Probability and Timing of Succession or Closure in Family Firms: A Switching Regression Analysis of Farm Households in Germany

Glauben, Thomas; Petrick, Martin; Tietje, Hendrik; Weiss, Christoph

Probability and Timing of Succession or Closure in Family Firms: A Switching Regression Analysis of Farm Households in Germany

Journal:	*Applied Economics*
Manuscript ID:	APE-06-0080.R1
Journal Selection:	Applied Economics
JEL Code:	J43 - Agricultural Labor Markets < J4 - Particular Labor Markets < J - Labor and Demographic Economics, Q12 - Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets < Q1 - Agriculture < Q - Agricultural and Natural Resource Economics
Keywords:	succession, family firms, agriculture

Probability and Timing of Succession or Closure in Family Firms: A Switching Regression Analysis of Farm Households in Germany

Thomas Glauben*, Martin Petrick*, Hendrik Tietje**, and Christoph Weiss***

* Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO), Halle (Saale)

** Department of Food Economics and Consumption Studies, University of Kiel

*** Department of Economics, Vienna University of Economics and Business Administration

Revision: November 6, 2006

Abstract

In a two-step econometric approach that corrects for selectivity bias, we analyze the determinants of the probability of succession and the timing of succession or closure in a unique sample of 233 North-German family farms. We set up the succession decision as an intertemporal optimization problem. The empirical results show that larger and more profitable farms which are specialized in dairy production are significantly more likely to have an intra-family successor. We find that a non-agricultural education of the current manager or the successor delay succession. When the family decided to stop farming operations, a non-agricultural education of the owner delays closure of the farm. Closure occurs earlier if the manager is able to lease out the land in the process of retirement. Although farm households react to incentives originating from tax and pension regulations, many important determinants of succession are beyond the control of policymakers.

Contact

Thomas Glauben
Leibniz Institute of Agricultural Development and Central and Eastern Europe (IAMO)
Theodor-Lieser-Strasse 2, 06120 Halle (Saale), Germany
Phone: +49 (0)345 2928 200, fax: +49 (0)345 2928 299
e-mail: glauben@iamo.de

The first three authors would like to thank the Stiftung Schleswig-Holsteinische Landschaft for financial support, Christoph Weiss gratefully acknowledges financial support from the Austrian Science Fund (SFB F 020).

Probability and Timing of Succession or Closure in Family Firms: A Switching Regression Analysis of Farm Households in Germany

Abstract

In a two-step econometric approach that corrects for selectivity bias, we analyze the determinants of the probability of succession and the timing of succession or closure in a unique sample of 233 North-German family farms. The succession decision is set up as an intertemporal optimization problem. The empirical results show that larger and more profitable farms which are specialized in dairy production are significantly more likely to have an intra-family successor. We find that a non-agricultural education of the current manager or the successor delay succession. When the family decided to stop farming operations, a non-agricultural education of the owner delays closure of the farm. Closure occurs earlier if the manager is able to lease out the land in the process of retirement. Although farm households react to incentives originating from tax and pension regulations, many important determinants of succession are beyond the control of policymakers.

I. Introduction

In recent years, family firms have received growing attention in economics. Most firms in the world are family firms. Gersick et al. (1997) report that family firms account for 65-80% of all worldwide business, and for about 40% of the Fortune 500 companies. Although many family firms are small, in aggregate they represent about half of the U.S. gross domestic product (Aronoff, Astrachan and Ward 1997) and employ over 80% of the work force (Neuberg and Lank, 1998).

The focus of our investigation is on one particular aspect of family firms: the issue of family succession. In an extensive review of the existing research, Handler (1994) finds that 'researchers in the field of family business agree that succession is the most important issue

that most family firms face' (p. 133).[1] However, the importance of family firms and family succession differs between economies and in particular between different sectors within the economy. By studying occupations of different family members (grandfathers, fathers, and sons), Laband and Lentz (1983) find that farmers' are nearly five times more likely to have followed in their fathers' footsteps than non-farm proprietors. It should thus come as no surprise that a large share of the literature on succession focuses on the farm sector. This interest is partly fuelled by the importance of succession decisions for the pace of structural change in agriculture. Family-operated enterprises dominate the farming sectors in West-European and North American countries, indeed in most countries of the world, and have been the target of extensive policy intervention, for example in the framework of the Common Agricultural Policy of the European Union (EU).

Empirical studies on succession in the farm sector have typically examined single aspects of the probability and the timing of family takeover. Because most studies made use of already existing census or survey data sets, the choice of determinants to be examined was usually restricted. Well-examined variables include the age structure and years of general schooling of household members. In an early study of the probability of family succession among German farms, Pfeffer (1989) found that older farmers and farm households with a smaller potential workforce (in terms of family members) are less likely to expect the continuation of their farm. Analyzing actual farm successions on the basis of census data for Upper Austria, Stiglbauer and Weiss (2000) showed that an increase in farm and family size, as well as a higher degree of on-farm diversification, raises the probability of farm succession within the family. Kimhi and Nachlieli (2001) identified parents' age, age difference to children and the farm owner's years of schooling to be among the statistically most important

[1] Succession is so central that Ward (1987) chooses to define family firms in terms of the potential for succession: 'we define a family business as one that will be passed on for the family's next generation to manage and control' (p. 252)

determinants of the probability to declare a successor in a set of Israeli family farms. Glauben, Tietje, and Weiss (2004), one of the first studies based on specifically collected survey data from Austria, found that large and specialized farms are more likely to be transferred within the family and to have appointed a successor.

By focusing on the timing of farm succession, Kimhi (1994) examined actual farm transfers on the basis of census data for Israel. The author found that the transfer time decreases with parents' age and with a child's years of schooling, but increases with parents' experience. Using survey data for 469 Maryland farmers, Kimhi and Lopez (1997) also found that older farm operators plan to retire later, as do more educated and wealthier farmers. On the basis of the same data set, Kimhi and Lopez (1999) investigated the importance of succession considerations for retirement plans of farmers relative to other personal considerations. Succession considerations were found to be more important for older and better educated farmers. Glauben, Tietje, and Weiss (2004) confirmed that the time of succession is delayed as the age of the farm operator increases.

Given this body of evidence, we extend the literature in a number of ways. Whereas previous work has focused on single aspects of the succession decision, this is the first study that analyses the probability of farming succession and timing of succession and closure simultaneously for the same dataset. In particular, the timing of closure of the farm, should there be no successor, has not systematically been investigated in the literature so far.

Furthermore, contrary to most earlier work, we make use of data specifically collected for the purpose of this study. Our dataset consists of cross-sectional survey data for 233 farms in Northern Germany, which was collected in 2003. Individual observations were then matched with accounting data for the same farms, covering the period from 1998 to 2001. This specific dataset allows us to statistically verify the importance of previously neglected factors influencing the succession decision-complex, for example concerning the role of

occupation-specific education of parents and successors, the role of age and health considerations of parents, or the relevance of tax and pension regulations, and at the same time control for certain farm characteristics such as profitability and size, based on the accounting data.

Our methodological approach assembles techniques used in previous research on the subject to analyze both the probability and timing of succession or closure in a consistent setting. It is a two-stage switching regression model with sample selection, initially proposed by Heckman (1979). In the first stage, a Probit model analyzing the probability of intra-family succession is estimated. In the second stage, two separate equations for the timing of succession and closure are estimated, which are corrected for selectivity bias arising from endogenous group selection.

In the following section II, we first motivate our analysis with a simple dynamic model of farm succession and a discussion of potential determinants. The dataset is described in the subsequent section III. Section IV presents the methodology and the empirical results and section V concludes.

II. A dynamic model of farm succession

Theoretical research suggests a number of explanations for the prevalence of succession within the family. A first is that parents transmit to their offsprings valuable work experience, reputation, and other managerial human capital (Rosenzweig and Wolpin 1985). In addition, maintaining family control has a symbolic importance to many farm households and thus, the transfer of the farm to the next generation is often seen as a key objective of farmers (Gasson and Errington 1993; Blanc and Perrier-Cornet 1993). Pesquin, Kimhi and Kislev (1999) point out that intra-family succession enables the family to realize benefits from intergenerational risk-sharing when annuity markets are incomplete. It provides an often implicit contractual insurance arrangement since the generations overlap and share income. The authors mention

additional advantages of intra-family farm succession such as 'smooth' transition, reduction in transfer cost, and lower transfer taxes.

We assume that a farm household consists of members of two generations, parents and successors, who jointly decide about the optimal timing of the succession decision, *s*. *s* is a trivariate control variable that, in each period, assumes one of three states: (1) the farm is transferred to a successor, (2) farming is exited without a successor and the farm is being dissolved, (3) the decision is delayed for another period. Both (1) and (2) are irreversible. Once one of these two options is performed, no further modification of *s* can be made. At a given period in time, the household derives utility from the level of its income-generating assets, A_t, and from the current status of the decision variable, s_t, so that $u_t = u(A_t, s_t)$, where *u* is a differentiable utility function. The household may have preferences for a specific status of *s*, particularly for transferring the farm to the next generation and hence keeping the farming tradition intact. Income-generating assets include the physical and financial capital stock of the farm-household and the human capital of its members. These assets evolve through time according to a differentiable household production function *f*,

$$A_{t+1} = f(A_t, s_t).$$

The latter implies that the succession decision has relevance for the development of the household's assets through time, for example because it is a signal for the accumulation of specific human capital of the successor generation.

Given a time discount factor δ, the household's problem is then to find the optimal growth path of the state variable *x* by making decisions on *s*:

$$\max_{s_t} U = u(A_t, s_t) + \delta u(A_{t+1}, s_{t+1}).$$

By applying standard dynamic programming techniques and assuming there exists an interior solution (Chow 1997, 7-8), the following Bellman equation results:

$$V(A_t) = \max_{s_t} \{u(A_t, s_t) + \delta V(A_{t+1})\},$$

where V is the maximised utility or value function of the household. The solution to this control problem yields the optimal timing of succession or farm closure, T, relative to the starting point. If option (1) is in the optimal set of s for any t, there will be family succession in period T^S, otherwise the farm will be closed in period T^C. In case that the parents die, the successors are naturally forced to make a decision on their own.[2]

Whether there will be succession and when is determined by a vector of variables, x, that influence the initial level of household assets (including both on-farm and off-farm assets), the production function, and utility shifters (Kimhi and Nachlieli 2001). The latter may include a particular preference for continuing the farming tradition within the family, or existing health issues of parents. x also contains variables characterising the existing legal framework concerning succession decisions, for example with regard to tax or public pension regulations. These variables determine the pay-offs of succession and next-best alternatives in the current and future time periods and can be grouped in four categories: (I) parents' characteristics, including age and education, (II) potential successor's characteristics, including sex and education, (III) farm characteristics, including profitability measures and specialisation, and (IV) specific intra-family issues concerning the succession decision, including the relevance of farming tradition. These aspects will be made operational in the subsequent analysis.

Following Kimhi and Nachlieli (2001), we may define V^S as the present value of household utility if there is succession, and V^C if there is not. These define a latent tendency to make a decision in favour of intra-family succession, $W^* = V^S - V^C$, which is determined by a subset of x. Let z denote the subset of x that determines whether there will be succession or not, x^S the subset that determines the timing T^S if there is succession, and x^C the subset that determines the timing of closure, T^C. The subsets of exogenous variables may partly

[2] The formal model abstracts from risk considerations that may affect on- and off-farm labour allocation decisions of parents or successors (Key, Roberts, and O'Donoghue, 2006).

overlap. Furthermore, define W_i as a dichotomous variable observed for farm *i*, for which $W_i = 1$ if $W_i^* > 0$, and 0 otherwise. Considering our decision model as a stochastic process, we may then write the estimating reduced-form equations as follows.

$$W_i^* = \alpha' z_i + v_i, \quad (1)$$

$$\text{if } W_i = 1,\ T_i^S = \beta^S{}' x_i^S + \varepsilon_i^S, \text{ and} \quad (2)$$

$$\text{if } W_i = 0,\ T_i^C = \beta^C{}' x_i^C + \varepsilon_i^C. \quad (3)$$

α, β^S, and β^C are parameter vectors to be estimated, v_i, ε_i^S, and ε_i^C are disturbance terms. The timing of succession is observed if family succession is likely, otherwise the timing of closure is observed. For the actual estimation it is convenient (and standard) to assume that both pairs $[v_i, \varepsilon_i^S]$ and $[v_i, \varepsilon_i^C]$ follow a bivariate normal distribution with zero means and correlations ρ^S and ρ^C (see e.g. Manrique and Ojah 2003).

III. Data

The analysis of inter-generational succession is based on a set of 233 German farm households surveyed in the state of Schleswig-Holstein in 2003. The focus was on older, full-time farm operators. The farm owners were asked about their farm transfer plans and several personal and household characteristics. In particular, the respondents were asked to indicate which of the following alternatives best describes their actual plans: (a) succession within the family is very likely, (b) succession within the family is rather likely, (c) we have not made any specific successions plans and don't know, (d) succession within the family is unlikely, and (e) succession within the family will not take place. We merge the statements (a) and (b) to obtain an indicator of 'family succession is likely' and the statements (c) to (e) to 'family succession is unlikely'. Note that about 70% of all respondents reported that family

succession is likely.[3] In addition, farmers were asked to report the number of years until they plan to stop operating the farm, from which information on the timing of succession (or timing of farm exits) was derived.

The survey data also includes a range of variables on personal characteristics of parents and successors. Moreover, several subjective assessments concerning farmers' attitudes towards farming and succession in general were collected. These were usually measured on a five-point scale, which is considered more meaningful than the otherwise often used dummy variables. This study gains additional advantage form the fact that the survey data has been linked to individual accounting data for the period 1998 to 2001 in order to get more reliable information on the financial situation of the farm. We use average values for the four year period in order to reduce the impact of short-run fluctuations in the variables used.

Table 1 reports descriptive statistics of all variables used in the analysis. Unfortunately, only a fraction of farm operators have reported the planned time of retirement. Thus the sample for the estimations regarding the timing equations is reduced to 181 observations.

Include table 1 around here

IV. Methods and empirical results

In the following, we show the results of a two-step estimation of equations (1) to (3) based on Heckman (1979). In the first stage, eq. (1) is estimated as a Probit model. The estimates are then used to calculate observation-specific Inverse Mills Ratios, which allow to test and correct for selectivity bias in ordinary least-squares (OLS) regressions of eqs. (2) and (3). Because characteristics of farms where succession is likely are expected to differ significantly

[3] One might argue that category (c) 'no decision made yet' should be treated as a third category. We therefore experimented with a multinomial logit model, where statements (a) and (b), and (d) and (e) were summarized and evaluated against alternative (c). Based on a Wald Category Test we found the probit specification to be the most appropriate specification.

and non-randomly from those without succession, selectivity is an important issue to be dealt with.[4] As a consequence of this procedure, standard errors of the second stage regression have to be adjusted for heteroscedasticity and the presence of estimated parameters.

The results of the econometric analysis are shown in **Table 2.** The estimated models are statistically significant at the 1% level or better, as measured by the likelihood ratio and *F*-tests. The Probit model correctly classifies 85.5% of cases with 'family succession is likely' and 73.1% of observations with 'family succession is unlikely'. Adjusted R^2's reveal a fairly good fit of the OLS models. The effect of the Inverse Mills Ratios in both second-stage regressions is statistically significantly different from zero, implying a positive correlation among error terms of the first and second stage. Neglecting this selectivity would therefore result in biased estimates.

Include table 2 around here

In the following, we analyze the results by groups of variables, as defined in section II. We start with the characteristics of parents. Given the evidence summarized in section I, it should come as no surprise that the age of the farm operator is of particular importance for the succession decision. All three models reveal a highly significant influence, whereby farms with older managers are more likely to have a successor, but both succession and closure will be earlier. The results concerning timing are immediately plausible, because operation must be stopped at some time when the current manager becomes older. Furthermore, as the age of

[4] An alternative approach to analyse equations (2) and (3) would be by means of duration analysis (Kiefer 1988; Diaz 1999). This has the advantage that the consequences of the time-dependent process for the structure of the error terms can explicitly be taken into account. We experimented with parametric accelerated failure time models. However, these models turned out to be much less able to isolate the effects of single determinants, perhaps because they impact on the duration only indirectly, by 'rescaling' the time axis of the hazard function. Furthermore, there is no established way of dealing with selectivity bias in these models. Finally, because an inspection of residuals did not reveal any irregularities for equations (2) and (3), we decided to choose the standard procedure based on normality of error terms.

the farm operator increases, he/she will be more aware of the need to make succession plans and more prepared to make irreversible long-run decisions (Kimhi and Nachlieli 2001), thus the positive 'age/succession' relationship. Younger farmers, on the other hand, may still be more willing and flexible to react to recently increased income pressure on farm households by recommending their children to give up farming altogether.

In contrast to several earlier studies (Laband and Lentz 1983; Stiglbauer and Weiss 2000; Kimhi and Nachlieli 2001, Glauben, Tietje and Weiss 2004), we could not verify a non-linear relationship between age and succession decisions. This was due to the multicollinearity of regressors, given a relatively small sample size.

Parents' educational level potentially affects the return to farming under their (as opposed to their heirs') management (Kimhi 1994). Contrary to earlier studies, we explicitly differentiate between specialist education in agriculture and non-agricultural education. However, no statistically significant effect of the level of agricultural education could be identified in the present data. A higher level of non-agricultural education on the other hand significantly delays the transition of the farm. We interpret this as (indirect) evidence for the stabilizing effect non-agricultural activities of the farm manager have on the farming enterprise. This effect is documented, in particular for part-time farms, by Pfeffer (1989) and Kimhi (2000). Because 71% of respondents in the present sample did not work off-farm at all, the effect is only weak here, and an impact of hours of off-farm employment on succession decisions could not be detected in our analysis.

A specific advantage of the data used for this analysis is that it includes statements of farmers concerning the importance of several criteria for the timing of the transfer decision. These criteria, although plausible on theoretical grounds, have received little attention in the empirical literature so far. We first focus on the role parents' personal physical conditions play in the timing of transition. During the interviews, respondents were asked to assess the

importance of age and health issues for the succession decision. Secondly, we examined the relevance of income tax legislation and public old-age pension regulations. In Germany, there are various ways in which farm succession can lead to tax benefits for the family of the farm owner. For example, rental or usufruct agreements with the successor may mitigate the progression of income tax or allow the multiple use of tax allowances (Köhne and Wesche 1995). Furthermore, there is a highly subsidized old-age pension system for German farmers. Apart from age requirements, one of the conditions for receiving benefits from this system is that the farm was transferred to the successor. The respondents assessed the relevance of all these criteria for their timing decision on a five-point scale from totally irrelevant to very relevant.

The regression analysis shows that these factors have a significant impact on the timing. Parents who consider age as an important factor transfer the farm later to their successors. Furthermore, farmers for whom health challenges are a relevant criterion close the farm later if there is no successor. Among those who transfer the farm to a successor, the perceived importance of tax regulations significantly accelerates succession, whereas pension requirements lead to a delay.[5] Compared to a hypothetical farmer's family with an average score for each criterion, managers thus transfer later who consider personal physical conditions as important. This finding suggests that these respondents are usually not affected by current age or health challenges and see no reason for an early transfer. However, the estimates are consistent with the view that farmers with a particular desire to have access to old-age pensions are forced to delay succession until the necessary retirement age is reached. On the other hand, potential tax benefits from succession arrangements do provide incentives for immediate action and thus induce parents to transfer the farm earlier. The highly significant effect of the importance of health for the closure of the farm indicates that current

[5] A very detailed empirical analysis of the impact of an early retirement program on farm succession in Finland is provided in Pietola, Väre, and Lansink (2003). The authors find that the timing and type of farmer exit decisions respond elastically to the economic environment, and to farmer and farm characteristics.

operators have a desire to continue to work on the farm as long as their health permits, which in this case is not affected by any strategic considerations concerning an early transfer to a successor.

We next turn to the characteristics of potential successors. A first variable that is established in the literature is the age differential between parents and children as their potential successors, measured as the age difference to the oldest child. The difference is expected to be negatively correlated with a decision in favor of succession, because children may be too young and still unwilling to make a long-term decision on this matter (Kimhi and Nachlieli 2001). This is confirmed by our Probit estimates. In addition, families with younger children may be more flexible to adjust the career plans for children to deteriorating pay-offs from agriculture. However, the age differential is also highly correlated with the age of the current manager, so that multicollinearity of regressors prevented to include this variable in the second-stage models.

Section II suggests that the number of years until succession takes place decreases with the expected returns a successor may derive from farming. Key for this is the human capital of successors. However, we are not aware of a study that has tested the influence of a specialist training of successors in agricultural vs. non-agricultural occupations. Our dataset allowed us to include variables measuring agricultural and non-agricultural education of designated successors in the timing of succession equation (the variable is only available for this subgroup). Both have the expected sign, showing that successors with agricultural education take over the farm earlier, whereas a non-agricultural education delays succession. Only the latter effect is statistically significant at the five percent level, however.

Following previous empirical studies (Kimhi and Nachlieli 2001), we find the number of male and female children to influence succession considerations. The probability of succession is negatively related to the number of daughters. This might be due to the concept

of sons as 'preferred successors', according to which parents have a preference for dealing with their son as opposed to their son-in-law as a future owner of the farm. Moreover, daughters may be less willing to continue to make a living from agriculture at all.[6]

The next group of variables includes several farm characteristics. In contrast to other studies, the present analysis is partly based on accounting data to measure financial and size characteristics of farms. More profitable farms report a significantly higher probability of being transferred within the family. Similarly, Kimhi and Nachlieli (2001), Glauben, Tietje and Weiss (2004), and Hennessy (2002) report that the likelihood of succession increases with some measure of farm income. These farms hold the best prospect of providing the succeeding child a reasonable and secure income in future. Concerning timing, one should expect the willingness of the heir to take over the farm as soon as possible to increase. On the other hand, a healthy financial performance of the farm may motivate the (successful) current farm operator to delay the transfer decision. Viewed from the current farm operator's perspective only, Kimhi and Lopez (1997) argue that it is not possible to show whether succession will be earlier or later in the presence of binding borrowing constraints. In line with this view, we find no significant effect of profitability on the timing of transition. Somewhat unexpectedly, low profitability also does not accelerate the process of farm closure.

For a given profitability, the probability of succession significantly increases with the amount of land owned by the farm. Land assets reflect the value of the farm and the (inter-generational) transfer. Further, more land also facilitates to overcome borrowing constraints and thus reduces restrictions to future farm growth. Thus, the higher the amount of land, the larger will be the willingness of the potential successor to take over the farm. However, timing is not affected by the size of landholdings. Only another size indicator, the full-time labor equivalents currently employed on the farm, do accelerate the transfer to a successor.

[6] Kröhnert et al. (2005) document that young women are systematically more likely to leave rural areas in Germany than men.

This may indicate a higher value of the farm, but also the need for restructuring of work processes.

A further characteristic that makes succession significantly more likely is a specialization in dairy production. As argued by Kimhi and Nachlieli (2001), this specialization may work in favor of succession for two reasons: first, dairy farms allow a convenient division of labor among generations, which is why parents have an incentive to make an early commitment to hand over the farm to a successor. Second, dairy operations provide a more stable source of income than, for example, plant production activities, which makes these types of farms more attractive for successors.

We finally look at a number of specific issues concerning succession and closure covered by the survey. Research in sociology stresses that the choice of becoming a farmer is strongly influenced by family traditions. Tradition also plays an important role in farm succession considerations in Germany. The longer a farm has been operated by the same family, the higher is the probability of being transferred to the next generation. Whereas the statistical significance of the latter effect is only weak, traditional farming families also tend to hand over the farm later, should there be a successor. This may be due to a particularly strong bargaining position of the current manager on traditional family farms, an attitude that is likely to be passed on to succeeding generations.[7]

The survey also provides a set of variables that is related to the decision to close the farm without a successor. These were included in the second-stage regression on the timing of closure. The first two concern the way the farm is going to be dissolved during closure, in particular whether the land is leased out or sold. They show that closure occurs earlier if the land is leased out, whereas the sale of land does not affect closure timing. The former finding

[7] The impact of parents' attitudes on the childrens' views in the German agricultural sector is well documented in Neldert et al. (1981).

is consistent with the view that leasing out land is usually involving lower transaction costs than selling it, which accelerates the process. Furthermore, retiring farmers may feel more comfortable with the somewhat reversible decision to lease out the land, as opposed to the final sale of land, and thus be more willing to close farming operations. Another variable measured whether the current manager has a preference for continuing active farming as long as possible, that is for example as long as personal physical conditions allow this. Quite plausibly, these farmers tend to close the farm later, a result that is consistent with the earlier finding that health considerations are a dominant criterion for the timing of closure.

V. Conclusions

In a two-step econometric approach that corrects for selectivity bias, we have analyzed the determinants of the probability of succession and the timing of succession or closure in North-German family farms. We set up the succession decision as an intertemporal optimization problem. The solution to this problem is determined by the relative pay-offs of parents and heirs from agricultural vs. non-agricultural income generation. Taken together, the empirical results show that larger (in terms of farm-owned land holdings) and more profitable farms which are specialized in dairy production are significantly more likely to have an intra-family successor. In addition, the timing of succession is strongly affected by the age of the current manager. Whereas this confirms findings from studies on other regions or countries, we also provide unique evidence that succession will be accelerated if the manager has no non-agricultural education (and thus no possible way to generate off-farm income), if the current manager has a particular interest in benefits from income tax regulations in the course of succession, if the designated successor has no specific training in a non-agricultural occupation, if the farm employs more labor equivalents, and if the tradition of farming in the family is less pronounced.

As a further contribution to the literature, we find that, if there is no intra-family successor, additional non-agricultural education of the manager delays closure of the farm. We suggest that this is due to the stabilizing effect of non-agricultural incomes on farming operations. Even so, closure occurs earlier if the manager is able and willing to lease out land in the process of retirement, as opposed to selling it, and if he/she does not have a particular preference for continuing active farming as long as physiologically possible.

The objectives of public policies with regard to structural change in the agricultural sector have not always been clear and consistent (cf. Thomson and Psaltopoulos 2004 for the EU). If it is a policy goal to accelerate structural change by fostering farm exits in the process of retirement of current operators, this study provides two messages how this may or may not be achieved. The first is that farm households do react to financial incentives. Income pressure, a variable that used to be strongly affected by policy measures in the past, makes exit more likely indeed. To the extent that future policy reforms lower agricultural incomes, exit rates will increase. Furthermore, we provide evidence that farmers do perceive incentives originating from income tax and old-age pension regulations, and show that these incentives have an effect on the timing of succession. However, the second message is that many other important determinants of succession identified in this study, such as age structure of the farm household, age and health issues of parents, and the sex composition of children, are largely beyond the control of policymakers. This restricts the scope for active structural policy in the agricultural sector.

References

Aronoff, C.E., Astrachan, J.H., and Ward, J.L., (1997), *Family Business Sourcebook II*. Business Owner Resources, Marietta, GA.

Blanc, M. and Perrier-Cornet, P., (1993), Farm transfer and family entry in the European Community. *Sociologia Ruralis* **33**: 319-335.

Chow, G.C. (1997), *Dynamic Economics*. Oxford University Press, New York.

Diaz, M.D.M., (1999), Extended stay at university: An application of multinomial logit and duration models. *Applied Economics* **31**: 1411-1422.

Gasson, R. and Errington, A., (1993), *The farm family business*. Wallingford, CAB-International.

Gersik, K., Davis, J., McCollom H. and Lansberg, I., (1997), *Generation to Generation: Life Cycles of the Family Business*. Boston: Harvard Business School Press.

Glauben, T., Tietje H. and Weiss, C., (2004), Intergenerational Succession in Farm Households: Evidence from Upper Austria. *Review of Economics of the Household* **2:** 443-461.

Handler, W.C., (1994), Succession in Family Business: A Review of the Research, *Family Business Review* **VII**: 133-157.

Heckman, J. J. (1979), Sample selection bias as a specification error. *Econometrica* 47: 153-161.

Hennessy, T., (2002), Modelling succession on Irish dairy farms. Paper presented at the 10th EAAE Congress, August 2002, Zaragoza.

Key, N., Roberts. M.J., and O'Donoghue, E. (2006), Risk and farm operator labour supply, *Applied Economics* **38**, 573-586.

Kiefer, N.M. (1988): Economic Duration Data and Hazard Functions, *Journal of Economic Literature* **26**, 646-679.

Kimhi, A., (1994), Optimal timing of farm transferral from parent to child. *American Journal of Agricultural Economics* **76**: 228-236.

Kimhi, A., (2000), Is part-time farming really a step in the way out of agriculture? *American Journal of Agricultural Economics* **82**: 38-48.

Kimhi, A. and Lopez, R., (1997), Retirement Planning and Succession Considerations of Maryland Farmers: Evidence from a Household Survey. Paper presented at the 11th Annual Conference of the European Society for Population Economics.

Kimhi, A. and Lopez, R., (1999), A note of farmers' retirement and succession considerations: Evidence from a household survey. *Journal of Agricultural Economics* **50**:154-162.

Kimhi, A. and Nachlieli, N., (2001), Intergenerational succession in Israeli family farms. *Journal of Agricultural Economics* **52**:42-58.

Köhne, M. and Wesche, R. (1995), *Landwirtschaftliche Steuerlehre, 3rd. Edition*, Verlag Eugen Ulmer, Stuttgart.

Kröhnert, S., van Olst, N., and Klingholz, R. (2005), *Deutschland 2020, Die demographische Zukunft der Nation*, Berlin-Institut für Bevölkerung und Entwicklung, Berlin.

Laband, D.N. and Lentz, B.F., (1983), Occupational Inheritance in Agriculture, *American Journal of Agricultural Economics* **36**: 311-314.

Manrique, J., and Ojah, K. (2003), The demand for housing in Spain: an endogenous switching regression analysis, *Applied Economics* **35**, 323-336.

Neldert, L., Pieper, I. and Kappus, W., (1981), Berufswünsche und -vorstellungen von Jugendlichen aus landwirtschaftlichen Familien unter besonderer Berücksichtigung der

Situation von Hofnachfolgern. ASG-Materialsammlung 154, Agrarsoziale Gesellschaft e.V., Göttingen.

Neuberg, F. and Lank, A.G., (1998), *The Family Business: Its Governance for Sustainability.* Macmillan, London.

Pesquin, C., Kimhi, A. and Kislev, Y., (1999), Old age security and intergenerational transfer of family farms. *European Review of Agricultural Economics* **26**: 19-37.

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

Pietola, K., Väre, M., and Lansink, A.O., (2003), Timing and type of exit from farming: farmers' early retirement programmes in Finland. *European Review of Agricultural Economics*, **30**: 99-116.

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

Stiglbauer, A. and Weiss, C.R., (2000), Family and non-family succession in the Upper-Austrian farm sector. *Cahiers d'économie et sociologie rurales* **54**: 5-26.

Thomson, K.J., and Psaltopoulos, D. (2004), 'Integrated' Rural Development Policy in the EU: a Term Too Far?. *EuroChoices* **3**: 40-45.

Ward, J.L., (1987), *Keeping the Family Business Healthy*. San Francisco: Jossey-Bass.

Tables

Table 1: Description of variables

	Entire sample				*Farms where succession is likely*		*Farms where succession is unlikely*	
	Mean	*Std. dev.*	*Min.*	*Max.*	*Mean*	*Std. dev.*	*Mean*	*Std. dev.*
Dependent variables								
Family succession is likely (0/1)	0.7	0.5	0	1	-	-	-	-
Years until succession or closure	8.2	6.1	0	30	6.3	4.5	13.4	7.0
Parents' characteristics								
Age of current farm manager (years)	51.9	6.9	34.0	65.0	53.9	6.1	49.1	7.0
Agricultural education of current manager (0..4)[1]	1.9	0.8	0	4	1.9	0.8	2.1	0.9
Non-agricultural education of current manager (0..4)[1]	0.2	0.6	0	4	0.2	0.6	0.1	0.3
Off-farm employment of current manager (hours/month)	10.7	26.1	0.0	200.0	12.0	28.8	11.6	27.9
Current manager perceives own age as an important criterion for timing of succession (1..5) [2]	4.0	1.0	1	5	4.0	1.1	4.4	0.7
Current manager perceives own health as an important criterion for timing of succession (1..5) [2]	3.8	1.1	1	5	3.8	1.2	4.1	1.0
Current manager perceives income tax regulations as an important criterion for timing of succession (1..5) [2]	2.5	1.3	1	5	2.6	1.3	2.7	1.3
Current manager perceives public pension regulations as an important criterion for timing of succession (1..5) [2]	2.9	1.4	1	5	3.2	1.4	3.0	1.3

Potential successors' characteristics								
Age difference to oldest child (years)	28.8	4.5	15.0	43.0	-	-	-	-
Successor has agricultural education (0/1)	-	-	-	-	0.9	0.4	-	-
Successor has non-agricultural education (0/1)	-	-	-	-	0.4	0.5	-	-
Number of sons	1.4	0.9	0	4	-	-	-	-
Number of daughters	1.1	0.9	0	3	-	-	-	-
Farm characteristics								
Farm profit ('000 EUR, av. 1998-2001)	61.2	54.4	-26.3	409.7	63.6	54.5	57.2	44.1
Farm-owned landholdings (ha, av. 1998-2001)	56.8	44.2	0.0	347.7	62.0	44.2	47.7	29.4
Full-time labor equivalents currently employed on farm	2.0	1.9	0.0	25.0	2.0	1.1	1.9	1.8
Specialized dairy farm (0/1)	0.5	0.5	0	1	0.5	0.5	0.3	0.5
Specific issues concerning succession and closure								
Number of generations farm is in family ownership (1..5)[3]	3.6	1.1	1	5	3.6	1.1	3.4	1.1
Farmland will be leased out after closure (0/1)	-	-	-	-	-	-	0.8	0.4
Farmland will be sold after closure (0/1)	-	-	-	-	-	-	0.3	0.5
Current manager wants to continue active farming as long as possible (0/1)	-	-	-	-	-	-	0.3	0.5
Observations	233				134		47	

Notes: [1] coded as: 0=no degree; 1=completed apprenticeship (*Lehre*); 2= master craftsman's certificate (*Meisterbrief*) or equivalent; 3=completed university of applied sciences (*Fachhochschule*); 4=completed university. [2] coded as: 1=totally irrelevant; 2=rather irrelevant; 3=of medium relevance; 4=rather relevant; 5=very relevant. [3] 5 means five or more generations.

Table 2: Results of the econometric analysis

	Probability of succession		*Years until succession*		*Years until closure*	
Variable	*Coeff.*	*t-value*	*Coeff.*	*t-value*	*Coeff.*	*t-value*
Constant	-1.561	-1.19	26.364 ***	7.35	35.749 ***	4.24
Age of current farm manager (years)	0.092 ***	4.81	-0.479 ***	-10.40	-0.641 ***	-5.58
Agricultural education of current manager (0..4)	-0.038	-0.27	0.361	1.11	0.592	0.79
Non-agricultural education of current manager (0..4)	0.144	0.62	1.289 ***	2.81	3.387 *	1.75
Off-farm employment of current manager (hours/month)	0.005	1.31	-0.001	-0.08	0.026	1.20
Current manager perceives own age as an important criterion for timing of succession (1..5)	-	-	0.564 **	2.33	0.622	0.74
Current manager perceives own health as an important criterion for timing of succession (1..5)	-	-	0.216	0.95	1.575 ***	2.60
Current manager perceives income tax regulations as an important criterion for timing of succession (1..5) [2]	-	-	-0.568 ***	-3.15	0.224	0.47
Current manager perceives public pension regulations as an important criterion for timing of succession (1..5) [2]	-	-	0.485 **	2.54	-0.134	-0.30
Age difference to oldest child (years)	-0.150 ***	-5.50	-	-	-	-
Successor has agricultural education (0/1)	-	-	-1.090	-1.52	-	-
Successor has non-agricultural education (0/1)	-	-	0.964 **	2.05	-	-
Number of sons	0.049	0.35	-	-	-	-
Number of daughters	-0.439 ***	-3.25	-	-	-	-

Farm profit ('000 EUR, av. 1998-2001)	0.007 **	2.26	0.003	0.48	0.003	0.21
Farm-owned landholdings (ha, av. 1998-2001)	0.009 **	2.32	0.006	0.81	0.018	0.71
Full-time labor equivalents currently employed on farm	-0.057	-0.94	-0.643 ***	-2.87	-0.154	-0.40
Specialized dairy farm (0/1)	0.800 ***	2.95	-0.700	-1.12	2.276	1.40
Number of generations farm is in family ownership (1..5)	0.129	1.27	0.357 *	1.68	0.345	0.66
Farmland will be leased out after closure (0/1)	-	-	-	-	-3.877 **	-2.57
Farmland will be sold after closure (0/1)	-	-	-	-	-0.529	-0.41
Current manager wants to continue active farming as long as possible (0/1)	-	-	-	-	2.202 *	1.90
Inverse Mills Ratio	-	-	1.828 **	1.96	4.527 ***	2.80
Observations	233		134		47	
McFadden's R^2	0.343					
LR test (χ^2)(p-value)	99.2 (<0.001)					
Predicted 1s that were actual 1s (%)	85.5					
Predicted 0s that were actual 0s (%)	73.1					
F-value (p-value)			11.4 (<0.001)		8.6 (<0.001)	
Adjusted R^2			0.632		0.791	

Notes: For coding of categorial variables see notes to Table 1. Each regression also contains a set of six regional dummy variables. t-values of OLS models corrected for selection according to Heckman (1979). *** (**; *)= significantly different from zero at the 0.01 (0.05; 0.1) level.