

Factors influencing land rental market participation: a case study in Northern Ireland

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Abstract

Agricultural land mobility through an efficient land rental market has been shown to contribute to the productive and sustainable utilisation of land, by facilitating the transfer of land from less productive farmers to more productive farmers. However, this is not the case in Northern Ireland where the sale of agricultural land is limited with a constrained tenanted sector. The objective of this study is to analyse the factors influencing participation in the land rental market in Northern Ireland. To achieve our objective, data from 1466 farmland owners was analysed using principal component analysis (PCA) and multinomial logistic regression model. The results show that land rental market participation is impacted by motivational and socioeconomic factors. The study recommends the development of schemes that support the early and comfortable retirement of older farmers to increase the access of young farmers to land and improve the land rental market.

Keywords: land; rental market; sustainability; conacre; multinomial logit model

JEL Classification code : Q15

1. INTRODUCTION

Agricultural land mobility has been shown to contribute to the productive and effective utilisation of land as a resource by facilitating the transfer of land from less productive farmers to more productive farmers (Bradfield, Butler, Dillon, & Hennessy, 2020; Deininger & Jin, 2008; Li, Ma, Mishra, & Gao, 2020; Tesfay, 2023). This can be achieved through an efficient land rental market, playing an important role in shaping farmers' land-use decisions and

supporting sustainable agricultural production (Min, Waibel, & Huang, 2017; Udimal, Peng, & Guillaume, 2021). A previous study in Poland by Marks-Bielska (2021) has shown that with stable long-term agreements, farming on leased land is comparable to farming on owned land as long as the rights of the lessor and a lessee are protected.

Land mobility is a significant issue in Northern Ireland (NI) as historically there have always been strong sentimental and cultural ties to land (Adenuga, Jack, & McCarry, 2023; Bradfield et al., 2023a). The majority of farming in the region is undertaken on owned land and the transfer of land through sale is limited due to high land sales prices. For example, the price of agricultural land in NI ranges between £11500 and £20,000 per acre and less than one percent of the total agricultural land area is offered for sale each year (Harris, 2022). This is reflected in the high proportion of farming undertaken on owned land compared to what occurs in other countries. Owned land as a percentage of farmed area in NI is 72% which in relative terms is high compared to other countries such as France and Germany where the proportion is 38% and 39% respectively and at the EU level, which is 48% (Adenuga, Jack, & McCarry, 2021; DAERA, 2023a; Eurostat, 2022). This makes the purchase of land for agricultural production in NI less optimal (Adenuga, Jack, & McCarry, 2021). This is because land ownership requires significant capital investment, and further purchases may not be financially optimal when alternative arrangements, such as renting, provide operational flexibility without the long-term financial burden of land acquisition. Additionally, owning a large proportion of land may indicate that a farmer's operational needs are already met, reducing the necessity for further expansion through purchase. In addition, the average agricultural land area in the region can be regarded as small relative to the other regions of the UK and has become highly fragmented with increased concentration and competition for use among active and intending farmers (Adenuga, Jack, McCarry, & Caskie, 2023; Milne et al., 2022). The low level of land mobility, and high fragmentation have a consequential effect on the overall competitiveness and productivity of

the NI agri-food sector. This potentially constrains opportunities for new entrant farmers to access land (Milne et al., 2022).

Access to land through the rental market provides an avenue for farmers and aspiring farmers to access land and increase their competitiveness since it requires less capital outlay (Adenuga, Jack, & McCarry, 2021; Bradfield et al., 2020; Jin & Deininger, 2009). With solid legal regulation, the land rental market can be regarded as a rational land management strategy (Marks-Bielska, 2013). Compared to the sale of land, it offers greater flexibility, with an opportunity to design contractual terms to suit both the lessor and the lessee (Zhang et al., 2018). It allows farmers to alter farm size, exploit economies of scale, increase operation as well as technical efficiency, and capture technological advances to achieve an optimal level of production (Bradfield et al., 2021; Bradfield et al., 2020; Geoghegan et al., 2021; Li et al., 2020; Zou & Luo, 2018). In addition, the land rental market makes it possible for rural households to generate additional income from their land (Lan Zhang et al., 2018; Zou, Mishra, & Luo, 2020). An efficient and fully functional land rental market that supports optimal allocation and transfer of land is therefore necessary to bring land to its most productive use and provide opportunities to transform the rural economies and improve the welfare of rural households (Bradfield et al., 2020; De Janvry, Gordillo, Sadoulet, & Platteau, 2001; Huy, Lyne, Ratna, & Nuthall, 2016; Jin & Deininger, 2009). For example, a study by Bradfield et al. (2020) for dairy farmers in Ireland, showed that farms that rent land generated a higher net margin than farms with no rented land. The study also showed that increased access to land through the land rental market enhanced farming households' succession plans.

Given the high cost and limited access to the sale of land in NI, an efficient land rental market provides an avenue for farmers in the region to increase their farmland area. This is particularly important given the shift towards sustainable farming with agricultural support policies now targeted at environment-based payments (Adenuga, Jack, McCarry, et al., 2023;

Little, Lyon, & Tsouvalis, 2023). In addition, it can also provide pathways for accessing agricultural land for those who may otherwise have very limited access, for example, young or new-entrant farmers (Abay et al., 2021). This will be vital for farmers to meet their environmental commitments. This paper sought to examine the determinants of participation in land rental markets in NI as a mechanism to improve access to land. To achieve our objective, we empirically analysed the motivational and socioeconomic factors influencing land rental market participation in NI. To the best of our knowledge, this study provides the first insights into the complex motivations and behavioural factors underlying farmers' decisions to participate in the land rental market. While these motivations may also apply to farming in general, understanding, how they influence farmers' land rental decisions is essential to improving the land market. A previous study in Ireland by Geoghegan et al. (2021) show that attitudinal factors are a significant predictor of openness to land mobility, both on the supply and demand side of the market. This study employs the multinomial logistic regression model which allows us to consider not just farmers who rent-in and rent-out land but also those who neither rent-out nor rent-in land. A previous study by Udimal et al. (2021) also employed a similar approach. However, they did not consider motivational factors that could influence participation in the land rental market. It remains unclear how the different farmers' motivations and behavioural factors influence their decision to participate in the land rental market. Results from this study will be useful in providing the requisite evidence base to inform the formulation of policies aimed at encouraging farmers and landowners to engage in the land rental market.

2. RESEARCH METHODOLOGY

In this study, we employed the multinomial logit (MNL) model to analyse the motivational and socioeconomic factors influencing land rental market participation in NI. Farms in NI are typically family-owned with a small, tenanted sector compared to other regions

of the United Kingdom. By making use of a couple of attitudinal statements, we derived different farming motivations of farmers using principal component analysis (PCA).

2.1 Data collection

The dataset used in this study was obtained from a cross-sectional survey of farmers in NI. The sampling frame was the farm census data for NI which consisted of 12 747 farmers for the year 2020 from which we selected 4029 farmers using a stratified random sampling technique. The farmers were classified into six strata based on farmland ownership and rental status: those farming solely on owned land, those farming both on owned and rented land, those farming owned and rented land while also leasing out land, those farming only on owned but also leasing out land, those farming exclusively on rented land and landowners who lease out all their land. Due to the large number of farmers in the “owned land only” and “owned and rented land” groups, we randomly selected 20% of farmers from these two groups. A well-structured questionnaire was developed after a comprehensive literature review and key informant interviews (Adenuga, Jack, & McCarry, 2021). The questionnaire was organised around some themes. This includes land ownership and rental status and duration, socioeconomic as well as farmers’ attitudinal characteristics. The questionnaire was developed in a hybrid format, making it possible to be completed online and on paper. The Snap survey software was used to design the online version of the questionnaire with a QR code that was generated and placed on the front page of the paper version of the questionnaire. Respondents either completed the paper questionnaire directly or scanned the QR code with their phone to complete it online. The survey took place between December 2021 and February 2022. We sent two reminders over this period with the QR code included in the letters and the respondents could request a paper copy of the questionnaire if they require a new one. No personally identifiable information was collected, and farmers were assured of their anonymity in reports or publications resulting from the project. To encourage the farmers to complete the questionnaire, each completed and returned

questionnaire was entered into a prize draw for 1 of 10 £100 e-vouchers. This was for farmers who had indicated their intention to participate in the draw. Out of the 4029 questionnaires administered, 1228 paper questionnaires were returned in the pre-paid envelopes sent alongside the questionnaire while 499 questionnaires were completed online. In total, we received 1727 responses. This number was reduced to 1466 following the dropping of 91 farmers who both rented out and rented in land, and farmers with no information relating on land ownership or rentals. Table 1 gives a summary of the socioeconomic characteristics of the farmers. Some of the variables do not add up to 1,466 because some of the farmers did not fully complete the questionnaire, omitting some questions.

2.2 Empirical model

The land rental market participation is modeled based on the random utility theory (Udimal et al., 2021). The theory assumes that each farmer i has different options ($k = 1, 2, 3 \dots K$) available to them and they chose a particular option (y) that offers the maximum utility by considering the economic and environmental risk associated with the various options (Diriye et al., 2022; Grant et al., 2019; McFadden, 1972). To analyse the factors influencing land rental market participation in this study, we employed the multinomial logit model (MNL)(Daly, 1987; Gensch & Recker, 1979). The MNL model has been used extensively in the literature to analyse farmers' behaviour and choices in decision-making (Diriye et al., 2022; Duressa, 2021; Otieno, 2022; Ouattara et al., 2022). The model, unlike the bivariate Tobit model employed in previous studies, for example, the study by Rahman (2010), can accommodate the non-binary, multivariate nature of the dependent variable (Dang & Pham, 2022; Osanya et al., 2020; Yasmin et al., 2022). Previous studies have also shown that the MNL model performs better than the multinomial probit model (MNP) (Dow & Endersby, 2004). Besides, the MNL model possesses fewer computational problems compared to MNP because the probit likelihood function is often flat near its optimum and it generally requires numerical

approximation for the multivariate integrals(Dow & Endersby, 2004). It is also not prone to optimization errors. Although it should be acknowledged that MNL model relies on the Independence of Irrelevant Alternatives (IIA) assumption, which requires that the relative probabilities of choosing between any two alternatives remain unchanged when other alternatives are introduced or removed. In this study, certain alternatives, such as the sale and purchase of agricultural land, were excluded due to the thin market for land transactions, as discussed in the introduction. While these alternatives may theoretically exist, their practical relevance is limited in this context. Nevertheless, we assess the validity of the IIA assumption and the results indicate that the exclusion of these alternatives does not significantly influence our findings.

Generally, our choice of a multivariate dependent variable is based on the need to capture the multiple dimensions of farmers' land rental behaviour within a single model framework which allows us to identify distinct factors influencing each dimension simultaneously. It should also be acknowledged however that our use of the MNL model means we are not modelling the actual amount of land rented-in or rented-out which could provide additional insight. The choice of our model is in line with the objective of this paper which was mainly to identify factors influencing farmers' land rental behaviour. In this study, it is assumed that a farmer can choose from any of three alternatives. That is rent-out land; rent-in land and neither rent-in nor rent-out land. The observed outcome, Y_{ik} as a function of the variables X_{ik} is presented in equation (1).

$$Y_{ik} = X_{ik}\beta_k + \varepsilon_{ik} \quad (1)$$

Where X is a vector of explanatory variables which include motivational and farmer-specific socioeconomic characteristics that are hypothesised to influence land rental market participation, β represents the parameters to be estimated and ε is the error term or random

component of the model and it is assumed to be independently and identically distributed (Diriye et al., 2022). The choice probability of the i_{th} farmer in choosing option k from the list of K options following Mellon-Bedi et al. (2020) is presented in equation 2.

$$(Y_i = k|X) = \frac{\exp(\beta_k X_i)}{1 + \sum_{j=2}^K \exp(\beta_j X_i)}, \text{ for } k > 1 \quad (2)$$

In estimating the model, one of the categories was normalised by equating it to one (equation 3). In our analysis, we used neither renting-out nor renting-in land category as the baseline such that only two equations are estimated. The probability of renting out and renting in land is compared to the probability of neither renting in nor renting out land.

$$P(Y_i = 1) = \frac{1}{1 + \sum_{j=2}^K \exp(\beta_j X_i)}, \text{ for } k = 1 \quad (3)$$

Based on this parameterisation, the j th element of the vector β_k is interpreted as the increase in the log-odds ratio of the k th category relative to the reference category holding the other explanatory variables constant to their mean values (Carpita et al., 2014). Y_i is the dependent variable representing farmers that rent out and rent in land in the two models respectively. The variables hypothesised to influence participation in the land rental market include the age of the farmer measured in years, membership of a business development group (BDG) measured as a dummy variable, having a diversification enterprise (this refers to owning a diversification enterprise on the farm) measured as a dummy variable, off-farm employment (defined as income earned outside of the farm by the primary decision-maker and may include spousal income, which could influence household labour availability and financial stability) measured as a dummy variable, identification of a successor measured as a dummy variable, the enterprise type of the farmer (dairy, beef sheep and others which include arable and horticulture enterprises), area of farmland owned measured in hectares, level of agricultural qualification measured as a dummy variable, level of formal education, time

commitment to farming (full-time or part-time) and land type (land classification based on their agricultural conditions as lowland, disadvantage or severely disadvantaged). These variables were obtained from the literature and are considered important factors likely to influence land market participation (Adenuga, Jack, & McCarry, 2021, 2023; Bradfield et al., 2020; Che, 2016; Zou et al., 2020). The descriptive statistics of the variables are presented in Table 1.

To incorporate the motivational factors into our analysis, principal component analysis (PCA) was employed. The PCA is a statistical technique that examines the pattern of correlations amongst the explanatory variables and creates a smaller set of uncorrelated linear combinations of the original variables (Lapple & Kelley, 2010; O’Kane et al., 2017). The higher a respondent’s score on each of the factor variables, the higher their associated level of agreement with the specific attitudinal component (Howley, 2015; O’Kane et al., 2017). The analytical technique was used to reduce sixteen attitudinal statements which represent varying motivations of farmers into four components. The statements included in our principal component analysis were obtained from a comprehensive review of related literature on farmers’ behaviour (Adenuga, Jack, & McCarry, 2023; Howley, 2015; Howley et al., 2015). We used the promax rotation to facilitate the interpretation of the components. As is the usual practice, components with an Eigenvalue of at least one were retained (O’Kane et al., 2017). We retained statements with loadings greater or equal to 0.3 on their target factor. Statements that did not load greater or equal to 0.3 on any component were dropped. The four motivational components obtained from the PCA include Principal Components (PC) 1 which shows high loadings for items relating to efficient farm management and technology adoption and was termed “progressive construct”, PC2 loads highly on statements that do not support pro-environmental behaviour such as “I am not that concerned about environmental issues” and was termed “environmental apathy” construct., PC3 which loads on the statements that prioritise the protection of the environment was termed “pro-environmental construct ” and

PC4 which loads highly on statements that relate to being risk averse and was termed “risk averse” construct. Two statements that did not align with any of the four components were dropped. The internal consistency of each component was assessed using Cronbach’s alpha coefficient which ranged between 0.60 and 0.68, showing good reliability. With a Kaiser–Meyer–Olkin measure of sampling adequacy of 0.75, the components represent a significant proportion of the variance in the data (Läpple & Kelley, 2013). The results of the PCA analysis are presented in Table A1 in the appendix. The STATA spost13 post-estimation command was employed to allow the coefficients of the MNL model to be interpreted in terms of the percentage change in odds for a unit change in the explanatory variable (Long & Freese, 2005).

3. RESULTS AND DISCUSSION

3.1 Descriptive and socioeconomic characteristics

Table 1 gives an overview of the socioeconomic and farm characteristics of the respondents. Similar to the general farming population in Northern Ireland, about 90% of the farmers in our sample are livestock farmers (DAERA, 2023b). Our analysis showed that more than half (55%) of the farmers undertake their farming activities in land categorised as either disadvantaged (DA) or severely disadvantaged areas (SDA). The SDA or DA (less favoured areas (LFA)) land types refers to land located in parts of the country which, because of their relatively poor agricultural conditions, have been so designated under EU legislation (Caskie et al., 2001; DAERA, 2023b). The majority of respondents are male (91.5%) and 75% of respondents are married. Thirty-two percent of the farmers stated that they had no general education qualifications. Based on land rental participation status, about 45% of those who rent out land have a diploma or degree level education while it is 35%, of those who rent in land. In terms of agricultural qualification, 33% of the farmers stated that they have formal agricultural qualifications. The value is higher for those that rent in land with 40% of them stating that they have a formal agricultural qualification. Only 30% of those who rent out land

stated that they have formal agricultural qualifications, and it is 33% for those who neither rent in nor rent out land. For 37.9% of respondents, farming was on a full-time basis (these are farmers who work, at least on average, 38.0 hours per week on the farm). Twenty-six percent of sheep farmers surveyed reported that they were farming full-time. Ninety-eight percent of the farms are family farms held either as sole ownership or partnership. The average years of farming experience is 35 years and 55% of the farmers stated that they have off-farm employment. The proportion of farmers with off-farm employment that rent in land was 61% while it was 47% for those that rent out land and 55% for those that neither rent in nor rent out land. Only 13% of the farmers are members of the Business Development Groups (BDGs). Nineteen percent of those who rent in land were in the BDG group compared to just 9% for those who rent out land and those who neither rent in nor rent out land. The BDGs is a knowledge transfer scheme developed by the Northern Ireland College of Agriculture, Food and Rural Enterprise (CAFRE) in March 2016. The scheme employs a group approach aimed at improving the performance of farm businesses through facilitated ‘peer-to-peer’ learning to encourage the fostering of knowledge capital and knowledge exchange between actors (Jack et al., 2020). Forty percent of the farmers stated that a successor to the farm has been identified. This was 34% among those who rent out land, 41% among those who rent in land, and 42% among those who neither rent out nor rent in land. The modal age group was 55 to 64 years and 68% of the farmers are aged over 55 years. Based on land rental market participation, as much as 83% of those who rent out land are older than 55 years, while it is 44% of those who rent in land and 66% of those who neither rent in nor rent out land. This is an indication that those who rent out land are older and more likely to include retired farmers. The average amount of cultivated land owned is 36 hectares. The value is 43 hectares for those that rent in land, 37 hectares for those that rent out land, and 28 hectares for those that neither rent in nor rent out land.

Table 1: Socioeconomic characteristics of respondents

Variables	Frequency	Percentage- (%)
Time commitment (n= 1354)		
Full-time	513	37.9
Part-time	841	62.1
Land types (n = 1351)		
Lowland	608	45.0
Disadvantaged	428	31.7
Severely Disadvantaged	315	23.3
Diversification activities (n=1466)		
Yes	258	17.6
No	1,208	82.4
Identification of successor (n=1347)		
A successor has been identified	536	39.8
Successor not yet identified	811	60.2
BDG membership (n = 1466)		
Yes	192	13.1
No	1,274	86.9
Age of the farmer (n = 1466)		

Less than 30	49	3.3
30-40	118	8.05
41-54	303	20.7
55-64	400	27.3
65-74	358	24.4
75 or older	238	16.2

Education of the farmer (n=1466)

No formal qualification	471	32.1
Less than 5 GCSEs	136	9.3
5 GCSEs or equivalent	219	14.9
A level or equivalent	97	6.6
Higher education - diploma or equivalent	242	16.5
Degree level or higher	301	20.5

Agricultural qualifications (n=1447)

No formal agricultural qualification	963	66.6
National Diploma NVQ Level 2 or equivalent	171	11.8
National Diploma NVQ Level 3 or equivalent	101	6.9
HND Level or equivalent (just below degree level)	74	5.1
Degree level or equivalent	68	4.7
Others	70	4.8

Off farm employment (n=1466)

Yes	808	55.1
No	658	44.8

Source: own elaboration

3.2 Land market participation

The results of our analysis in terms of land rental characteristics showed a relatively even distribution among the three categories of farmers. We found that 31% of the farmers farmed on owned land only (i.e., neither rent in nor rent out land) while 37% and 31% of the farmers rented in and rented out land respectively. Table 2 provides an overview of how land is rented in and rented out in conacre and on long-term lease. The conacre is the predominant form of land rental system in the region. It is a traditional short-term land rental system unique to the island of Ireland in which land is let to a farmer nominally for 11 months or 364 days without the need for either party to enter a long-term commitment. Specifically, 91% and 78% of the land that is rented out and rented in respectively are in conacre (Adenuga, Jack, & McCarry, 2023). While the duration for renting land in conacre is 11 months or 364 days, the arrangement between the landlord and the tenant is such that it can be rolled over for several years with no formal contract signed. For example, as shown in Table 2, among landlords renting out and farmers renting in land, it can be observed that 48% and 67% have been rented out and rented in respectively for more than 10 years. The long-term lease refers to a land rental arrangement in which a formal contract has been signed between the landlord and the tenant. This proportion of long-term leases among landowners and farmers in NI is still relatively small with a higher proportion on 5-year leases as shown in Table 2.

Table 2: Land rental system and duration of rental

Land Rental Characteristics	Renting out land		Renting in land	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Ways by which land is rented				
Conacre	422	91.1	426	78.0
A long-term lease	22	4.8	66	12.1
A combination of conacre and long-term lease	19	4.1	54	9.9
Duration of Conacre (years)				
Less than 3	40	9.1	34	7.1

3	413	9.3	17	3.5
4	25	5.7	11	2.3
5	34	7.7	28	5.8
More than 5 but less than 10	88	20.0	68	14.2
10 or more years	212	48.2	322	67.1
Duration of long-term lease				
Less than 3	2	4.9	9	7.5
3	2	4.9	8	6.7
4	1	2.4	0	0
5	20	48.8	42	35.0
More than 5 but less than 10	5	12.2	15	12.5
10 or more years	11	26.8	46	38.3

As presented in Table 3, we also analysed the land market participation characteristics of the respondents based on enterprise types. The results show that renting in land was more common among dairy farmers compared to other enterprise types with 79% of the dairy farmers renting in land, in addition to farming on owned land. Only 5.5% rented out land. This may reflect the intensive nature of dairy farming in Northern Ireland (Adenuga et al., 2020). It also may have been driven by the relatively higher incomes of dairy farms and their ability to pay higher rents. This is evidenced by the high percentage (84%) of dairy farmers who undertake farming on a full-time basis. Although the majority (84%) of the land rented in was in conacre rather than long-term leases.

Table 3: Land rental characteristics by enterprise type

Enterprises	Frequency	percentage	Rent out land (%)	Rent in land (%)	Neither rent out nor rent in land (%)	Proportion that are full-time farmers (%)
Beef suckler	409	32.2	18.3	43.3	38.4	36.3
Beef finishing	316	24.9	25.0	39.9	35.1	35.4

Sheep	306	24.1	29.1	35.3	35.6	25.8
Dairy	110	8.7	5.5	79.1	15.5	83.6
Arable	81	6.4	49.4	27.2	23.5	43.2
Poultry	30	2.4	33.3	23.3	43.3	66.7
Horticulture	13	1.0	61.5	23.1	15.4	38.5
Pig	5	0.3	20.0	60.0	20.0	80.0

Source: own elaboration

3.3 Results of econometric analysis

The results of the parameter estimates resulting from the MNL model are presented in Table 3. The likelihood ratio chi-square of 366.61 with a p-value < 0.0001 indicates that the model fits well. A test for The Independence of Irrelevant Alternatives (IIA) showed that it was not violated. Like other categorical response models, the interpretation of the MNL model is complex because of its nonlinearity. To interpret our MNL model, we have employed the Long and Freese (2006) SPost13 command, listcoef which can provide a single table of the estimates for all the comparisons of outcome categories for each variable included in the model. The coefficients are interpreted in terms of the standardized or percentage change in odds for a unit change in the explanatory variable holding all other variables constant (Howley et al., 2015; Long & Freese, 2006).

The results show that motivational and socioeconomic factors influence the likelihood of land rental market participation. In total, fourteen explanatory variables were statistically significant for factors influencing the decision to rent out, land. For the factors influencing the decision to rent in, land, we found seven explanatory variables to be statistically significant compared to the baseline (the decision to neither rent in nor rent out land). We found the progressive construct variable to be a statistically significant factor ($p < 0.05$) for the decision to rent out and rent in land. In specific terms, one standard deviation increase in the progressive

orientation factor decreases the odds of renting out, land for the average farmer by 15.9%. On the other hand, a standard deviation increase in the progressive orientation factor increases the odds of renting in, land by 18.6%. This implies that farmers, with a progressive and positive mindset and the motivation to maximise profit, have a lesser tendency to rent out land compared to the baseline and are more likely to rent in land. This is understandable as more land is often required to take advantage of economies of scale, adopt new technology, and increase farm incomes (Huy et al., 2016; Geoghegan et al., 2021). The pro-environment factor was found to have a positive relationship with renting out land, but it was not statistically significant. It was however statistically significant and negatively related to renting-in land. A standard deviation increase in the pro-environment factor reduces the odds of renting in, land by 13.5%. The negative relationship between pro-environmental behaviour and renting in, land may be linked to the predominantly short-term conacre land rental system predominant in NI. This is because environmentally friendly agricultural practices often require long-term investments in soil health and this is difficult to achieve on short-term land rentals without adequate tenure security. Besides, farmers with pro-environmental behaviour may avoid renting additional land to retain effective control of their land in line with their values of ensuring proper stewardship of the land.

In terms of the socioeconomic characteristics, we found the enterprise type and the time commitment to farming to be statistically significant factors in both the decision to rent out and rent in land but with opposite signs. Specifically, farms that are classified as dairy, beef or sheep enterprises are less likely to rent out land and more likely to rent in relative to the baseline enterprises of arable, horticulture, poultry, and pig farms which were categorised as “others”. Having a dairy, beef or sheep enterprise reduces the odds of renting out land by 75%, 63% and 46% respectively and increases the odds of renting in land by 378%, 68% and 28% respectively. This reflects the intensive nature of land usage in livestock production in NI

relative to other enterprises with about 79% of the total farmed area used for livestock production (DAERA, 2023a). On the other hand, the age of the farmer, land type, identification of a successor, the education of the farmer, the area of land owned, and land type were found to be statistically significant factors influencing the decision to rent out land. Membership of the BDG and access to off-farm income were found to be statistically significant factors influencing the decision to rent in land.

The identification of a successor reduces the odds of renting out land by 37% relative to the baseline. With a successor already identified, farmers would rather keep their land to themselves to keep the successor on the farm rather than renting out land. A previous study by Bradfield et al. (2020) has also shown that with a successor identified, farmers are more likely to keep their land and instead rent in land to provide the successor with immediate employment and skill development. Similarly, study by Daniele (2024) has shown that the identification of a successor in a farming household significantly influences farmers' strategic choices. Farmers with higher education are more likely to rent out land. A standard deviation increase in degree level or higher education increases the odds of renting out land relative to the baseline by 34%. This may imply that farmers who are highly educated may be spending less time in direct farming activities. This is because higher education tends to increase the opportunity cost of farming due to the increased potential of securing higher-paying jobs outside agriculture. Consequently, these farmers may choose to rent out their land instead of farming it themselves. This connection between education and land rental decisions reflects broader economic trends where higher education leads to more diverse career options, thereby influencing land use choices. This result corresponds to that obtained by Rahman (2010), Bizimana (2011), and Zhang et al. (2022) in which they found that farmers with higher levels of education are more likely to rent out land. The result is however in contrast to that obtained by Tesfay (2023) in which they found that the less educated farmers are more likely to rent out their land.

Our result also showed that farmers older than 55 years are more likely to rent out land. These are farmers who may be approaching retirement and probably do not have a successor. Such farmers will be better off renting out part of their land for additional income. This result corresponds to that obtained by Tesfay (2023) and Min et al. (2017) in which they found older farmers to be more likely to rent out land. The result is also in line with that obtained by Mellon-Bedi et al. (2020) in their study of smallholder participation in the land rental market in China in which they found that households with a higher share of older people were more likely to participate in the land rental market, It is however in contrast to that obtained by Zhang et al. (2022) who found that aged farmers participate less in renting out land. Our result also shows that farmers who own larger farm areas are more likely to rent out land. One standard deviation increase in owned land area increases the odds of renting out land by 34% relative to the baseline. A similar result was obtained by Vranken and Swinnen (2006) in which they found farming households who own more land to be more likely to rent out land. Farmers that farm in lands categorised as disadvantaged or severely disadvantaged are less likely to rent out land compared to farming on low land relative to the baseline. This may be because most of the farmers that farm on disadvantaged and severely disadvantaged lands are small beef and sheep farmers who undertake farming usually on a part-time bases. For this group, farming is mostly to keep the family enterprise with a greater attachment to the land. As a result, they are less likely to rent out their land.

Table 4: Determinants of land market participation (N= 1,121)

Variables	Coef.	Rent-out land			Rent-in land			
		Std. Err.	%	%StdX	Coef.	Std. Err.	%	%StdX
Environmental- apathy	0.029	0.052	2.9	4.7	-0.035	0.047	-3.5	-5.6
Risk-averse	0.117	0.080	12.4	13.5	0.051	0.068	5.2	5.6
Pro-environment	0.079	0.078	8.2	9.3	-0.128*	0.071	-12.0	-13.5
Progressives	-0.104**	0.052	-9.9	-15.9	0.103**	0.049	10.8	18.6
BDG membership	0.187	0.267	20.5	7.0	0.611***	0.223	84.1	24.6
Off-farm income	-0.149	0.195	-13.8	-7.1	0.484***	0.185	62.3	27.3
Successor	-0.466***	0.175	-37.3	-20.5	-0.095	0.159	-9.1	-4.6
Dairy enterprise	-1.376***	0.534	-74.7	-32.9	1.566***	0.375	378.8	57.5

Beef enterprise	-0.989***	0.231	-62.8	-38.9	0.520**	0.264	68.2	29.6
Sheep enterprise	-0.609**	0.259	-45.6	-22.1	0.250	0.296	28.4	10.8
Owned land area (ha)	0.006***	0.002	0.6	33.5	0.003	0.002	0.3	17.7
Agricultural qualification	0.251	0.210	28.5	12.7	0.021	0.195	2.2	1.0
Lower than 5 GCSEs	-0.590*	0.348	-44.6	-15.5	-0.266	0.276	-23.3	-7.3
5 GCSEs or equivalent	0.070	0.273	7.3	2.6	-0.206	0.238	-18.7	-7.2
A level or equivalent	0.758**	0.352	113.5	21.0	0.251	0.345	28.5	6.5
Higher education—diploma or equivalent	0.540*	0.283	71.6	22.7	0.126	0.263	13.4	4.9
Degree level or higher	0.724***	0.253	106.3	33.6	-0.260	0.258	-22.9	-9.9
Full-time	-0.402*	0.206	-33.1	-17.9	0.804***	0.184	123.4	48.4
Age (greater than 55)	1.142***	0.225	213.2	70.6	0.003	0.191	0.3	0.1
Disadvantaged	-0.656***	0.189	-48.1	-26.4	-0.191	0.180	-17.4	-8.5
Severely Disadvantaged	-0.984***	0.231	-62.6	-33.8	-0.159	0.194	-14.7	-6.5

416 Source: own elaboration

417 Note: % is the percent change in odds for unit increase in our explanatory variable; %StdX is the percent
418 change in odds for a standard deviation change in our explanatory variable; single, double, and triple
419 asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively

420 The result for the factors influencing the decision to rent in land showed that farmers
421 with off-farm income have a positive and statistically significant ($p < 0.01$) effect on the
422 decision to rent in land. This may imply that the farming households with off-farm income
423 have enough money to invest in and expand their farming activities compared to households
424 with no off-farm income. A previous study by Zou et al. (2020) has also found that farmers
425 with part-time, off-farm employment have a greater likelihood of renting in, land. Similar result
426 was obtained by Geoghegan et al. (2021). However, the studies by Vranken and Swinnen
427 (2006) and Kung (2002) found a contrasting result as they showed that greater availability of
428 off-farm income reduces the probability of renting in land. One possible explanation for the
429 contrasting result is that off-farm income, as defined in this study, may include spousal income.
430 If this is the case, the variable may also serve as a proxy for household labour availability, as
431 married farmers may have additional family members contributing to farm work. This
432 increased labour capacity could, in turn, make land expansion through rental agreements more
433 viable. Farmers who are members of the BDGs are also more likely to rent in, land. A previous
434 study by Adenuga, Jack, Ashfield, et al. (2021) has shown that farmers who are members of
435 the BDG operate a more profitable enterprise. Their higher profitability and access to

information through membership of the BDG may contribute to the decision to rent in, more land and earn more income from farming. Similarly, farmers who undertake farming on a full-time basis are more likely to rent in, land compared to the baseline. This may be linked to the assumption that farmers who undertake farming on a full-time basis are more likely to increase their farm size by renting more land.

4. CONCLUSIONS

In this paper, the effect of motivational and socioeconomic factors on farmers' participation in the land rental market has been analysed using a multinomial MNL model. The use of the MNL model allows for greater flexibility as it is able to incorporate not just the demand side but also the supply side of participation and non-participation in the land rental market simultaneously. An efficient land rental market is essential to increase the efficiency and sustainability of agricultural production through greater access of young and productive farmers to land. Our results showed that participation in the land rental market is not only influenced by socioeconomic factors but also motivational factors. Most land rentals in NI are still on short-term leases called conacre with a majority of the farmers undertaking farming on owned land. From a policy perspective, it implies that the development of appropriate strategies to encourage land market participation can contribute to the transformation of the rural economy through efficient land use. The enterprise type of the farmer, the identification of a successor and the amount of time devoted to farming are particularly significant factors in the decision to participate in the land rental market. While the result shows that farmers with successors are less likely to rent out land, only 40% of the farmers in our sample already have a successor identified. Policies that support succession planning and the transfer of sustainable practices could help maintain the viability of farms in disadvantage areas while programmes that facilitate the transfer of land from farmers without successors to younger and more productive farmers will strengthen the rental market. Our results showed that older farmers are

also more likely to rent out their land compared to younger farmers.. The study recommends the development of policies that encourage the younger generation to engage in farming on a full-time basis through schemes that allow for early and comfortable retirement of the older farmers who are happy to make their land available for rent. An example is the NI land mobility scheme which although has now been replaced with a new scheme (farming for future generations) gave young farmers the opportunity to partner with retiree farmers. This allowed young farmers to learn their trade from those hoping to retire and prove themselves with the eventual aim that they will be able to take over and lease the land in a few years. This is essential to promote generational renewal and the modernisation of agriculture for environmental improvements.

Another important result of this study is the negative relationship between pro-environmental behaviour and renting in, land. While this may be linked to the fact that sustainable agricultural practices often require long-term investment in land, an alternative explanation is that more intensive farming systems, which tend to generate higher profits, create a greater demand for rented land. This is supported by our data in Table 3, which shows that dairy farmers, who typically engage in more intensive production, rent the most land. These factors highlight the complex relationship between environmental practices and land rental decisions. This supports the need for policymakers to develop measures aimed at encouraging the adoption of long-term land leasing which provides the tenure security needed to invest in sustainable practices. This could incentivise farmers with pro-environmental behaviour to rent in, land, improving land quality and protecting the environment. Financial incentives could also be provided to landowners to rent to less intensive tenants. A previous study by Adenuga, Jack, McCarry, et al. (2023) has shown that incentives such as income tax incentives to landlords and tenants for sustainable management of agricultural land could encourage long-term land leasing and increase the likelihood of farmers with pro-

environmental behaviour renting in more land. This will enhance long-term productivity and improve the efficiency of land use by allowing more diverse and sustainable practices.

Our finding that progressive farmers are less likely to rent out land and more likely to rent in land also has important policy implications. By developing a policy framework that encourages the renting of more land by progressive farmers, land will be put to more effective and productive use, leading to a more functional land market. This can be achieved if the government enacts policies that promote long-term flexible arrangements and encourage landowners to lease out their land to more productive farmers if they are not being used efficiently. The creation of an enabling environment that allows progressive farmers to rent in more land will contribute to a more dynamic and competitive land market

The fact the majority of the land in the region is located in disadvantaged areas has implications for the rental market with most farmland being fragmented. This supports the need to encourage pro-environmental practices that ensure long-term stewardship of the land. There is also the need to provide targeted financial incentives and infrastructure to make the renting of the land more attractive. A previous study by Onofri et al. (2023) also supports the need to provide incentives (tax incentives and subsidies), to drive decision-making of both tenants and landowners. Income tax relief provided for renting out land on long-term lease in the Republic of Ireland has resulted in increased land rental (Bradfield et al., 2023b). Recently, the NI government has embarked on a soil health nutrient scheme (SHNS) aimed at testing all soils in NI between 2022 and 2026 to improve sustainability and efficiency in the farming sector. This is a good starting point as it provides up-to-date data on the conditions of the land and how it can be improved. This may encourage a more balanced land rental market in which disadvantage areas are not left behind in terms of productivity gains and land market participation. A limitation of our study is that our methodology does not consider the area of land (as a proportion of total land area) rented in or rented out. This should be considered in future research as it has the

potential to influence landowners and farmers' motivations to rent out or rent in land. Future research should also consider possible interaction between the explanatory variables as this could have an effect on the results.

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697 Appendix

698 A. Principal component analysis

699 This study employed the principal component analysis (PCA) to reduce 14 attitudinal
700 statements to four main motivational constructs which were hypothesized to influence
701 farmers' participation in the land rental market. The statements and the constructs are
702 included in Table A1.

703 **Table A1: Principal components (component loadings) for farming motivations (values > .3 are**
704 **highlighted in bold) (N= 1,121).**

Variables	PC1	PC2	PC3	PC4
	Progressive ($\alpha = 0.68$)	Environmental apathy ($\alpha = 0.60$)	Pro- environment ($\alpha = 0.63$)	Risk Averse ($\alpha = 0.66$)
I am generally keen to adopt new technologies	0.5360	-0.0368	0.0201	-0.2164
I try to find new ways of increasing profit on the farm	0.4888	-0.0139	-0.0174	-0.0547
I find farming rewarding from a quality-of-life perspective	0.3374	-0.1124	-0.0162	0.1251
I think good record keeping is very important in managing a farm business	0.4264	-0.1116	0.0329	0.0461
It is more important to maximize profits than protect the environment	-0.0833	0.4775	0.0411	-0.0721
I believe society places too much emphasis on environmental issues	-0.0387	0.5274	0.0356	0.0335
I am not that concerned about environmental issues	-0.1169	0.4402	-0.0541	-0.0787
I think the media exaggerate the negative impact of agricultural activities on the environment	0.1206	0.3663	0.0557	0.0120
I take some actions to protect the environment when managing my farm because I feel it is the right thing to do	0.0919	0.0829	0.4373	0.0621
Farmers should receive subsidies for protecting the environment and not for the total amount of land farmed	-0.0818	0.0928	0.5357	0.0333
In terms of what I produce on my farm, I think it is important to take the environment into consideration, even if it lowers profit	0.0119	-0.0593	0.4794	-0.0226
I am concerned about the loss of biodiversity in our farmed environment	0.0293	-0.0479	0.5210	-0.0420
I try to avoid taking risky farm business decisions	-0.1034	-0.0046	-0.0144	0.6889
I try to keep debt levels as low as possible	-0.0568	-0.0381	0.0267	0.6628
Initial eigenvalues	2.92	2.70	1.38	1.17

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