multifunctionality	24	2,2
Product quality enhancing	99	9,1
Action 2) Product and process technical consultancy	*274*	*25,1*
Process Enhancing assistantship	28	2,6
Product certification	50	4,6
Collective labeling	14	1,3
Diffusion of sustainable techniques	70	6,4
Animal welfare and sanitary requirements assistantship	47	4,3
Food chains and networks management	50	4,6
Supply planning	12	1,1
Marketing strategies	2	0,2
Non-farm activities	1	0,1
Type 2) Dissemination, animation and information	263	24,1
Information dissemination	224	20,5
Rural animation	12	1,1
Updating activities	27	2,5
Type 3) Specialized services	202	18,5
Animal breeding improvement	23	2,1
Agro-meteorology	46	4,2
Animal genealogy	28	2,6
Other services	105	9,6
Total number of services	1091	100,0

Source: our elaboration based on the field survey information, 443 farmers interviewed.

tween the error terms of the equations ACS and DIAS is negative and significant at 1% level, indicating that the use of ACS is negatively correlated with the use of DIAS. However, the correlation between the error terms of the equations DIAS and SAS are positively correlated. This result shows that when DIAS are chosen, farms increase their probability of using specialized services. Finally, there is again a negative correlation between the error terms of equation ACS and SAS. Consequently, farmers who choose ACS are less likely to use SAS. This result highlights the nature of the relationships between different AES and how they are perceived by farmers: the more specialized and problem-solving ACS, which targeted the specific needs of the farmers, are chosen as an alternative to the more "untargeted" DIAS, which were provided mainly by collective action (meetings, networking, newspapers, etc.), and the "very specialized" SAS. Hence, the choice of ACS was considered as a *substitute* of DIAS , and SAS. By contrast, farmers who chose DIAS were more likely to choose SAS, considering them a *complement*. They thus complete their needs for specialised services by mainly choosing DIAS and SAS together. In summary, there was both a *substitution effect* between ACS vs DIAS and SAS, and a *complementary effect* between DIAS and SAS.

(ii) The second step is to analyse factors affecting the farmer's likelihood to choose AES. Farmers supported by a rural development measure (*RDP_ben*) showed a larger probability of choosing more targeted AES like ACS and SAS while they were less likely to use DIAS. The European rural development measures typically involved farmers in decisions and strategies which require several sources of information and knowledge transfer. In most cases, farmer participation in a specific rural development measure represents a significant challenge, since it sometimes induces a radical change in practices, activities and farming techniques. Such dynamics are most likely to be managed by advisory services or very specialized ones, both focused on the specific needs of the farmer and his/her business. By contrast, DIAS act mostly in the *ex-ante* situation when farmers are looking for general information to enter RD measures. Therefore after "entry", DIAS are less likely to be used by beneficiaries. Farm characteristics such as size and specialization (*nlab, perm, anbreed*) played a significant role in the choice of both ACS and SAS, while a non-significant role results for the choice of DIAS. Advisory services like ACS are more likely to be chosen by farms specialized in permanent crops (*perm*) (e.g. vines, olives, other tree crops) and large size farms (*nlab*) while SAS by livestock farms (*anbreed*). The model highlights the major role of specialization in explaining the farmer's probability of using targeted, problem-solving services: permanent crops are often challenging for farmers because they demand complex knowledge and management throughout the year (not only in relation to specific agronomic phases like cereals or horticulture). Within the context of the Marche re-

Table 4 - Description of the variables used in the empirical models.

Variable name		Description	Unit of measure	Mean	S.D.
	Type of SERVICE (Yi)				
Y_1	*ACS*	Use of Assistantship and Consultancy Services	*Dummy*	yes = 72.0 %	-
Y_2	*DIAS*	Use of Diffusion, Information and Animation Services	*Dummy*	yes = 52.8 %	-
Y_3	*SAS*	Use of Specialized Assistantship Services	*Dummy*	yes = 18.7%	-
	Farm features and needs (X_{ff})				
X_1	*nlab*	Total employees	*Number*	2.38	2.71
X_2	*perm*	UAA devoted to permanent crops	*Ha*	0.22	0.81
X_3	*anbreed*	Number of Livestock units (importance of animal breeding)	*LU*	2.07	11.63
X_4	*need_ACS*	1 if ``Farmer shows a need for ACS``	*Dummy*	yes = 33.9%	-
X_5	*need_DIAS*	1 if ``Farmer shows a need for DIAS``	*Dummy*	yes = 19.4%	-
X_6	*need_SAS*	1 if ``Farmer shows a need for SAS``	*Dummy*	yes =10.8 %	-
X_7	*RDP_ben*	1 if ``Farmer participates at least in one Regional Rural Development Measure``	*Dummy*	yes = 39.1%	-
Service features(X_{sf})					
X_8	*pub_AES*	1 if the service is provided by public agencies or entities	*Dummy*	yes = 73.6 %	-
X_9	*net*	1 if ``Farmer uses local (rural) networks providing information and knowledge``	*Dummy*	yes = 64.3%	-
X_{10}	*meet*	1 if ``Farmer participates in periodic meetings with other rural actors for sharing information``	*Dummy*	yes = 48.1%	-
X_{11}	*doc*	1 if ``Farmer receives information through specialized newspapers and periodicals``	*Dummy*	yes = 49.2%	-
X_{12}	*assoc*	1 if ``Farmer belongs to a professional association providing information and knowledge``	*Dummy*	yes = 42.0%	-
	Location (X_{loc})				
X_{13}	*prov_AN*	1 if ``Location is in Ancona province``	*Dummy*	yes = 29.6%	-
X_{14}	*prov_AP*	1 if ``Location is in Ascoli Piceno province``	*Dummy*	yes = 21.9 %	-

Source: field survey.

gion, specialization mainly concerns vines and olive trees, chiefly related to wine and olive-oil production respectively. They both require processing knowledge and competences. Any use of SAS (*anbreed*) by livestock farmers is mainly due to the type of services embodied within them. Indeed, SAS are mainly related to veterinary assistance, breed-genealogy and feeding supports (as reported in table 3, SAS includes also non-animal related services such as agro-meteorology and problem-solving for plant diseases).

Farms with a higher number of employees (*nlab*) are more likely to use ACS, while neither DIAS nor SAS choice is affected by farm size. If we interpret the size variable also as a proxy of the complexity of the farm organization this result comes as no surprise: the more complex the organization of farm activities, the higher is the probability of using specific, targeted services mainly organized in the form of consultancy and/or assistance. The ACS type was mainly organized as a support system for the specific decision-making process of the users.

When the AES are organized through public organizations (*pub_AES*) (i.e. public agencies or authorities) then farmers are more likely to choose the generalized services, mainly related to animation and information (DIAS) than specialized services (SAS). This variable also indicates a negative perception of the capacity of public agencies to provide efficient targeted advisory services.

A set of questions were related to farmers' perceptions of actually needing specific AES types. The inclusion of such variables (*need_ACS, need_DIAS and need_SAS*) was due to the idea of ascertaining whether the use of advisory and extension services was really demand-driven (hence aligned with specific farmer needs and aims) or else supply-driven (because they were strongly conditioned by public intervention). According to the results, only for targeted (ACS) and specialized services (SAS) does the need of information and knowledge transfer play an effective role in increasing a farmer's probability of choosing them.

The relation between the farmers and the social context, the type of network they are involved in and the inclination to participate in farmers' associations were found very relevant to explaining the likelihood of a farmer choosing different types of AES. More specifically, use of local networks (*net*) reduces the likelihood of farmers to formally use DIAS while participation in periodical meetings (*meet*), frequent (or regular) consultation of sector newspapers (*doc*) and using association memberships (*assoc*) as sources of information and knowledge increase the likelihood of choosing DIAS. Interpretation of these results stems from the idea that DIAS are mainly provided in the same way: organizing collective or targeted group meetings, using newspapers and magazines, formally involving farmers' association. Hence the more the farmer is accustomed to these

Table 5 -Estimates of the MVP: Advisory and Extension Services use.
Iteration 0: log likelihood = -695.6717
…
Iteration 3: log likelihood = -688.5958

Coefficients	Assistantship and consultancy (Y_1 = ACS)			Dissemination, information and animation (Y_2 = DIAS)			Specialized Services (Y_3 = SAS)		
	Estimates	*t-ratio*		*Estimates*	*t-ratio*		*Estimates*	*t-ratio*	
Intercept	-0.086	-0.39		-0.600	-3.21	***	-0.869	-4.21	***
RDP_ben	0.415	2.76	***	-0.278	-2.01	**	0.282	1.78	*
perm	0.767	2.91	***	-0.179	-0.56		-0.179	-1.39	
anbreed	0.008	0.93		-0.007	-1.20		0.017	3.09	***
nlab	0.110	2.08	**	0.028	1.22		0.022	0.89	
pub_AES	0.232	1.47		0.979	6.36	***	-0.425	-2.57	***
need_ACS	0.290	2.02	**						
need_DIAS				0.065	0.41				
need_SAS							0.876	4.20	***
net	0.106	0.41		-0.802	-3.20	***	-0.272	-0.93	
meet	0.009	0.05		0.502	2.73	***	-0.003	-0.01	
doc	0.098	0.49		0.411	2.19	**	-0.115	-0.53	
assoc	-0.005	-0.03	**	0.277	1.65	*	0.398	1.87	**
prov_AN	-0.314	-2.01	***	-0.107	-0.73		-0.088	-0.48	
prov_AP	-0.443	-2.48	**	-0.082	-0.48		0.104	0.54	
N	443								
% predictions	72.4%			Mc Fadden R^2 = 0.12					
μ_{12}	-0.201	-2.51	***						
μ_{23}	0.200	2.20	**	Likelihood ratio test of $\mu_{12} = \mu_{23} = \mu_{13} = 0$:					
μ_{13}	-0.185	-1.97	**	chi2(3) = 13.5831 Prob > chi2 = 0.0035					

(***) (**) (*) denotes statistical significance at the (1) (5) (10) per cent significance levels
Source: field survey

sources of information, the more s/he is likely to use the same sources when s/he chooses a type of AES. Informal local networks (*net*) act as a substitute. DIAS are not used when farmers are more likely to use their local networks and community memberships to acquire information.

Association membership (*assoc*) is also important for explaining the likelihood of farmers using ACS and SAS. Membership of a farmers' association reduces the likelihood of farmers using ACS and increases the likelihood of using SAS. The type of association membership we looked at is that which is professionally motivated. Such associations are usually organized according to the main specialization of the farm business (in the Marche there are associations of dairy farmers, olive growers, vine growers and wine producers, etc.). These associations mainly provide their members with consultancy services which clearly substitute those provided by the regional AES system. By contrast, very specialised services (SAS) still remain in the regional domain and are not provided by farmers' associations.

Finally, the location of farmers in the provinces of Ancona (*prov_AN*) and Ascoli Piceno (*prov_AP*) decreases their probability of using ACS. AES are organized at the province level for all four regional provinces. This means that there is no effect due to an insufficient supply of services, such as too great a distance between farmers and providers. Moreover, farmers show no significant differences in terms of ACS needs due to their location, nor is location bias present due to any sample selection. Thus we interpreted these results as an indicator of the specific lower quality of ACS in these two provinces.

8. Conclusions

The main goal of AES reform was to reduce the role of public agencies and to re-conceptualize the entire approach to AES provision, increasing the opportunities for farmers to choose them accordingly to their needs and preferences. Moreover, a more private-based mechanism of AES supply and demand was stimulated. In this light, we discuss the results of our analysis and provide some conclusions that may also be of use in policy evaluation.

In our conceptual framework we applied a broader vision of AES, switching from a linear to a systemic perspective. Accordingly, the farmer's decision whether or not to use AES is driven by a plurality of attributes and characteristics belonging both to the farm(er) and to the type of service involved. Moreover, the MVP approach gave us the opportunity to test empirically the importance of all these specific driving factors in a *ceteris paribus* condition. At the same time it allowed us to test the hypothesis of joint decisions of using multiple service types. The results highlighted the relevance of many farm(er), service- and location-related features to explain the likelihood to choose AES. More specifically, they clearly showed the presence of joint decisions about which type of services to be used. Each farmer's need of knowledge and information is satisfied by looking at all the potential alternatives available: informal networks, local communities, farmers' associations and newspapers. Two distinct strategies also emerged from the analysis: choosing advisory and consultancy services (ACS), targeting farm features and farmers` needs, and addressing specific problems, or, on the other hand, choosing jointly a broader provider of in-

formation and knowledge (DIAS) and a very specialized one (SAS).

Despite our conceptual framework the presence of multiple activities within farm strategies did not play a role in conditioning the likelihood of farmers to choose a service. Only variables related to agricultural specialization were found to be significant. By contrast, what played a major role was the opportunity to use social capital as a source of information and knowledge, substituting or complementing the formal sources. This result confirmed the trend described elsewhere concerning the increased role of local institutions, informal networks and new rural actors in providing AES (Brunori et al., 2008).

If we consider the type of services provided and used by famers (table 3) it is clearly shown that only agriculture-related services (regardless of type) were mainly preferred. It indicates the lower importance attached to the services related to what we define as diversification strategies. Because the rate of farms in the sample involved in these strategies are as large as in the regional context (table 4) we interpret this result as being due to the lower supply of more non-farm related services. From this angle, the outcome of the MRA reform might be viewed as negative: it has not been sufficiently geared to supporting new strategies of value creation at farm level. Another result to underline is the absolute irrelevance of the cost (price) of the service in the model results. It may indicate that the threshold of 30% as private participation in the overall cost of the service (at least 70% was guaranteed by public funds in any event) was insufficient to consider the reform as effective "privatization" of AES. The reduction of the public support rate from a maximum of 90% to a maximum of 70% of the total costs was one of the main goals of the MRA policy interventions to stimulate demand-led and privatized AES.

Future development for improving such types of AES could be explored by using the model results: steering in the direction of services other than those which are only farm-related appears strongly advisable; the use of the ACS type of services is perceived as being more farm-specific and shows the "private nature" of these services which allows for further privatization in this AES type; social capital and local sources of information are important in implementing the services as farmers are used to sharing information and following traditional cultural paths. There is room for new extension service types in which the local community can play a fundamental role in enhancing public organized (and still mainly funded) activities such as information and knowledge dissemination. This also points towards the nature of farmers' knowledge and the tacitness of innovation in rural areas, which have to be considered in a more systemic and holistic perspective.

Acknowledgements

The authors gratefully acknowledge the Marche Regional Administration for allowing them to use the information presented in the Evaluation Report on the effects of Extension Services in Agro-food Systems funded by Regional Law 37/99 and R.T.I. Ecoter – Resco - Unicab who compiled the report.

Stefano Pascucci benefited from the support of the European Commission through the Marie Curie Actions Intra-European Fellowships (IEF), Call: FP7-PEOPLE-IEF-2008, project title "Institutional Compatibility Analysis of Resource Use Sustainability" (ICARUS).

Tiziana de-Magistris is benefitting from the support of the European Commission through the Marie Curie Actions Outgoing International Fellowships at Arkansas University.

References

Brunori, G., Rand, S., Proost, J., 2008. Towards a Conceptual Framework for Agricultural and Rural Innovation Policies. IN-SIGHT-Project.

Curtin, R., Presser, S., Singer, E., 2005. Changes in Telephone Survey Nonresponse over the Past Quarter Century. Public Opinion Quarterly 69 (1), 87-98.

Dinar, A., Karagiannis, G., Tzouvelekas, V., 2007. Evaluating the impact of agricultural extension on farms' performance in Crete: a nonneutral stochastic frontier approach. Agricultural Economics 36, 135-146.

Fletcher, S.M., Terza, J.V., 1986. Analyzing Farmers Selection of Available Marketing Alternatives Using the Multivariate Probit Model. Canadian Journal of Agricultural Economics 34 (2), 243-252.

Godin, B., 2006. The Linear Model of Innovation: The Historical Construction of an Analytical Framework. Science, Technology, and Human Values 31 (6), 639-667.

Isengildina, O., Pennings, J.M.E., Irwin, S.H., Good, D.L., 2006. U.S. Crop Farmers' Use of Market Advisory Services. Journal of International Food & Agribusiness Marketing 18 (3/4), 67-86.

INEA, 2003. Banca dati RICA. Rome, Italy.

ISTAT, 2000. Censimento Generale dell`Agricoltura. Rome, Italy.

ISTAT, 2003. Indagine sulla struttura e le produzioni delle aziende agricole (SPA). Rome, Italy.

Kent, P. 1994. Management Advisory Services and the Financial Performance of Clients. International Small Business Journal 12 (July-September 1994), 45-58.

Kidd, A., Lamers, J., Ficarelli, P., Hoffmann, V., 2000. Privatizing Agricultural Extension: Caveat Emptor. Journal of Rural Studies 16, 95-102.

Kimhi, A., 1996. Demographic composition of farm households and its effect on time allocation. Journal of Population Economics 9, 429-439.

Klerkx, L., Leeuwis, C., 2008. Matching demand and supply in the agricultural knowledge infrastructure: Experiences with innovation intermediaries. Food Policy 33, 260-276.

Knickel, K., Brunori, G., Rand, S., Proost, J., 2009. Towards a Better Conceptual Framework for Innovation Processes in Agriculture and Rural Development: From Linear Models to Systemic Approaches. Journal Agricultural Education and Extension 15 (2), 131-146.

Labarthe, P., 2009. Extension services and multifunctional agriculture. Lessons learnt from the French and Dutch contexts and approaches. Journal of Environmental Management 90, 193-202.

Laurent, C., Cerf, M., Labarthe, P., 2006. Agricultural Extension Services and Market Regulation: Learning from a Comparison of Six EU Countries. The Journal of Agricultural Education and Extension 12 (1), 5-16.

Lowell Hill, L., Kau, P., 1973. Application of Multivariate Probit to a Threshold Model of Grain Dryer Purchasing Decisions. American Journal of Agricultural Economics 55 (1), 19-27.

Maddala, G.S., 1993. The Econometrics of Panel Data. Edward Elgar Publishing, Cheltenham.

Marche Regional Administration, 1999. Legge Regionale 23 dicembre 1999, n.37 "Disciplina dei servizi per lo sviluppo del sistema agroalimentare regionale". Ancona, Italy.

Marche Regional Administration, 2003. Programma Obiettivo Triennale dei Servizi allo Sviluppo Agroalimentare 2003 – 2005 (All. B1 alla DGR 1353/03). Ancona, Italy.

Masten, S.E., Saussier, S., 2002. Econometrics of contracts: an assessment of developments in the empirical literature on contracting, in: Brousseau, E., & Glachant, J.M. (Eds.), The Economics of Contracts; Theories and Applications. Cambridge University Press, Cambridge, pp. 273-293.

OECD (1994). Creating rural indicators. Paris, France.

Oude Lansink, A., van den Berg, M., Huirne, R., 2003. Analysis of strategic planning of Dutch pig farmers using a multivariate probit model. Agricultural Systems 78, 73-84.

Pennings, J.M.E., Irwin, S., Good, D., Isengildina, O., 2005. Heterogeneity in the Likelihood of Market Advisory Service Use by U.S. Crop Producers. Agribusiness: an International Journal, 21, 109-128.

Rivera, W. M., Gary, A., 2004. Extension system reform and the challenges ahead. Journal of Agricultural Education and Extension, 10 (1), 23-36.

Rivera, W.M., Qamar, M.K., Mwandemere, H.K., 2005. Enhancing Coordination Among AKIS/RD Actors: An Analytical and Comparative Review of Country Studies on Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD). FAO, Rome, Italy.

Rivera, W.M., 2008. Pathways and Tensions in the Family of Reform. Journal of Agricultural Extension and Education, 14 (2), 101-109.

Rogers, E. M., 2003. Diffusion of innovations (5th ed.). New York: The Free Press.

Santucci, F.M., Alrefae'e, Hamzah, W., Nassour, G., Othman, S., Saker S.E., 2002. Farmers opinion about agricultural extension service in Syria. New Medit, 1(1), 56-61

Snapp, S.S., Blackie M.J. and Donovan, C., 2003. Realigning research and extension to focus on farmers' constraints and opportunities. Food Policy, 28 (2003), 349–363.

Sonka, S.T., Hornbaker, R.H., Hudson, M.A., 1989. Managerial performance and income variability for a sample of Illinois cash grain producers. Applied Economic Perspectives and Policy, 11, 37-47.

Stephenson, G., 2003. The Somewhat Flawed Theoretical Foundation of the Extension Service. Journal of Extension (41) 4.

Velandia, M., Rejesus, R.M., Knight, T.O., Sherrick, B.J., 2009. Factors Affecting Farmers' Utilization of Agricultural Risk Management Tools: The Case of Crop Insurance, Forward Contracting, and Spreading Sales. Journal of Agricultural and Applied Economics 41 (1).