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Submitted Article

# Exploring the Role of Incentives in Agricultural Extension Programs

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**Abstract** *While many governments subsidize extension programs, financial incentives for participation in extension programs are rare and little is known about such initiatives. This article assesses whether a financial incentive for an agricultural extension program for dairy farmers in Ireland has an impact on the type of farmer that participates in extension services. The findings reveal that financial incentives encourage participation, especially with cohorts of farmers that previously eschewed such programs. Several aspects of the overall economic effectiveness of the extension program are discussed and policy recommendations are outlined.*

**Key words:** Agricultural extension, Financial incentives, dairy farms.

**JEL codes:** Q12, Q16.

Agricultural extension is often considered to have private rather than public good characteristics, and hence the shift towards more privatized provision of extension services in many countries. It has been argued by some that information and advice that is farm-specific does not have public good characteristics (Marsh and Pannell 2000). While information per se is often seen as a public good, information provision becomes complicated for private extension services if non-fee-paying farmers cannot be prevented from benefiting from this information (Umali and Schwarz 1994). However, proponents of publicly funded extension argue that there is a larger societal gain from investing in agricultural extension, especially when publicly funded extension is targeted at agri-environmental measures, or other mechanisms designed to increase positive or reduce negative externalities associated with farming.

Privatizing extension into a "fee for service" can result in a truncation of the demand for extension, where only commercial farmers can afford to pay for the services. This has led to a concentration of extension services in

productive regions that contain large farms, thus excluding farmers in disadvantaged regions from the market, which has had adverse effects on both the productivity of farming and balanced rural development (Cary 1993). In addition, governments often decide to concentrate extension services in regions with high agricultural potential (Dercon et al. 2009), thereby adding to this adverse effect.

Governments play an active role in the operation of extension services in many countries, promoting extension in order to diffuse knowledge and promote technology adoption. For example, the EU Commission has used programs under Pillar II of the Common Agricultural Policy (CAP) for many years to fund public extension programs. Within the EU there is now a renewed interest in the importance of knowledge transfer, which is evident by the creation of European Innovation Partnerships (EIPs) to promote "faster and wider transposition of innovative solutions into practice by better linking research and practical farming," (EU SCAR 2012). Apart from co-financing, public bodies have also sought to increase the number of farmers using extension by making services more accessible, and such efforts have led to a gradual transformation of extension services from a largely linear model with a top-down approach, to more participatory or farmer-led approaches (Rivera 1996). However, to date efforts by governmental agencies to increase participation in extension services have largely been confined to funding or co-funding of such services. In contrast, direct financial rewards to farmers for participating in extension programs are a relatively new policy phenomenon, and consequently very little knowledge exists about the impact of such a government intervention.

This study aims to fill this knowledge gap by assessing whether extension programs that are directly incentivized by payments to farmers make extension services accessible to a larger variety of farmer types. This is particularly relevant as it is widely recognized that efficiency gains in the agricultural sector can be achieved through improvements by frontier farmers, as well as a catching up processes of less productive farmers (Kimura and LeThi 2013). By encouraging the participation of a wider cohort of farmers in extension services, efficiency gains within the sector can be achieved through both means. To this end, this paper uses data from Ireland to assess the effectiveness of an extension program that financially rewards farmers for participation.

The paper begins by embedding our research in the existing literature. This is followed by a description of the extension scheme under consideration. Next, a theoretical model of participation in extension programs is developed, the empirical specification required for estimating such a model is described, and a presentation of the results follows. The paper concludes with a discussion of the effectiveness of the extension program, and policy recommendations for possible changes are outlined.

## Relevant Literature

In line with the significant public expenditure on extension programs worldwide, a large number of studies have been conducted in this area. For example, there is an extensive body of literature on the evaluation of extension programs (e.g., Birkhaeuser et al. 1991; Feder et al. 2004; Marsh et al. 2004; Dercon et al. 2009; Davis et al. 2011; Läpple et al. 2013). Overall,

outcomes of extension services are generally positive (Dercon et al. 2009; Davis et al. 2011), but some also report mixed results (Feder et al. 2004).

In contrast, relatively little research has been published on the factors influencing participation in extension programs. One exception to this trend is Akobundu et al. (2004). While mainly focusing on the economic impact of extension on limited-resource farmers in the U.S. state of Virginia, the authors also explored factors that affect joining extension programs. The paper assessed a small farm outreach, training, and technical assistance program that involved farm management specialists who provided one-to-one and group training. The findings of the participation model revealed that only race and prior visit by an extension agent were significant determinants of participation in the extension program, while farm and farmer characteristics such as farm size, off-farm income, and education were not found to have a significant impact on participation. In terms of economic impact, the paper concluded that sufficient intensity of participation was necessary for the program to contribute to an increased farm income.

To increase participation in extension services and thereby improve performance of the sector, it is important to know the different farmer types who participate in extension programs. Within this context, the factors affecting participation in extension services are similar to those affecting the uptake of agricultural technologies in general, in terms of the adoption and diffusion process. Diffusion was first described by rural sociologists with a sigmoidal curve, based on the observation that only a few farmers adopt new technologies in the early stage of the diffusion process (Rogers 1962). Based on this observation, Rogers (1962) categorized adopters into five groups (innovators, early adopters, early majority, late majority, and laggards) with distinct characteristics. For example, the innovators are characterized as adventurous risk-takers who are strongly connected with other innovators but may not be respected by other members in the social system. Pannell et al. (2006) also highlighted the importance of social networks for adoption decisions and stressed the importance of geographic proximity, which has also been found to be an important influence factor in the adoption process by Holloway and Lapar (2007) and Läpple and Kelley (2015). According to Rogers (1962), the early adopters are more embedded in the social community and present a model to follow that is based on thorough information gathering, which has also been identified as being important for adoption decisions by others (e.g., Genius et al. 2006). Rogers' early majority are farmers who carefully consider adopting new ideas, while the late majority tends to adopt a new technology only after it is more widely diffused. This group is often older and less educated than earlier adopters. Again, this is in line with literature findings that risk adversity, increasing age, and lower levels of education can constrain adoption (e.g., Feder et al. 1985; Gardebroek 2006). Rogers' last category, the laggards, focus on traditional values and are the slowest to adopt, if they adopt a new technology at all. While Rogers' adopter categories may lead to the conclusion that farmers with certain characteristics always adopt technologies early or late, Pannell et al. (2006) argued that adoption decisions depend on personal circumstances, as well as characteristics of the new technology. Hence, typical innovative characteristics only lead to early technology adoption if the technology provides advantages to the farmer. This implies that if a farmer adopts one technology early, it does not automatically mean that the farmer always adopts technologies early.

However, within the vast body of literature on the related and very pertinent topic of technology adoption, to date, only a few studies have looked at differences in the factors affecting technology adoption over time, and no studies have categorized farmer types who participate in extension programs over time.

One of the few examples in relation to technology adoption is a study by Läpple and VanRensburg (2011) explaining the adoption of organic farming of Irish drystock farmers over time. The study revealed that the factors that affect uptake decisions play a different role for early, medium, and late adopters, particularly with regard to farm intensity, age, information gathering, as well as attitudes of the farmer. Another example is Barham et al. (2004), who explored agricultural biotechnology adoption of Wisconsin dairy farmers. By separating farmers into non-adopters, early-, late- and dis-adopters, these authors' findings revealed that attitudes toward biotechnology as well as location are linked to early adoption. The size of the farm and complementary technology emerged to be important factors for all adopter groups. Finally, Diederen et al. (2003), focusing on agricultural innovation, assessed differences between innovators, early adopters and laggards utilizing Dutch data. This study used structural and socio-demographic characteristics, such as age, to describe differences in adoption behavior between early and later adopters, while external sources of information and contribution to the development of the new technology explained differences between innovators and early adopters.

The general paucity of studies focusing on participation decisions and resulting farmer types in extension programs in general, and differences over time in particular, highlights the need for further research in this area. Hence, the current work provides a significant contribution to the literature on extension services, as well as important policy insights in relation to publicly funded extension programs.

## Background

The imminent removal of milk quotas in the EU in 2015 is placing a renewed focus on output-enhancing technologies and farm-level productivity gains across the dairy farming sector of Europe, a sector largely stifled of growth opportunities under the milk quota regime Läpple and Hennessy (2012). It was in this context that the Irish Department of Agriculture launched the Dairy Efficiency Programme (DEP) in 2009. The program was designed to achieve efficiency gains in the dairy sector through the promotion of technology transfer, and provided a financial reward to farmers for participating in discussion groups. Discussion groups are a form of participatory extension, and were actively used in Ireland as a form of extension for many years before the program was launched. However, in line with the scheme, the provision of discussion groups has been increased to accommodate a greater demand for discussion groups. Under the auspices of the DEP, farmers participating in the discussion groups received a payment of up to €1,000 in 2010, 2011, and 2012, amounting to an investment of almost €20 million over three years. Nevertheless, farmers still had to pay for participation in discussion groups. Hence, after deducting fees, the net financial gain from participation was generally €600 to €700 per annum. This payment applied to both new members and those who were already

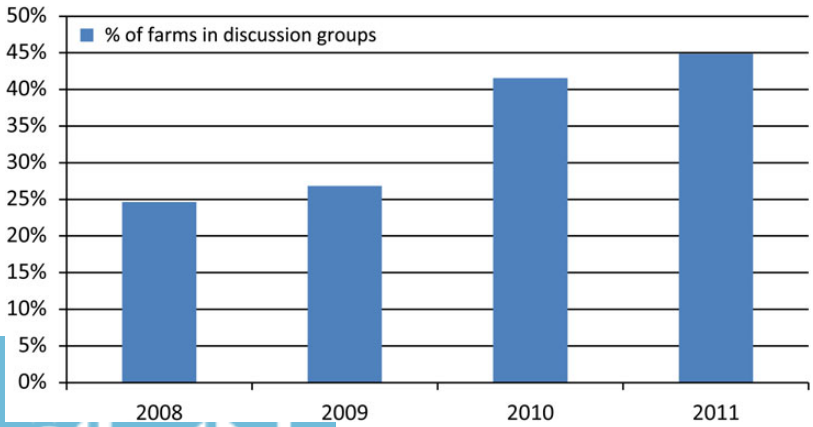
participating in discussion groups when the program was launched. The program was funded from the CAP's Single Payment Scheme fund. Following the Health Check agreement, Article 68(1) of Council Regulation (EC) 73/2009 made provision for the use of unspent Single Payment Scheme funds to address specific disadvantages affecting farmers in the dairy sector EC (2009).

In terms of the operational details of the program, discussion groups were held on a monthly basis focusing on topics such as the adoption of best practices in breeding, grassland, or financial management. Under the terms of the scheme and in order to receive the financial reward, farmers had to be officially registered as group members and were required to attend at least eight meetings in 2010 and nine in subsequent years. However, farmers were obliged to attend at least one meeting dealing with each of the three key areas and were also required to host one meeting at their own farm within the scheme period. In addition, farmers were expected to complete specific projects in relation to managing their finances, breeding and grass utilization, as well as to attend other extension events, such as research visits or open days.

Since the introduction of the DEP in 2010, the number of farmers participating in discussion groups has increased from 24.6% of all dairy farmers in 2008 to 44.8% in 2011. Figure 1 illustrates the development of discussion group membership from 2008 and 2011. Participation rates increased rapidly between 2009 and 2010 following the announcement of the DEP.

In terms of the benefits arising from discussion group participation, an economic analysis of Irish discussion groups revealed that although participation in extension services suffered from selection bias, the economic returns to membership were positive even when controlling for this bias. The study showed that a discussion group member could gain, on average, about €310 gross margin per hectare (or an approximate 12% increase) due to participation in discussion groups (Läpple et al. 2013). Much of this financial gain can be attributed to efficiency gains, and particularly to technology adoption. In fact, discussion group members have a statistically significant higher probability of adopting a wide range of technologies than non-members (Hennessy and Heanue 2012). The evidence of such positive impacts of discussion group membership, coupled with the information on the relatively limited participation rates, that is, skewed towards more

**Figure 1** Development of discussion group membership



intensive farms in advantaged regions, were critical motivating factors in the introduction of the DEP.

## Conceptual Framework and Empirical Specification

### *Theoretical Model of Extension Participation*

Becker (1965), in a seminal paper, assumed that households behave in accordance with a well-defined utility function related to the consumption of commodities, and that time is allocated between work and leisure so as to maximize that utility. Singh et al. (1986) further developed these theories in their oft-cited agricultural household model. In summary, the agricultural household model explains that technology and/or human capital that increases farm profits relaxes the budget constraint on households, and therefore allows farmers to allocate less time to farm work and more time to leisure while maintaining consumption, other things being equal. It follows then that utility-maximizing farmers will participate in an extension program if they believe that the benefits of participation ($B_{DG}$) exceed the cost of participation ($C_{DG}$).

Before the introduction of the financial incentive for participation in discussion groups, farmers decided to participate based only on the expected benefits and costs associated with participation. Expected benefits associated with participation may be pecuniary, such as reduced costs of production, increased productivity, and so forth, or may be non-pecuniary, and in some cases unobservable, such as the positive effect gained from interaction with peers. The expected costs may include observable variables such as fees paid for participation, time spent attending meetings, cost of travelling to meetings, and unobservable variables such as fear of group participation or reluctance to host group meetings.

While all of these factors are still relevant for decisions to participate after the scheme was launched, the financial incentive offered for participation, as well as the increasing number of discussion groups, have considerably changed farmers' expected costs and benefits. The benefits of participation now include the associated payment $P$. Costs of participation change as well, by $T$, due to an increased provision of discussion groups that improves accessibility and thereby reduces travel costs. However, there are also increased transaction costs that come with the introduction of the scheme, such as compulsory attendance at a certain number of meetings. Whether or not private costs increase or decrease depends on the individual farmer's preferences, which are unobserved to the researcher. However, it becomes clear that the utility threshold to join discussion groups has changed, and a farmer is expected to jC$_{DG}$oin if $B_{DG} + P > C_{DG} + T$.

In summary, the utility $U_{DG}$ received from participation in an extension program is a function of the expected benefits $B_{DG}$ and costs associated with participation, payment $_P$ and additional costs/benefits $_T$, where applicable, and a vector of farm and farmer characteristics $_Z$, that affect the expected benefits and costs of participation, such that:

$$U_{DG} = f\,(B_{DG},\ P,\ C_{DG}, \mathrm{T}, Z).$$

It is clear from our theoretical model that the participation decision has changed with the introduction of the scheme. Although all of those

participating in the extension program in 2011 receive the financial award, due to the above outlined reasons, it is important to distinguish between early participants (i.e., those who joined before the scheme) and late participants (i.e., those who joined after the scheme was introduced), as well as non-participants (i.e., those who did not join). The empirical model, which is outlined next, will help to reveal important differences between these three farmer groups.

### *Empirical Model of Extension Participation*

Since there are multiple choices and particular interest lies in the individual effects of explanatory variables on each outcome, farmers' participation choices are modeled using a multinomial logit model. Although one could argue that the choices have a time order, particular interest lies in the differences between coefficient estimates between the individual groups, which cannot be revealed with an ordered choice model. In addition, multinomial logit models have been used in similar situations. Barham et al. (2004), for example, modeled early, late and dis-adoption of a biotechnology with a multinomial logit model, while Läpple and VanRensburg (2012) applied this model to explain early and late adoption of organic farming.

In general, the multinomial logit model is an extension of the binary logit model where the unordered response variable has more than two responses. The outcome variable $y_i$ can take on the values $j = 1, 2, \ldots J$, with $_J$ being a positive integer. In particular, the model explains the probability of early-participation ($j = 1$), late participation ($j = 2$), or non-participation ($j = 3$). The determinants associated with each category can be contrasted with the base category, which in this study is late participation. Interest lies in how *ceteris paribus* changes in the elements of $x_i$ affect the response probabilities $P(y_i = j|x), j = 1, 2, \ldots J$ (Wooldridge 2010), where $x$ represents a set of explanatory variables comprising farm and household characteristics that are expected to determine the participation decision. See, for example, Wooldridge (2010) or Long (1997) for a detailed explanation of a multinomial logit model. Overall, the model is used to reveal significant differences between early, late, and non-participants.

## Data

The analysis is based on Irish Farm Accountancy Data Network (FADN) data for 2010 (Hennessy et al. 2011) that are collected through the Irish National Farm Survey (NFS).[1] The NFS was established in 1972 and has been published on an annual basis since. Overall, a statistically representative random sample of 1,100 farms, representing a farming population of approximately 110,000 farms, is surveyed each year through a series of face-to-face interviews with a professional data collection team. Farms are classified into farming systems, based on the dominant enterprise that is calculated on a standard gross margin basis. The NFS distinguishes between six farming systems: specialized dairying, dairying other, cattle rearing, cattle other, mainly sheep, and tillage. Here, a sub-sample of 326 specialized dairy farms is used. While these farms are specialized in dairy production,

[1]*The FADN is the official database of farm-level information on farms in Europe. See http://ec.europa.eu/agriculture/rica/.*

there is typically a significant alternative enterprise also operating on the farm. In addition to data on the farm business, the farm operator, and the household, data on discussion group membership, including date of initial membership, are also recorded since 2008. Hence, it is possible to identify early, late and non-participants and assess their characteristics.

For the purposes of this study, farmers were categorized into three participation groups based on their initial year of participation. Farmers were classified as early participants if they participated in discussion groups before the government program was launched, that is, before 2009; this group accounts for 29.7% of our sample.[2] Farmers were classified as late participants if they participated in discussion groups after the payment for participation in discussion groups was announced, that is, 2009; this group accounts for 17.2% of the sample. Finally, non-participants are farmers who do not participate in discussion groups; they account for 53.1% of the sample.

Drawing from the theoretical model above, the participation decision is affected by the perceived benefits and costs associated with participation. Based on the data at hand, explanatory variables that are likely to influence these expected benefits and costs are selected for the analysis. Previous studies have found that farm characteristics are likely to affect participation with larger, more intensive farms being more likely to participate (Cary 1993). Hence, farm characteristics including farm size, the size of the dairy herd, farming intensity measured as livestock density (i.e., the number of dairy cows per hectare of forage area), and the extent of specialization of the farm in dairy production are considered in this analysis. Additionally, the amount of family labor available on the farm and whether or not the farmer has an off-farm job are included. Studies of technology adoption cite the important positive influence of age, access to information, and education levels on the likelihood of adoption (Feder et al. 1985). Consequently, the age of the farmer at the year of participation and whether or not the farmer has formal agricultural education are considered in this analysis, with the prior expectation that younger and more educated farmers are more likely to be early participants in discussion groups. While a specific variable measuring farmers' access to information, either electronically or through membership of farm networks is not available, formal agricultural education is taken as a proxy. A description of variables used in this analysis, as well as their expected influences on overall participation in discussion groups, are depicted in table 1.

One of the objectives of the DEP was to expand the scope of discussion groups and to promote participation in less-advantaged dairy farming regions of the country. To explore the significance of the regional location of the farm in the participation decision, four regional dummy variables are included: South, South West, East, and North West. The South and the South West are considered typical dairy regions, and account for the majority of milk production with more intensive farms and favorable soil and climatic conditions. The east region is characterized by good soils and the majority of Ireland's (small proportion of) arable farms are located in this region. The North West region is typically seen as a more disadvantaged dairying region that is characterized by lower stocking density based on gley soils and higher rainfall areas.

[2]*Please note that the data used for the analysis are raw data, while the overall description of discussion group membership is based on weighted data in order to provide the reader with national representative figures.*

**Table 1** Description of Variables

| Variables | Definition | Hypothesised sign |
|---|---|---|
| South | = 1 if farm is located in the south region | + (early participants) |
| South West | = 1 if farm is located in the south-west region | +/− |
| East | = 1 if farm is located in the east region | +/− |
| North West | = 1 if farm is located in the north-west region | + (late participants) |
| UAA | Utilizable agricultural area of the farm measured in hectares | + |
| Dairy herd | Number of dairy cows | + |
| LU/ha | Dairy livestock units per hectare forage area | + |
| Specialization | Proportion of dairy livestock units to total livestock units | + |
| Age | Age of the farmer at year of joining for participants | − |
| Household members | Number of household members | + |
| Family labour | Family labor measured in standard man days | + |
| Agricultural education | If the farmer has formal agricultural education = 1, 0 otherwise | + |
| Off-farm job | If the farmer has an off-farm job = 1, 0 otherwise | +/− |

*Note: Hypothesized signs indicate the expected effect of a variable on the probability of a farmer to participate in extension programs. It applies for early and late participants, unless indicated otherwise.*

## Results

### *Comparison of Farmer Groups*

Initially, the farm and household characteristics of the three farmer groups are contrasted and compared. Table 2 presents summary statistics of the characteristics, classified by participation status.

One observation in relation to targets of the scheme is the difference in the regional distribution of participation rates between the groups. As shown, 41% of early participants are located in the South region, a typical dairy region. In contrast, almost 30% of late participants are located in the North West region, which is considered a more disadvantaged dairy region. This suggests that participation in discussion groups was more prevalent in more advantaged dairy regions prior to the introduction of the scheme, and later increased in more disadvantaged dairy regions. This was expected, as a greater number of discussion groups was offered to farmers with the introduction of the scheme.

A number of observations in relation to characteristics of the farmer groups are worth noting. First, focusing on early participants and non-participants only reveals that those two groups are quite different along a number of characteristics. The most obvious differences are in relation to the size of dairy herd, the farmer's age, and agricultural education. Early

**Table 2** Summary Statistics for the Sample by Participant Groups

| Variable | Non-participants n = 173 | Early participants n = 97 | Late participants n = 56 | All farms n = 326 |
|---|---|---|---|---|
| South | 0.27 | 0.41 | 0.21 | 0.30 |
| South West | 0.21 | 0.12 | 0.16 | 0.18 |
| East | 0.26 | 0.27 | 0.34 | 0.28 |
| North West | 0.26 | 0.20 | 0.29 | 0.24 |
| UAA | 56.44 (32.36) | 75.53 (32.77) | 66.05 (33.88) | 63.77 (33.71) |
| Dairy herd | 49.28 (30.78) | 86.07 (39.72) | 68.59 (37.13) | 63.54 (38.27) |
| LU/ha | 1.76 (0.53) | 1.99 (0.44) | 1.95 (0.48) | 1.86 (0.50) |
| Specialization | 0.57 (0.18) | 0.62 (0.10) | 0.60 (0.13) | 0.59 (0.15) |
| Age | 52.89 (10.54) | 40.01 (11.05) | 47.03 (10.33) | 48.05 (12.04) |
| Family labor | 1.40 (0.49) | 1.51 (0.53) | 1.48 (0.52) | 1.44 (0.51) |
| Household members | 3.38 (1.57) | 3.93 (1.68) | 3.82 (1.50) | 3.62 (1.61) |
| Agricultural education | 0.57 (0.50) | 0.86 (0.35) | 0.87 (0.33) | 0.71 (0.45) |
| Off-farm job | 0.12 (0.32) | 0.05 (0.22) | 0.05 (0.23) | 0.09 (0.29) |

*Note: Means and standard deviations appear in parentheses.*

participants have an average herd size of 86 dairy cows compared to 49 dairy cows for non-participants. Early participants are also younger (40 years versus 53 years), and a higher proportion have completed agricultural education (86% versus 57%), suggesting greater commitment to dairy farming by early participants. These findings are also in line with the general consensus in the literature that there are initial differences between farmers who participate in extension services and farmers who do not participate (e.g., Feder et al. 2004; Imbens and Wooldridge, 2009; Davis et al. 2011).

Of particular interest in this analysis, however, are late participants and how this group of farmers compares to early and non-participants. In certain characteristics, this group of farmers is similar to early participants, for example in relation to livestock density (animals per unit area), agricultural education, and engagement in off-farm jobs. However, in relation to farm and herd size, as well as specialization of the farm, late participants appear to lie between early and non-participants. It appears that agricultural education is an important factor in participation in discussion groups, which could be due to human capital factors or information dissemination about the existence of extension services through agricultural education. It is also worth noting that farmers who participate in extension services are less likely to be engaged in off-farm work, suggesting that off-farm work increases the opportunity costs of time (Genius et al. 2006), hence increasing the expected costs of participation.[3] Alternatively, having an off-farm income may reduce the necessity of improving the income-generating capacity of the farm.

Overall, two observations are worth highlighting: first, a change in the characteristics of the participants can be observed over time, which is in line

[3]*Due to the small percentage of farmers engaging in off-farm work, this variable is not included in the subsequent statistical analysis.*

with Rogers' (1962) adoption and diffusion theory. Second, the early participants show distinct characteristics of typical adopters of new technology, such as large farm size, younger age and higher levels of education. In contrast, the late participants are older and manage smaller farms, which is generally negatively associated with technology adoption (Feder et al. 1985). Given the characteristics of the late participants, it seems likely that they would tend to be low adopters of technology, even after participating in discussion groups. This, of course, could be a constraining factor in realizing the targets of the scheme as efficiency gains in the dairy sector are sought through the adoption of new technologies and farm practices.

### *Multinomial Logit Model*

The multinomial logit model separates individual farmers into three distinct participation groups in order to explore the factors that distinguish these groups. Given the considerable change in incentives to join discussion groups that accompanied the introduction of the DEP, particular interest lies in whether or not late participants significantly differ from early and non-participants. The results of the multinomial logit model are reported as relative risk ratios and are presented in table 3. In terms of interpretation, a relative risk ratio above one means a positive effect, while a value between zero and one implies the opposite. More specifically, for a unit change in an explanatory variable, the odds of one choice to another (e.g., early to late participation) are expected to change by the relative risk ratio, holding all other variables constant (Long and Freese 2006).

Overall, the model confirms that there are significant differences between the groups, which is revealed by a Wald test that rejects the null hypothesis that the three different farmer groups can be merged (e.g., early and late participants would be combined into one group). More specifically, the null hypotheses that non-participants and late participants or non-participants and early participants can be combined are rejected at the 1% level, while the null hypothesis that late and early participants can be combined is rejected at the 5% level. While the previous test is based on the overall characteristics, the individual coefficient estimates provide detailed insights into

**Table 3** Results of the Multinomial Logit Model

| Variables | Non-participants | Early participants |
|---|---|---|
| South West | 1.18 (0.62) | 0.38 (0.22)* |
| East | 0.66 (0.31) | 0.37 (0.18)** |
| North West | 0.51 (0.25) | 0.30 (0.16)** |
| Dairy herd | 0.99 (0.006)** | 1.01 (0.005)** |
| LU/ha | 0.73 (0.26) | 0.82 (0.33) |
| Specialization | 0.32 (0.40) | 0.58 (0.85) |
| Family labour | 0.61 (0.22) | 1.04 (0.37) |
| Age | 1.03 (0.02)** | 0.94 (0.01)*** |
| Household members | 1.03 (0.10) | 0.98 (0.11) |
| Agricultural education | 0.22 (0.10)** | 1.77 (0.99) |
| Log likelihood | −251.15 | |
| Pseudo-R2 | 0.23 | |

*Note: Asterisks ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Late participants as comparison group, relative risk ratios (RRR) are reported, standard errors (se) of RRRs are reported in parentheses and are calculated as* $se(RRR) = \exp(\beta) \cdot se(\beta)$.

the differences between the groups, which provide the basis for conclusions about the DEP.

Conducting a regional analysis first, the model reveals significant differences between early and late participants in relation to all regions, while there is no difference between non- and late participants. For example, the odds of an early participant being located in the South West, East or North West region in comparison to the South region are significantly lower compared to late participants. Stated differently, late participants are less likely to be located in the South region than in the remaining regions compared to early participants. These results statistically confirm our initial discussion about regional differences. More importantly, this suggests that with the introduction of the DEP, discussion groups have become more accessible in less intensive dairy regions such as the North West region. First, due to a greater number of discussion groups offered, travel costs for farmers in more remote regions decreased, thus reducing costs of participation. Second, the financial reward gives less productive farmers the option to attend discussion groups, and such farmers might not otherwise be in a position to pay for extension services. Overall, the financial incentive increases expected benefits of participation, making attendance at discussion groups attractive to a larger cohort of farmers.

In relation to farm characteristics, dairy herd size is the only characteristic that distinguishes the three groups from each other, with early participants being more likely to have larger herds and non-participants being more likely to have smaller dairy herds than late participants. This indicates that there is still a tendency for farmers with larger herd sizes to participate in extension services. Herd size is often associated with productivity (Weersink and Tauer 1991), which suggests that participation in extension services is still skewed towards more productive farmers.

In terms of farmer characteristics, the age of the farmer has a significant impact on the decision to join discussion groups. For example, non-participants are more likely to be older, and early participants are likely to be younger than late participants. In other words, the DEP has attracted a slightly older cohort of farmers to participate in discussion groups compared to early participants, again providing evidence that a wider group of farmers participated in discussion groups under the new scheme. This finding is in line with the literature on technology adoption, which suggests that younger farmers adopt new technologies earlier (Barham et al. 2004).

In relation to human capital, non-participants have significantly lower odds of having completed agricultural education than late participants, while there is no significant difference in relation to agricultural education between late and early participants. This suggests that agricultural education has a positive impact on extension participation, which could be due to the underlying motivation of the farmer in relation to acquiring external knowledge in relation to farming, or alternatively, that extension services are promoted through agricultural education.

## Concluding Remarks

This study analyzed whether extension programs that are directly incentivized by payments to farmers made agricultural advice more accessible to a larger cohort of farmers. Given the rather unique policy move to incentivize

participation, the findings of this study provide policy insights of broad relevance.

A number of important findings have emerged from this study. First, after introducing the extension scheme, participation rates in discussion groups increased from about 25% in 2008 to almost 45% in 2011, these figures are based on our own data analysis (see Figure 1). While an increase of 20% over this period may initially seem to be a considerable achievement, it has to be set in the context of the significant associated expenditure, that is, almost €20 million. Given the generosity of the scheme, an increase of 20% seems quite low, especially when considering that based on Rogers' diffusion theory, a proportion of those farmers would have joined anyway. Assuming that farmers were aware of the scheme, it follows that in many cases the perceived costs of participation were still higher than the perceived benefits including the payment. It is possible that farmers were discouraged by the strict guidelines of the scheme (e.g., compulsory attendance), or that farmers were not sufficiently informed about the associated benefits of discussion groups.

Second, the scheme encouraged higher extension service usage in disadvantaged regions. The results of this study showed that early participants tended to farm more productive holdings mostly based in commercial and advantaged dairy regions, while the financial reward increased participation by farmers in less productive dairy regions. Hence, if efficiency gains in the dairy sector are sought through improving productive as well as less productive farms, the scheme can be categorized as successful. However, some might argue that by allowing less efficient farmers to stay in production, the overall efficiency of the sector may decrease in the long term, which might be worth further consideration in the future.

Finally, our results also revealed that the scheme attracted a significantly different type of farmer. Under the auspices of the scheme, an increasing number of older farmers with smaller farms joined discussion groups, while farmers who participated in discussion groups before the scheme are generally younger, with larger farms. This may indicate that, given the characteristics of the new cohort, the anticipated increase in technology adoption may not occur, as older farmers with smaller farms are generally less likely to adopt new technologies (Feder et al. 1985). Hence, whether or not efficiency gains in the dairy sector will be achieved through increased adoption of best practice by new participants appears to be uncertain.

Overall, the question remains: does the program deliver "value for money" or a return on investment? Previous economic research suggests that there is an economic return to participating in discussion groups in an Irish context (Läpple et al. 2013). However, these economic benefits were quantified for the early participants and it is not clear that late participants will benefit to the same extent, if at all. The theoretical model outlined in this article shows that farmers participating only when the financial incentive is offered have lower perceived benefits and possibly higher perceived costs associated with participation. Hence, it can be concluded that this is likely to lead to lower levels of motivation and possibly lower benefits. In fact, there is some evidence that some farmers mainly joined for the financial reward and less for the knowledge gain (Bogue 2013). Quantifying these benefits is an empirical question that would certainly prove an interesting topic for future research.

Furthermore, it is important to consider whether an alternative policy approach would have provided a higher benefit cost ratio. One alternative policy option would have been to provide free advice to farmers and to actively market the extension program to the target audience. This would have reduced the overall aggregated cost of the scheme, and assuming a slightly lower uptake rate by more knowledge-oriented farmers, this approach would have probably only caused a slight decrease, if at all, in aggregated benefits.

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