Modeling Succession on Irish Dairy Farms

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Abstract

This paper examines intergenerational succession on Irish dairy farms. The factors that influence the decision to enter dairying farming are examined using a binary choice logit model. Reasons that are frequently published in the popular farming press as being an obstacle to intergenerational succession are analysed and the significance of their effect is quantified. Results show that the level of education of the heir is the most significant factor in the succession decision. Heir's with third level education are 30% less likely to enter dairy farming than their second level only educated counterparts. The sizes of milk quota and income that are associated with high probabilities of succession are identified.

Keywords: *Dairy Farming, Structural Change, Succession, Logit Model*

Introduction

Structural change and the future number of farmers has become an issue of great interest for agricultural economists, rural sociologists, policy makers, food processors and farmers themselves. With a fixed area of agricultural land, a change in the number of farmers has an impact on scale and size of the remaining farms and has implications for the volume of output and the location of production (Gardner 1992), hence the interest from farmers, economists and food processors. For many years it has been argued that the number and location of farms has implications not only for the agricultural sector but also for the vibrancy of rural areas (Goddard et al 1993), hence the relevance to policy makers and sociologists. In more recent years the importance of the 'European Model of Agriculture', as a policy issue is widely discussed and published. Fischler (1999) states that the number and relative dispersion of farms is inextricably linked to the concept of the European Model of Agriculture. Clearly the future number of farmers is an issue worth investigating.

Many research studies have shown that when farm incomes fall below a viable level, farmers tend to remain in the business and try to supplement their income from other sources. This tends to delay structural change within the sector, (Kimhi and Nachlieli 1998). However, the survival of the family farm is highly dependent on successful intergenerational transfer. Entry into farming by the 'next generation' holds a place of central importance in the determination of the industry's structure and the total number of farmers, (Gale 1993). Succession on farms is important as it has implications for the total number of farms. This paper investigates the issue of succession on Irish dairy farms. Factors that are likely to influence succession decisions are examined. Farm and successor characteristics that are likely to result in a higher probability of succession will be identified. An understanding of the factors that influence succession is important as it allows policy makers to alter these factors to prevent or promote desired structural changes, depending on the prevailing social, political and economic goals.

Background

Few economies have changed as radically and rapidly as Ireland. In the last ten years Ireland has transformed from a country plagued with chronic unemployment, low growth rates and a high debt to GDP ratio in the 1980s to become the fastest growing economy in the EU in the 1990s. GDP grew by almost 70% between 1990 and 1998. Unemployment, which stood at close to 16% in 1993, was closer to 5% in 1999 (ESRI, 1999). Against the backdrop of strong macro-economic growth, Irish farming has undergone major structural change. There has been a significant exit from farming; between 1990 and 1998 the number of farms decreased by 15% (Fingleton and Cushion, 1998). Average industrial wages have continued to increase faster and more consistently than agricultural earnings and as a result the participation rate of young people in farming has declined. Figure 1 presents the number of farmers in various age cohorts over the last ten years.

Figure 1: Number of Farmers by Age Cohort
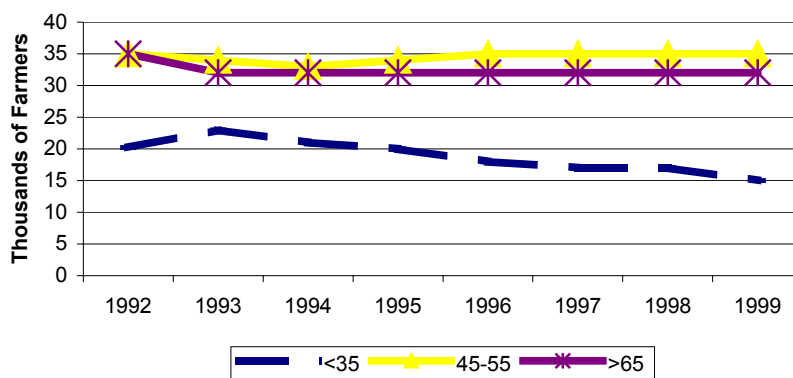
Source: Central Statistics Office of Ireland

The number of farmers that are less than 35 years of age has declined by 25% in the seven-year period while the other age cohorts have remained relatively static. Clearly, there is a trend of declining numbers of young people participating in farming.

The succession process in Ireland is somewhat different to other European countries. Traditionally, the successor tends to take over the farm, at least the operation of the farm if not the ownership, from the previous generation while they are still alive. Unlike the tradition in Northern Europe, the successor does not purchase the farm from his parents or siblings instead he operates the farm and provides a living for the previous generation and any other dependent siblings out of the farm income. Hence a young farmer entering the industry will not necessarily have a large debt burden. However, he may have some considerable long-term drawings to make from the farm income, this is often perceived as a deterrent to enter the farming business.

The discussion of young people in farming and succession rates receives a great deal of coverage in the popular farming press in Ireland. A poor outlook for income is the most commonly stated reason for the decline of young people in agriculture. Macra Na Feirme, the young farmers union, claims that the availability of opportunities and the attractive income prospects off farm has pulled young people out of the industry while poor incomes and the pressures to provide for their parents and siblings have pushed them out (Irish Farmers Journal 2000). It is also argued that the rigidity of

agricultural policy discourages young people from entering the industry. The unavailability of milk quota, the inability to expand the dairy business due to policy constraints and frustration with milk quota allocation are some of the most frequently mentioned issues in the 'young farmer' debate.

All of these reasons that are hypothesised to affect the decision to enter farming will be examined in this paper. Through the use of an economic model the impact of the various issues discussed here can be measured. The significance of income, size of milk quota, number of dependents etc, on the succession decision can be examined and quantified. The methods used to model the succession decision are outlined in the following text.

Methods

Neo-classical economic theory suggests that individuals are profit maximisers and thus will always endeavour in the most profitable activity. Many studies have applied this theory to succession decisions in farming. Gale (1993) states that the trend toward fewer entrants in farming is influenced by improvement or deterioration of income prospects in farming relative to other sectors. Perloff (1991) also claims that the decision to enter farming is based on wage differential expectations. This approach does not take account of the influence of factors other than profit on the decision to enter into farming. Herrmann and Uttitz (1990) conducted a survey of farmers in 12 European countries. They asked farmers why they entered the profession and what they enjoyed about being a farmer, 58% of farmers said that they enjoyed the independence of being their own boss and the responsibility of running their own business. A further 37% valued the connections they had with nature and working in the outdoors. Just 16% of farmers identified income prospects and economic security as their principal reason for entering farming. Clearly, people choose to become farmers and to take over the family farm for a number of different reasons and not all are economic based. The aim of this paper is to identify the factors that influence the decision to enter farming and to estimate the significance of those factors.

A dichotomous choice logit model is developed to identify the variables that affect the probability of succession on Irish dairy farms. The models' estimates are used to identify what farm and successor characteristics are likely to result in a higher probability of succession. By taking a sample of dairy farms surveyed in 1999, and identifying which farms have a successor present it is possible to develop the logit model where the dependent variable is the binary indicator of the presence of a successor. The dependent variable is binary, which is equal to 1 where a successor is present and 0 where there is no successor. The dependent variable can be regressed on the explanatory variables that are assumed to affect the likelihood of a successor being present.

The linear logistic model is of the general form:

$$\text{Logit}(p) = \log(p/(1-p)) = \alpha + \beta x$$

where α is the intercept parameter, x is a vector of independent variables and β is a vector of regression parameters. Coefficients of parameter estimates can be interpreted as influencing the probability of a successor. Coefficients with negative values reduce the probability that a successor is present while those with positive

values increase the probability. Using the parameter estimates from a model comparing farms with a successor and without a successor it is possible to calculate the logit estimated probability of the presence of a successor for varying levels of the explanatory variables. The probability (p) can be derived as follows;

$$p = e^{logit(p)} / (1 + e^{logit(p)})$$

Logit models are widely applied in agricultural economic research, Kimhi and Nachlieli (1998) used logit models to estimate the rate of succession on Israeli family farms while Wynn et al (2001) also used binary response models to examine farmer entry into environmental schemes.

Data
A national survey of a stratified random sample of over 300 active dairy farmers was conducted in the autumn of 1999. The sample was selected to be representative of dairy farming in general in Ireland. The question that is the focus of this study is 'Do you have an heir for your farm?' One hundred and forty seven farmers responded either yes or no to this question. The remainder either failed to respond or stated that they did not know. This 'non-response' was largely correlated with age, as younger farmers had not yet considered the issue of their retirement and subsequent succession. These farmers were excluded from the sample. The next question asked of the remaining 147 respondents was whether their heir would continue the dairy farm business. Twenty-seven respondents stated they did not know. These respondents were also excluded from the remainder of the analysis. A sample of 120 farms remained, for these 120 farms the expected succession status is known. The succession status is represented by variable CONTINUE, it is a binary variable which equals one when a successor is present, that is if the heir plans to continue the dairy farm, and equals zero when the heir is not planning on continuing the farm business. In addition to the questions relating to succession there were also questions regarding size, profitability, demography of the farm household, demography of the heir and some sociological variables. These variables were used as the explanatory variables that are hypothesised to affect CONTINUE.

A number of studies have shown that the wage differential between farming and other occupations plays a key role in determining whether an individual will enter farming or migrate to a non-farm job (Perloff 1991). The income provided by the farm in 1999 was one of the principal explanatory variables. Level of education of the heir was used as a proxy to estimate what level of income may be earned in another profession. Level of education was a dummy variable, where the categories were some secondary education, completed secondary education and third level education. In previous studies education levels have proved to be significant in the decision to enter farming (Kimhi and Nachlieli 1998). The area of the farm in acres was used as a proxy for the potential profitability of the farm. In some cases farm income was quite low on large farms. This may reflect poor management by the current generation and thus income potential may be of more significance in the decision-making process rather than current income.

There have been heated debates in Ireland on the topics of milk quota and succession. Macra Na Feirme, the young farmers union, claims that entry into farming is severely affected by the constraining milk quota system. They maintain that if more of the

national milk quota was allocated to young farmers that succession rates would improve. Milk quota on the surveyed farms in 1999 was selected as one of the explanatory variables in order to test its significance in the succession decision. A priori knowledge of farm level data indicates that milk quota and income may be highly correlated which could introduce a problem of multicollinearity into the model. Multicollinearity can be detected through the use of a coefficient of correlation, if the coefficient is equal to 0.8 or higher then multicollinearity exists, (Greene 1997). The coefficient of correlation between income and milk quota is $r = 0.68$. Hence it was assumed that multicollinearity was not an issue, furthermore the main symptom of multicollinearity is a high R^2 while the t-values are mostly insignificant this problem did not arise in the model.

A debt to income ratio was also selected as an explanatory variable. It was intended to test whether the burden of a high debt to income ratio was likely to discourage entry into farming. As discussed earlier, the number of dependents on the farm income is perceived to deter many young people from taking over the family farm. The number of people living in the farm household was selected as an explanatory variable. Unfortunately, it was not possible to distinguish between residents in the farm household and dependents on the farm income.

Finally the significance of the lifestyle associated with dairy farming in the succession decision is tested. The farmers surveyed were asked a number of questions relating to their lifestyle, quality of life and social interaction. The farmers were asked how often they holiday away from home, how often they interact with other farmers, whether they are a member of local clubs or societies and finally how involved they are in social events, (sporting, entertainment, farming related or otherwise). The lifestyle variable is a dummy, the categories are never involved or participate, occasionally involve or participate and frequently. All of the variables used and the mean values are presented in the Table 1.

Table 1: Variable Definitions and Sample Means

Variable	Definition	Sample Mean
CONTINUE	A successor exists on the farm	0.63
INCOME	Income from farm 1999 -€	28572
EDSS	Dummy variable some secondary education	0.16
EDS	Dummy variable completed secondary education	0.55
ED3	Dummy variable third level education	0.29
AREA	Total land area owned – acres	122
QUOTA	Total milk quota owned – gallons	52733
DEBT	Debt to income ratio	1.54
NO	Number of people in farm household	4.23
LSNEV	Dummy variable never attends social occasions	0.16
LSOC	Dummy variable never occasionally social occasions	0.58
LSFREQ	Dummy variable never frequently social occasions	0.26

Results

The logit results can be found in Table 2. The table shows the estimated coefficients, the marginal effect, i.e. the effect of a unit change in each independent variable on the

probability of the heir continuing the dairy farm and finally some goodness of fit measures of the model. The first measure of goodness of fit is the standard R^2, the value is 0.7833 which implies that 78% of the variation in CONTINUE is explained by the explanatory variables selected. The likelihood ratio statistic is equal to 31.69, with 9 degrees of freedom and at the 95% confidence level the critical value $\chi^2_9 = 18.31$. Hence, the hypothesis that the explanatory variables are equal to zero is rejected. The percentage of the correct predictions of CONTINUE is 66%.

Table 2: Results of Logit Model

Variable	Coefficient	Marginal Effect
INTERCEPT	-1.6240	
INCOME**	0.4246 E-4	0.8590 E-5
EDS	0.70410	0.14244
ED3*	-1.4855	-0.3005
AREA*	0.006738	0.001363
QUOTA**	0.2105 E-4	0.4258 E-5
DEBT	-0.10634	-0.02151
NO	0.12235	0.02475
LSNEV	-1.0566	-0.21037
LSFREQ	-0.67525	-0.12660
$R^2 = 0.7833$		
Likelihood Ratio Statistic = 31.69		
Percentage of correct predictions of CONTINUE = 66%		

* $p < 0.05$ ** $p<0.10$

The factors that are associated with a significant ($p<0.05$) effect on the probability of the heir continuing the farm are total agricultural area (AREA) and whether the heir had third level education or not (ED3). The level of education of the heir has the highest t-value making it the most significant factor. The effect of education at second level only is positive while the effect of education at third level is negative. Heirs that have third level education are less likely to take over the dairy farm by 30 percentage points. This is a highly significant result. If an heir goes from having secondary education to third level education the probability of entry into farming falls by 30%. The effect of AREA is positive, i.e. an increase in the total area owned increases the probability of succession occurring. The marginal effect of a unit change in land area is quite low if total land area owned increases by 50 acres then the probability of a successor being present increases by 7%.

Quota and income are slightly less significant, ($p<0.10$). The marginal effect of a unit change in QUOTA is small this is because of the scale of the variable. However, if milk quota was to increase by 10,000 gallons then the probability of a successor being present increases by 4.4%. Similarly, INCOME has a positive marginal effect, an increase in income of €10,000 increases the probability of a successor being present by 6.7%. All other variables did not significantly ($p>0.1$) improve the predictive ability of the model. The effect of DEBT, debt to income ratio is negative as to be expected. Contrary to opinions stated in the popular press and by lobby groups the effect of NO, number of people living in the farm household, is positive. This suggests that the more people living in the farm household the higher probability of one of them becoming a successor. The lifestyle variables are not significant and both have negative effects. This is counterintuitive, one would expect LSNEV, never

participating in social occasions, to be negative and LSFREQ, frequently participating in social occasions to be positive.

Using the parameter estimates derived from the model it is possible to calculate the probability of the heir continuing the farming business for varying levels of the explanatory variables and to identify at what level there is a higher probability that the heir will continue farming rather than exit the industry, i.e. $p > 0.5$. Two of the most frequently discussed issues in the 'young farmer' debate, milk quota and income, are graphed below.

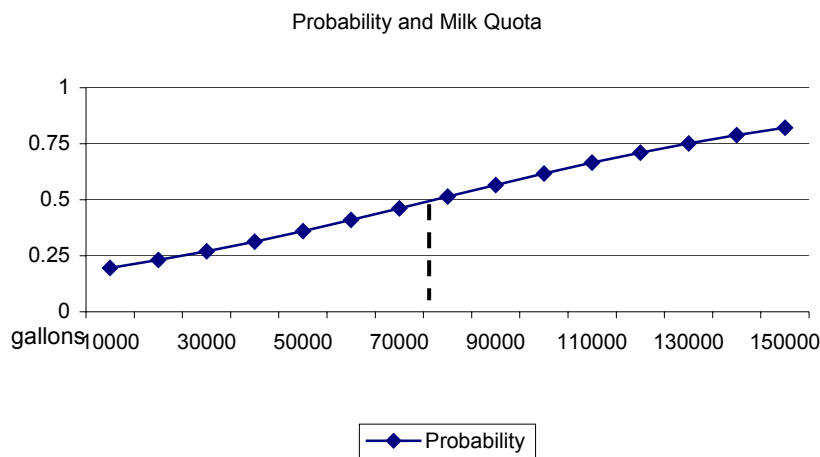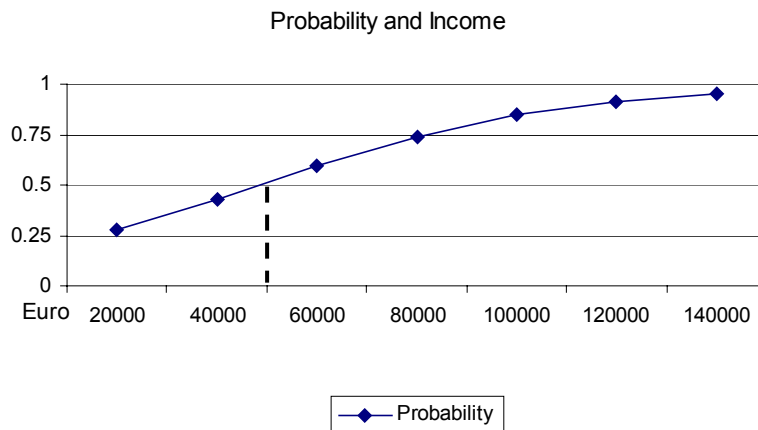**Figure 2: Probabilities Associated with Milk Quota Levels**

Figure 3: Probabilities Associated with Income Levels

Figures 2 and 3 show the probabilities of succession on farms with various levels of milk quota and income. On a farm with a milk quota of 30000 gallons there is only a 25% probability that the heir will continue the farm business. In 2000, 15% of dairy farmers in Ireland were over 60 years of age (National Farm Survey 2000) that is 5085 farms. It is assumed that heirs on these farms are currently or will soon be deciding on whether to take over the operation of the dairy enterprise. Fifty-six per cent of these 'retiring age' farmers have a milk quota of 30000 gallons or less. Thus for these 2861 farms there is only a 25% chance that the heir will continue the farm

business. However, it should be noted at this stage that the calculated probabilities are based on a sample of 120 farms where the heirs are both second level and third level educated. The probability of a second level educated heir taking over a farm with a milk quota size of 30000 gallons is higher than 25% while the probability is lower than 25% for the third level educated heir. The probability of succession is slightly larger than 0.50 for the 80000 gallon milk farmer. There are 523 farms, 10% of retiring farms, with a milk quota of this size or larger. On these farms heirs are more likely to continue the dairy farming operation than to exit the industry. Similar results can be drawn for income level. Fifty-three per cent of farmers in the retiring group earned a family farm income of €20000 or less in 2000. For these farms the probability of succession is just 25%. Heirs inheriting farms that earned an income of €48000 or more are more likely to continue the dairy enterprise than to cease production. There are 15% of retiring farms in this category.

Conclusions and Discussion
This paper examines the issue of succession on dairy farms in Ireland. The farm, economic and demographic factors that influence succession are analysed using a logit model. In accordance with economic theory, the level of income or some indicator of farm profitability was expected to be the most significant factor in the succession decision. Unexpectedly, the logit model estimated the level of education of the heir as the most significant factor. Heirs with third level education are 30% less likely to take over the dairy farm than heirs with only secondary education. The reason for the importance of education level may be interpreted as its effect on opportunity cost. The level of income is not as significant as education but the level of education represents the opportunity cost to the heir of taking over farming which may be considered an income effect. Those with third level education have better income prospects and are therefore less likely to enter farming. However, farming still provides a somewhat competitive income for those who have second level education only. Total agricultural area, size of milk quota and farm income also significantly affect the succession decision. Contrary to opinions often published in the farming press, the life-style associated with farming and the number of people living in the farming household does not significantly impact on the heir's decision to continue farming.

From the logit results it was possible to estimate the probability of succession occurring for varying levels of the independent variables. These results were presented for milk quota size and income level and were set in the context of the current population of 'retiring' dairy farmers, i.e. those over 60 years of age. Results showed that on 56% of retiring dairy farms the probability of succession was just 25% based on quota size, farms require a milk quota of at least 80000 gallons to make succession more likely than exit. As was discussed earlier this level may be lower for farms where the heir has only second level education but will be higher for farms where the heir has third level education. Similarly, farms would need to provide an income of at least €48000 to make succession more likely than exit. Currently, just 15% of retiring dairy farms are achieving this level.

This paper has highlighted the most significant factors affecting succession on dairy farms. The levels of milk quota and income that are necessary to improve the rate of entry of young people into the industry have been identified. This information has implications for policy. If policy makers wish to maintain the maximum number of

young people in the dairy industry then specific policy initiatives need to be established to target retiring farms with small milk quotas and poor incomes. The output of this research informs policy makers on the levels of milk quota, in particular, that a farm requires in order for succession to occur. Understanding the influence of milk quota on the succession decision is highly important for policy makers because first it is easier for policy makers to manipulate milk quota than any other factor and it is easier for them to allocate new quota to young farmers if that is what they wish. Second an increase in milk quota should result in an increase in income, which should improve entry rates. If policy makers wish to reverse the trend of declining numbers of young people in dairy farming, then they should ensure that all retiring farms have the option to increase their quota size to a level that is associated with a high probability of succession.

References

Economic and Social Research Institute. 1999. Medium Term Outlook.

Fingleton, W., and Cushion, M., 1998. Agriculture in Figures. Published by Teagasc.

Fischler F (1999) The European Model of Agriculture – Facing the WTO Acid Test. CER Congress, Verona, September 24.

Gale F (1993) Why did the Number of Young Farm Entrants Decline? American Journal of Agricultural Economics 75 138-146

Gardner B. (1992). Changing Economic Perspectives on the Farm Problem. Journal of Economic Literature 32-101

Goddard E. Weersink A. Chen K. and Turvey G. (1993). Economics of Structural Change in Agriculture. Canadian Journal of Agricultural Economics 475-489

Greene W (1997) Econometric Analysis. Third Edition. Prentice–Hall INC. New Jersey.

Herrmann V and Uttitz P (1990) If only I didn't Enjoy Being a Farmer. Sociologia Ruralis Vol XXX-1.

Kimhi L and Nachlieli N (2001) Intergenerational Succession on Israeli Family Farms. Journal of Agricultural Economics. Vol 52 No 2.

National Farm Survey. 2000. Published by Teagasc, Dublin 4.

Perloff J (1991) The Impact of Wage Differentials on Choosing to Work in Agriculture. American Journal of Agricultural Economics, 73(3) 671-80.

Wynn G, Crabtree B and Potts J (2001) Modelling Farmer Entry into Environmentally Sensitive Area Schemes in Soctland. Journal of Agricultural Economics Vol 52 No 1