Explaining farm succession: the impact of farm location and off-farm employment opportunities

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Abstract

This paper studies the impact of farm location on family farm succession, using a sample of farm households located at different distances from the urban centre in a rural region of Spain. Aggregated household data and household/child cross section data are used to analyze farm succession from two different perspectives, the father’s and that of each of the children. The research considers both the father’s expectations for the transfer of the farm to the next generation and, also, the impact of the individual characteristics of each child on the likelihood of his/her entering agriculture. Two estimates, the probit and random parameter ordered probit model, suggest that farm location has a significant effect on the probability of one of the farm operator’s children taking on the business. Other important factors that affect farm succession are firm size and farm children’s level of education. Then, policy initiatives to foster qualified employment and structural change in agriculture may perhaps help to retain young people in farming.

Additional key words: agricultural household, econometric models, Navarra.

Introduction

The relative aging of the economically active population in Spanish agriculture, especially in disadvantaged areas of the country, poses a social welfare problem, not only because of its impact on the economic and social viability of the areas in question, but also because of its potential impact on environmental conservation. The main cause of the problem is the failure of farm succession and persistent rural-urban emigration of farmers’ children.

The literature on intergenerational succession in family farms highlights the fact that the size of the holding and the characteristics of the farm operator have a strong influence on how successfully the intergenerational transfer of family farms is carried out (Fennell, 1981; Blanc and Perrier Cornet, 1993; Handler, 1994; Kimhi and López, 1999; Kimhi and Nachlieli, 2001; Glauben

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1 See OECD (2001) for an analysis of multifunctional agriculture.
et al., 2002a,b, 2004). Larger holdings run by more highly educated farmers are more likely to be taken over by one of the children. Although some studies underline the influence of part-time farming in this matter, few explore the impact of farm location on the success of farm succession. Glauben et al. (2004), for instance, show regional differences in the pattern of family farm transfer between northern Germany and Austria. In Germany, farms are larger and successors work full time on their parents’ farm, while most successors in Austria are part-time farmers. Conversely, Kimhi and Nachlieli (2001), for Israel, conclude that success in intergenerational family farm transfer is not conditioned by location.

In Spain, there has been little research on the subject of intergenerational transfer of family farms (Ramos, 2004). However, an interesting and innovative perspective, that is lacking in the economic literature on family farm succession, can be found in studies on rural youth, where the problem is addressed from the standpoint of the second generation (González, 1991; González and Gómez Benito, 1997, 2001; Gómez Benito and González, 2002; González et al., 2002). These works underscore the fact that the outcome of succession is heavily influenced by farm size, farmers’ children’s educational level and agricultural policy. These studies also highlight the economic transformation of rural areas in Spain, via the development of new activities, as a factor that may influence farm succession. Young farmers have bigger farms and are more pluriactive than their parents. As far as the second of these characteristics is concerned, therefore, the likelihood of the younger generation continuing in farming increases if the farm is close to a source of supplementary employment.

In contrast with the literature on farm succession, several studies on farm exit stress that the survival and growth of farms is increasingly influenced by the surrounding economic environment. For instance, Aldanondo and Ramos (1999) relate agricultural exit to farm succession and farmer retirement and demonstrate the impact of off-farm employment on the stabilization of farms. Glauben et al. (2003) reach similar conclusions in their analysis of regional farm exit in Germany. Farm exit is related to retirement and succession in Germany, with lower exit rates being reported in regions where there is a high share of part-time farmers. Goetz and Debertin (2001) also suggest that the farm exit rate in the US is partially conditioned by off-farm employment opportunities.

This paper therefore examines farm succession in a rural area of Spain by analyzing the impact of farm location. We consider the possible impact of the availability of opportunities for part-time farming, taking into account that they differ for each farm, depending on its distance from an urban centre. The study is based on a survey of farm operators located at various distances from the urban centre in a county (Estella), in the Autonomous Region of Navarre, northeastern Spain. Farm operators were asked whether there was a successor for the farm and questioned about the personal characteristics and employment status of their children. Farm succession was then analyzed both from the standpoint of the farm operator and his expectations and also in terms of the extent to which the adult children participate in farm work.

**The area of study**

The data are drawn from a 1998 farm household survey conducted in the western part of Estella County. Estella has a population of 12,000 and has been one of the county’s labor and population magnets. However, job opportunities are in short supply all over the county and there has been and continues to be considerable emigration to other more industrial regions.

The area is in fact characterized as a rural area (according to OECD, 1994, classification) with its industrial and services sectors still in the early phase of development. Employment in agriculture currently stands at around 27%, as compared with 9.9% in the surrounding region and 10.7% in Spain. The agricultural specialty of the area is cereal crops and it has an emerging pork sector.

Farm holdings range from small to medium in size (with an average of 20 ha of non-irrigated crops). The number of holdings fell by 30% during the 1990s, mainly because of the failure of inter-generational transfer on family farms. The tendency of farmers’ children to emigrate to other areas, a phenomenon that took on massive proportions during the nineteen seventies and eighties, has grown further in recent years due to higher levels of educational attainment among young people in rural areas.

The average age of farm operators is very high. Despite the high incidence of second jobs among younger farmers, moreover, there is less part-time farming and on-farm pluriactivity than in other areas of Navarra.

The fact is that little progress has been made in the diversification of the rural economy: the agro-food industry in this area was minimal at the time of the survey, and there were only two cases of rural tourism.
Another characteristic feature of West Estella county is its isolation. There were no major transport routes through the area and the local roads were narrow and winding. The nearest population centers to the county town of Estella are a quarter of an hour’s drive away, and the furthest three quarters of an hour. The next closest towns were much further away.

Regulation of farm succession in the area has historically been dominated by the institution of the unique heir (Moreno Almárcegui and Zabalza Seguín, 1999). As a rule, parents named one child to be the unique heir, who was then expected to take care of them in their old age. This member of their offspring, whether male or female, inherited the farm in its entirety. The remaining siblings were given an economic compensation (known as the Legítima) and were helped and encouraged to find an alternative means of earning a living. Nowadays, due to the overall growth of the Spanish economy and a variety of other reasons, this institution has for fallen into decline in many regions (Ramos, 2004). In this area in particular, a better educated youth and increasing job opportunities in other sectors have lessened the appeal of farm work and the rural lifestyle as a career option for young people. In many cases, moreover, the success of intergenerational transfer depends more on the preferences of the farmer’s children than on their parents’ decision, though usually the parents are who encourage their children to pursue other careers.

Methodology and sample restrictions

A key step in the analysis of farm succession is to define the relevant population of analysis and to identify which farms have a successor. Both matters are related. Farm succession studies usually consider the relevant population to be farm households operated by farmers over the age of 45. However, Kimhi and Nachlieli (2001) proposed two methods for identifying farms with a successor: one is by directly asking the operator, the other is to ascertain whether any of the farmer’s grown-up children are working on the farm. To apply these criteria, a sample selection of the relevant population is needed. This study is based on these two concepts of successful intergenerational farm transfer, though households with grown-up children working on the farm were often not the ones whose operators claimed to have found a successor. Following these criteria, the relevant sample for the analysis is defined below.

The sample includes 195 farm operators of all ages. It should be noted that, in addition to analyzing farm succession, there was another aim to the survey, which was why the sample included farmers of all ages.

All the farm operators were asked if any of the children intended to carry on with the farm, by requesting them to choose one of the following replies: 1) Yes, I have someone to succeed me on the farm; 2) No, none of the children intends to continue in agriculture; and 3) I don’t know/no answer. The first option was taken as an affirmative reply, while don’t knows and households without grown up children were removed from the sample. The study then focused on succession in the 61 households in which the farm operator had grown up children and claimed to know whether or not he had identified a successor. The household was the unit of analysis when analyzing succession from the farm operator’s perspective.

One of the main issues in a successful outcome, therefore, relates to the incentives for the next generation to go into agriculture. Staying on the farm also involves an opportunity cost directly proportional to the potential wage that each potential successor could earn in the off-farm labor market. Hence, the personal characteristics of each of the farmer’s children may also influence the

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2 According to the data, the active agrarian population in the area was older and part-time farming had less weight than on average in Spain (Aldanondo and Ramos, 1999). This reflects the rural nature of the county as a whole and the limited job opportunities it has to offer.

3 70% of the farm operators with grown-up children working on the farm claimed that one of their children would continue to run the farm; 20% said they did not know; and 10% stated that they had no-one to succeed them. The inverse percentages apply among those with no grown-up children working on the farm.

4 Farm operators without children declared themselves to have no successor, while (with the exception of three) those whose children had not yet reached adulthood said they did not know whether any of them would succeed their father on the farm. Of the 90 farm operators that have grown up children, 29 claimed not to know whether any of them would continue with the farm. The Vella (1992) bias test was applied and the null hypothesis of sampling bias was rejected.
likelihood of his/her entering agriculture. This paper has therefore extended the analysis performed by Kimhi and Nachlieli (2001) by individually questioning farmers’ children regarding their participation in farm work. The purpose of this is to isolate the impact of overall household characteristics from the influence that may be brought to bear by the individual characteristics of each child in the family. The relevant population in this case is the cohort of farmers’ children over the age of 23. This was taken as the minimum age because it is the age at which students complete their higher education in Spain. To analyze entry into farming by farm operators’ children, a cross section household-child data panel was used. The relevant sample for this part of the study is made up of the 76 households with 195 children above the age of 23.

The survey provided information on the educational level, age, and job situation of all the grown-up farm children in the sample, with no distinction between the successor and the rest of the siblings.

Henceforth, the study will focus on measuring the impact of distance and other variables on the likelihood of the farm operator having a successor among his children, and finally on the likelihood of each grown-up son or daughter deciding to work on the farm.

### Results

#### Sample description

Tables 1 and 2 highlight the differences in location, demographics, human capital characteristics and household activity for each of the farms and individuals in the sample. Farm diversification has not advanced much in the area, and the farm operators rarely diversify their activities by providing mechanization services to neighboring farms. Diversified farmers were therefore included alongside full-time farm operators.

Most of the variables in the tables are used to proxy for farm income and potential market wage in each situation. Fixed factors, such as land, machinery, heads of livestock, buildings, farm specialization, and the rest of the household labor supply relate to farm income.

**Table 1. Household description in farm succession**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Household with successor (cases = 39)</th>
<th>Non successor (cases = 22)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Distance to the urban center</td>
<td>15.86</td>
<td>9.25</td>
</tr>
<tr>
<td>Operator age</td>
<td>65.69</td>
<td>9.74</td>
</tr>
<tr>
<td>Operator education</td>
<td>10.88</td>
<td>0.46</td>
</tr>
<tr>
<td>Operator in off-farm employment</td>
<td>0.06</td>
<td>0.22</td>
</tr>
<tr>
<td>Number of children</td>
<td>3.38</td>
<td>1.46</td>
</tr>
<tr>
<td>Offspring’s age</td>
<td>31.53</td>
<td>9.10</td>
</tr>
<tr>
<td>Offspring’s education</td>
<td>0.88&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.09</td>
</tr>
<tr>
<td>Land</td>
<td>28.61</td>
<td>26.13</td>
</tr>
<tr>
<td>Heads of livestock</td>
<td>2.41</td>
<td>6.16</td>
</tr>
<tr>
<td>Machinery</td>
<td>11.35</td>
<td>10.74</td>
</tr>
<tr>
<td>Share in farm income:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>— Cereal</td>
<td>61.92</td>
<td>38.21</td>
</tr>
<tr>
<td>— Sunflower</td>
<td>1.68</td>
<td>4.81</td>
</tr>
<tr>
<td>— Tobacco</td>
<td>5.00</td>
<td>14.37</td>
</tr>
</tbody>
</table>

<sup>a</sup> SD: standard deviation. <sup>b</sup> Household average educational attainment = \[ \frac{\sum_{i=1}^{N} A_i}{N} \], where \( A_i \) = education attainment of grown-up child \( i \); and \( N \) = number of children above 18th in the household. At the same time: \( A_i = [(\text{Years of education per level} \times \text{level of education}) + 5]/\text{Age}_i \), if the grown up child is younger than 23 years old; or \( A_i = [(\text{Years of education per level} \times \text{level of education}) + 5]/23 \), if the grown up child is older than 23 years old.

In past econometric research, it has been found that assistance to part-time farm operators is important for family members under the age of 23 working in the farm.

An annual average of more than two hours a day.
The variables used to estimate the actual employed labor force include the different degrees to which labor-intensive and labor-extensive crops contribute to farm income. Cereals are the main extensive crop in the area. Tobacco is a labor-intensive crop, cultivated as a supplement or an alternative to cereals.

Age and educational level may be potential wage indicators. All the models included age and age-squared of the farm operator in order to capture life-cycle variables. Education is expressed as total years of schooling corresponding to a 5-point scale, ranging from elementary studies to a university degree.

These simple mean values provide a preliminary characterization of the different types of agricultural households. The most outstanding features of the households in which there is a successor or the grown-up children work on the farm are a) that they are nearer to the urban centre, b) they are slightly larger than the rest, and c) the children present a lower average of academic attainment. They present a combination of higher farm labor income and children with a lower potential market wage.

Within this overall picture of agricultural entry, there are two possible situations: one is that the son/daughter works exclusively on the farm and the other is that he/she takes up part-time farming. At this stage in the analysis, no distinction is made between these two categories, which differ in the dependent variable included in the specification of the econometric model of next generation agricultural entry.

These data offer a first hint at the importance of the spatial component in farm succession. However, this spatial component is only represented by the different distances of the farms in the sample to the capital of the county: Estella. Wojan (2000) indicated that there is increasing occupational specialization in non-metropolitan areas. This affects all sectors and is not associated with high skills requirements. Some data from the survey suggest that Estella County, including the capital, may be ripe for this specialization process. On the basis of these simple measurements, it is difficult to discern whether local distances have an influence on farm entry decisions only in households where the children are poorly educated, or whether other groups of rural young are also affected.

### Table 2. Household description in agricultural entry

<table>
<thead>
<tr>
<th>Variable</th>
<th>Household with working sons (cases = 29)</th>
<th>Household without working sons (cases = 47)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Distance to the urban center</td>
<td>14.87</td>
<td>9.11</td>
</tr>
<tr>
<td>Operator age</td>
<td>63.25</td>
<td>11.18</td>
</tr>
<tr>
<td>Operator education</td>
<td>1.93</td>
<td>0.26</td>
</tr>
<tr>
<td>Operator in off-farm employment</td>
<td>0.14</td>
<td>0.36</td>
</tr>
<tr>
<td>Number of children</td>
<td>3.21</td>
<td>1.47</td>
</tr>
<tr>
<td>Offspring’s age</td>
<td>29.94&lt;sup&gt;c&lt;/sup&gt;</td>
<td>8.39</td>
</tr>
<tr>
<td>Offspring’s education</td>
<td>14.97&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.78</td>
</tr>
<tr>
<td>Land</td>
<td>35.73</td>
<td>48.27</td>
</tr>
<tr>
<td>Heads of livestock</td>
<td>0.81</td>
<td>1.71</td>
</tr>
<tr>
<td>Machinery</td>
<td>15.31</td>
<td>1.19</td>
</tr>
<tr>
<td>Share in farm income:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cereal</td>
<td>60.18</td>
</tr>
<tr>
<td></td>
<td>Sunflower</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Tobacco</td>
<td>6.79</td>
</tr>
</tbody>
</table>

<sup>a</sup> The averages refer to the household. <sup>b</sup> SD: standard deviation. <sup>c</sup> Age and years of study of working offspring. Number of observations = 38. <sup>d</sup> Age and years of study non-working offspring. Number of observations = 157.

*Compulsory schooling begins at age 5. Primary level represents 9 years’ schooling (after which compulsory education used to be complete), the second level = 11 years’ schooling, the third = 13 years, the fourth = 16 years and the fifth = 18 years.

* 40% of the children that work on the family farm have a second job.

Estimation and results of the succession models

Table 3 reports the estimated parameters of different econometric models. The first equation is a probit model...
that determines the impact of the different variables on the likelihood of the farm operator having someone to succeed him. The second equation is a random parameter ordered probit model in which the dependent variable $Y_{ij}$ indicates whether the $j^{th}$ grown-up child (over the age of 23) on the $i^{th}$ farm does not work on the farm at all (0), works on the farm and holds a second job (1), or works exclusively on the farm (2).

The explanatory variables in both models include both farmers’ personal profiles and the financial reward that the farm holds out to the second generation. The

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Dependent variable: The farmer has successor (1 = «yes»; 0 = «no»)</th>
<th>Independent variables</th>
<th>Dependent variable: Son works in the farm (2 = «yes, exclusively»; 1 = «yes, part time»; 0 = «no»)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameter estimates (t-values)</td>
<td></td>
<td>Parameter estimates (t-values)</td>
</tr>
<tr>
<td><strong>Fixed parameters</strong></td>
<td></td>
<td><strong>Fixed parameters</strong></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>33.523** 1.958</td>
<td>Intercept</td>
<td>5.961 1.687</td>
</tr>
<tr>
<td>Distance</td>
<td>–0.071** –2.245</td>
<td>Distance</td>
<td>–0.062*** –5.822</td>
</tr>
<tr>
<td>Operator age</td>
<td>–1.206** –2.297</td>
<td>Operator age</td>
<td>–0.180* –1.742</td>
</tr>
<tr>
<td>Age squared/100</td>
<td>1.031** 2.445</td>
<td>Age squared 100</td>
<td>0.245* 1.609</td>
</tr>
<tr>
<td>Operator education</td>
<td>0.655 1.351</td>
<td>Operator education</td>
<td>–0.390*** –1.757</td>
</tr>
<tr>
<td>Operator in off-farm employment</td>
<td>0.380 0.467</td>
<td>Operator in off-farm employment</td>
<td>0.499 1.433</td>
</tr>
<tr>
<td>Number of offspring</td>
<td>0.057 0.306</td>
<td>Number of children</td>
<td>–0.164** –2.690</td>
</tr>
<tr>
<td>Offspring’s education</td>
<td>–5.640** –2.124</td>
<td>Offspring’s education</td>
<td>–0.021 –1.378</td>
</tr>
<tr>
<td>Age difference father-child</td>
<td>0.018 –0.362</td>
<td>Age difference father-son</td>
<td>–0.013* –1.921</td>
</tr>
<tr>
<td>Land</td>
<td>0.032** 2.178</td>
<td>Land</td>
<td>–0.249*** –3.451</td>
</tr>
<tr>
<td>Livestock</td>
<td>–0.036 –1.128</td>
<td>Livestock</td>
<td>0.310*** 3.451</td>
</tr>
<tr>
<td>Log-Machinery</td>
<td>0.036 –1.343</td>
<td>Log-Machinery</td>
<td>Sales share of:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>— Cereal –0.021* –2.374</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>— Sunflower –0.060** –2.223</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>— Tobacco 0.084 –0.473.291</td>
</tr>
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<td></td>
<td><strong>Random parameters</strong></td>
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<td></td>
<td><strong>Offspring’s education</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean –0.085** –2.146</td>
</tr>
<tr>
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<td></td>
<td>Scale 0.027*** 4.256</td>
</tr>
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<td><strong>Threshold parameter</strong></td>
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<td></td>
<td>Threshold parameter 0.568*** 4.356</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N (76,195)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>lnL –83.673</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>lnL0 –121.667</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>lnLR0 –111.046</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2(lnLL – lnL0) 29.711*** (13)</td>
</tr>
<tr>
<td>Entire samplec</td>
<td>77.0%</td>
<td>Yes =1 75.0%</td>
<td></td>
</tr>
<tr>
<td>Yes = 1</td>
<td>80.0%</td>
<td>No = 0 80.0%</td>
<td></td>
</tr>
</tbody>
</table>

\[^a\text{lnL} = \text{Log-likelihood of an ordered probit model, with only intercept and threshold.} \ ^b\text{lnLR0 = Log-likelihood of an ordered probit model with all the parameters equal to zero and the constant random.} \ ^c\text{Used to predict sample probabilities.}\]
age of the farm operator is a key factor, because it
determines when he will begin to seek a successor.

There is a lack of consensus on the influence of the edu-
cational level of the farm operator on farm succession.
For some authors a higher level of education helps the
father to make a more efficient choice of successor
among his children (Khimi and Nachlieli, 2001). This
could be an important factor in traditional societies.
In another study on succession in Europe, Glauben et
al. (2004) showed that the success of intergenerational
transfer of family businesses could be negatively
affected by the educational level of the father. In this
case, it might be more a question of intergenerational
transmission of social status: the children of poorly
educated farmers go into agriculture, while those of
better educated farmers do not. Since this impression
needs to be put to the test, our study includes the father’s
educational level as an explanatory variable in the
succession models.

When it comes to the reward to be gained from the
farm, it is the farm structure and farm specialization
variables that determine both farm household income
and another important factor, which is the intensity and
continuity of farm labor demand. An extra incentive
for children willing to take over the family business is
the possibility of combining farm-work with a second
job. The two main factors here are whether the father
holds an off-farm job and the commuting distance from
the urban centre; the first because it shows off-farm
employment to be a workable option and the second
because it entails commuting costs for those consider-
dering pluriactivity.

Finally, farm children’s educational level has been
included in the models in order to capture the oppor-
tunity costs of their remaining on the farm. In the first
model, where the variable is the probability of the farm
operator having a successor (based on his response in
the survey), a specific indicator has been constructed.
In fact, the educational level of the grown-up children
may be related with the age of the individual. For in-
stance, an 18 year old would not normally have completed
university studies. In the model, therefore, the average
educational level of grown-up children has been replaced
with an explanatory variable called average academic
attainment. Academic attainment is calculated by di-
viding each child’s declared number of years of educa-
tion
9 (corresponding to the level of completed education)
by his/her age, for ages under 23, or by 23 (the age by
which higher education is normally completed in
Spain), for ages over 23. In the next generation agri-
cultural entry model, years of study, corresponding to
the level of completed education, is kept as an explana-
tory variable, since all the farmers’ children are over
23 years old.

Thus, both models included variables intended to
capture income from on-farm labor, be it full or part-
time, and the opportunity costs involved in each alter-
native.

Econometrically speaking, there is nothing remarkable
about the first model. It is a probit model in which the
dependent variable, which is the probability of the farm
operator having a successor, is dependent on the nor-
mal distribution of a linear combination of the explana-
tory variables.

The econometric model of agricultural entry by farm
children is less common in the literature. It is a random
parameter ordered probit model (Train, 2003; Green,
2004) using a cross section household/child data. The
explanatory variables of the model include household
data, which are common to all the offspring of an indi-
vidual farm operator, and the age and years of schooling
completed by each child. The objective of this model
is to analyze each child’s probability of taking one of
three options: not working, working part-time or
working full-time work on the farm. An ordered model
has been used because it provides the best fit to this
type of decision (Sadoulet et al., 1998; Aldanondo and
Ramos, 1999). If farm labor income and conditions are
worse than the child’s potential off-farm salary and
conditions, he/she may decide not to continue with the
father’s business. If they are more or less similar,
he/she may opt to combine it with a second job. If they
are better, it may be worth full-time dedication. Thus,
the model is specified as follows:

\[
Pr(\text{child}_i \text{ will not work on the farm}) = Pr(Y_{ij}^* \leq \mu_1)
\]

[1]

\[
Pr(\text{child}_i \text{ will combine farm work with a second job}) = Pr(\mu_1 < Y_{ij}^* \leq \mu_2)
\]

[2]

\[
Pr(\text{child}_i \text{ will work exclusively on the farm}) = Pr(Y_{ij}^* > \mu_2)
\]

[3]

where \(Pr\) is the normal distribution function, \(Y_{ij}^*\) is a
latent dependent variable and \(\mu_1\) and \(\mu_2\) are the thres-
holds of this latent variable. When the latent variable
crosses the first threshold, the prediction is that the

9 Plus five, because compulsory schooling at the age of five.
child will opt for part-time farm work. When it crosses the second, the prediction is that the child will opt for farm work exclusively. The latent variable also depends on a set of explanatory variables according to the following linear function:

\[ Y_{ij}^* = \alpha + \beta_{1i} + \beta_2 \text{Age of child}_{ij} + \lambda_k X_k + \epsilon_{ij} \]  \[4\]

\( X_k \) are a set of explanatory variables that are common to all the children of the household, while educational attainment and age are specific to each of those over the age of 23. Finally, \( \epsilon_{ij} \) is the error, which has a normal distribution \( N(0,1) \).

Another of the aims of this paper, in addition to testing the impact of farm location, was to examine whether educational attainment among young people who remain in agriculture is always lower or varies across farm households. It would appear reasonable to expect that the effect of the educational level of the children on their possible entry into agriculture will itself depend on non-measured household-specific factors. The random parameter model allows us to test whether the effect of farm children’s educational level on agricultural entry varies across the households or not. This study uses a model in which the coefficient of the explanatory variable, farm child’s educational level, in the second equation, \( \beta_{1i} \), is specified as a random parameter. This coefficient varies across households according to the following equation:

\[ \beta_{1i} = \beta_1 + \sigma v_i \text{N}(0,1) \]  \[5\]

This equation decomposes the coefficient of farm children’s education, \( \beta_{1i} \), into two parts: one is the average, \( \beta_1 \), which is fixed and common to all households, while the other is the standard deviation of the random parameter, \( \sigma \) multiplied by an unobservable random term, \( v_i \) in the \( i \)th observation in \( \beta_{1i} \), which is independently normally distributed (Revelt and Train, 1998; Train, 2003; Green, 2004). The model assumes that the education level parameter is heterogeneous and varies across households, with a mean \( \beta_1 \) and a standard deviation \( \sigma \).

Table 2 gives the results of the estimations. Both models were estimated for a sub-sample of the overall sample. In all cases the Vella (1992)\(^{10}\) selection bias test was used to test for sample bias. In the succession model, two independent probit sample selection equations were estimated: one, for the binary variable, «has grown-up children» and, the other, for the binary variable, «knows whether there is someone to succeed him». A bivariate probit model was used first, to test for error correlation between these two models. For the panel data model of next generation agricultural entry, the generalized residual of the sample selection equation was introduced as a household-specific variable. Having clarified these procedural details, it should be added that in all cases the null hypothesis that the sample is random with respect to the population as a whole was confirmed. All models were estimated with the Limdep 8.0\(^{11}\) statistical package.

The succession model is statistically significant at better than the 1% level, as measured by the Log-likelihood (lnL) test ratio \(^{12}\). The percentage of correctly classified observations is 76%. In the next generation agricultural entry model, the lnL of the random parameters ordered probit model –83.673. The results confirm that the scale or the standard deviations of the random coefficients of the offspring’s educational level are statistically significant. In other words, the results verify unspecified group-specific heterogeneity and confirm that the impact of farm children’s educational attainment on the probability of their working on the farm varies for each household.

The data in the second equation perfectly fit an ordered probit model, which could be considered an appropriate econometric specification to analyze participation in farm-work by farm children, while distinguishing between those who hold a second job and those who work full-time on the farm. The threshold parameter for the index is set to zero by the estimation for the first level and takes a value of 0.568 for the second level. The fact that the parameters are significant suggests that there is some order in the decisions.

\(^{10}\) This is an extension of the Heckman (1979) test to qualitative variables, where the generalized residual of the probit selection equation is introduced as one more explanatory variable in the main equation. Under the null hypothesis, of no sample bias, its coefficient is not different from zero. Using this procedure, it is possible to reduce the multi-collinearity problem associated with sample selection models (Nawata, 1993; Leung and Yu, 1996; Vella, 1998; Moffit, 1990). Pagan and Vella’s (1989) normality test was also applied, given that the distribution has to be normal in order for the estimators to be consistent. Results indicate that the residuals of the selection equation have a normal distribution. All these results can be obtained from the authors upon request.

\(^{11}\) Provided by Econometric Software, Inc., 15 Gloria Place, Plainview, New York, 11803 USA.

\(^{12}\) The test is based on the statistic \(-2[L(\hat{\beta}) – L(0)]\) which is distributed as a \(\chi^2\) with different degrees of freedom for each model.
Discussion

The coefficient of the distance variable in both models is found to be statistically significant and to have the same negative sign. These results suggest that fewer of the children on farms located in remote areas will go into agriculture. Despite being a new finding in the analysis of farm succession in Spain, this is consistent with the conclusions of the literature on farm exit.

As far as fixed factor endowment is concerned, land (total surface area of the farm in hectares) and investment in machinery have a positive impact on the likelihood of the heirs continuing to work the farm.

The only surprising result is the negative sign of the coefficient of the number of heads of livestock in the second equation. The probability of the next generation working on the farm decreases with the number of heads of livestock. It is difficult to account for the fact that farms with more livestock should have less appeal for the heirs to the holding, because livestock farming tends on the whole to yield a higher level of income per unit of surface area than does arable farming. The reason may therefore lie partly in the hard work, harsh conditions and long hours associated with livestock farming (especially on small poorly mechanized holdings such as those of the sample), and partly in the high incidence of pluriactivity (40%) among farmers’ children.

The coefficients of the remaining variables, which reflect the economic orientation of the farms, are consistent with this interpretation. The participation of farmers’ children in on-farm work is negatively influenced by the share of cereal (Eqs. [1] and [2]) and sunflower (Eq. [2]) and positively influenced by the share of tobacco (Eq. [2]). This is an expected result. Cereals and oil-seed crops are mechanized crops that do not require much labor, while tobacco is a highly profitable labor intensive crop, where seasonal labor demand peaks in summer.

The coefficient for off-farm employment of the father is not statistically significant in any of the models. At first sight, this lack of significance appears to suggest that the intergenerational transfer of part-time holdings is no easier than that of full-time holdings. In this respect, the fact that both the distance and land variables affect succession might indicate that the reason that the heirs continue in agriculture is, in some cases, because the business provides them with acceptable full-time employment and, in others, because the farm’s location allows them to hold two jobs. This could be an indication that there are two alternative modes of agricultural entry.

When it comes to the demographic variables involved in succession, «number of children» bears the expected sign: it is positive in the succession model and negative in the «next generation agricultural entry» model. This means that succession is more likely to happen when the farmer has numerous offspring and each child’s probability of opting for farm-work decreases with the number of siblings. Although these effects appear obvious and logical, the coefficient is significant only in the second model. The lack of significance in the first model contrasts with the importance of this variable in previous analyses of succession mentioned earlier. It may be due to the fact that they use a different household category from the one used in this paper, which analyzes the antecedents of successful intergenerational farm transfer in households whose operators have children and claim to know whether they have someone to succeed them. Other studies use apparently wider-ranging household samples.

The age of the farm operator, and hence that of his children, has a quadratic effect on the likelihood of identifying a successor. Within the narrow age range of the farm operators in the sample, the probability of there being a successor is polarized around the youngest and the oldest. This probability decreases with the father’s age up to the age of 59 and with the child’s age up to the age of 39, and increases after these ages, respectively. This result is in line with some other studies on farm succession in the EU (Glauben et al., 2002a, 2004). This pattern might be related to the moment of time in which intergenerational transfer of farm management is considered. Indeed, the implementation of 1993 common agricultural policy (CAP) grants for newly established young farmers (under forties) in this region required the farm to be of a par-
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Farms with larger extensions of land and more machinery are more likely to attract the children of the household into agriculture. This is logical and consistent with the economic literature on farm succession. With more land and more fixed capital, aspiring young farmers will be able to obtain a higher income from their efforts. It appears less obvious that the probability of farmers’ children working on the farm is inversely related to the number of heads of livestock, since livestock farming is a good potential source of farm income. The explanation for this, we believe, lies partially in the hard work, long hours and harsh conditions associated with livestock farming, but also in the tendency of young people to combine farm-work with other jobs. These results suggest that young people deciding to work on the family farm take into consideration the set of conditioning factors that such a decision imposes on their lifestyle. These include not only the income they can obtain from the farm but also the degree of satisfaction or hardship involved.

Finally, farm children’s educational level has a significant negative impact on the likelihood of their carrying on with the farm. This result confirms one of the main findings reported in studies of rural youth in Spain. Additionally, our research provides econometric proof that the probability of agricultural entry for each adult child of the farming household diminishes as his/her level of education rises, whatever the farm type.

As conclusion, in this paper we have analyzed the impact of farm location on farm succession in a rural area in Spain. This is an empirical analysis based on the data obtained from a survey of farm owner-operators located at different distances from the local county town. We have analyzed intergenerational farm succession from different perspectives, using different models. We used a probit model to analyze succession from the farm operator perspective and estimated a random parameters ordered probit model to analyze next generation agricultural entry. The results of the econometric models lead us to the conclusions summarized below.

First, distance from the local urban centre has a negative effect on succession. The more remote the holding, the less likely the operator is to be succeeded by one of his offspring and the less likely the latter are to work on the farm. This may be due to the high incidence of pluriactivity among those farmers’ children who do work on the farm. The greater the distance from the urban centre, the more difficult it becomes to combine farming with a second job.

The actual study adds to previous research, on the effect of young people’s educational level on their decision whether or not to remain on the farm, by allowing the weight of the variable to vary across households in the second model. As can be seen from Table 2, this coefficient has an estimated mean of −0.085 and estimated standard deviation of 0.027. The estimated standard deviation is highly significant, indicating that the parameter varies across households. However, the estimated standard deviation is quite low in relation to the mean. Considering that the coefficient follows a normal distribution, this low relative value of standard deviation implies that practically none of the households has an estimated coefficient of offspring’s educational level lower than zero. Thus, the results suggest that, regardless of farm structure and household characteristics, youngsters with a higher level of education, within and across households, do not opt to remain on the farm.

These results are affected by local conditions in the study area. This particular area is characterized by a combination of relatively homogeneously structured medium-sized holdings and a high level of education among farmers’ offspring. Nevertheless, it can be said in their favor that they are consistent with the main findings reported in studies of rural youth in Spain.
In short, the probability of a positive outcome to farm succession diminishes as the educational level of the farmers’ children rises. For less educated young people, however, the attraction of remaining on the farm increases with the size of the holding and its proximity to urban centers. This finding, obtained with methodology hitherto untried in the research on succession, is an additional contribution to the analysis of farm succession in Spain. The coefficient of farm children’s level of education was allowed to vary across farms in the cross section data model used to describe farm children’s entry into agriculture. The results show that this coefficient is always negative, irrespective of farm type.

The economic policy implications of our results are somewhat intuitive. Policy initiatives to foster qualified employment both on- and off-farm in rural areas may perhaps help to retain young people in agriculture as the mean educational level of the population rises. Several studies have shown that the relocation of firms from urban to rural areas generally tends to affect medium- or low-skilled jobs. Nevertheless, agriculture itself may provide a source of skilled jobs. The structural requirements are likely to involve major transformations from the farms we are used to seeing. Possible changes could mean the horizontal growth of farms through mergers or integration, or vertical growth, where farms diversifying into industrial processing activities acquire enough scale to permit the efficient use of skilled labor.

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