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Farmers' willingness to pay for private agricultural advisory services: the case of citrus growers in the Mitidja, Algeria

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Description of the subject. In Algeria, agricultural advice tends to diversify and intensify as farmers' needs become more specific.
Objectives. The article aims to examine farmers' willingness to pay (WTP) for agricultural advisory services in a context of growing privatization. The goal is also to better understand the farmers' advisory needs, their motivation and the socio-economic factors that influence the ability to afford privatized advice.
Method. The study concerned citrus production and involved 362 farmers in the Mitidja plain (121 in the wilaya of Boumerdes, 241 in Blida). This study uses the contingent valuation method to estimate farmers' WTP for agricultural advice combined with an Ordinary Least Square model to analyze its determinants.
Results. The results indicate that 90% of farmers are willing to pay for private advice, with an average estimated willingness to pay (WTP) of 1,269 DZD (9.42 $) per visit. The WTP is positively conditioned by the level of specialization in crop production, household size, the farmer's level of education, the efficiency of the advisors and the satisfaction with the service. Additionally, it was found that farmers primarily seek advice on disease treatment and fertilizer use.
Conclusions. This study demonstrates that the privatization of agricultural advisory services is possible in Algeria, provided that the advisory supply aligns farmers' needs.
Keywords. Contingent valuation, education, extension, agriculture, North Africa.

Consentement des agriculteurs à payer les services de conseils agricoles privés : cas des producteurs d'agrumes dans la Mitidja, Algérie

Description du sujet. En Algérie, les conseils agricoles ont tendance à se diversifier et à s'intensifier à mesure que les besoins des agriculteurs deviennent plus spécifiques.
Objectifs. Cet article vise à étudier la volonté des agriculteurs de payer (WTP) pour des conseils agricoles dans un contexte où ces derniers sont de plus en plus privatisés. Il cherche également à mieux comprendre les besoins en conseils des agriculteurs, leur motivation et les facteurs socio-économiques influençant leur capacité à se permettre des conseils privatisés.
Méthode. L'étude s'intéresse à la production d'agrumes et a impliqué 362 agriculteurs dans la plaine de la Mitidja (121 dans la wilaya de Boumerdès, 241 dans Blida). Cette étude utilise la méthode de la valorisation contingente pour estimer la WTP des agriculteurs pour des conseils agricoles, combinée à un modèle des moindres carrés ordinaires pour analyser ses déterminants.
Résultats. Les résultats montrent que 90 % des agriculteurs déclarent être prêts à payer pour des conseils privés. La WTP moyenne estimée est de 1 269 DZD (9,42 $) par visite. La WTP est conditionnée positivement par le niveau de spécialisation dans la production de cultures, la taille du ménage, le niveau d'éducation de l'agriculteur, l'efficacité des conseillers et la satisfaction à l'égard du service. Il a également été démontré que les agriculteurs cherchent principalement des conseils sur le traitement des maladies et l'utilisation d'engrais.
Conclusions. Ce travail démontre que la privatisation des services de conseil agricole est possible en Algérie, à condition que l'offre de conseils réponde aux besoins des agriculteurs.
Mots-clés. Évaluation contingente, éducation, service de vulgarisation, agriculture, Afrique du Nord.

1. INTRODUCTION

Agricultural and rural development heavily depends on the pertinence of extension services (Agholor et al., 2013; Temesgen & Tola, 2015; Garai et al., 2017). These services provide farmers with the necessary knowledge and skills to enhance their capacity and influence their attitude towards effective farm management decision making (Swanson & Rajalahti, 2010). Thus, it is justifiable that agricultural extension, referred now as farm advisory services, is receiving renewed interest from researchers and agricultural policy makers in many countries (Knierim et al., 2015; Klerkx et al., 2016; Faure et al., 2017; Turner et al., 2023).

Over the past decades, the agricultural advisory service has undergone several changes. It has moved from an almost exclusively public model in the 1980s to a current mixed model involving both public and private services (Benson & Jafry, 2013; Nettle et al., 2017). This shift results from several factors such as the evolution of farmers'needs. Indeed, as agriculture becomes more specialized and industrialized, farmers increasingly bypass public advisory services, considered as less relevant to address farmers' specific needs and technological challenges (Davidson & Ahmad, 2003; Birner et al., 2009). Instead, they seek private advisors, universities, or research organizations, providing more effective technical assistance (Rivera, 2011). On the other hand, there are public spending constraints on the state budget. Indeed, the agricultural advisory system has been, and still is, almost entirely funded publicly, as it is the case in most developing countries (Anderson & Feder, 2004; Norton & Alwang, 2020). As more governments face severe financial difficulties, policymakers generally choose one or both of two solutions:

– saving on the overall cost of public extension; and/or
– gradually privatizing advisory services, leaving the private sector and users to assume increasing responsibility, including covering the cost of service delivery (Agbamu, 2000; Van den Ban, 2000; Katz, 2002; Uddin et al., 2016).

In Algeria, agricultural advisory services are dominated by the public services and tend to adopt top-down approaches, which limits their effectiveness in diagnosing farmers' actual needs. They are therefore not in line with farmers' priorities (Boudedja, 2017; Laouar & Dugué, 2019). A new paradigm of agricultural extension emerged in the 1990s, coinciding with market liberalization, including for inputs and agricultural products, except for a few strategic products such as cereals and milk. This new model includes new actors, such as international agrochemical companies and private input sellers, and reflects a transition to participatory-based agricultural extension models designed to better respond to farmers' needs. According to Jibowo (2001), privatizing and/or commercializing advisory services could be advantageous by providing farmers with better access to advisors and agricultural inputs, reducing bureaucratic obstacles and creating new jobs opportunities. However, problems that could arise include unequal access to advice between the richest and poorest farmers (Labarthe & Laurent, 2013). Therefore, the issue of studying farmers' willing to pay for private advice becomes primordial. This is especially the case as private companies dedicated to agricultural advisory services do not formally exist and the opportunity to create them to address the deficit of public services and provide quality advice – which is not linked to the sale of inputs – must be examined (Laouar et al., 2023).

In the literature, contingent valuation is often used to estimate willingness to pay (WTP), defined as the maximum amount an individual is willing to pay for goods and services without causing losses (Hanemann et al, 1991; Mogas et al., 2006; Nijkamp et al., 2008; Schulz et al., 2013). This method has been used in several studies to estimate farmers' WTP for agricultural advice (Farinde & Atteh, 2009; Yegbemey, 2014; Abed et al., 2020). Other studies have focused on factors influencing farmers' WTP and shown that farmers' WTP may depend on many interrelated factors, such as socioeconomic status, access to market and infrastructure, the content and quality of the advice provided, and the type of crop (Charatsari et al., 2011; Ahmed et al., 2015; Shee et al., 2019; Al-Amin et al., 2020).

Although many studies have been conducted on the privatization of agricultural advisory services worldwide (Uddin et al., 2016; Kpadé et al., 2017; Mungai et al., 2024), to the best of our knowledge, no study has focused on farmers' willingness to pay for agricultural advice in Algeria. This study aims to analyze the extent to which citrus producers in Mitidja are willing to pay for private advisory services using the contingent valuation method. Additionally, we examine the socio-economic factors, expected benefits, and farmer needs that influence their willingness to pay using discrete choice models. Identifying these factors and understanding their impact on WTP, as well as the types of information for which farmers would be willing to pay, can guide the development of a more effective advisory system (Vincent et al., 2020).

2. METHODOLOGY

2.1. Study area and data sources

The study area is spread over two wilayas, Blida and Boumerdes, located in the Mitidja plain, which is

considered the most fertile land in the country. The majority of the farms are concessions[1] (EAC and EAI) since the land belongs to the State. Blida and Boumerdes are among the top five citrus producing wilayas in Algeria, with Blida being the leading wilaya. Its production has experienced significant growth over the past two decades, rising from 1.46 million quintals in 2000 to 4.25 million quintals in 2020. Furthermore, Boumerdes has doubled its production in the last decade, increasing from 0.2 million quintals in 2010 to 0.43 million quintals in 2020 (MADR, 2021). The expansion of cultivated citrus areas by 12% in Boumerdes and 20% in Blida, as well as the 40% increase in yields in both wilayas, explain these results.

This study involved a random sample of 362 citrus farmers in the study region. Data collection was based on a structured questionnaire divided into three sections. The first section includes questions on the farmers' profile (age, household size, education, experience, etc.), the second section covers farm characteristics (SAU, type of production, etc.), and the third section addresses farmers' willingness to pay (WTP), with questions on their willingness to pay, the amount they are willing to pay, their advisory needs, and their perception of the advisory service and advisors.

2.2. Willingness to pay: estimation using the contingent valuation method

The literature describes several methods used for estimating willingness to pay (WTP) in agriculture. Among the most commonly used are modeling methods and contingent valuation methods. The latter is particularly preferred when dealing with goods and services that are not readily available in the market (Desaigues & Lesgards, 1992) or are not yet traded in the market (Mogas et al., 2006; Cawley, 2008; Nijkamp et al., 2008; Schulz et al., 2013).

There are several approaches to revealing WTP through contingent valuation; including the open-ended format, iterative bidding, and the card payment method (Bateman et al., 1995; Alberini & Cooper, 2000). However, the most widely used approach to obtaining information about respondents' WTP is the dichotomous choice format, which can be single or double bounded (Alberini & Cooper, 2000). The double bounded contingent valuation approach has been shown to provide more efficient asymptotic estimates than the conventional single bounded contingent valuation approach (Hanemann et al., 1991). Consequently, this method is generally preferred over open-ended question (Shi et al., 2014). In addition, the data collected can be analyzed using a regression model to highlight the determinants of WTP (Cawley, 2008). For all these reasons, the double bounded dichotomous choice question format is applied in this study.

Regarding the interview process, we started with a description of the private advisory service, including the applied tariffs, it is an average of 1,000 DZD (7,33 $) per visit in the study area. This step is crucial to avoid judgment biases. According to Morwitz et al. (2007), respondent's familiarity with the product or service reduces hypothetical bias. The availability of agricultural advisory services may help to reduce hypothetical bias in the study area, as farmers are already familiar with the characteristics and benefits of such services. Then, we asked respondents if they were willing to pay for private agricultural advice, with a "yes" or "no" answer. For those who answered "yes," an initial offer of 1,000 DZD (7,33 $) per visit was proposed to the farmer. If the response to this offer is "no," the next question presents the respondent with a lower offer – corresponding to half the initial amount –, a "yes" response is followed by a higher offer – corresponding to double the initial amount.

2.3. Analysis of determinants: model used

The dependent variable, Willingness to Pay (WTP), is continuous, making the Ordinary Least Squares (OLS) method an appropriate estimation technique. We developed and estimated four distinct specifications of the WTP model to examine how different sets of explanatory variables influence WTP. The first model included socio-economic variables, the second model included variables related to farmers' needs in terms of advice, the third model covers variables related to farmers' perceptions of advisory services and advisors, and the fourth model includes variables related to the externalities valued by farmers. Using four different models allows us to independently explore the impact of each dimension on WTP. This approach also allows us to avoid the influence of interactions between the different variables, ensuring clearer and more distinct results for each dimension.

For a model with p explanatory variables, the statistical model of the OLS regression is written:

$$Y = \beta_0 + \sum_{j=1}^{p} \beta_j X_j + \varepsilon \quad (1)$$

where Y is the dependent variable, β_0 is the constant, X_j denotes the jth explanatory variable of the model ($j = 1$

[1] In 1987, the Socialist Agricultural Domains were reorganized, leading to the creation of collective agricultural holdings (EAC) and individual agricultural holdings (EAI).

to *p*), and ε is a random error with an expected value of 0 and a variance of σ^2. In the case of *n* observations, the estimated value of the variable *Y* for observation *i* is given by the equation:

$$Y_i = \beta_0 + \sum_{j=1}^{p} \beta_j X_{ij} + \varepsilon_i \ (\mathrm{I} = 1,\ldots \mathrm{n}) \qquad (2)$$

The dependent variable *Y* for the four models is the amount that the farmer is willing to pay for agricultural advisory services. The remaining control variables are presented in **table 1**.

In the first model (Model 1), we introduced control variables that introduced both dichotomous variables (yes *vs* no)[2] related to the socio-economic characteristics of the farms and farmers: non-agricultural activity, agricultural training, practice of animal husbandry, and the land tenure (0 for tenants and 1 for owners). Additionally, we included continuous variables: age of the farmer, household size, area of citrus fruits, and the percentage of the area occupied by citrus fruits. In the second model (Model 2), the control variables are dichotomous (yes *vs* no) related to farmers' needs for advice on various aspects: disease treatment, fertilizer use, choice of varieties,

[2] Or dummy variable, as it takes only two distinct values, noted as 0 = No and 1 = Yes.

Table 1. Descriptive statistics for variables included in the OLS model — *Statistiques descriptives pour les variables inclues dans le modèle OLS*.

Variables	Continuous variables				Dummy variables	
	Mean	SE	Min	Max	Farmers' number with dummy = 1	Farmers' % with dummy = 1
Age (years)	59	11	20	87		
Houshold size (persons per household)	7	3	1	30		
Utilized Agricultural Area (UAA) (ha)	4.8	5	0.3	45.5		
Citrus land in % from total	75	29	3	100		
Education in agriculture					130	36
Non-farm activity					37	10
Land tenure					354	98
Breeding					34	9
Disease treatment					290	80
Fertilizer use					212	59
Varieties choice					43	12
Cultivation techniques					125	35
Irrigation					80	22
Harvesting and processing					18	5
Marketing and commercialization					33	9
Exportation					23	6
Public preference					181	50
Advisor reputation					78	22
Advisor reliability					114	31
Advisor effectiveness					147	41
Satisfaction about the service					293	81
Economic gain					320	88
Working conditions improvement					120	33
Protection of the environment					102	28
Technical training					173	48
Awareness of innovation					125	35

cultivation techniques, irrigation system, harvesting and processing, marketing, and exporting. For the third model (Model 3, perception), we introduced dichotomous control variables (yes *vs* no) related to farmer's perception: public preference, advisor reputation, advisor reliability, advisor effectiveness, and satisfaction with the service. Additionally, we included a variable measuring the degree of impact, with four levels (weak, medium, strong and very strong). In the fourth model (Model 4, desired externality), we introduced dichotomous control variables (yes *vs* no) related to the externalities sought by farmers: economic gain, improvement in working conditions, environmental protection, technical training, awareness of new techniques and innovations, and marketing improvement. Moreover, the variable Wilaya was included as a control variable in each model, taking the value of 1 for the wilaya of Boumerdes and 0 for the wilaya of Blida (the two wilayas where the survey was conducted). This inclusion allows us to examine potential differences in the behavior of the surveyed farmers based on their respective wilayas.

3. RESULTS

3.1. Respondent characteristics

Farmers' characteristics. The results of the descriptive analysis (**Table 1**) show that citrus fruit producers in the Mitidja region tend to be older. The average age of the 362 surveyed farmers is 59 years, and only 11% (40 farmers) are under the age of 45. There are two main reasons for this. The first reason is financial, as the high cost of investment in tree cultivation cannot be supported by young farmers, who tend to prefer seasonal and high-value crops such as horticulture, as the investment cost is lower than that of arboriculture. These farmers are constantly looking for new opportunities and are responsible for shaping new production systems under greenhouses, particularly in the south of the country (Naouri et al., 2015). The second factor is land. The majority of fruit-growing farms in the two study regions are state concessions, which rental is prohibited, and are operated by farmers – 98% are tenanted **(Table 1)** – who received them in the late 1980s and are now aged. Most farmers are men, only five farms (representing 1% of the sample) are operated by women. This is common in most African countries, where male culturally dominate as heads of households (Shausi et al., 2019). Regarding educational levels, 78% of the respondents have at least a primary education, and 8% have university degrees. This indicates that there are more literate people interested in agriculture. It is also an indication that newsletters and other printed media and phone messaging could be used by advisors to disseminate useful information to farmers.

In most cases, household incomes come from agriculture. Only 10% of farmers have non-farm activities, notably commercial ones. Thirty-six percent (36%) have received at least one training course in agriculture (**Table 1**). However, these are short-term courses – with a maximum of three days – taken as part of a training program of the Ministry of Agriculture delivered by technical and training institutes.

Most citrus farmers surveyed (96%) are not members of a producers' organization. More than a quarter (27%) are members of the Wilaya Chamber of Agriculture (CAW), which can be explained by the fact that members of the chamber of agriculture can benefit from subsidies for fertilizers and from preferential or interest-free credit. On the other hand, fewer farmers – less than 5% of producers – join cooperatives or associations. This low rate can be explained by the fact that farmers do not always perceive the benefit of joining cooperatives or associations. Indeed, the services provided by these organizations are often limited, particularly the lack of technical support, tailored advice, and access to credit. These are primarily provided by input suppliers, which further diminishes the appeal of cooperatives for producers. Farmers also criticize the fact that cooperatives often do not follow the rules of cooperative governance and that they operate in a non-democratic and non-participatory manner internally (Brabez & Bedrani, 2015; Berdaguer & Bessaoud, 2019).

Farms' characteristics. The average farm size is 4.8 ha. Most farms (73%) have an area between 2 and 10 ha, 19% are less than 2 ha and 8% are 10 ha or more with a maximum of 45.5 ha (**Table 1**). Citrus represents on average 75% of the Utilized Agricultural Area (UAA) of these farms that are more or less diversified. Other crops are mainly represented by vineyards, followed by horticulture and cereals. Additionally, 10% of farmers practice livestock farming, mainly cattle breeding and beekeeping. Approximately 98% of respondents have a direct land tenure system (**Table 1**), which is logical in our study area where 93% of farms are state concessions. In 20% of cases, citrus fruits are sold before harvest, while in 57% of cases, sales are made at the wholesale markets.

Advisory systems. Based on the provided sample, it appears that farmers have access to a wide range of advisory sources, including both public and private systems. A significant portion of farmers request private advisors, particularly input suppliers, with 44% reporting doing so. Additionally, most farmers (60%) participate in agricultural extension campaigns delivered by public services. It is also interesting to note

that a substantial proportion of farmers (35%) use both public and private facilities at the same time. In contrast, the chambers of agriculture and agricultural cooperatives seem to be less involved in providing agricultural advice, with only 14% of citrus growers reporting using them for advice. Farmer-to-farmer exchanges are also not widely used, it concerns only 7% of farmers.

Surveys show that private advisors are represented by various actors. Firstly, there are input sellers who are in constant contact with farmers, providing them with inputs and advice as needed. Such advices are either given through phone calls or directly at the retail store. In this situation, the cost of advice is added to the price of the inputs sold. Some farmers prefer that advisors visit their farms to make a diagnosis. Farmers are therefore billed directly and individually for the services provided. This method is preferred by no less than 75% of farmers. This choice proves that farmers are looking for very specific advice, expressed in a punctual manner and based on observations, rather than generalized advice, as it is the case with advice given during extension campaigns. Additionally, representatives of agrochemical multinationals and national consulting firms are also present, offering additional services to citrus farmers who want to renew their aging citrus orchards or install new ones. In this case, advisors from these companies accompany farmers throughout the development stages of these new orchards, from choosing varieties to harvest. This practice prevents farmers from unpleasant surprises at the start of production, such as receiving a different variety or even species than what they originally intended. It is therefore a guarantee of investment. Lastly, there are advisors from public organizations who also provide services informally as private advisors.

3.2. WTP estimation

Before asking the surveyed farmers about the amount they would be willing to pay for private agricultural advice, we first inquired whether they would agree to pay for such advice with a simple "Yes or No" question. The study revealed that most of the farmers (90%) are willing to pay for private advisory services, while the remaining 10% are not willing to pay at all. Then, we asked them about the amount they would be willing to pay, following the contingent valuation method detailed in section 2.2. According to estimates, the average amount that farmers are willing to pay (WTP) for each visit is 1,269 Dzd (9.42 $). Additionally, 21% of farmers responded positively to a second offer of 2,000 DZD (14.66 $) per visit, while 8% are willing to pay 3,000 DZD (21.99 $) per visit. The surveyed farmers also indicated their preferred payment method for the advisory services. The majority (70%) prefer direct cash payment after each visit by the advisor.

3.3. Determinants of WTP

Socioeconomic factors. Table 2 shows that socio-economic attributes strongly influence farmer's willingness to pay for advisory services. The age of the farmers is significant with a negative effect on the WTP for advisory services. This means that younger farmers who have higher levels of education are more inclined to pay for advisory services. This result contrasts with the findings of Budak et al. (2010), which showed that the education level of livestock farmers in the province of Antalya had no effect on their willingness to pay for extension services. However, our finding is consistent with those of Uddin et al. (2016) and Foti et al. (2007), suggesting that younger farmers are more aware and have a better understanding of the benefits associated with seeking advice from advisors. The household size is also significant, with a positive effect on the willingness to pay. The larger the household size, the more responsibilities the farmer has to ensure a certain standard of living for household members. In this situation of increased risk aversion, farmers are more likely to seek advisory services.

Farmers without formal agricultural training demonstrate a higher willingness to pay (WTP) for advisory services compared to their trained counterparts, although the variable is not statistically significant. Farmers who have received training, consider themselves to have acquired sufficient knowledge to manage their farms and therefore have reduced reliance on farm advisors. Farmers who have additional sources of income, such as livestock or non-agricultural activities, tend to have a higher willingness to pay for advisory services. This may be because these sources of income increase their overall financial capacity (Oladele, 2008) and they may have a greater need for advice on managing multiple activities.

The results show that the WTP is influenced by the level of specialization. Farmers who specialize in citrus crops have a higher WTP, as they are willing to pay for advice to mitigate the risks associated with monoculture and poor yields resulting from improper fertilizer use, for example. In addition, specialized farmers require specific information that is only provided by private advisors and cannot be limited to 'generic' advice provided by public advisory services. Although farm size has been identified as a determinant of farmers' WTP for advisory services in several studies (Foti et al., 2007; Oladele, 2008), the results of this study show that farm size has no significant effect on WTP. Finally, the results show no significant difference in WTP between the two wilayas.

Farmers' needs. The results (Model 2 in **table 2**) show that WTP depends on the content of the advice and its ability to respond to farmers' needs. Indeed, two main

Table 2. Determinants of the WTP- OLS model — *Déterminants du modèle WTP-OLS*.

Variables	Model 1	Model 2	Model 3	Model 4
Socioeconomic				
Age	-13.22*** (3.507)			
Household size	30.64*** (11.71)			
Formation in agriculture	-23.40 (79.65)			
Non-farm activity	227.1* (126.2)			
Citrus land	-0.262 (7.538)			
Citrus land in %	2.414* (1.425)			
Breeding	126.8* (74.98)			
Land tenure	114.5 (280.0)			
Farmers' needs				
Disease treatment		274.7*** (85.97)		
Fertilizer use		336.9*** (74.74)		
Varieties choice		-318.3** (130.7)		
Cultivation techniques		299.8*** (83.95)		
Irrigation		255.6*** (95.16)		
Harvesting and processing		-163.4 (234.6)		
Marketing and commercialization		534.1*** (165.8)		
Exportation		-399.3* (226.4)		
Perception				
Public preference			-76.52 (77.25)	
Advisor reputation			-20.64 (102.3)	
Level of impact			198.3*** (70.91)	
Advisor reliability			168.1* (86.83)	
Advisor effectiveness			338.1*** (96.93)	
Satisfaction about the service			353.8*** (116.3)	
Externalities				
Economic gain				42.40 (125.2)
Working condition improvement				190.7* (106.2)
Protection of the environment				-50.17 (111.0)
Technical training				150.3* (86.85)
Awareness of innovation				-72.90 (89.65)
Enhancing commercialization				267.2* (139.4)
Wilayas (ref : Blida)	15.15	32.95	-41.69	-26.57
Boumerdes	(89.45)	(81.31)	(95.36)	(88.55)
Constant	1,298*** (382.1)	644.8*** (85.29)	482.2** (216.4)	1,054*** (117.1)
Observations	351	362	330	362
R-squared	0.081	0.198	0.147	0.045

The coefficients are reported in the table — *les coefficients sont indiqués dans le tableau*; the standard errors are in parentheses — *les erreurs standard sont entre parenthèses*; Significance level: *** for 1%, ** for 5%, * for 10%, no asterisk: no significance level — *niveau de signification : *** pour 1 %, ** pour 5 %, * pour 10 %. Pas d'astérisque : pas de niveau de signification*.

categories of needs emerge: the first contains technical issues, such as disease treatment, fertilizer use, and irrigation, while the second is more managerial, such as the search for better market integration and product export.

According to **table 1**, 80% of farmers are willing to pay for private advice on disease identification and control. In second place, with 59%, farmers are looking for information on soil amendment, specifically the type and amount of fertilizer to apply, which helps reduce losses resulting from incorrect dosage (overuse or underuse of fertilizers). Farmers are also willing to pay for advice on other technical needs, such as irrigation and tree pruning, and for information on new technologies.

Other aspects related to marketing advice are also of interest to farmers but to a lesser extent, with only 9% of farmers expressing this need, as their main concern is to produce in quantity and quality. However, it is interesting to note that almost 6% of the farmers are looking for information on international markets and export procedures.

Farmers' perception. The results (Model 3 in **table 2**) show that the degree of impact and satisfaction with the advice provided influence farmers' willingness to pay (WTP) for private advisory services. The results also indicate that farmers' WTP increases with the perceived reliability of the advice – defined as being based on a high level of expertise and increasing the likelihood of achieving intended objectives – and with the perceived effectiveness of the advisors – understood as the ability to offer relevant solutions tailored to the farmer's specific problems and aligned with their goals and interests.

Desired externalities. As expected, the majority (88%) of farmers responded that increased profit is the primary externality sought (**Table 1**). Furthermore, although the coefficient related to economic gain is not statistically significant (**Table 2**), the positive sign of the coefficient indicates that the WTP is relative to the expected economic gain. This finding aligns with Charatsari & Papadaki-Klavdianou (2009) who found that the main expected benefits derived from an educational process are the possibility of increasing the prospects of agricultural enterprise and enhancing the financial results. Learning technical practices comes second, with 48% of farmers prioritizing this aspect (**Table 1**). This variable is statistically significant and determines the farmers' WTP (**Table 2**). For farmers, learning to carry out some tasks themselves is a way to become autonomous, which reduces expenses and thus allows to obtain a better profit. Furthermore, **table 1** shows that environmental protection is one of the least externalities considered by farmers, with only 28% of farmers considering it important.

4. DISCUSSION

This study showed that although there are few farmers (only 15%) who are currently paying for advice, the majority (90%) of the surveyed farmers are willing to pay for advisory services. This finding indicates that farmers are seeking for private, fee-based services to address specific needs. This finding is consistent with the results obtained by Jones & Garfoth (1997) and Uddin et al. (2016) who report that, in the future, farmers will seek more efficient, autonomous, and consumer-oriented advisory services. In this context the focus will be on the quality of interaction between farmers and advisors rather than on a top-down, hierarchical approach.

The average calculated WTP is 1,269 Dzd per visit, which is 27% higher than the average price currently paid by farmers. This higher WTP is influenced by several socioeconomic factors, such as age, household size, degree of specialization (in citrus production), and income diversification. In the study by Mabe et al. (2014) conducted in Ghana, socioeconomic variables also play a significant role. Notably, our results for the age variable differ from those of Mabe et al. (2014): we observe a negative effect of age on WTP, whereas in their study, age has a positive effect (significant at the 10% level). This negative effect is explained by the fact that younger farmers generally have a higher level of education and are more aware of the need to acquire new information, which translates into a higher willingness to pay. In Burkina Faso, Ouedraogo et al. (2018) observed that various socioeconomic factors, including education level and age, greatly influence willingness to pay for climate information. Other studies, such as Ahmed et al. (2015), have shown that farmers with higher income levels and household size were willing to pay more.

The results show that having multiple sources of income positively affects the WTP for advisory services. However, the privatization of advisory services could disadvantage the poorest farmers, as Labarthe & Laurent (2013) report that small farmers would suffer from the privatization trend, especially in region where free public extension services had disappeared and there were no alternative programs designed for small-scale farmers. The solution could be to combine different types of advice to make it accessible or to subsidize advice (Umali & Schwartz, 1994; Carney, 1995; Klerkx & Jansen, 2010).

The results also show that WTP is influenced by the needs expressed by farmers. It appears that the two most crucial technical needs expressed by farmers are related to disease treatment and soil fertilization, which are predominantly fulfilled by private advisors. On the other hand, the advice given by the latter is less concerned with managerial or business management

issues – the need for information on exporting, for example – nor with environmental issues. Private advisors are more concerned with their own profit – the advice is provided in conjunction with sales of their products – and with meeting the needs of farmers than with issues of general interest such as the environment. This can lead to negative health and environmental externalities due to excessive fertilizer use (Wuepper et al., 2021). The resolution of these environmental concerns may necessitate a commitment from the government, as private advisors may lack the motivation to address them. If agricultural advisory services were privatized, it could potentially allow public services to concentrate on providing agro-ecological and natural resource conservation practices to farmers. This would entail creating an integrated system that combines agricultural research and advisory services.

5. CONCLUSIONS

In recent years, we have witnessed a gradual privatization of agricultural advisory services in Algeria in response to the specific needs of farmers in terms of advice. This is what motivated us to study farmers' willingness to pay for this service as well as the factors that affect it. The relevance of the study lies in its originality. Indeed, it is the first one to specifically examine farmers' willingness to pay for agricultural advice in Algeria.

The study showed that the majority (90%) of farmers are willing to pay up to 27% more than the current fee charged by private advisors. This willingness to pay is strongly influenced by the degree of impact and the effectiveness of the advice. Consequently, the emergence of formal agricultural advisory enterprises is possible if they meet the most sought-after needs of the farmers. However, it is important to recognize that this willingness to pay is based on farmers' declarations, and actual behavior may differ. Our study showed that the farmers' needs are mainly technical, with the effective use of fertilizers and the adoption of the best phytosanitary treatments being the two primary needs identified. The study also illustrated that the most sought-after externality (88% of farmers) is economic gain, while the least sought-after is environmental protection. Therefore, it is recommended to integrate this issue to facilitate the transition towards more environmentally friendly practices. In our specific case, it is suggested that public advisory systems, which are considered less effective of meeting farmers' needs, should focus on environmental and social considerations, and allow private agricultural advisors to handle the economic aspect of the advisory services. Moreover, since farmers' income determines their willingness to pay, the study implies that in the event of establishing paid agricultural advisory mechanisms, financial support measures for small farmers – such as aids for acquiring fertilizers – or even subsidized loans – such as the "Rfig" credit – are recommended to ensure equitable access to private advice.

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