Family and Non-Family Succession in the Upper-Austrian Farm Sector

Alfred M. STIGLBAUER,
Christoph R. WEISS

Cahiers d'économie et sociologie rurales, n° 54, 2000

Alfred M. STIGLBAUER *, Christoph R. WEISS **

Successions familiales et non familiales dans les exploitations agricoles de la Haute-Autriche

Résumé – Comprendre la transmission des exploitations agricoles est essentiel pour analyser les changements structurels du secteur agricole. Grâce à des données de recensements apariées de 1980, 1985 et 1990, les décisions de succession des ménages ruraux de Haute-Autriche sont examinées empiriquement en utilisant un logit multinomial. Contrairement aux enquêtes auprès des exploitations qui examinent les projets de succession, le recensement des exploitations permet d'identifier des successions ayant réellement eu lieu. Deux types de successions sont distingués sur la base de la comparaison de l'âge de l'exploitant et de celui des autres membres du ménages de chaque exploitation dans deux recensements consécutifs : les « successions familiales », définies par la transmission de l'exploitation à un enfant de l'exploitant et les « successions non familiales » (dans lesquelles l'exploitation est vendue hors de la famille). Les fermetures d'exploitation sont considérées comme une catégorie supplémentaire dans le modèle. Un impact significativement négatif (positif) de la taille de la ferme et de la diversification des activités agricoles sur la probabilité de fermeture d'exploitation (de transmission) est mis en évidence. La probabilité d'une succession familiale commence par augmenter puis diminue avec l'âge de l'exploitant alors que les probabilités d'une transmission hors de la famille et d'une fermeture d'exploitation augmentent de façon monotone avec l'âge, indiquant que les exploitants qui ne prennent pas leur retraite à temps courent le risque de ne pas trouver de successeur au sein de la famille. La taille de la ferme ainsi que l'éducation et le sexe de l'exploitant semblent également avoir une influence sur les transmissions et les fermetures d'exploitations. Enfin, les exploitants pluriactifs ont une probabilité significativement plus faible de transmettre leur ferme au sein de la famille mais ont une probabilité significativement plus élevée de fermer leur exploitation. Cela suggère qu'un emploi non agricole peut être le premier pas d'une exploitation familiale vers la sortie du secteur agricole. Le choix du modèle, les questions de spécifications et les directions de recherches futures sont également discutés.

Mots-clés :
analyse micro-économique des ménages ruraux, mobilité professionnelle et inter-générationnelle, modèles de choix qualitatifs

Family and Non-Family Succession in the Upper-Austrian Farm Sector

Summary *– Using linked census data from 1980, 1985, and 1990 actual succession decisions of Upper-Austrian farm households are examined empirically. Two types of succession are distinguished by inspecting the age of the farm operator and other household members in the consecutive census observations: "family succession" (succession by the farm operator's child) and "non-family succession" (the farm is sold outside the family). Farm exits are considered as an additional category in the model. Several characteristics of the farm and of the farm operator's household are found to influence the succession decision significantly. Model choice and specification issues are discussed.*

Key-words:
micro-analysis of farm households, occupational and intergenerational mobility, qualitative choice models

* *Department of Economics, Johannes Kepler University of Linz, A-4040 Linz-Auhof, Austria*
e-mail : a.stiglbauer@jk.uni-linz.ac.at

** *Department of Food Economics and Consumption Studies, University of Kiel, Olshausenstrasse 40, D-24118 Kiel, Germany*
e-mail : cweisse@food-econ.uni-kiel.de

We wish to thank three anonymous referees for their suggestions and Ernst Fürst for providing the data. We received helpful comments on an earlier version of the paper from Alfons Ballmann, the participants of the IAES conference in Vienna as well as the EAAE conference in Warsaw and particular from Ayal Kimhi. Financial support from the Austrian Science Fund, Project No. P12071-OEK is gratefully acknowledged.

IN contrast to most other sectors of the economy, agriculture is dominated by family forms of production in nearly all developed countries with a free-market economy. As pointed out in Gasson and Errington (1993), the term "family farm" is common currency but open to a wide range of interpretations. In examining the specific characteristics to define a farm family business, they argue: *"the final distinguishing feature of the ideal type of farm family business is that business ownership and management are handed down within the family"* (p. 39).

Different explanations for this predominance of intergenerational extension in agriculture have been offered, a more detailed survey is available in Kimhi (1997). According to Pesquin *et al.* (1996), intrafamily succession enables the extended family to enjoy the benefits of intergenerational risk-sharing when annuity markets are imperfect. It also allows farmers to rely on the farm for old-age support and thus enables them to partly overcome binding borrowing constraints (Kotlikoff and Spivak, 1981, as well as Kimhi and Lopez, 1997). Similarly, Tweeten and Zulauf (1994) argue that intrafamily farm succession allows entering farmers to overcome borrowing constraints, at least in commercial farms. Rosenzweig and Wolpin (1985), on the other hand, emphasize that the predominance of intergenerational familial (non-market) transactions in land and labour does not arise from imperfections in land, labour or capital markets. Instead, the existence of returns to land-specific experience creates incentives for farm offspring to work on the family land when young. This transfer of farm-specific human capital from father to son increases the value of the transferred physical asset; the young thus are the highest market bidders for their parents' land.

Another field of theoretical work, which is closely related to the issue of succession, aims at explaining the characteristics of financial parent-child transfers. The most prominent approaches in this literature are the altruistic transfer model (Becker, 1974) and the exchange model (Cox, 1987). Whereas the first approach assumes that families can be characterised by altruistic parents (but selfish children) and parents thus derive utility from the well-being of their children, the exchange model claims that relationships between parents and their adult children are defined by reciprocity instead of altruism. It is assumed that children provide personal services for which there may not be good market substitutes, such as care and affection, to their parents and receive financial transfers in return.

Given the importance of (family) succession in the farm sector, surprisingly little theoretical and empirical work is devoted to this issue in agricultural economics. The existing literature is dominated by social scientists and anthropologists (Khera, 1973; Errington, 1993; Blanc and Perrier-Cornet, 1993). A formal economic model, that could serve as an adequate basis for deriving testable predictions in the farm-household context is not available yet.

The purpose of this study is to analyse the succession decision[1] in the Upper-Austrian farm sector empirically. Using data from three farm censuses (1980, 1985 and 1990), which have been linked, we identify farms where the person operating the farm did not change in two succeeding years (no farm succession), where the farm has been handed down within the family (family succession), and where the farm has been transferred to a person that did not live on the farm before (non-family succession). In cases where there is no successor in the farm operator's family the decision to retire often goes hand in hand with the exit of the farm from the agricultural sector. This situation will also be captured by considering farm exits as a separate category in the empirical model. We examine the family and farm attributes which affect the likelihood of actual farm succession and farm exits between 1985 and 1990[2].

Using census data allows us to investigate **actual decisions** as opposed to **succession plans**, which have been the subject of many empirical studies based on farm surveys. Although farm surveys typically provide more detailed information on the motives of a specific behaviour, they often consider the farm operator's point of view only and do not pay enough attention to the children's view. The farm operator's plans however do not always materialize as the designated successor may decide to develop a career in the non-farm business. In particular, the probability of the farm operator's succession plans to come true might be related to farm and family characteristics (such as farm size) thus introducing biases into empirical results from farm surveys.

The first section describes the data set and the econometric model, the second one is devoted to the discussion of the empirical results and the last one concludes.

DATA AND ECONOMETRIC METHOD

The process of how farms are passed on from one generation to the next differs substantially between countries. In Austria, the successor does not have to buy the farm from his parents but instead must take

(1) In analysing how farms are passed on from one generation to the next, a distinction between inheritance (the transfer of legal ownership) and succession (the transfer of management control) is important. In this paper we investigate the transfer of legal ownership. However, since we exclude farm operators who are not working on their farm at all, it may be assumed that ownership of the farm and farm management typically is in the hand of the same person and the distinction between inheritance and succession thus is less important. In what follows, we use the terms «inheritance» and «succession» interchangeably.

(2) The empirical results when investigating the 1980 to 1985 period are reported in Tables A.3 and A.4 in the Appendix.

care of them and cover some of their needs. Succession contracts may also include a monetary compensation, which depends on the successor's financial abilities. More details on the conditions under which property is transmitted from one generation to the next in different European countries is available in Blanc and Perrier-Cornet (1993).

In the empirical model, we identify farm successions from a panel of more than 50,000 Upper Austrian farm households for three years, 1980, 1985, and 1990. Upper Austria, which is the third largest state in Austria (14.3 % of area and 17.2 % of population) is one of three major agricultural regions in Austria and is particularly devoted to dairy production. Whereas 19 % of all farms are located here, farms own 29 % of all livestock in Austria. For each year, the farm census collects information on the farm as well as some family characteristics such as age, sex, and schooling of various family members, and the off-farm employment status. Information on the farm operator was used to identify farm successions. If the age of the farm operator between 1985 and 1990 has increased by less than 3 years (or more than 6 years), we conclude that the person operating the farm has changed. Farm succession **within the family** is observed in cases where the farm operator changed **and** the age of the new farm operator (in 1990) equals the age of a family member in the 1985 census plus 3 to 6 years[(3)]. In those cases, where the farm operator changed but we could not identify a family member whose age in 1985 corresponds to the age of the new farm operator in 1990, we consider this as farm succession outside the farm family (non-family succession)[(4)]. The definition of farm exits, finally, is derived from the measure of farm size. Exiting farms are those reporting a positive farm size in 1985 and a farm size of zero in 1990. Two alternative measures of farm size are available: acres under cultivation and the number of livestock (measured in "median large animal units")[(5)]. Unfortunately, more appropriate variables in a farm management sense (e.g. net farm income or

(3) Alternative age differential criteria have been used in order to show that the estimation results are robust to the choice of a threshold. Using information on the sex of the farm operator in addition to the age of all family members, we also identified 2,171 cases in the data set where the farm operator has handed over the farm to his marital partner (wife or husband). Estimation experiments where family succession is broken down into succession to children and succession to the partner have not been successful however. In particular, the empirical model completely failed in "explaining" succession to husbands and wives. For this reason, succession to the partner will be considered as "no succession" in the following empirical model and "family succession" thus implies intergenerational succession within the same family only.

(4) Clearly, this definition is too general in that succession to distant relatives would erroneously be considered a "non-family succession". However, a more precise differentiation is not possible with the available data set.

(5) A median large animal unit is an index defined according to the live weight of an animal. A live weight of 650 kg (1,433 pounds) corresponds to one median large animal unit.

net worth) are not available. Given the importance of dairy farming in Upper Austria, most of what follows analyses farm succession and exits by utilising livestock as a measure of farm size. The results when using the alternative farm size measure are, however, very similar. To guarantee a homogenous data base, the analysis is restricted to households that reported all relevant information for estimating the equations. The farm households satisfying these criteria in 1985 number 42,405.

Table 1 reports the classification of the farms into the various categories. The definition and summary statistics of all other variables used are reported in Table A.1 in the Appendix.

Table 1.
Farm succession in Upper Austria between 1985 and 1990

	Number of farms	Dependent variable ($SUCC_{85-90}$)
Number of farms in 1985	42,405	
# of farms with no succession	34,055	0
# of farms with family succession	4,125	1
# of farms with non-family succession	1,247	2
# of farm exits	2,978	3

Table 1 suggests that succession has occurred in 12.7 % of all farms (13.6 % of all surviving farms) between 1985 and 1990. In most of these cases (76.8 %), the farm has been handed down within the family. This strong hereditary tendency corresponds to evidence from a farm survey in Upper Austria (Mayr and Peterseil, 1995) as well as to empirical studies from other European countries (Gasson *et al.*, 1988).

In the empirical model, we aim at explaining the individuals' decisions between the four alternatives: no succession ($SUCC$ = 0), family succession ($SUCC$ = 1), non-family succession ($SUCC$ = 2), and farm exits ($SUCC$ = 3). Suppose that household utility (which can be conceived as a weighted average of the utility of all household members) U_{ij} associated with alternative j (j = 0, 1, 2, 3) for individual i is $U_{ij} = \alpha + \beta_j' X + \varepsilon_{ij} = Z_j + \varepsilon_{ij}$, where X is a matrix of farm and household characteristics, β_j is a vector of parameters and ε_{ij} are disturbances. If the household makes choice j in particular, we assume that U_{ij} is the maximum among the J alternatives: $U_{ij} > U_{ik}\ \forall\ k \neq j$. Assuming that the J disturbances ε_{ij} are independent and identically distributed with Weibull distribution $F(\varepsilon_{i,j}) = \exp(-\exp(-\varepsilon_{i,j}))$, the probability for a specific decision can be computed as $\Pr(SUCC = j) = P_j = \frac{e^{z_j}}{1 + \sum_{j=1}^{J} e^{z_j}}$. The log-likelihood for estimating the parameters β_j in this multinomial logit model is $\ln L = \sum_{i=1}^{n} \sum_{j=0}^{j} d_{ij} \ln P_j$ with d_{ij} = 1 if alternative j is chosen individual i, and 0 if not. As with the probit or logit model, the parameters β_j of the multinomial logit model are difficult to interpret. In the following section, we thus also refer to the marginal effects δ_j of the attributes on the probabilities $\delta_j = \frac{\partial P_j}{\partial x_i} = P_j\,[\beta_j - \bar{\beta}]$, with $\bar{\beta} = \sum_{j=1}^{J} P_j \beta_j$.

The multinomial logit model assumes the odds ratio P_j/P_k of any pair of alternatives to be independent of the other alternatives (assumption of the independence of irrelevant alternatives, IIA). The validity of this assumption is examined using Hausman's specification test where a "reduced" version of the model (excluding one alternative) is estimated in addition to the full model and a Chi-squared test statistic is derived based on the differences of the coefficients. A rejection of this test would indicate that the choice of the alternative in question is not on the same level and would suggest a "nested" structure of the decision tree (Maddala, 1983).

We have carried out several estimation experiments to test the IIA-assumption. When eliminating the family succession alternative (*SUCC* = 1 in experiment 1), the non-family succession alternative (*SUCC* = 2 in experiment 2), as well as the exit alternative (*SUCC* = 3 in experiment 3), the Hausman test does not reject the IIA-assumption. However, when eliminating the no succession alternative (*SUCC* = 0) and re-estimating the restricted model, the Hausman test rejects the IIA-assumption (χ^2 = 458.93 with 38 degrees of freedom). The farmer's decision to continue to farm (*SUCC* = 0) and the decisions about the type of succession (*SUCC* = 1, *SUCC* = 2, and *SUCC* = 3) thus do not seem to be made at the same choice level. Investigating the different levels of the farmer's choice problem in more detail (in a nested logit model) would be an important area of future research[(6)].

FARM SUCCESSION AND EXIT

The results of the multinomial logit model are reported in Table 2, the corresponding marginal effects are shown in Table A.2 in the Appendix.

[(6)] Unfortunately, some first estimation experiments with the full information maximum likelihood estimator (using LIMPDEP 7.0) have not been successful. The estimation procedure did not converge, as it is not uncommon with these models. The same problem arises when experimenting with alternative nested logit tree structures (e.g. with three levels). An additional problem in the nested logit model is that there is no well defined testing procedure for discriminating among different tree structures. For these reasons, we did not follow this econometric approach any further in the present paper.

Table 2. **Results of the multinomial logit model (succession and exits 1985-1990)**

Independent Variables	Family Succession $SUCC_{85\text{-}90} = 1$ Param.	(t-value)	Non-Family Succession $SUCC_{85\text{-}90} = 2$ Param.	(t-value)	Farm Exits $SUCC_{85\text{-}90} = 3$ Param.	(t-value)
Intercept	-41.699	(-36.33)	-5.092	(-10.49)	1.172	(4.24)
$\ln(S)_{85}$	0.435	(14.97)	0.098	(2.77)	-0.293	(-17.12)
$\Delta\ln(S)_{80\text{-}85}$	-0.194	(-3.55)	-0.118	(-2.09)	-0.016	(-0.67)
$BERRY_{85}$	0.667	(5.34)	0.558	(3.27)	-1.857	(-17.50)
PT_{85}	-0.223	(-4.62)	0.354	(4.67)	0.634	(11.18)
AGE_{85}	1.096	(28.54)	0.037	(2.28)	-0.076	(-7.29)
$AGE_{85}^2/100$	-0.787	(-24.22)	0.036	(2.31)	0.102	(9.49)
EDU_{85}	0.254	(5.81)	0.162	(2.34)	0.049	(0.99)
$MARR_{85}$	-0.412	(-5.82)	-0.426	(-5.01)	-0.739	(-12.83)
$\#FAM_{85}$	0.246	(18.62)	-0.555	(-20.02)	-0.159	(-9.62)
$GENDER_{85}$	0.573	(10.62)	0.373	(4.89)	0.184	(3.35)
$R1$	-0.137	(-1.05)	-0.084	(-0.43)	-0.375	(-3.30)
$R2$	-0.120	(-1.78)	-0.006	(-0.06)	-0.459	(-6.13)
$R3$	0.069	(0.93)	0.128	(1.09)	-0.097	(-1.21)
$R4$	-0.043	(-0.67)	-0.038	(-0.38)	-0.397	(-5.57)
$R5$	0.045	(0.76)	0.012	(0.12)	-0.450	(-6.71)
$HZ0$	-0.186	(-2.78)	0.061	(0.59)	1.484	(16.64)
$HZ1$	-0.128	(-1.86)	-0.163	(-1.43)	0.545	(5.67)
$HZ2$	-0.124	(-1.59)	0.006	(0.05)	0.358	(3.36)

Number of Observations:	42,405	Likelihood Ratio Index (DF):	0.247 (54)
Log Likelihood:	-22,115	Likelihood Ratio Test (DF):	14,543 (54)
Restricted Log Likelihood:	-29,387		

Predicted

Actual	$SUCC = 0$	$SUCC = 1$	$SUCC = 2$	$SUCC = 3$	Total
$SUCC = 0$	33,137	584	41	293	34,055
$SUCC = 1$	3,245	832	5	43	4,125
$SUCC = 2$	1,101	72	17	57	1,247
$SUCC = 3$	2,601	45	16	316	2,978
Total	40,084	1,533	79	709	42,405

Remarks: The definition of all variables is described in Table A.1 in the Appendix. DF refers to the degrees of freedom. Outcome $SUCC = 0$ is the comparison group.

The estimation model is statistically significant at the 1 % level or better as measured by the likelihood ratio test. The predictive power of the model when it comes to explaining actual classifications into the four categories differs substantially between the individual categories. From the total number of 42,405 observations 80.88 % are correctly classified by the econometric model. Whereas 97.3 % of all farms with no succession are correctly predicted, the percentage of family successions and farm exits being correctly classified is substantially lower with 20.1 % and 10.6 %, respectively. As expected, the most difficult task is to predict non-family successions. Here, only 1.4 % of all successions that actually occurred between 1985 and 1990 are classified in the correct category by the model which indicates that a number of important explanatory variables are missing in the above shown specification.

According to Table 2, the probability of farm succession is significantly influenced by farm characteristics such as farm size, previous farm growth and on-farm diversification. The probability of farm succession (both, family and non-family succession) increases and the probability of farm exits decreases with farm size ($\ln S_{85}$). For a hypothetical farm household,[7] an increase in farm size by 1 standard deviation reduces the probability of failure by 1.74 %-points. Larger farms tend to experience economies of scale and produce greater returns than smaller farms, thus bolstering the relative profitability of remaining in farming versus seeking other employment. A one standard deviation increase in farm size increases the probability of family succession (non-family succession) by 0.70 %-points (0.26 %-points). Large farms hold out the best prospects of providing a potential successor with a reasonable and secure income. The positive relationship between farm size and succession corresponds well with findings from farm surveys. Summarising a number of these studies, Gasson *et al.* (1988) conclude: *"one of the main reasons for children not taking over the family farm is that the farm is too small"* (p. 23).

A related issue is the link between previous farm growth ($\Delta \ln S_{80\text{-}85}$) and succession. Griliches and Regev (1995) found firms that will exit in the future ("doomed firms") to have significantly lower growth rates several years earlier. The authors called this a "shadow of death effect". Here, we do not find a significant negative effect of previous farm growth on the probability of exits. Alluding to Griliches and Regev's work, Kimhi *et al.* (1995) hypothesize that the occurrence of succession in the future might motivate farm operators to invest and raise current farm size. Contrary to this "shadow of succession effect", we find that the relationship between previous farm growth and the probability of farm succession is negative. A one standard deviation increase in previous growth rates lowers the probability of family succession (non-family succession) by 0.12 %-points (0.14 %-points). This might be due

[7] A hypothetical farm is characterised by taking mean and mode values of exogenous continuous and dummy variables, respectively. The probability of family succession, non-family succession and farm exits for a hypothetical farm are 1.07 %, 2.05 %, and 6.28 %, respectively. These results cannot be inferred directly from table 2 because in addition to the parameter estimates, the mean and mode values of all exogenous variables (see Table A.1) are involved in the calculation.

to the fact that farm operators do not want to make important long-term decisions immediately before handing over the farm to a successor. After farm succession has taken place, however, farm growth is found to increase significantly (Weiss, 1999).

Table 2 also reports a significant impact of on-farm diversification on farm exits and succession. A one standard deviation increase in the Berry index ($BERRY_{85}$) decreases the probability of farm exits by 1.98 %-points and increases the probability of family succession (non-family succession) by 0.18 %-points (0.30 %-points). Diversification thus is a successful strategy to reduce the risk of failure in the farm business. The positive relationship between diversification and the likelihood of succession is consistent with results from farm surveys showing that farmers without successors are more likely to reduce their enterprise mix. Potter and Lobley (1992) motivate this finding by the desire of older farmers without successors to reduce working hours and make life easier.

In addition to these farm characteristics, Table 2 suggests a number of personal characteristics of the farm holder to influence farm succession and exits significantly. In particular, we observe a significant life-cycle pattern in the farmer's succession and exit behaviour. The effect of age (*AGE*) on the probability of farm exits is negative for young farmers and becomes positive when *AGE* exceeds 38 years, which is somewhat below the average age of farmers[(8)]. The negative relationship reported for farm operators at younger ages may be explicable in terms of learning effects and the acquisition of experience (Jovanovic, 1982). Furthermore, switching from farming to a non-farm job becomes a less viable option as the individual ages, since specific human capital investments are involved, and the time to retirement over which those investments can be recouped is shorter for older farmers. On the other hand, and almost by definition, we expect the probability of farm exits to increase as the farm operator further advances in years in particular in farms where succession is unlikely. The probability of family succession, on the other hand, first increases with the farm operators age and then decreases again. Also note, that the relative importance of family versus non-family succession changes with the farm operator's age. This is shown in Figure 1.

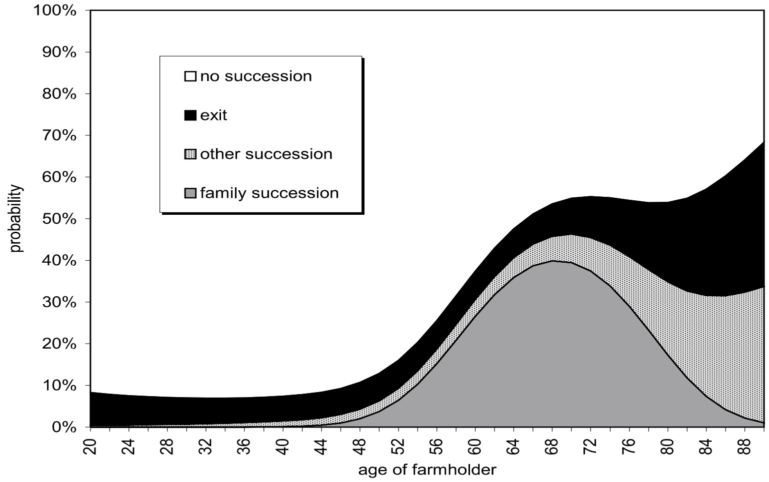
Based upon the parameter estimates in Table 2, Figure 1 reports the probabilities of family succession, non-family succession, and farm exits for a hypothetical farm household depending on the age of the farm operator[(9)]. The probability of family succession first increases with the farm operator's age as children become older and more suitable for suc-

[(8)] The actual age distribution of the farm operator for different types of succession is reported in Figure A.1 in the Appendix.

[(9)] The actual percentages for no succession, family succession, non-family succession, and farm exits for different age groups are reported in Figure A.2 in the Appendix.

cession and parents become more prepared to make succession decisions.

Figure 1.
Farm operator's age and the predicted probabilities of succession and exit



The family succession — age profile reaches its peak at an age of 68 years and then declines again. The negative relationship between the farm operator's age and the probability of family succession might indicate that a farmer who postpones succession will have more difficulties in finding a successor within the family since his children will have started looking for alternative employment in the non-farm economy (Kimhi, 1994). The only choices left for the operator in this case are selling the business outside the family or closing down the farm. According to Figure 1, the probabilities of non-family succession and farm exits substantially increase as the farm operator's age exceeds 68 years.

The owner's education is considered a key determinant of structural change in the farm sector (Goddard *et al.*, 1993; Tweeten, 1984). However, formal education may have two opposing effects on farm succession and exits. First, an increase in human capital allows the farm operator to process information, allocate resources and to evaluate new technologies more effectively. By raising the current farm's earning capacity, this would suggest a negative impact of schooling on farm succession and exits. On the other hand, increases in human capital by those within the agricultural sector increase their opportunity for employment outside the sector and thus reduce the attractiveness of remaining in the farm economy. The results reported in Table 2 suggest that the second effect is stronger than the first. The coefficient of a dummy variable measuring higher levels of schooling (*EDU*) is significantly different from zero and positive in columns [1] and [2]. A higher level of schooling (*EDU* = 1) increases the probability of family succession (non-family succession) by 0.30 %-points (0.34 %-points). This result corresponds to Kimhi and Nachlieli (1998) who find that education increases the likelihood of having a successor. The education variable however is not significantly different from zero at the 10 %-level in column [3]. In order to investigate cohort effects of schooling and the hypothesis of a decline in the value of human capital over the life cycle, we also tested for interactions of schooling with age. These interaction effects, however, did not contribute significantly to the explanatory power of the model and are thus not shown here.

The size of the farm family is another important factor determining farm succession and exits. A highly significant and negative impact on farm succession and exits is reported in Table 2 for farms where the farm operator is married (*MARR* = 1). The exit-probability for a hypothetical farm whose operator is married is 5.84 %-points lower than that of farms with unmarried farm operators. The figures for family succession and non-family succession are 0.42 %-points and 0.84 %-points respectively. The number of other family members living on the farm (#*FAM*) also significantly influences the probability of farm succession and exits. An additional family member aged 16 and above increases the probability of family succession by 0.32 %-points and reduces the probabilities of non-family succession and farm exits by 0.85 %-points and 0.84 %-points respectively. These results are not surprising since family members provide both an incentive as well as the necessary labour resources for continuation of the family farm business.

The coefficient estimate for *GENDER* is positive and significantly different from zero in all three columns. All else equal, farms operated by a woman (*GENDER* = 1) report higher failure rates (1.05 %-points) and the probabilities for family and non-family succession are 0.77 %-points and 0.84 %-points higher compared to farms operated by men. Sociological studies point to women's primary responsibility for the home which pulls them away from the business and thus represents an additional major factor that places women at a disadvantage relative to men (Goldberg, 1984; Watkins and Watkins, 1983).

Regional differences have been controlled for by using several regional dummy variables (*R*1 to *R*5 and *HZ*0 to *HZ*2). Hardship zones (*HZ*0 to *HZ*2) are regional classifications indicating unfavourable production conditions due to climate, transportation facilities, and mountainous nature of the area. *HZ*0 = 1 indicates most unfavourable production conditions[10]. The dummy variables *R*1 to *R*5 classify farms into one of six political districts in Upper Austria. These two regional classifications (*HZ*0 to *HZ*2 and *R*1 to *R*5) are overlapping. Regional dummy variables turn out to be significant when explaining farm differences in exit behaviour but seem to be less important in columns [1] and [2] where they do add only moderately to the explanatory power of the model.

[10] *HZ*1 = 1 and *HZ*2 = 1 indicate average and favourable productions conditions, respectively, whereas the reference case are most favourable conditions.

It is frequently asked whether part-time farming is a steady state phenomenon or the first step of the family farm on the way out of the agricultural sector (Gasson, 1986; Pfeffer, 1989). In Table 2, we observe highly significant parameter estimates for PT_{85}. If the married couple spends less than 90 % of total working time on the farm ($PT = 1$), the probability of exit increases by 2.83 %-points, the probability of family succession decreases by 0.31 %-points and the probability of non-family succession increases by 0.56 %-points, compared to a hypothetical full time farm. A lower likelihood of children to follow in the farm occupation has also been reported for part-time farms in Gasson *et al*. (1988). Given that a specific farm does not allow the farm operator and his wife to work full-time, it is very likely that the potential successor also has to find a non-farm employment before he will be handed over the farm. Experiencing other lifestyles and acquiring new skills raises the opportunity costs of his labour in the farm sector. The potential successor may then be less inclined to take over the farm at the time the farm operator is willing to yield power. From the negative (positive) parameter estimate of PT in the family succession (farm exit) equation we conclude that off-farm activities have to be considered a first step of the farm family on the way out of the agricultural sector.

SUMMARY AND CONCLUSION

Farming is dominated by family forms of production, where business ownership and management are handed down within the family. Despite the importance of succession (within the farm family) for family businesses, surprising little theoretical work has been devoted to this issue. This study examines the succession decision empirically, using linked census data for Upper Austria from three years (1980, 1985, and 1990). In contrast to farm surveys analysing **succession plans**, the farm censuses allows to identify **actual** farm successions. Two types of successions are distinguished: (i) “family succession” (defined as handing over the farm to the farm operator’s child) and (ii) “non-family succession” (where the farm is sold outside the family). Farm exits are considered as an additional category in a multinomial logit model.

The predictive power of the model differs substantially between the individual categories. In the case of non-family succession, the percentage of correct classifications of the empirical model is very low, indicating that a number of important explanatory variables are missing. This has to be kept in mind when interpreting the following results.

A significant and negative (positive) impact of farm size and on-farm diversification on the probability of farm exits (farm succession) is reported. Previous farm growth, on the other hand, has no effect on the probability of exits and only a minor influence on farm succession. The probability of family succession first increases and then decreases with the farm operator's age whereas the probabilities of non-family succession and farm exits increase monotonically with age indicating that farmers who do not retire on time run the risk of not having a successor within the family. The size of the farm family as well as the education and sex of the farm operator are also found to influence farm successions and exits significantly. Finally, part-time farmers are significantly less likely to hand over the farm within the family but are characterized by a significantly higher probability of farm exits. This suggests that off-farm employment is a first step of the farm family on the way out of the agricultural sector.

However, care is needed in attributing cause and effect with the farm structure variables since farmers lacking a successor (or with a low expectation that a successor will appear) are likely to adjust farm structure to this situation as early as possible. In particular, they may have reduced farm size and taken off-farm employment as a response to the lower probability of family succession. Furthermore, a change in the off-farm employment status often takes place at the time the farm is handed down to a new successor. Analysing this simultaneous relationship between off-farm employment and farm succession could be a promising issue for future research into the process and causes of structural change in the farm sector.

REFERENCES

BECKER (G. S.), 1974 — A theory of social interactions, *Journal of Political Economy*, 82, pp. 1063-1093.

BLANC (M.) and PERRIER-CORNET (Ph.), 1993 — Farm transfer and family entry in the European Community, *Sociologica Ruralis*, 33, pp. 319-335.

COX (D.), 1987 — Motives for private income transfers, *Journal of Political Economy*, 95, pp. 508-546.

ERRINGTON (A.), 1993 — Managing succession in the farm family business, *Farm Management*, 8, pp. 349-359.

GASSON (R.), and ERRINGTON (A.), 1993 — *The Farm Family Business*, CAB International, Wallingford, UK.

GASSON (R.), 1986 — Part time farming : Strategy for survival ?, *Sociologia Ruralis*, 24, pp. 364-376.

GASSON (R.), CROW (G.), ERRINGTON (A.), HUTSON (J.), MARSDEN (T.) and WINTER (M.), 1988 — The farm as a family business: A review, *Journal of Agricultural Economics*, 39, pp. 1-41.

GODDARD (E.), WEERSINK (A.), CHEN (K.) and TURVEY (C. G.), 1993 — Economics of structural change in agriculture, *Canadian Journal of Agricultural Economics,* 41, pp. 475-89.

GOLDBERG (R.), 1984 — The determinants of consciousness through gender, family and work experience, *The Social Science Journal*, 21, pp. 75-85.

GRILICHES (Z.) and REGEV (H.), 1995 — Firm productivity in Israeli industry: 1978-88, *Journal of Econometrics*, 65 (1), pp. 175-203.

JOVANOVIC (B.), 1982 — Selection and evolution of industry, *Econometrica*, 50, pp. 649-670.

KHERA (S.), 1973 — Social stratification and land inheritance among Austrian peasants, *American Anthropologist*, LXXV, pp. 814-823.

KIMHI (A.), 1997 — Intergenerational succession in small family businesses: Borrowing constraints and optimal timing of succession, *Small Business Economics*, 9, pp. 309-318.

KIMHI (A.), 1994 — Optimal timing of farm transferal from parent to child, *American Journal of Agricultural Economics*, 76, pp. 228-236.

KIMHI (A.), KISLEV (Y.) and ARBEL (S.), 1995 — Intergenerational succession in Israeli family farms: Preliminary evidence from panel data, 1971-1988, mimeo, Department of Agricultural Economics, Hebrew University.

KIMHI (A.) and LOPEZ (R.), 1997 — Retirement planning and succession considerations of Maryland farmers: Evidence from a household survey, Paper presented at the Eleventh Annual Conference of the European Society for Population Economics.

KIMHI (A.) and NACHLIELI (N.), 1998 — Intergenerational succession in Israeli family farms, Paper presented at the 1998 Annual Meeting of the American Agricultural Economics Association.

KOTLIKOFF (L. J.) and SPIVAK (A.), 1981 — The family as an incomplete annuities market, *Journal of Political Economy*, 89, pp. 706-732.

MADDALA (G. S.), 1983 — *Limited-dependent and Qualitative Variables in Econometrics,* Econometric Society Monograph in Quantitative Economics, Cambridge University Press.

MAYR (M.) and PETERSEIL (J.), 1995 — Hofübergabe und Hofnachfolge, Landwirtschaftskammer Oberösterreich.

PESQUIN (C.), KIMHI (A.) and KISLEY (Y.), 1996 — Old age security and intergenerational transfer of family farms, Working Paper n° 9604, The Center for Agricultural Economic Research, Rehovot, Israel.

PFEFFER (M.), 1989 — Part-time farming and the stability of family farms in the Federal Republic of Germany, *European Review of Agricultural Economics*, 16, pp. 425-444.

POTTER (C.) and LOBLEY (M.), 1992 — Ageing and succession on family farms: The impact on decision making and land use, *Sociologia Ruralis*, 32, pp. 317-334.

ROSENZWEIG (M. R.) and WOLPIN (K. I.), 1985 — Specific experience, household structure, and intergenerational transfers: Farm family land and labour arrangements in developing countries, *Quarterly Journal of Economics*, 100, pp. 961-987.

TWEETEN (L.) and ZULAUF (C.), 1994 — Is farm operator succession a problem ?, *Choices* (Second Quarter), pp. 33-5.

TWEETEN (L.) 1984 — *Causes and Consequences of Structural Change in the Farming Industry,* National Planning Association, Report #207, Washington, D.C.

WATKINS (J.) and WATKINS (D.), 1983 — The female entrepreneur: Background and determinants of business choice — Some British Data, *International Small Business Journal*, 2, pp. 21-31.

WEISS (C. R.), 1999 — Farm growth and survival: Econometric evidence for individual farms in Upper Austria, *American Journal of Agricultural Economics,* 81, pp. 103-116.

APPENDIX

Table A.1. **Definition and descriptive statistics of variables**

Variable	Symbol	Succession category $SUCC_{85\text{-}90}$	Mean	Std. Dev.	Min.	Max.
Farm operator's age in years 1985	AGE_{85}	0	44.360	10.760	18	88
		1	57.560	5.800	21	94
		2	54.000	12.320	18	88
		3	48.600	13.640	18	87
Dummy for higher education (= 1 for "farm master", high school or university ; = 0 else)	EDU_{85}	0	0.227	0.419	0	1
		1	0.265	0.441	0	1
		2	0.247	0.431	0	1
		3	0.234	0.423	0	1
Farm operator's sex (0 = male, 1 = female)	$GENDER_{85}$	0	0.130	0.336	0	1
		1	0.249	0.432	0	1
		2	0.283	0.451	0	1
		3	0.234	0.423	0	1
Off-farm employment status (1 = married couple spends less than 90% of total working time on farm employment; 0 = else).	PT_{85}	0	0.554	0.497	0	1
		1	0.535	0.499	0	1
		2	0.655	0.476	0	1
		3	0.803	0.398	0	1
log of Farm Size in 1985 (number of livestock measured in median large animal units)	$\ln(S)_{85}$	0	6.844	1.265	0	9.738
		1	7.126	1.058	0	9.134
		2	6.523	1.375	0	9.637
		3	5.322	1.804	0	9.262
Growth rate of farm size between 1980 and 1985 (= $\ln S_{i,85} - \ln S_{i,80}$)	$\Delta\ln(S)_{80\text{-}85}$	0	0.015	0.575	-7.433	6.565
		1	0.033	0.461	-7.923	3.513
		2	-0.078	0.685	-5.598	4.021
		3	-0.445	1.216	-7.399	5.114
Number of family members in the farm household between 16 and 65 years	$\#FAM_{85}$	0	3.876	1.459	1	10
		1	4.461	1.393	1	10
		2	2.836	1.290	1	9
		3	3.237	1.356	1	9
Dummy for operator's married state (1 = married ; 0 = unmarried)	$MARR_{85}$	0	0.845	0.362	0	1
		1	0.867	0.340	0	1
		2	0.712	0.453	0	1
		3	0.711	0.454	0	1
Berry index for 1985. The Berry index for one year *(t)* is defined as 1 minus the sum of the squared shares s_j of nine different products: $BERRY_t = 1 - \sum_{j=1}^{9} s_{j,t}^2$	$BERRY_{85}$	0	0.470	0.206	0	1
		1	0.519	0.184	0	1
		2	0.446	0.216	0	1
		3	0.276	0.240	0	1
Regional dummy variable 1 (Linz)	*R1*	0	0.028	0.164	0	1
		1	0.024	0.152	0	1
		2	0.029	0.168	0	1
		3	0.054	0.226	0	1

(to be continued)

Table A.1. **(continued)**

Variable	Symbol	Succession	Mean category $SUCC_{85\text{-}90}$	Std. Dev.	Min.	Max.
Regional dummy variable 2 (Steyr, Wels, Gmunden)	*R*2	0	0.145	0.353	0	1
		1	0.169	0.375	0	1
		2	0.143	0.350	0	1
		3	0.150	0.357	0	1
Regional dummy variable 3 (Voecklabruck)	*R*3	0	0.097	0.296	0	1
		1	0.096	0.294	0	1
		2	0.101	0.302	0	1
		3	0.106	0.308	0	1
Regional dummy variable 4 (Braunau, Kirchdorf, Ried i. I.)	*R*4	0	0.214	0.410	0	1
		1	0.223	0.416	0	1
		2	0.227	0.419	0	1
		3	0.214	0.410	0	1
Regional dummy variable 5 (Eferding, Grieskirchen, Perg, Schärding)	*R*5	0	0.254	0.435	0	1
		1	0.255	0.436	0	1
		2	0.251	0.434	0	1
		3	0.244	0.429	0	1
Hardship zone 0 (unfavourable and most unfavourable production conditions)	*HZ*0	0	0.498	0.500	0	1
		1	0.498	0.500	0	1
		2	0.557	0.497	0	1
		3	0.705	0.456	0	1
Hardship zone 1 (average production conditions)	*HZ*1	0	0.249	0.432	0	1
		1	0.258	0.437	0	1
		2	0.195	0.396	0	1
		3	0.153	0.360	0	1
Hardship zone 2 (favourable production conditions)	*HZ*2	0	0.134	0.340	0	1
		1	0.124	0.330	0	1
		2	0.129	0.336	0	1
		3	0.081	0.273	0	1

Table A.2. **Marginal effects of the multinomial logit model (succession and exits 1985-90)**

Independent Variables	No Succession ($SUCC_{85-90}$=0)/100		Family Succession ($SUCC_{85-90}$=1)/100		Non-Family-Succession ($SUCC_{85-90}$=2)/100		Farm Exits ($SUCC_{85-90}$=3)/100	
	Param.	(t-value)	Param.	(t-value)	Param.	(t-value)	Param.	(t-value)
Intercept	25.259	(12.23)	-21.791	(-8.34)	-9.980	(-8.57)	6.512	(5.41)
$\ln(S)_{85}$	0.827	(7.44)	0.233	(8.49)	0.221	(3.04)	-1.282	(-14.89)
$\Delta\ln(S)_{80-85}$	0.389	(2.37)	-0.099	(-3.33)	-0.236	(-2.06)	-0.054	(-0.52)
$BERRY_{85}$	6.383	(10.82)	0.387	(5.19)	1.299	(3.68)	-8.068	(-14.41)
PT_{85}	-3.228	(-11.38)	-1.358	(-4.65)	0.660	(4.18)	2.704	(9.79)
AGE_{85}	-0.291	(-4.36)	0.575	(7.93)	0.072	(2.09)	-0.355	(-7.29)
$AGE_{85}{}^2/100$	-0.112	(-1.73)	-0.415	(-7.65)	0.073	(2.33)	0.454	(9.46)
EDU_{85}	-0.641	(-2.47)	0.130	(5.01)	0.321	(2.27)	0.189	(0.89)
$MARR_{85}$	4.118	(12.96)	-0.194	(-4.67)	-0.789	(-4.52)	-3.135	(-11.36)
$\#FAM_{85}$	1.614	(18.34)	0.138	(8.88)	-1.114	(-12.36)	-0.639	(-8.38)
$GENDER_{85}$	-1.768	(-6.04)	0.291	(7.29)	0.733	(4.63)	0.744	(3.14)
$R1$	1.799	(2.77)	-0.062	(-0.91)	-0.133	(-0.33)	-1.604	(-3.27)
$R2$	1.997	(5.07)	-0.052	(-1.46)	0.031	(0.15)	-1.976	(-5.97)
$R3$	0.128	(0.30)	0.037	(0.96)	0.268	(1.13)	-0.435	(-1.25)
$R4$	1.756	(4.67)	-0.012	(-0.37)	-0.039	(-0.19)	-1.704	(-5.45)
$R5$	1.841	(5.22)	0.033	(1.10)	0.065	(0.34)	-1.939	(-6.51)
$HZ0$	-6.244	(-14.11)	-0.133	(-3.59)	-0.013	(-0.06)	6.389	(13.81)
$HZ1$	-1.908	(-4.01)	-0.078	(-2.13)	-0.379	(-1.65)	2.366	(5.56)
$HZ2$	-1.451	(-2.77)	-0.073	(-1.78)	-0.019	(-0.08)	1.544	(3.34)

Remarks: The definition of all variables is described in Table A.1.

Table A.3. **Results of the multinomial logit model (succession and exits 1980-1985)**

Independent Variables	Family Succession $SUCC_{85-90} = 1$ Param.	(t-value)	Non-Family Succession $SUCC_{80-85} = 2$ Param.	(t-value)	Farm Exits $SUCC_{80-85} = 3$ Param.	(t-value)
Intercept	-38.661	(-43.97)	-8.047	(-13.89)	1.473	(4.15)
$\ln(S)_{80}$	0.426	(17.37)	0.033	(1.16)	-0.426	(-25.86)
$BERRY_{80}$	0.756	(6.98)	0.533	(3.60)	-1.797	(-14.13)
PT_{80}	0.115	(2.74)	0.165	(2.53)	0.325	(4.89)
AGE_{80}	1.025	(34.97)	0.147	(7.24)	-0.096	(-7.03)
$AGE_{80}2/100$	-0.739	(-28.24)	-0.030	(1.64)	0.145	(10.61)
$MARR_{80}$	-0.406	(-5.98)	-0.257	(-2.93)	-0.746	(-9.62)
$\#FAM_{80}$	0.298	(23.81)	-0.575	(-22.03)	-0.147	(-6.79)
$GENDER_{80}$	1.019	(18.29)	0.574	(7.15)	0.246	(3.21)
$R1$	-0.014	(-0.13)	-0.343	(-1.94)	-0.015	(-0.13)
$R2$	-0.184	(-3.18)	-0.142	(-1.55)	-0.295	(-3.37)
$R3$	0.051	(0.77)	0.019	(0.18)	-0.032	(-0.32)
$R4$	-0.130	(-2.32)	-0.041	(-0.47)	-0.526	(-5.94)
$R5$	-0.026	(-0.50)	-0.083	(-0.99)	-0.432	(-5.27)
$HZ0$	-0.258	(-4.43)	0.142	(1.47)	1.640	(14.38)
$HZ1$	-0.218	(-3.53)	-0.034	(-0.33)	0.501	(3.89)
$HZ2$	-0.035	(-0.51)	0.051	(0.44)	0.129	(0.87)

Number of Observations:	45,064	Likelihood Ratio Index (DF):	0.322 (48)
Log Likelihood:	-22,722	Likelihood Ratio Test (DF):	21,542 (48)
Restricted Log Likelihood:	-33,493		

	Predicted				
Actual	$SUCC = 0$	$SUCC = 1$	$SUCC = 2$	$SUCC = 3$	Total
$SUCC=0$	32,857	1,546	120	236	34,759
$SUCC=1$	3,345	3,186	27	58	6,616
$SUCC=2$	1,160	361	87	71	1,679
$SUCC=3$	1,497	151	58	304	2,010
Total	38,859	5,244	292	669	45,064

Remarks: The schooling of the farm operator as well as farm growth in the previous period is not available for 1980, the variables are thus not included in the estimation model. The definition of all variables is described in Table A.1. DF refers to the degrees of freedom.

Table A.4. **Marginal effects of the multinomial logit model (succession and exits 1980-85)**

Independent Variables	No Succession ($SUCC_{80-85}$=0)/100		Family Succession ($SUCC_{80-85}$=1)/100		Non-Family-Succession ($SUCC_{80-85}$=2)/100		Farm Exits ($SUCC_{80-85}$=3)/100	
	Param.	(t-value)	Param.	(t-value)	Param.	(t-value)	Param.	(t-value)
Intercept	71.937	(26.36)	-59.991	(-12.17)	-17.443	(-9.61)	5.499	(6.30)
$\ln(S)_{80}$	0.271	(2.64)	0.680	(11.50)	0.086	(1.29)	-1.036	(-17.12)
$BERRY_{80}$	1.808	(3.44)	1.228	(6.65)	1.323	(3.76)	-4.359	(-11.35)
PT_{80}	-1.287	(-5.43)	0.161	(2.44)	0.362	(2.36)	0.764	(4.56)
AGE_{80}	-1.652	(-20.35)	1.595	(11.42)	0.311	(5.70)	-0.277	(-8.12)
$AGE_{80}2/100$	-0.831	(-11.58)	-1.156	(-10.85)	-0.052	(-1.17)	0.377	(10.56)
$MARR_{80}$	2.891	(8.88)	-0.594	(-5.31)	-0.542	(-2.65)	-1.755	(-8.55)
$\#FAM_{80}$	1.183	(13.79)	0.493	(13.05)	-1.347	(-13.45)	-0.328	(-5.97)
$GENDER_{80}$	-3.363	(-10.62)	1.557	(11.98)	1.290	(6.60)	0.515	(2.79)
$R1$	0.824	(1.47)	-0.008	(-0.05)	-0.800	(-1.93)	-0.016	(-0.06)
$R2$	1.267	(3.83)	-0.270	(-2.96)	-0.307	(-1.44)	-0.690	(-3.27)
$R3$	-0.044	(-0.12)	0.080	(0.78)	0.044	(0.18)	-0.080	(-0.33)
$R4$	1.491	(4.61)	-0.181	(-2.06)	-0.061	(-0.30)	-1.249	(-5.67)
$R5$	1.216	(4.02)	-0.020	(-0.25)	-0.168	(-0.86)	-1.027	(-5.08)
$HZ0$	-3.699	(-9.72)	-0.471	(-4.92)	0.245	(1.09)	3.926	(11.48)
$HZ1$	-0.750	(-1.80)	-0.358	(-3.64)	-0.101	(-0.41)	1.209	(3.86)
$HZ2$	-0.358	(-0.76)	-0.061	(-0.58)	0.113	(0.42)	0.307	(0.86)

Remarks: The schooling of the farm operator as well as farm growth in the previous period is not available for 1980, the variables are thus not included in the estimation model. The definition of all variables is described in Table A.1.

Figure A.1.
Farm operator's actual age distribution for different types of succession in 1985 and 1990

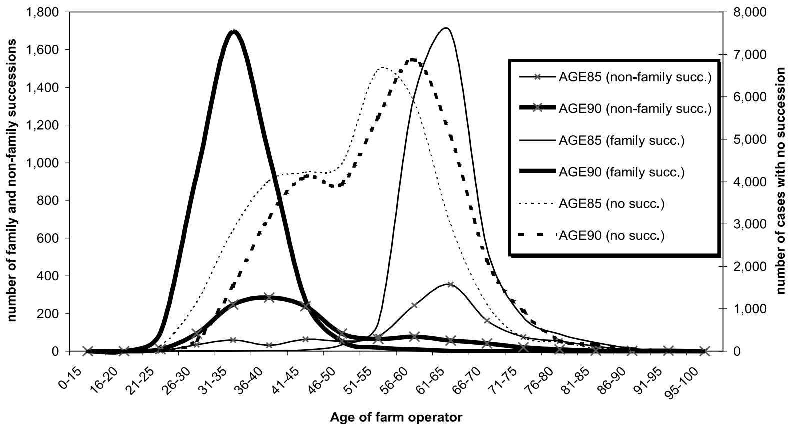
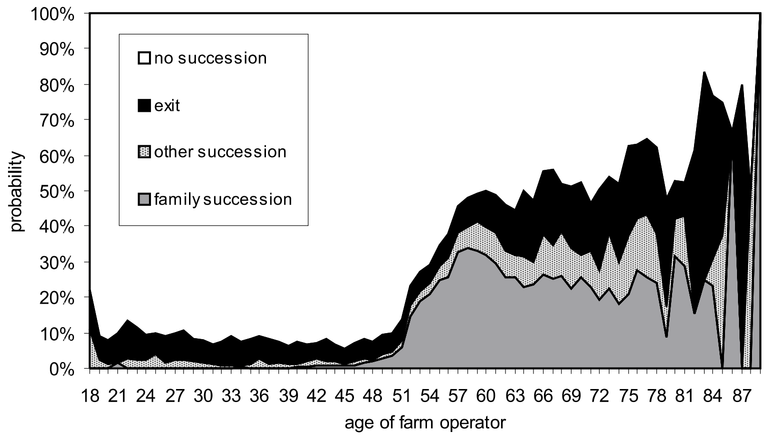


Figure A.2.
Farm operator's age and the actual shares of succession and exit



Remarks: The large fluctuations in the shares of the different alternatives at higher ages of the farm operator are due to the low number of observations in these age groups.