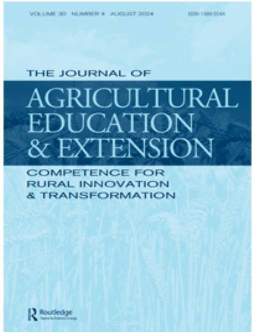


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**The Journal of Agricultural Education and Extension**

Competence for Rural Innovation and Transformation

**ISSN: 1389-224X (Print) 1750-8622 (Online) Journal homepage: www.tandfonline.com/journals/raee20**

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**To cite this article:** Simone Angioloni, Simone Cerroni, Claire Jack & Austen Ashfield (2024) Eliciting farmers' preferences towards agriculture education in Northern Ireland, The Journal of Agricultural Education and Extension, 30:4, 591-615, DOI: 10.1080/1389224X.2023.2249446

**To link to this article:** https://doi.org/10.1080/1389224X.2023.2249446



Published online: 23 Aug 2023.

THE JOURNAL OF AGRICULTURAL EDUCATION AND EXTENSION
2024, VOL. 30, NO. 4, 591–615
https://doi.org/10.1080/1389224X.2023.2249446

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# Eliciting farmers' preferences towards agriculture education in Northern Ireland

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**ABSTRACT**

**Purpose:** Agriculture education promotes farmers and societal welfare through a more efficient use of resources and the adoption of sustainable farming practices. Nevertheless, farmers' educational attainment is limited across countries. This study explores farmers' intention to participate in formal agriculture education.

**Design/methodology/approach:** A discrete choice experiment survey with 363 farmers exploring their preferences for different specifications within a diploma in agriculture was employed. We focus on Northern Ireland, a country with a relatively large agricultural sector and were farmers have a low level of formal education.

**Findings:** Our results show that farmers exhibited a preference for short courses delivered in the evenings, with 75% of the teaching time delivered online, favouring educational topics linked to farm performance against those related to socio-environmental outcomes. Part-time younger farmers, operating in small farms located in less favoured areas, reported the highest willingness to pay for the course. However, farmers that had previously participated in a Young Farmer Payment Scheme reported the lowest interest in undertaking the course.

**Practical implications:** The study provides useful information to education providers in relation to the design of agriculture courses to better meet farmers' preferences and therefore encourage levels of uptake. Secondly, the study can help policymakers to make informed decisions about policy instruments incentivising farmers to engage in education.

**Theoretical implications:** By drawing from random parameter choice models, the study highlights that the heterogeneity of farmers' preferences should be considered when modelling their decision to engage in agriculture education.

**Originality/value:** This is the first study that elicits farmers' preferences towards agriculture education via a discrete choice experiment. Secondly, the study explores preference heterogeneity based on farmers and farms' characteristics.

**ARTICLE HISTORY**
Received 8 December 2022
Accepted 5 August 2023

**KEYWORDS**
Agriculture education; sustainable farming; willingness to pay; young farmer payment; discrete choice experiment; mixed logit

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This article has been corrected with minor changes. These changes do not impact the academic content of the article.

## 1. Introduction

Formal education is organised around structured lessons and finalised to earn a legally recognised certificate (Fielke and Bardsley 2014). Formal education can improve human capital as well as individual and societal welfare because it provides knowledge and cognitive skills to understand new information and elaborate adequate strategies to achieve a better outcome (Hatch and Dyer 2004). In the agricultural sector, formal education has provided several benefits to farmers and their businesses. For example, the level of farmers' formal education has been shown to be positively linked to a higher adoption of agricultural innovations (Langyintuo and Mungoma 2008; Mariano, Villano, and Fleming 2012), sustainable farming practices (Picazo-Tadeo, Gómez-Limón, and Reig-Martínez 2011; Van Passel et al. 2009), and an improved farm business performance (e. g., Giannakis and Bruggeman 2015). Nevertheless, farmers' engagement is heterogeneous across countries with low levels of training still common in several regions. In the European Union (EU), more than 50% of farm managers have no formal agricultural training (Eurostat 2013). Similarly, in the USA less than 6% of farmers were fully trained in agriculture (Data USA 2019). To overcome this problem, our paper explores farmers' preferences for different specifications of a formal educational course.

This study makes two important contributions to the current research and policy debate. First, this study assessed farmers' preferences and willingness to pay towards different characteristics of a course in agriculture such as duration, online/in person teaching mix, and covered topics. To this end, a discrete choice experiment (DCE) with 363 farmers was employed to investigate the trade-offs that agricultural operators face when presented with a level 3 course in Northern Ireland (NI).[1] This study focuses on Northern Ireland, a country with a relatively large farming sector and a particularly low level of formal agricultural training (Department of Agriculture, Environment, and Rural Affairs – DAERA 2019; Eurostat 2013). While several studies have employed DCEs to assess students' preferences towards formal education (Jin, Mjelde, and Litzenberg 2014; Walsh, Cullinan, and Flannery 2018), to the author's knowledge this is the first study that employs this preference elicitation method to assess farmers' preferences towards an agriculture qualification. We found that farmers prefer short courses organised in the evenings, with 75% of the teaching time delivered online, and focused on livestock nutrition and grassland management. Overall, we found that farmers prioritise educational topics linked to farm performance over those related to the socio-environmental outcome of their agricultural land use.

Second, our analysis explores preferences heterogeneity based on farmers and farms' characteristics. At the farmer's level, we focus on age, gender, highest education level, prior agriculture qualification, full/part-time farmer, and participation to the EU Young Farmer Payment (YFP) scheme. Similarly, we study how farmers' preferences change by land type, farm size (ha), number of labour units, household's share of farm income, and farm type. We found that younger part-time farmers, farming smaller farms, on less productive land reported the highest willingness to pay for the course. However, farmers that had previously taken part in the YFP reported the lowest interest in the course.

These results can help policy makers to make informed decisions about policy instruments incentivising farmers to engage in education. For example, in the EU the YFP is designed to reduce the aging of the farm population (EU 2021) and includes the provision for individual member states to set a minimum level of formal agricultural training. This option has been adopted by several member states including NI, which requires participants to have obtained a level 2 diploma in agriculture to participate (DAERA 2021). Similarly, in the USA the National Institute of Food and Agriculture (NIFA) has implemented at the federal level the Beginning Farmer and Rancher Development Program (BFRDP) providing grants to organisations for education, mentoring, and offering technical assistance to young farmers (NIFA 2021). From this point of view, our study can provide useful information to researchers, education providers, and policy makers across countries interested in promoting the growth of formal agriculture education amongst farmers. Second and more broadly, given the positive linkage between formal education and the adoption of sustainable farming practices (Fielke and Bardsley 2014; Picazo-Tadeo, Gómez-Limón, and Reig-Martínez 2011; Van Passel et al. 2009), this study is relevant to those interested in promoting farmers' behavioural change to address climate change and foster increased natural capital conservation. The following section introduces the background, section 3 presents materials and methods, results are discussed in section 4 while section 5 draws out the conclusions and policy implications.

## 2. Background

### *2.1 Literature review*

Previous research has shown that farmers benefit from undertaking formal agriculture training. First, several studies have indicated that formal education facilitates farmers' adoption of new ideas and innovations. For example, in a study including observations from 90 OECD countries in 2004–2014 Pindado and Sánchez (2019) showed a positive relationship between the level of farmers' agriculture qualification and their orientation towards profitable business opportunities. Similarly, Läpple, Renwick, and Thorne (2015) studied the drivers of technology adoption on dairy, cattle, and arable farms in the Republic of Ireland (ROI) and established that the level of formal agriculture qualification of farmers who were observed to be innovators was twice the educational level of farmers adverse to technology adoption. In general, a substantial body of research has indicated that the level of formal education helps to explain the adoption of new seed varieties (Langyintuo and Mungoma 2008), novel agricultural technologies (Mariano, Villano, and Fleming 2012), and ICT equipment (Mittal and Mehar 2016).

Second, formal education helps farmers to acquire the necessary skills to face the increasing global challenges of environmental sustainability (Coomes et al. 2019). The level of formal qualifications obtained in agriculture has been shown to be positively linked to pro-environmental behaviours (Picazo-Tadeo, Gómez-Limón, and Reig-Martínez 2011; Van Passel et al. 2009) and improved commitment towards sustainable farming practices (Padel 2001). Fielke and Bardsley (2014) analysed the Australian farming sector and indicated that more educated farmers prioritise socio-environmental outcomes of their agricultural land use to reduce carbon emission and restore soil degradation. In general, welfare gains from agriculture education are expected to increase with the size and incidence of agricultural land (Sumner 2014).

Third, the level of formal training impacts positively on farm performance, both technical and managerial. Giannakis and Bruggeman (2015) analysed the effect of formal training in agriculture across the EU 27 countries and concluded that farmers with higher education levels had a positive effect on farm performance. Specifically, countries with a high proportion of farmers with formal agriculture training, namely the Netherlands and Germany, are nine times more likely to obtain a higher level of economic performance than countries characterised by a lower percentage of formal qualifications within their farming population such as Portugal and Bulgaria.

While formal education has been shown to be a worthwhile investment for farmers, their engagement is limited (Data USA 2019; Eurostat 2017). The lack of an adequate prior education and concerns about time taken from farming are often cited as the main barriers towards a formal certificate (Deming et al. 2019; Kilpatrick and Johns 2003). Furthermore, while outside the agricultural sector a formal certificate is often a way to signal the skills level in the job market, this can fail in agriculture as formal competencies are frequently not required to run a family business (Seymour and Barr 2014). A greater knowledge and understanding of the factors that affect farmers' commitment to formal education is needed to encourage wider engagement and subsequently deliver improvements in farm practices (Coomes et al. 2019). Within this debate, a significant element of research has been dedicated to developing effective curricula. Previous studies have recognised farmers as a heterogeneous group with different preferences towards formal agriculture qualifications and findings indicate the importance of tailoring the educational offer to their needs (Deming et al. 2019).

In terms of course content, research has focused on the ability of the course to meet farmers' personal interest and the specific skills gap in agriculture. For example, Gray et al. (2004) recommended the importance of farm business training to improve farmers' management skills and increase their chances to access credit and land, as investment plans are usually required to operate within these markets, and, therefore, to increase farm profitability. Similarly, Bone (2005) indicated that farmers tend to acquire skills in technical agriculture to improve farm productivity.

The way in which a course is organised is an important factor when aiming to engage farmers in formal learning. Farmers are usually interested in a combination of different approaches which may include classroom-based activities, online seminars, and live farm-based demonstrations (Brown and Fraser 2011). Moreover, indications are that farmers prefer short courses as a long-time commitment tends to discourage uptake and participation (Bone 2005; Seymour and Barr 2014).

### 2.2 Agriculture education in northern Ireland

In NI, agriculture education falls under the responsibility of DAERA and is delivered by the College of Agriculture, Food and Rural Enterprise (CAFRE). CAFRE comprises of three campuses which provide training in agriculture, horticulture, food, equine, floristry, veterinary nursing, and land use. With respect to agriculture, CAFRE provides formal education for level 2–4 qualifications and foundation/honours/postgraduate degrees.[2]

Despite research providing strong evidence to support farmers engaging in formal agricultural training, statistics show that farmers lag behind especially in NI. Figure 1 reports the distribution of farmers by agriculture qualification for selected European countries and shows that NI has the lowest level of formal training in agriculture. Specifically, nearly three quarters of farmers in NI had practical experience only, compared to 67% in Great Britain, 50% in ROI, and 47% in Denmark.

In addition, 75% of the territory in Northern Ireland is classified as agricultural land, a large percentage when compared to other countries such as ROI (65%), France (52%), and Italy (44%; World Bank 2022). As a result, farms are dispersed over the entire region making the in-person attendance time consuming and therefore challenging for most farmers (Figure 2).

Another factor contributing to the relatively low level of agricultural education of farmers in NI is the size of farms, which are generally smaller and more frequently run as a family business compared to other parts of the UK (DAERA 2020). In this context, there is less of a requirement and/or motivation to obtain a formal agricultural qualification than would be a requirement for someone operating a large and more capital-intensive farm. Moreover, outside the agricultural sector, NI lags behind the rest of the UK with the relatively limited educational progression of its population (Ulster University Economic Policy Centre 2021). This can be due to different structural factors such as relatively low labour productivity, wages and therefore less value is placed on human capital formation.[3] Public authorities in NI are aware of the skills-gap setting a

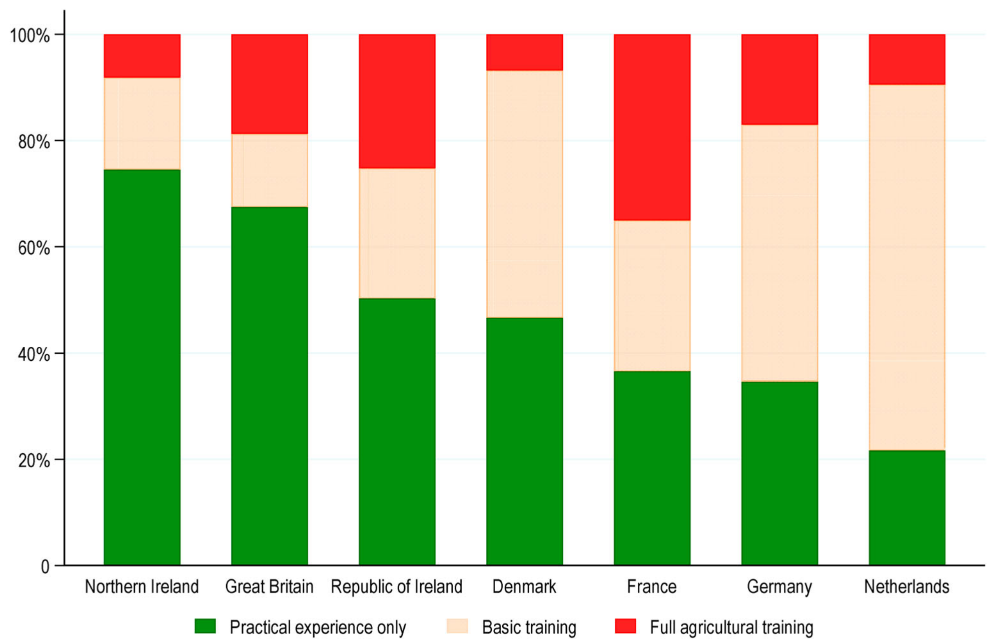


**Figure 1.** Farmers' distribution by agricultural training in selected European countries[a]. [a]Basic training: any training course completed at a general agricultural college including agricultural apprenticeship. Full agricultural training: any training course for the equivalent of at least 2 years full-time training after the end of compulsory education completed at an agricultural college, university or other institute of higher education in agriculture or an associated subject (Eurostat 2013).

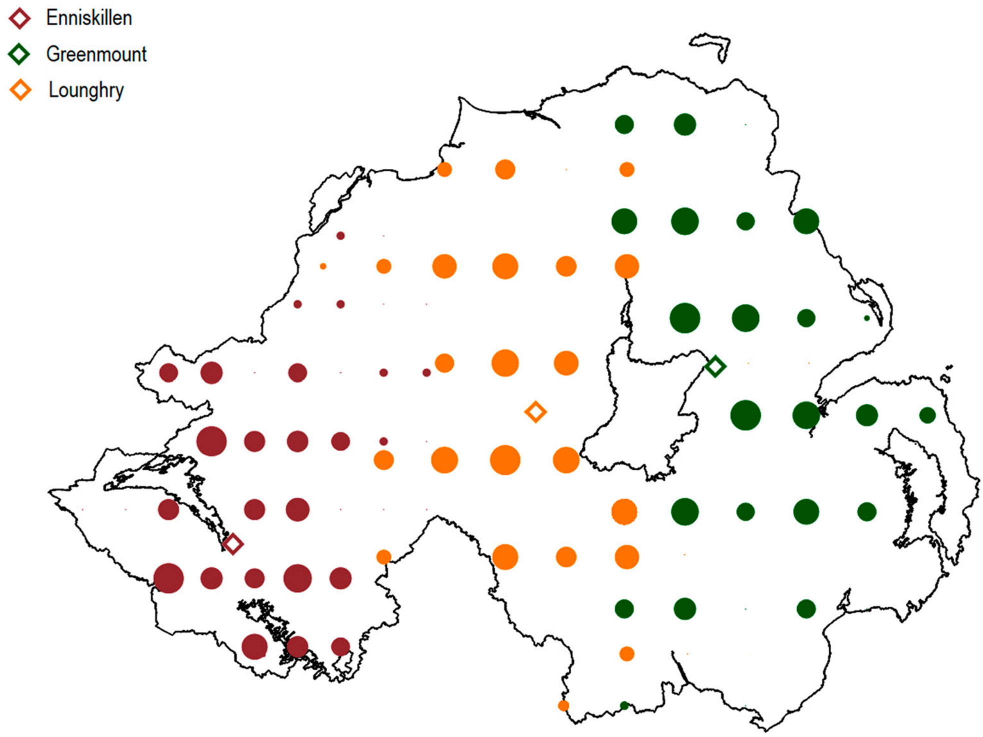


**Figure 2.** Estimated distribution of the farmers' driving distance to the preferred CAFRE campus. The figure shows the estimated distribution of the farmers' driving distance to the preferred CAFRE campus (coloured diamonds) where the size of the circles represents to the number of farmers in the nearby area and the colour of the circle matches the colour of the closest campus.

specific target to ensure that by 2025 anyone who is head of a commercial farm or a horticultural business should have at least a level 3 relevant qualification, i.e. the minimum qualification for anyone in a managerial position (DAERA 2019).

## 3. Materials and methods

### *3.1 Experimental design*

The experimental design of the study consisted of a DCE about different characteristics of a part-time level 3 diploma in agriculture. In the experimental condition, farmers were presented with 12 choice tasks. In each choice task, participants were asked to select their most preferred option amongst three alternatives, comprising two different courses and an opt-out (not taking the course).

To accommodate the farmers' work schedule, the proposed course was organised in the evenings, and it had four attributes: duration, online-in person teaching mix, study area, and course fee/price. The selection of attributes and their levels were assessed via focus groups and stakeholders' discussions. Participants to the focus groups were selected from two sources, namely famers with a level 2 agriculture qualification and farmers without any agriculture qualification (see section 3.2). Focus groups comprised semistructured interviews containing open-ended questions about different attributes and levels of the course. Three focus groups with 6 farmers each took place between March and May 2021. Focus groups lasted between sixty and ninety minutes and three researchers attended each session. Several attributes and levels were tested including a wider range of course fee (£500–£2500), different study subjects (environment, health, and safety), intensity/duration of the course, and customisation of the course content. From the focus groups, the included levels were two for duration, three for online-in person teaching mix, three for the study area, and four for the price (Table 1).

Regarding the study area, analysis of the literature review, the results from the focus groups with farmers, and advice from experts in agricultural education suggested three levels for this attribute linked to three different aspects of farming, namely increasing productivity (technical agriculture), improving profitability (farm management), and lowering the risk of disease on the farm (animal and plant health).

Before making their choices, farmers were introduced to the general structure of the course and a detailed description of each attribute and level. The 12 choice tasks were generated using a D-efficient design (Ferrini and Scarpa 2007) with the software Ngene 1.3 by ChoiceMetrics. Estimated prior coefficients from the pilot study with 25 farmers were used to generate the final design.

To mitigate potential learning and fatigue effects, the order of the choice tasks was randomised across participants. At the end of the experiment, participants filled in a short questionnaire about their socio-demographic characteristics including their attitudes towards formal education in agriculture.

### 3.2 Sample and data collection

Participants were recruited with the support of DAERA. An invitation letter explaining the purpose of the research and the privacy regulations on data protection was sent by DAERA to a pool of 3082 farmers with a level 2 diploma in agriculture and 944 farmers with only practical agricultural experience. In September–October 2021, participants were contacted

**Table 1.** Attributes and levels of the discrete choice experiment.

| Attribute | Levels | Description |
|---|---|---|
| Duration of the course[a] | 3 years | 30 weeks per year for 3 years from mid-September to mid-April |
| | 2 years | 45 weeks per year for 2 years from mid-September to mid-August |
| Online-in person teaching mix | 75% online – 25% in person | % sessions delivered online and on campus |
| | 50% online – 50% in person | |
| | 25% online – 75% in person | |
| Study area | Technical agriculture | Soil and land management, livestock nutrition, improving fertility, grassland management, technical crop production, livestock breeding |
| | Animal and plant health | Farm bio-security, minimising disease risk, safe use of medicine, disease identification and treatment |
| | Farm business management | Benchmarking, farm finance, succession planning, financial management and planning |
| Course fee (price) | £500 | |
| | £800 | |
| | £1200 | |
| | £1800 | |

Note: [a]The course consists of 540 h over 180 evening sessions lasting 3 h each one, 2 sessions per week.

via phone by a survey company which has proven previous experience of undertaking research/surveys with farmers (Social Market Research – UK & Ireland Market Research Agency). Screening questions about their formal educational level in agriculture (only farmers with level 2 diploma or lower were included) and age (under 45 years) were checked in advance.[4] Each potential participant was asked to express consent before taking part to the experiment. If they agreed to do so, a web-link to the online DCE was shared. All participants had the opportunity to receive a £20 e-voucher on completion of the choice experiments; 93% elected to receive the payment.

Overall, 363 participants completed the experiment, 269 with a level 2 diploma (74%) and 94 with only practical training in agriculture (26%). Table 2 reports some selected farmer and farm characteristics. Table 2 indicates that 39% were below 35 years of age, 17% were female, and 59% were full-time farmers. Regarding the characteristics of the farm, 72% were beef and sheep, 51% were small size, and 53% were in Less Favoured Areas (LFA). The term LFAs is used to describe those parts of the country which, because of their relatively poor agricultural conditions, have been so designed under EU legislation (DAERA 2020). Overall, Table 2 shows consistent similarities with the farmers' population $\leq$ 45 years of age. For LFA, the distribution of land type by age is not publicly available and the reported percentage includes all the age classes. The higher incidence of good quality land (lowland) in the sample is expected because older farmers own relatively more land in the hills and upland that are classified as severely disadvantaged areas in NI (Alexander and Drake 2002).

### 3.3 Discrete choice modelling data analysis

DCEs are based on the extension to standard consumer theory (Lancaster 1966) and are modelled using Random Utility Models (RUMs, McFadden 1974). The utility ($U$) that farmer $n$ attaches to each alternative $j$ in each choice task $k$ ($U_{n,j,k}$) is split into two parts: $V_{n,j,k}$, the part of the utility observed by the researcher, and $\varepsilon_{n,j,k}$, which cannot be observed by the researcher, so that, $U_{n,j,k} = V_{n,j,k} + \varepsilon_{n,j,k}$. We followed the classic

**Table 2.** Sample and population characteristics of farmers below 46 years of age.

| Type | Variable | Sample | Population | Definition |
|---|---|---|---|---|
| | Part-time farmer | 41% | 45%[a] | % farmers that work on the farm less than 30 h per week |
| Farmer's Characteristics | Young farmer | 39% | 36%[a] | % farmers below 35 years of age |
| | Female | 17% | 14%[b] | % female farmers |
| | College⁺ | 33% | 28%[b] | % farmers with college degree or higher |
| | Participation to YFP | 47% | 49%[a] | % farmers who took part to YFP |
| | Agricultural qualification | 74% | 68%[a] | % farmers with a level 2 diploma in agriculture |
| Farm's Characteristics | Small area farm | 51% | 50%[c] | % farms with farm area < 48 ha (median) |
| | Less Favoured Area (LFA) | 53% | 62%[c] | % farms located in disadvantaged and severely disadvantaged areas |
| | Household's share of farm income $\leq$ 50% | 65% | 63%[c] | % farms with household share of farm income $\leq$ 50% |
| | < 1 labour unit | 51% | 56%[c] | % farms with less than 1 full time worker (main farmer not included) |
| | Beef & sheep farm | 72% | 78%[b] | % beef suckler, beef finishing, and sheep farm |

Note: [a]DAERA (2016); [b]DAERA (2020); [c]DAERA (2018).

modelling approach used in DCE literature for RUMs where $\varepsilon_{n,j,k}$ is assumed to be IDD extreme value distributed with variance $\mu_n^2 \cdot \left(\frac{\pi^2}{6}\right)$ and scale parameter $\mu_n$. Farmer $n$ chooses the alternative $j$ that maximises his/her utility $U_{n,j,k}$ in choice task $k$. In other words, the dependent variable is the choice made by farmers amongst different alternatives in a choice task. Random parameters were used to account for unobserved heterogeneity (Train 2009). Specifically, multinomial logit models were estimated in WTP space with correlated coefficients (Train and Weeks 2005).

Estimation in WTP space has several advantages with respect to standard estimation in preference space. First, it allows direct estimation of marginal WTP (mWTP) for different levels of course attributes, which is the amount of money that participants are willing to pay for different characteristics of the course. Second, it reduces possible biases due to the confounding of variation in scale (i.e. the standard deviation of the unobserved part of the utility) and WTP (e.g. Balogh et al. 2016; Cerroni et al. 2019b; Hole and Kolstad 2012; Scarpa, Thiene, and Train 2008; Train and Weeks 2005). This is particularly useful in the present study given the focus on how the mWTP distributions change across groups of farmers (see section 3.4). Nevertheless, the number of studies that employed this methodology to elicit students' preferences towards formal education are limited. For example, a study by Walsh, Cullinan, and Flannery (2018) employed an estimation in WTP space to elicit students' preferences for the attributes of higher education institutions in ROI. Jin, Mjelde, and Litzenberg (2014) employed a mixed logit model to examine undergraduate students' preferences towards job selection in Texas. Specifically, the observed part of the utility function was defined as:

$$V_{n,j,k} = -\lambda_n \cdot course\_fee_{n,j,k} + (\lambda_n \cdot \beta_n^{duration\_long}) \cdot duration\_long_{n,j,k} + (\lambda_n \cdot \beta_n^{75\%\_online}) \cdot 75\%\_online_{n,j,k} + (\lambda_n \cdot \beta_n^{75\%\_inperson}) \cdot 75\%\_inperson_{n,j,k} + (\lambda_n \cdot \beta_n^{tech\_agr}) \cdot tech\_agr_{n,j,k} + (\lambda_n \cdot \beta_n^{animal\&plant\_health}) \cdot animal\&plant\_health_{n,j,k} \quad (1)$$

where $\lambda_n = \alpha_n/\mu_n$, $\alpha_n$ indicates farmers' preferences for the course fee. Variables in Equation (1) are binary indicators and each respective coefficient indicates:

- $\beta_n^{duration\_long}$ = mWTP for a 3 years course (base level: 2 years)
- $\beta_n^{75\%\_online}$ = mWTP for a course delivered 75% online and 25% in person (base level: 50% online and 50% in person)
- $\beta_n^{75\%\_inperson}$ = mWTP for a course delivered 25% online and 75% in person (base level: 50% online and 50% in person)
- $\beta_n^{tech\_agr}$ = mWTP for a course specialised in technical agriculture (base level: farm business management)
- $\beta_n^{animal\&plant\_health}$ = mWTP for a course specialised in animal and plant health (base level: farm business management)

More details of the derivation of the utility function in WTP space similarly to what employed in this study can be found in Macdiarmid et al. (2021), Cerroni et al. (2019b), Hole and Kolstad (2012), and Train and Weeks (2005).

In order to account for unobserved heterogeneity, it was assumed that the non-price coefficients follow a multivariate normal distribution, the price coefficient follows a log-normal distribution, and that these preferences are correlated (Train and Weeks 2005). Finally, we employed a random intercept for the opt-out alternative as is customary when the opt-in alternatives are unlabelled (Espinosa-Goded, Barreiro-Hurlé, and Ruto 2010). The random intercept informs on farmers' preferences for not taking the course. The estimation of the mean, standard deviation, and the correlation matrix were determined via maximum simulated likelihood (MSL) with 1000 Halton draws (Train 2009).

### 3.4 Heterogeneity of WTP distributions by farmer and farm's characteristics

This study examined how farmers' preferences towards the course change according to their individual and farm characteristics. To this end, the model presented in Equation (1) was estimated separately for 11 sub-samples based on: age, gender, part/full-time farmer, highest educational achievement (above/below college degree), prior agriculture qualification (only practical training vs. level 2), participation to YFP, land type, farm size (ha), size of farm labour force, household's share of farm income, and farm type. Regarding the farm size, we used the median number of hectares per farm from the Farm Business Survey (FBS).[5] Similarly, we grouped the observations according to the household's share of farm income above/below 50% and the size of the labour force above/below the sample median. Table 2 reports the definitions of these classifications.

Afterwards, mWTPs across groups were compared via the Poe test (Poe, Giraud, and Loomis 2005) which is widely used in literature to assess differences in mWTPs across groups and treatments (Cerroni, Notaro, and Raffaelli 2019a; Koetse and Brouwer 2016; Schaafsma et al. 2014). Specifically, we focus our attention on two types of results. First, we employed the Poe test to compare changes of mWTP of each characteristic of the course across groups of farmers. Second, we applied the Poe test on the random intercept for the opt-out alternative (no course) to assess the differences in course participation by farmers' group. The random intercept is inversely related to the course adoption, i. e. the higher is the utility for the opt-out alternative, the less a farmer will choose to take the course. Thus, if a group has a higher WTP to undertake the course, it shifts to the left the distribution of the random intercept, i. e. it has a lower utility from not taking the course.

## 4. Results and discussion

### 4.1 Farmers' preferences for agriculture education

In this section, we discuss the results by focusing on the mWTPs estimated for the pooled sample. Table 3 indicates that participants were willing to pay a lower premium for courses of a longer duration. Specifically, farmers are willing to pay £315 less for a 3 years course than for a 2 years course ($\beta_n^{duration\_long} = -3.15,\ p < 0.01$). This result confirms previous studies which indicated that course duration is a barrier to farmers' participation in formal education (Bone 2005; Seymour and Barr 2014). Secondly, this result identified that farmers found evening classes a particularly suitable mechanism for reducing the time to complete a diploma (Hoyt, Howell, and Young 2009). This is

**Table 3.** Mixed multinomial logit model estimates: pooled sample.

| Means (mWTP) | Coefficient | Standard error |
|---|---|---|
| $\beta_n^{duration\_long}$ | −3.15*** | 0.11 |
| $\beta_n^{75\%\_online}$ | 5.38*** | 0.31 |
| $\beta_n^{75\%\_inperson}$ | −5.57*** | 1.30 |
| $\beta_n^{tech\_agr}$ | 2.04*** | 0.15 |
| $\beta_n^{animal\&plant\_health}$ | −1.19** | 0.51 |
| Opt-out (ASC) | −20.04*** | 3.23 |
| Course fee (price) | −0.15*** | 0.04 |
| *Standard Deviations* | *Coefficient* | *Standard error* |
| $\beta_n^{duration\_long}$ | 4.85*** | 0.22 |
| $\beta_n^{75\%\_online}$ | 7.21*** | 0.75 |
| $\beta_n^{75\%\_inperson}$ | 7.49*** | 0.11 |
| $\beta_n^{tech\_agr}$ | 4.83*** | 0.04 |
| $\beta_n^{animal\&plant\_health}$ | 10.01*** | 0.36 |
| Opt-out (ASC) | 25.81*** | 4.97 |
| Course fee (price) | 0.24*** | 0.03 |
| Observations | 13068 | |
| LLF | −3303.6 | |
| LR test (*p*-value) [a] | 0.00 | |

Notes: [a]$H_0$ = uncorrelated preferences. *, **, *** indicate statistical significance at the 10%, 5%, and 1% level. Robust standard errors clustered at the agricultural qualification level. Course fee divided by 100.

because the short course was based on summer evenings (Table 1), the period of the year when farming is the most intense and work can be conducted until late to take advantage of the increased daylight span (Angioloni and Jack 2022).

Respondents indicated a preference for a course with a higher degree of online delivery as opposed to in person teaching. Table 3 shows that participants were willing to pay £538 more for a course that is delivered 75% online and 25% in person ($\beta_n^{75\%\_online} = 5.38,\ p < 0.01$) than for a course delivered 50% online and 50% in person, the base level. Farmers' interest in a course delivered online can be linked to their busy farming schedule and the fact that they have become familiar with accessing online information, for example in making application for subsidies/grants, completing farm census forms, and recording livestock movements. It is also possible that the time spent to drive to the campus affects farmers' decisions around online teaching (Brown and Fraser 2011). As shown in Figure 2, in NI farmers are dispersed over the entire region making in-person attendance challenging for most of them. Finally, a formal certificate in agriculture is generally directed towards a younger farming cohort that maybe more familiar and comfortable with online learning (Fielke and Bardsley 2014). Overall, this result is in contrast with previous studies that highlighted that farmers are interested in a combination of classroom-based activities and online seminars (Bone 2005; Seymour and Barr 2014).

The results also indicate that farmers were willing to pay £204 more for a course that gives more emphasis to technical agricultural topics ($\beta_n^{tech\_agr} = 2.04,\ p < 0.01$) such as livestock nutrition and breeding, soil and grassland management, and crop production compared to a course more focused in the area of farm business management, the base level. Conversely, the premium is £119 lower for a course specialised in animal and plant health ($\beta_n^{animal\&plant\_health} = -1.19,\ p < 0.05$) such as farm biosecurity, disease risk, and safe use of medicine. Overall, this means that farmers prioritise technical training linked to farm productivity, viewing it as the most important followed by management skills to improve farm profitability (Bone 2005; Murray-Prior, Hart, and Dymond 2000).

Farmers may have been least interested about animal and plant diseases because they can receive assistance from a veterinarian or specialist advisor (Seymour and Barr 2014). In general, farmers preferred educational topics linked to farm performance over sustainable farming. Figure 3 reports the farmers' responses from the socio-economic questionnaire administrated at the end of the DCE and indicates that farmers ranked a course that gives more emphasis to animal and plant health and environmental management as the least useful to them. These results suggest that farmers may not identify enough with their role as environmental stewards (Fielke and Bardsley 2014) and consider a diploma in agriculture mainly to increase the performance of their farms (Giannakis and Bruggeman 2015). In terms of model specification, Table 3 shows that there is substantial heterogeneity in farmers' preferences as shown by the statistically significant standard deviations.

### *4.2 Heterogeneity of WTP distributions by farmer's characteristics*

Table 4 presents the estimates of mWTPs by farmer's types and indicates that young farmers (<35 years) opted-in for the course more than old farmers (35-45 years; Poe test on ASC $p < 0.01$). This is consistent with the results by Sutherland et al. (2021) and Seymour and Barr (2014), suggesting that younger farmers recognise the value of obtaining an agricultural qualification as they have higher returns to education than old farmers.

The results also show that full-time farmers reported one of the highest mWTP for a short course (£411) and online learning (£675). It is interesting to notice that part-time farmers are not willing to pay more for a shorter course and reported a lower mWTP for online teaching. This means that the time spent on farming affects farmers' preferences

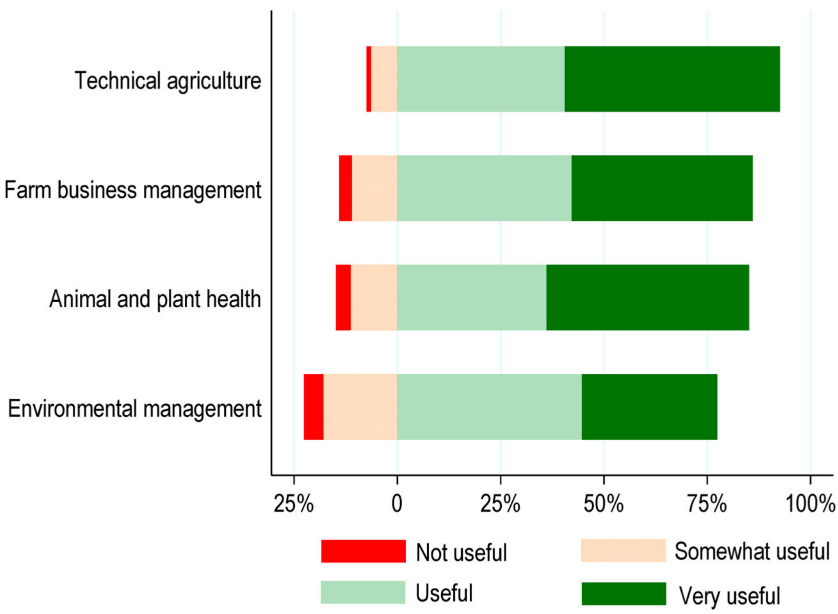


**Figure 3.** Interest in the course content (%).

**Table 4.** Mixed multinomial logit model estimates by farmer's characteristics.

| | Age | | Full-time/part-time | | Young Farmer Payment | |
|---|---|---|---|---|---|---|
| Means (mWTP) | Young | Old | Full-time | Part-time | Participant | Non-participant |
| $\beta_n^{duration\_long}$ | −2.90*** | −2.90*** | −4.11*** | −0.37 | −3.21*** | −3.83*** |
| | (0.70) | (0.04) | (0.02) | (0.41) | (0.10) | (0.67) |
| $\beta_n^{75\%\_online}$ | 2.15*** | 7.48*** | 6.75*** | 3.25*** | 9.06*** | 3.25*** |
| | (0.10) | (0.55) | (0.09) | (0.64) | (0.78) | (1.00) |
| $\beta_n^{75\%\_inperson}$ | −4.48*** | −7.52*** | −7.32*** | −4.46*** | −7.54*** | −5.74*** |
| | (0.42) | (0.61) | (0.18) | (0.18) | (0.36) | (0.34) |
| $\beta_n^{tech\_agr}$ | 0.17 | 2.90*** | 2.12*** | 1.61*** | 1.77*** | 2.12*** |
| | (0.39) | (0.47) | (0.09) | (0.08) | (0.27) | (0.19) |
| $\beta_n^{animal\&plant\_health}$ | −1.99*** | −0.36 | −2.42*** | 0.40*** | −2.96*** | 1.17*** |
| | (0.16) | (0.80) | (0.20) | (0.07) | (0.32) | (0.45) |
| Opt-out (ASC) | −38.09*** | −14.58*** | −11.70*** | −28.80*** | −13.36*** | −24.23*** |
| | (1.71) | (0.42) | (0.16) | (0.67) | (0.64) | (1.39) |
| Course fee (price) | −0.12*** | −0.21*** | −0.19*** | −0.16*** | −0.24*** | −0.12*** |
| | (0.01) | (0.06) | (0.02) | (0.01) | (0.00) | (0.02) |
| *Standard Deviations* | *Young* | *Old* | *Full-time* | *Part-time* | *Participant* | *Non-participant* |
| $\beta_n^{duration\_long}$ | 6.39*** | 4.27*** | 5.00*** | 4.43*** | 4.04*** | 6.02*** |
| | (0.37) | (0.39) | (0.26) | (0.49) | (0.05) | (0.64) |
| $\beta_n^{75\%\_online}$ | 8.00*** | 10.85** | 7.83*** | 7.08*** | 10.52*** | 6.00*** |
| | (0.97) | (4.80) | (0.66) | (0.26) | (0.20) | (1.93) |
| $\beta_n^{75\%\_inperson}$ | 6.55*** | 7.02*** | 6.61*** | 7.45*** | 9.23*** | 7.26*** |
| | (0.31) | (0.33) | (0.48) | (0.15) | (0.35) | (0.97) |
| $\beta_n^{tech\_agr}$ | 6.92*** | 4.01*** | 3.67*** | 7.15*** | 6.64*** | 5.60*** |
| | (0.34) | (1.04) | (0.26) | (0.91) | (0.18) | (0.29) |
| $\beta_n^{animal\&plant\_health}$ | 8.97*** | 9.16*** | 9.76*** | 7.92*** | 8.90*** | 8.97*** |
| | (0.42) | (1.04) | (0.13) | (0.22) | (0.25) | (0.89) |
| Opt-out (ASC) | 38.93*** | 22.06*** | 20.73*** | 28.98*** | 22.17*** | 30.70*** |
| | (0.88) | (6.14) | (1.11) | (0.29) | (0.03) | (3.59) |
| Course fee (price) | 0.25*** | 0.42*** | 0.96 | 0.40*** | 1.10*** | 0.20*** |
| | (0.02) | (0.12) | (2.41) | (0.02) | (0.06) | (0.02) |
| Observations | 5112 | 7956 | 7668 | 5400 | 6120 | 6948 |
| LLF | −1327.27 | −1910.18 | −1876.86 | −1322.91 | −1388.14 | −1849.65 |
| *Poe test* | *p-value* | | *p-value* | | *p-value* | |
| $\beta_n^{duration\_long}$ | 0.50 | | 0.00 | | 0.17 | |
| $\beta_n^{75\%\_online}$ | 0.00 | | 0.00 | | 0.00 | |

*(Continued)*

**Table 4.** Continued.

| | Age | | Full-time/part-time | | Young Farmer Payment | |
|---|---|---|---|---|---|---|
| Means (mWTP) | Young | Old | Full-time | Part-time | Participant | Non-participant |
| $\beta_n^{75\%\_inperson}$ | 0.00 | | 0.00 | | 0.00 | |
| $\beta_n^{tech\_agr}$ | 0.00 | | 0.00 | | 0.14 | |
| $\beta_n^{animal\&plant\_health}$ | 0.02 | | 0.00 | | 0.00 | |
| Opt-out (ASC) | 0.00 | | 0.00 | | 0.00 | |

Notes: *, **, *** indicate statistical significance at the 10%, 5%, and 1% level. In parenthesis, robust standard errors clustered at the agricultural qualification level. Course fee divided by 100. The definition of the group variables is reported in Table 2.

for a course that allows them to save time, namely shorter and delivered online (Deming et al. 2019; Kilpatrick and Johns 2003). The Poe test on the ASC ($p < 0.01$) indicates that part-time farmers opted-in for the course more than full-time farmers to confirm this.

Finally, farmers who participated in the YFP opted-in less to taking the course. This indicates a low interest towards educational progression as the level 2 qualification in agriculture is one of the requirements of YFP in NI (DAERA, 2021), i. e. farmers with a level 2 in agriculture were the least interested in the level 3 course. This result is in contrast with other studies that indicated that prior education is positively linked to further training (Kilpatrick and Johns 2003; Seymour and Barr 2014), and it can be due to two elements introduced by the YFP in NI. First, YFP farmers may have expected the course proposed in this survey to be funded as they received a subsidy to participate in the level 2 course. Second, a particularly short level 2 part-time certificate in agriculture was developed in NI to meet the eligibility criteria of the YFP (CAFRE 2022). In other words, YFP farmers may have had an expectation about the course duration.

### *4.3 Heterogeneity of WTP distributions by farm characteristics*

Table 5 reports the results by farm characteristics and indicates that operators of large farms located in the lowland areas (non-LFA) reported the highest interest in technical agricultural topics as shown by their mWTP which was equal to £326 and £303, respectively. This finding is consistent with studies that indicated that operators of larger and more productive farms are interested in specialised skills to increase productivity of their farms (Sheng and Chancellor 2019; Sumner 2014).

Regarding the farm type, Table 5 indicates that beef and sheep farms opted-in for the course less than other types of farms. This result is interesting considering that beef and sheep farms have a series of characteristics typical of course adopters, for example small area, located in LFAs, and have twice the incidence of part-time farmers than other farm types as shown in Figure 4. The only characteristic linked to a lower adoption of the course that differentiates beef and sheep farms from other farm types is the higher participation in the YFP as indicated by the Pearson's chi-squared tests in Figure 4. This suggests that linking a level 2 course to the YFP allowed it to reach a large audience of farmer-students (beef and sheep) although it may have saturated its most prominent market segment.[6]

Finally, Table A1 of the appendix reports the estimates by additional variables and confirms the previous results. Specifically, farmers less reliant on the farm income and with fewer labour units opted-in for the course more than their respective counterparts. Similarly, farmers with only practical training opted-in more than those with a prior level 2 qualification in agriculture. Finally, female and college degree farmers were less concerned about time availability than their male and secondary school farmers although they reported a similar participation to the course. This result disagrees with other studies which indicated that female and college degree farmers are more likely to engage in agriculture training (Kilpatrick and Johns 2003; Murray-Prior, Hart, and Dymond 2000; Seymour and Barr 2014).

**Table 5.** Mixed multinomial logit model estimates by farm characteristics.

| | Farm area | | Land type | | Farm type | |
|---|---|---|---|---|---|---|
| Means (mWTP) | Small | Large | LFA | Non-LFA | Beef and sheep | Other |
| $\beta_n^{duration\_long}$ | −1.64*** | −4.05*** | −1.23*** | −3.66*** | −2.66*** | −2.54*** |
| | (0.46) | (1.00) | (0.48) | (0.27) | (0.46) | (0.26) |
| $\beta_n^{75\%\_online}$ | 2.76*** | 8.28*** | 3.94*** | 6.87*** | 4.82*** | 5.73*** |
| | (0.48) | (0.32) | (0.72) | (2.08) | (0.16) | (0.68) |
| $\beta_n^{75\%\_inperson}$ | −4.33** | −14.02*** | −4.92*** | −5.41*** | −6.40*** | −8.86*** |
| | (1.83) | (1.85) | (1.13) | (1.12) | (0.62) | (0.79) |
| $\beta_n^{tech\_agr}$ | 1.78*** | 3.26*** | 1.19 | 3.03*** | 1.90** | 1.64*** |
| | (0.24) | (0.58) | (0.99) | (0.07) | (0.84) | (0.05) |
| $\beta_n^{animal\&plant\_health}$ | 1.30*** | −0.96 | 0.24 | −2.09** | −0.39*** | −1.53*** |
| | (0.19) | (0.57) | (0.66) | (1.01) | (0.13) | (0.16) |
| Opt-out (ASC) | −22.30*** | −14.27*** | −28.31*** | −7.89** | −20.16*** | −29.57*** |
| | (0.75) | (2.50) | (2.28) | (3.33) | (0.53) | (0.32) |
| Course fee (price) | −0.16*** | −0.16*** | −0.13*** | −0.24* | −0.19*** | −0.11*** |
| | (0.01) | (0.06) | (0.01) | (0.15) | (0.01) | (0.01) |
| *Standard Deviations* | *Small* | *Large* | *LFA* | *Non-LFA* | *Beef and sheep* | *Other* |
| $\beta_n^{duration\_long}$ | 2.79*** | 7.58*** | 3.29*** | 5.08*** | 3.08*** | 9.19*** |
| | (0.72) | (0.46) | (0.69) | (0.13) | (1.06) | (0.13) |
| $\beta_n^{75\%\_online}$ | 8.68*** | 11.47*** | 6.75*** | 9.15*** | 7.29*** | 10.62*** |
| | (1.28) | (0.44) | (0.90) | (1.38) | (0.93) | (0.88) |
| $\beta_n^{75\%\_inperson}$ | 6.74*** | 13.15*** | 7.48*** | 5.84*** | 6.91*** | 10.09*** |
| | (0.65) | (1.11) | (0.87) | (0.20) | (0.12) | (0.62) |
| $\beta_n^{tech\_agr}$ | 7.59*** | 5.32*** | 6.21*** | 3.82*** | 2.97*** | 7.84*** |
| | (0.42) | (0.06) | (0.69) | (0.13) | (0.99) | (0.20) |
| $\beta_n^{animal\&plant\_health}$ | 9.28*** | 9.16*** | 8.52*** | 10.66*** | 6.88*** | 11.04*** |
| | (0.04) | (0.64) | (1.94) | (0.12) | (0.95) | (0.20) |
| Opt-out (ASC) | 24.64 | 29.34*** | 27.09 | 20.10*** | 24.34*** | 42.88*** |
| | (0.48) | (4.06) | (1.57) | (3.57) | (1.27) | (0.30) |
| Course fee (price) | 0.21*** | 0.89 | 0.22*** | 0.62 | 0.68 | 0.34*** |
| | (0.01) | (0.80) | (0.07) | (0.81) | (1.15) | (0.05) |
| Observations | 7272 | 5796 | 6912 | 6156 | 9396 | 3672 |
| LLF | −1881.91 | −1340.49 | −1812.33 | −1449.74 | −2315.37 | −927.78 |
| *Poe test* | *p-value* | | *p-value* | | *p-value* | |
| $\beta_n^{duration\_long}$ | 0.02 | | 0.00 | | 0.40 | |
| $\beta_n^{75\%\_online}$ | 0.00 | | 0.09 | | 0.10 | |
| $\beta_n^{75\%\_inperson}$ | 0.00 | | 0.38 | | 0.01 | |
| $\beta_n^{tech\_agr}$ | 0.01 | | 0.03 | | 0.38 | |
| | 0.00 | | 0.03 | | 0.00 | |
| Opt-out (ASC) | 0.00 | | 0.00 | | 0.00 | |

Notes: *, **, *** indicate statistical significance at the 10%, 5%, and 1% level. In parenthesis, robust standard errors clustered at the agricultural qualification level. Course fee divided by 100. The definition of the group variables is reported in Table 2.

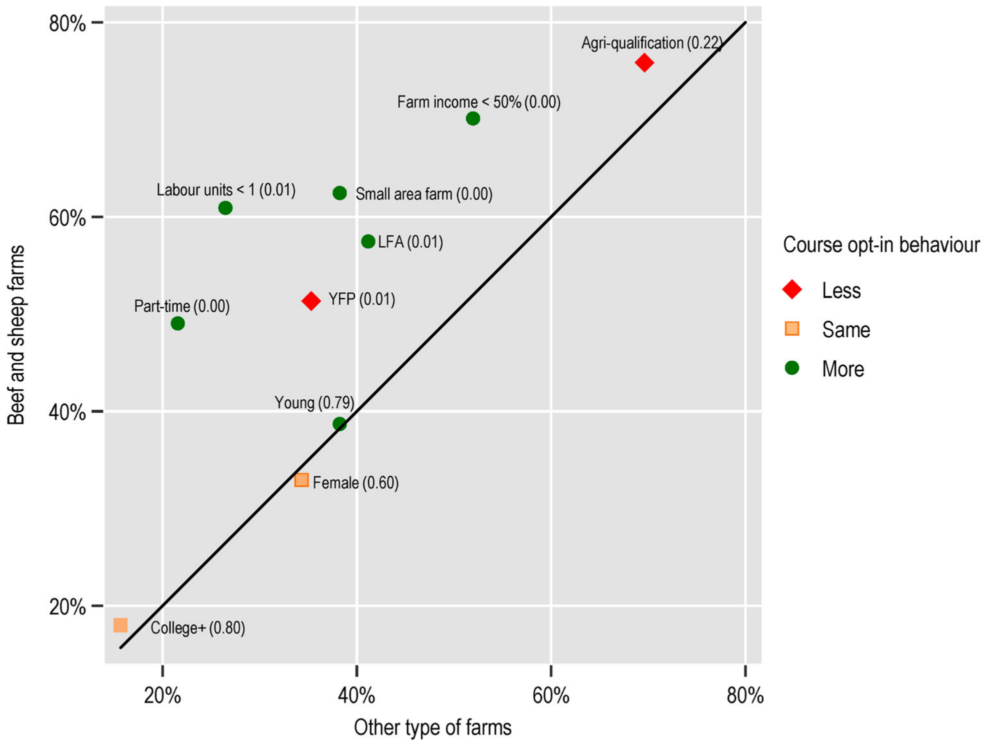


**Figure 4.** Sample characteristics and course adoption by farm type. The axes show the percentage of farms by farm type with a given characteristic. In parenthesis, the *p*-value of the Pearson chi-squared test on the independence across farm type (Chi2(1)). The classification of the course opt-in behaviour (less, same, more) is based on the statistical significance of the Poe test on opt-out ASC by farmer/ farm's characteristic reported in Tables 4 and 5, and Table A1 of the appendix. The solid line is at 45$^{\circ}$ angle.

## 5. Conclusions

Educational decisions affect the size and structure of human capital and have important consequences for individuals and the economy (Sumner 2014). In agriculture, formal education contributes to acquire skills to face the challenges associated to food safety, food security, and environmental sustainability (Coomes et al. 2019). However, across countries most farmers have only practical training in agriculture (Data USA 2019; Eurostat 2013). In this paper, we test how the design of courses that meet the needs of farmers can be used to promote their formal agriculture education by conducting a DCE survey with 363 farmers in NI. Specifically, we explore the trade-offs that farmers' face amongst different attributes of the course. This research makes three contributions to the literature.

First, while there is a wide literature exploring the impact of formal education on farmers' performance (Giannakis and Bruggeman 2015; Pindado and Sánchez 2019), resilience (Makate et al. 2019; Velandia et al. 2009), and adoption of pro-environmental behaviours (Padel 2001; Picazo-Tadeo, Gómez-Limón, and Reig-Martínez 2011; Van Passel et al. 2009), our study represents the first attempt to directly explore farmers' preferences for different attributes of a diploma in agriculture. Specifically, farmers prefer a course with 75% of teaching activity delivered online, organised in a shorter period (2 years), and focused on technical agricultural topics such as livestock nutrition and breeding, soil and grassland management, and crop production. At the aggregate level, our results show that farmers preferred online teaching over every other attribute indicating that they see this option as the most suitable to combine farm work and study. This is important as the relevance of online teaching will increase in the future for educational institutions (Brown and Fraser 2011; Charatsari, Papadaki-Klavdianou, and Michailidis 2011) and agricultural extension services (Giulivi et al. 2023).

Second, it is important to diversity and upgrade the learning offer to mitigate the low interest of YFP farmers. In relation to this, our results indicate that organising classes in the evenings can help to overcome farmers' concerns around time taken away from their daily farming activities (Kilpatrick and Johns 2003). Similarly, more emphasis on technical agricultural topics can stimulate the participation of more experienced farmers operating in large farms located in lowland areas. This should be a policy goal considering that these farmers are responsible for half of the value of the agricultural output in NI (DAERA 2020) and that the number of young new entrant-farmers is expected to continue to fall (Vigani et al. 2020).

Moreover, farmers' participation in the YFP may have created an expectation in terms of duration of the course that discouraged them to progress from the level 2 certificate to the level 3 certificate. This is because a particularly short part-time course was offered to farmers in NI to obtain a level 2 certificate in agricultural studies and be eligible for the YPF. In addition, farmers may have had an expectation that they may receive access to a subsidy which was the case under the YFP. Considering this, our results indicate that education providers should balance the trade-offs between marginal benefit and commitment across qualifications by making the progression more uniform such that farmers that earned a lower-level diploma are encouraged to move to the next qualification stage.

Finally, our findings indicate that skills in animal and plant health are regarded as the least important by farmers. Farmers need these skills to give their contribution to disease control and safe use of medicine in food production (Sok and Fischer 2020). More broadly, farmers value training in relation to the performance of their farm businesses as particularly important and were less concerned about their role as agricultural land stewards (Giannakis and Bruggeman 2015). This finding agrees with Fielke and Bardsley (2014) that found that the socio-environmental outcome of the agricultural land use is prioritised mostly by farmers with a university degree to suggest that there is a threshold in the educational spectrum below which farmers are less interested in environmental topics. From this point of view, the incorporation of environmental education at various stages of human development, from preschool centres to extension services, can increase farmers' adoption of sustainable farming practices (Fielke and Bardsley 2014). Furthermore, investing in education even outside a specific agricultural focus, can promote farmers' behavioural change towards socio-environmental outcomes of their agricultural land use (Coomes et al. 2019).

The case study is Northern Ireland, a region of the UK with a particular low level of formal training amongst those involved in managing farm businesses (DAERA 2019). From a policy perspective, our results are relevant to all those countries with a substantial skill gap in agriculture such as Northern Ireland, for example Romania, Bulgaria, Greece, Portugal, and Spain where more than 75% have only practical training (Eurostat 2013). Moreover, our results can be extended to other countries with disparities of agricultural skills across regions and that are interested in promoting farmers' education.

## Notes

1. In the UK, a level 3 qualification provides knowledge and understanding of facts, procedures, $\beta_n^{animal\&plant\_health}$ and ideas in the area of study or field of work to complete complex and non-routine problems (UK Government 2021). A similar qualification is present across EU countries as a level 2 or level 3 depending on the national framework (EuroPass 2022).
2. In the UK, the level 2–4 qualifications range from basic and practical knowledge and solving routine tasks to more technical training to handle complex tasks (UK Government 2021).
3. The value of individuals' skills, knowledge, and competencies in the labour market, i. e. human capital, is £363k per person in the working age population in NI compared to £487k in the UK overall (Northern Ireland Statistical Research Agency 2023).
4. The analysis of the literature review (Seymour and Barr 2014; Charatsari, Papadaki-Klavdianou, and Michailidis 2011; Murray-Prior, Hart, and Dymond 2000) and discussions with DAERA and education providers from CAFRE indicated to set the age limit at 45 years for potential farmer-students.
5. The FBS data are collected annually by DAERA and is a stratified sample of all farms in NI (DAERA 2018).
6. Amongst farmers that did not take part to YFP, the two sample-test of equal proportions indicates that beef and sheep opted-in for the course more than other farm types ($p - value < 0.01$).

## Disclosure statement

No potential conflict of interest was reported by the author(s).


## Funding

This work was supported by Department of Agriculture, Environment and Rural Affairs, UK Government: [Grant Number grant number E-I 19-2-02].


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## Appendix

**Table A1.** Mixed multinomial logit model estimates by additional farmer and farm's characteristics.

| | Gender | | Education | | Agricultural qualification | | Share of farm income | | Farm labour force | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Means (mWTP)* | *Women* | *Men* | *College+* | *College-* | *Level 2* | *Practical training* | $\leq$ 50% | $>$ 50% | $<$ 1 *unit* | $\geq$ 1 *unit* |
| $\beta_n^{duration\_long}$ | −2.08*** | −2.94*** | −1.81*** | −3.80* | −2.09*** | −2.74*** | −1.17*** | −6.63*** | −1.19*** | −2.61*** |
| | (0.12) | (0.20) | (0.08) | (2.28) | (0.39) | (1.09) | (0.26) | (0.29) | (0.28) | (0.24) |
| $\beta_n^{75\%\_online}$ | 3.17*** | 5.82*** | 1.47*** | 4.98*** | 5.74*** | 6.21*** | 2.50** | 10.11*** | 2.31*** | 6.98*** |
| | (0.40) | (0.04) | (0.22) | (1.25) | (0.52) | (1.75) | (1.22) | (0.63) | (0.03) | (0.32) |
| $\beta_n^{75\%\_inperson}$ | −3.67*** | −6.74*** | −4.35*** | −6.53*** | −5.48*** | −10.80*** | −5.61*** | −10.70*** | −7.26*** | −7.12*** |
| | (0.19) | (1.70) | (0.77) | (0.48) | (0.76) | (1.73) | (0.47) | (2.31) | (0.79) | (0.18) |
| $\beta_n^{tech\_agr}$ | 0.22*** | 1.66*** | 3.11*** | 1.56*** | 1.86*** | 0.43 | 1.50*** | 2.16*** | 2.69*** | 1.71*** |
| | (0.05) | (0.34) | (0.27) | (0.53) | (0.42) | (1.39) | (0.31) | (0.54) | (0.62) | (0.11) |
| $\beta_n^{animal\&plant\_health}$ | −0.94 | −1.35 | 1.37*** | −1.47 | −1.85** | 0.00 | −0.01 | −4.71*** | 1.69*** | −3.58*** |
| | (0.81) | (1.52) | (0.41) | (3.53) | (0.85) | (1.38) | (0.67) | (0.40) | (0.24) | (0.10) |
| Opt-out (ASC) | −22.89*** | −19.71*** | −26.42*** | −20.65*** | −15.68*** | −29.68*** | −27.77*** | −8.73*** | −16.82*** | −12.94*** |
| | (9.10) | (0.33) | (1.57) | (7.08) | (0.73) | (4.58) | (1.37) | (1.73) | (1.39) | (0.62) |
| Course fee (price) | −0.21*** | −0.16*** | −0.18*** | −0.15** | −0.19*** | −0.09*** | −0.15*** | −0.22*** | −0.16*** | −0.17*** |
| | (0.07) | (0.03) | (0.001) | (0.07) | (0.02) | (0.02) | (0.01) | (0.00) | (0.02) | (0.03) |
| *Standard Deviations* | *Women* | *Men* | *College+* | *College-* | *Level 2* | *Practical training* | $\leq$ 50% | $>$ 50% | $<$ 1 *unit* | $\geq$ 1 *unit* |
| $\beta_n^{duration\_long}$ | 0.36*** | 6.36*** | 5.38*** | 6.73* | 4.59*** | 7.38*** | 1.28 | 6.48*** | 3.10*** | 4.97*** |
| | (0.07) | (2.01) | (0.81) | (3.88) | (0.36) | (1.16) | (1.22) | (0.35) | (0.09) | (0.25) |
| $\beta_n^{75\%\_online}$ | 4.97*** | 8.29*** | 6.72*** | 9.47*** | 10.18*** | 11.53*** | 8.24*** | 12.31*** | 8.24*** | 9.55*** |
| | (0.42) | (1.67) | (0.44) | (2.78) | (1.27) | (2.12) | (1.31) | (0.36) | (1.06) | (0.25) |
| $\beta_n^{75\%\_inperson}$ | 7.41*** | 6.15*** | 7.55*** | 7.96*** | 9.22*** | 8.79*** | 7.29*** | 10.29*** | 6.74*** | 8.18*** |
| | (0.36) | (0.36) | (0.92) | (0.19) | (0.75) | (1.59) | (0.64) | (1.50) | (0.35) | (0.51) |
| $\beta_n^{tech\_agr}$ | 2.71*** | 7.06*** | 6.14*** | 5.42*** | 4.37*** | 8.96*** | 7.01*** | 4.28*** | 7.16*** | 3.02*** |
| | (0.62) | (1.56) | (0.21) | (0.29) | (0.48) | (2.24) | (0.88) | (0.47) | (0.12) | (0.12) |
| $\beta_n^{animal\&plant\_health}$ | 3.97*** | 11.19*** | 8.80*** | 8.64*** | 8.44*** | 10.02*** | 8.21*** | 11.34*** | 9.95*** | 6.49*** |
| | (0.54) | (0.41) | (0.73) | (0.53) | (0.74) | (1.56) | (1.23) | (1.01) | (0.46) | (0.23) |
| Opt-out (ASC) | 20.86* | 24.82*** | 21.80*** | 25.45*** | 25.39*** | 42.46*** | 27.37*** | 22.32*** | 28.84*** | 20.71*** |
| | (12.15) | (2.08) | (1.13) | (10.21) | (2.18) | (7.82) | (1.76) | (3.02) | (4.73) | (0.50) |
| Course fee (price) | 0.46*** | 0.22*** | 0.18*** | 0.68*** | 0.59*** | 0.19*** | 0.22*** | 1.06 | 0.18*** | 0.74*** |
| | (0.12) | (0.03) | (0.02) | (0.13) | (0.18) | (0.02) | (0.01) | (0.81) | (0.01) | (0.09) |
| Observations | 2268 | 10800 | 4356 | 8712 | 9684 | 3384 | 8496 | 4572 | 6696 | 6372 |
| LLF | −545.97 | −2718.35 | −1099.23 | −2132.90 | −2380.61 | −884.08 | −2190.03 | −1009.31 | −1723.94 | −1508.66 |
| *Poe test* | *p-value* | | *p-value* | | *p-value* | | *p-value* | | *p-value* | |
| $\beta_n^{duration\_long}$ | 0.00 | | 0.19 | | 0.29 | | 0.00 | | 0.00 | |
| $\beta_n^{75\%\_online}$ | 0.00 | | 0.00 | | 0.40 | | 0.00 | | 0.00 | |

| | | | | | |
|---|---|---|---|---|---|
| $\beta_n^{75\%\_inperson}$ | 0.0 | 0.01 | 0.00 | 0.02 | 0.43 |
| $\beta_n^{tech\_agr}$ | 0.00 | 0.01 | 0.17 | 0.15 | 0.06 |
| $\beta_n^{animal\&plant\_health}$ | 0.41 | 0.21 | 0.12 | 0.00 | 0.00 |
| Opt-out (ASC) | 0.37 | 0.21 | 0.00 | 0.00 | 0.01 |

*, **, *** indicate statistical significance at the 10%, 5%, and 1% level. In parenthesis, robust standard errors clustered at the agricultural qualification level. Course fee divided by 100. The definition of the group variables is reported in Table 2.