Analysing Family Farm Succession: A Probit and a Competing Risk Approach

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Abstract

The present study examines family and farm characteristics affecting the choice and the timing of intergenerational farm transfers. Using survey data which are linked to accounting data for 272 farms in Northern Germany, we use a probit approach to examine whether specific farm and family characteristics are related to the likelihood of succession within a given period. We go beyond the existing literature by applying a competing risk approach to study the process and thus the timing, respectively of the two competing events – succession or exit from farming. We find that farm characteristics significantly influence succession considerations to the extent that they affect the value of the farm for the potential successor.

JEL Classification: Q12, J26

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1. Introduction and Literature

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 et al. 1997) and employ over 80% of the work force (Neuberg and Lank, 1998).

The economics of family firms can be discussed from different perspectives: literature on entrepreneurship focuses on the decision to enter into family businesses, labor market economists investigate the entrepreneurs' decisions to retire and from the perspective of the corporate governance literature, family firms allow economists to study the patters of separation of ownership and control. The focus of our investigation is on one particular aspect of family firms: the issue of family succession. The circumstances of family succession are of great importance not only for the family members directly involved but also (per definition) for the long-run survival and success of family firms. In an extensive review of the existing research, Handler (1994) finds: 'researchers in the field of family business agree that succession is the most important issue that most family firms face' (p. 133).[1]

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.

Previous research in this area suggests two possible explanations for the prevalence of succession within the family. The first stresses the importance of capital market imperfections. Pesquin et al. (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. To the extent that capital market imperfections are important, successful entrepreneurs may be better able to transfer financial wealth to their offspring, thereby relaxing capital market restraints.

The second explanation argues that parents transmit to their offsprings valuable work experience, reputation, and other managerial human capital. According to Rosenzweig and Wolpin (1985), the existence of returns to land-specific experience creates incentives for children to work on the family farm when young. 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 1993).

Empirical studies on succession in the farm sector typically examine the probability and the timing of family takeover. Analyzing actual farm successions on the basis of census data for Upper Austria, Stiglbauer and Weiss (2000) find the probability of farm succession to be significantly influenced by farm, as well as, personal characteristics. Their results suggest 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. Similar results are reported in Glauben, Tietje, and Weiss (2002) for Austrian survey data. By focusing on the timing of farm succession, Kimhi (1994) examines actual farm transfers on the basis of census data for Israel. The author finds that the transfer time varies systematically with family and farm characteristics. Transfer time decreases with parents' age and with a child's educational level, but increases with parents' experience. Using survey data for 469 Maryland farmers, Kimhi and Lopez (1997) also find that farm owners' plans with respect to the

[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)

timing of retirement are systematically related to farm and household characteristics. 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) investigate the importance of succession considerations for retirement plans of farmers. Glauben, Tietje, and Weiss (2002) additionally find that the time of succession is delayed as the age of the farm operator increases.

The present study investigates the choice and the timing of intergenerational farm transfers using survey data which are linked to accounting data for 272 farms in Northern Germany. Following previous work, we use a probit approach to examine whether specific farm and family characteristics are related to the likelihood of succession within a given observation period. We go beyond the existing literature by applying a competing risk approach (Kalbfleisch and Prentice 1980) to study the process and thus the timing, respectively of the two competing events – succession or exit from farming. In addition, this study focuses on the importance of parents' values and attitudes towards agriculture and farming. Finally, by combining data from a farm survey with farm accounting data, we hope to more accurately account for farm and financial characteristics in addition to the subjective evaluations captured by a survey. The data are described in section 2, section 3 presents the methodology and the empirical results and section 4 concludes.

2. Data

The analysis of inter-generational succession is based on a survey of 272 Northern German farm households in 2003. Only (full-time) farm operators aged 45 or above have been surveyed. 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. 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) will be derived.

The survey data also include information on personal and household characteristics such as the farm operators' age (*AGE*), education (*EDUC*), number of male and female children (*CM, CF*), as well as the number of generations the farm has been in 'the hand' of the family. Moreover, several subjective assessments concerning farmers attitudes about farming and succession in general were collected and condensed into few variables via a factor analysis (see the appendix). We expect to find a close 'tie to the farm' (*BOND*) and a good financial situation (*FINAN*) to stipulate the probability of transferring the farm within the family, whereas a negative attitude towards 'being a farmer' (*FARM*) as well as exogenous restrictions of farm growth (*GROW*) might induce the opposite. Similar, some subjective personal characteristics (*PERS*), as for example the health of the owner, or some subjective attitudes to the succession process itself (*SUCC*) might influence the timing of retirement, that is the planed time to hand down the farm within the family or close down the farm and exit from farming (see below).

This study gains additional advantage form the fact that the above mentioned survey data have been linked to individual accounting data for the period 1998 to 2002 in order to get more reliable information on the financial situation of the farm. We use average values for a three year period (1999 to 2002) in order to reduce the impact of short-run fluctuations in the variables used. The variable 'annual farm profit' (*PROF*) measures the annual income capacity from farming. The variable 'owned farm land' (*OWN*) is used as a measure of the farms assets and the value of the farm. The 'land rent per hectare' (*RENT*) measure the price per hectare leased in land and should be an indicator for the marginal returns of land. The variables 'change of farm land' (*CHFL*) and 'net borrowed capital' (*NBC*), respectively account for recent developments in the land endowment and a 'well-defined' capital endowment (leverage-effect of borrowings). In order to account for farm differences in technical efficiency, we carry out a Data Envelopment Analysis to construct an index of relative technical efficiency (*TEFF*). This index is bounded between zero and one. If the farm is on the production frontier (best observed practice), it will be assigned an efficiency score of 1.

Table 1 reports descriptive statistics of all variables used in the analysis. Unfortunately, only 209 of the 272 farm operators have reported the planed time of retirement. Thus the sample for the estimations regarding the timing equations thus is reduced to 209.

Table 1: Definitions and Descriptions of Variables

Variable	*SYMBOL*	Mean	Std.dev.	Min.	Max.
Dummy variable for farm succession (1 = farm succession is very likely or likely , 0 = else)	*FAMSUC*	0.669			
Timing of succession (years until planned transfer)	*TSU*	7.219	4.558	1.000	25.000
Timing of exit (years until planned exit)	*TEX*	10.364	6.953	2.000	25.000
Profits from farming (1000 EUR)	*PROF*	59.493	52.954	-64.734	409.736
Farmed land (ha)	*FL*	105.969	79.875	14.590	661.210
Change in farmed land (ha)	*CHFL*	1.233	4.648	-21.920	27.610
Owned farmed land (ha)	*OWN*	56.361	44.193	0.000	347.670
Land rent (EUR/ha)	*RENT*	297.627	396.595	0.000	5588.333
Net borrowed capital (1000 EUR)	*NBC*	127.363	168.304	-307.707	1095.646
Dummy variable cash crop farms with mainly root crops	*CCRC*	0.169			
Dummy variable farms with cash crops and pig production	*CCPIG*	0.063			
Technical Efficiency (0-1)	*TEFF*	0.873	0.110	0.530	1.000
Farmer's age	*AGE*	52.445	7.021	34.000	73.000
Number of daughters	*CF*	1.313	0.926	0	4
Number of sons	*CM*	1.040	0.914	0	3
Land farmed from farmer’s family… (1= farmed since 5 generations or more, 0= else)	*GEN*	0.279	0.450	0	1
Farmer's education (1-5, 1= lowest level, 5=highest level)	*EDUC*	1.746	0.994	1	4
Factor value "bond to farm"	*BOND*	-0.074	0.979	-2.447	2.484
Factor value „financial situation“	*FINAN*	0.031	1.022	-2.123	2.625
Factor value "attitudes towards being farmer"	*FARM*	0.022	1.012	-2.673	2.828
Factor value "restrictions of further growth"	*GROW*	0.011	1.005	-3.181	2.163
Factor value „personal criteria“	*PERS*	0.041	1.019	-2.114	2.206
Factor value „successor’s criteria“	*SUCC*	-0.009	1.025	-2.402	2.651
Factor value „tax criteria“	*TAX*	0.032	0.995	-2.554	1.988

3. Methods and empirical results

Probit apprach

Following previous studies, we apply a standard probit analysis on the likelihood of succession over the whole observation period. Therefore, we summarize the statements (a) and (b) as 'family succession is likely' (*FAMSUC* = 1) and the statements (c) to (e) as 'family succession is unlikely' (*FAMSUC* = 0). Note, that almost 70% of all respondents reported, that family succession is likely.[2] The results of the econometric analysis are shown in table 2.

Table 2: Results of the econometric model on the probability of succession

Variable	*SYMBOL*	Param.	(z-value)
Profit / 100	*PROF*	0.766	(2.43)
Change in farmed land	*CHFL*	0.076	(2.72)
owned farmed land / 100	*OWN*	0.888	(2.44)
Land rent / 100	*RENT*	0.162	(2.51)
Net borrowed capital / 100	*NBC*	0.447	(3.04)
Net borrowed capital² / 1000	*NBC2*	-0.261	(-0.87)
Technical efficiency	*TEFF*	0.504	(0.47)
Number of sons	*CM*	0.240	(1.98)
Number of daughters	*CF*	-0.346	(-3.01)
Farmers age	*AGE*	0.414	(2.68)
Farmers age² / 100	*AGE2*	-0.340	(-2.31)
Land farmed since 5 generations	*GEN*	0.468	(1.99)
Farmers education	*EDUC*	-0.243	(-2.19)
Bond to farm	*BOND*	-0.321	(-2.96)
Attitudes towards being farmer	*FARM*	0.220	(2.23)
Growth restrictions	*GROW*	0.175	(1.75)
Constant		-13.579	(-3.24)

LogL:	-109.770	RLogL:	-172.666
LR(DF):	125.791 (16)	N:	272
R^2_{MF}:	0.364	R^2_{MF}:	0.266
R^2_{ML}:	0.370	R^2_{CU}:	0.515
AIC:	0.932	BIC:	-1209.939
% Correct predictions			84.56
% Correct predictions of "ones" ("zeros")			86.46 (80.00)

The estimated model is statistically significant at 1% level or better, as measured by the likelihood ratio test. The model correctly classifies 86.6% of all observations, whereby 86.5% of all cases with 'family succession is likely' and 80.0% of the observations with 'family succession is unlikely' are correctly classified. Over all, the results in table 2 suggest that the probability of succession is significantly influenced by a number of personal, household, and farm characteristics as well as by farm operator attitudes to farming and succession (factor values).

According to table 2, more profitable farms (*PROF*) report a significantly higher probability of being transferred within the family. These farms hold the best prospect of providing the succeeding child a reasonable and secure income in future. Similarly, Kimhi and Nachlieli (2001), Glauben et al.

[2] One might argue, that category (c) 'no decision made yet' should be treated as a third category. Thus we additionally estimate a multinomial logit model, where statements (a) and (b), and (d) and (e) are summarized and evaluated against alternative (c). We use a Wald Category Test (Long and Freeze 2004) and find the probit specification to be the most appropriate specification.

(2002), and Hennessy (2002) report that the likelihood of succession increases with some measure of farm income.

For a given profitability, the probability of succession significantly increase with the amount of own farm land (*OWN*). Land assets reflect the value of the farm and of the (inter-general) 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.

Previous farm growth (*CHFL*) is positively related to the likelihood of succession. There might be a problem, however, of distinguishing cause and effect with respect to this variable. A farm, for example, that has invested in land in the past might be more attractive for a potential successor, increasing the likelihood of succession. Yet, the causation could also be reversed. Sociological studies as well as Kimhi et al. (1995) suggest that farm operators, who plan to transfer the farm within the family, tend to have an incentive to expand their enterprise. Farm growth and the likelihood of succession would also be positively related. Differentiating empirically between the two explanations would require analyzing individual farms over a longer time period, which is not possible on the basis of our data set, unfortunately.

At first glance it might be surprising, that a high rental price (*RENT*) paid per hectare significantly increase the probability transferring the farm within the family. However, the rental price for land is an indication of the quality of land and a high rental price thus signals a high marginal return to land and a high potential to generate income.

Table 2 suggests that the probability of succession first increases with the amount of outstanding debt (*NBC*), and then declines again. A negative relationship between debt and the likelihood of succession at high debt levels indicates an increasing probability of bankruptcy, which reduces the attractiveness of taking over the farm for the child.

One should expect more efficient farms to be more attractive to the potential farm successor and the likelihood of family succession thus to increase with a measure of technical efficiency. The empirical results, however, do not support this conjecture. The parameter estimate of *TEFF* (our measure of technical efficiency derived from a DEA analysis) is not significantly different from zero. It remains unclear whether this is due to *TEFF* being a poor approximation of true differences in farm productivity or due to the fact that other explanatory variables (such as age, education, rental price of land, …) included in the probit model also capture part of these productivity effects. Table 2 clearly suggests that the probability of succession is significantly higher for farms, where the current farm operator has a high level of education (*EDUC*).

It should come as no surprise, that the age of the farm operator (*AGE*) is of particular importance for the succession decision. The probability of succession first increases with the farm operator's age, reaches its maximum at 60 years of age and then declines again. A number of studies support this non-linear impact of age on succession considerations (Laband and Lentz, 1983; Stiglbauer and Weiss, 2000; and Kimhi and Nachlieli, 2001, Glauben et. al 2002). As the age of the farm operator increases, he will be more aware of the need to make succession plans, thus the positive 'age/succession' relationship. The negative relationship between age and the probability of succession at advanced ages of the farm operator might indicate that a farmer, who postpones succession will have more difficulties in finding a successor within the family since his or her children will have started looking for alternative employment in the non-farm economy (Kimhi, 1994).

Following previous empirical studies (Pfeffer, 1989; Stiglbauer and Weiss, 2000, Glauben et al. 2002), we find the number of family members living on the farm to significantly influence succession considerations. The probability of succession is positively related to the number of sons (*CM*) but negatively related the number of daughters (*CF*). This might be due to the concept of sons as 'preferred successors' (Kimhi and Nachlieli, 2001, p. 49).

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.

Farms that have been operated by the same family for at least five generations (*GEN*) show a significantly higher probability of being transferred to the next generations within the same family.

Finally, farm operators (subjective) attitudes towards farming and family succession, that are condensed in factor values significantly contribute to the explanatory power of the probit model. As expected a closer 'tie to the farm' (*BOND*) and a higher contentedness with the financial situation (*FINAN*) significantly increases the likelihood or family succession, while a negative attitude towards being a farmer (*FARM*) significantly decreases the probability that the farm will be transferred. Similarly, if further farm growth (*GROW*) is not considered to be restricted family succession will become more likely. Although these variables reflect the views of the current farm operator, the close relationship between parents' and childrens' attitudes is well documented in economic psychology.[3]

Competing risk approach

This section focuses on the timing of the planned events. Farmers were asked, in which year they plan to stop operating the farm. The variable *TIME* then measures the number of years until this event takes place. To address this issue, one would estimate a duration model.

Assume that the hazard rate into a specific event j, $\lambda_j(\tau)$, is separable into a baseline component $\lambda_{0j}(\tau)$ and a component that depends on a linear combination of observed characteristics x and estimated parameters β_j: $\lambda_j(t;x) = \lambda_{0j}(t)\exp\left[x\beta_j\right]$. If $\exp\left[x\beta_j\right] > 1$, then the risk of the event j for this individual would increase over the whole period, and if $\exp\left[x\beta_j\right] < 1$ the opposite holds. Thus, hazard models describe the risk process and allow to gain insights into how risks change with the covariates (βx).

In the present case, we distinguish between two different events: family succession and farm exits. For those farm operators, which report family succession to be likely (*FAMSUC* = 1), we consider *TIME* to measure timing of succession. In cases where *FAMSUC* = 0, *TIME* refers to the timing of exits. It should be noted, that the two decisions (succession and exits) are 'competing' during a particular period of time. A farmer can choose one of the two options. Once a farmer has decided to hand over the farm to his successor in five years, for example, he no longer can make any plans about whether or not to close down the farm after this period. This implies that the timing of the competing event (in this case farm exit) is censored at this point in time. A similar reasoning applies for farm operators, who plan to close down the farm in five years. In this case, any plans on the timing of succession will be censored at this point.

Since we are mainly interested in the analysis of the failure times of both events (succession and exit), and not of their risk processes, we specify the competing risk approach as an 'accelerated failure time' (AFT) model. In this case, the cause specific hazard functions can be written as $\lambda_j(t_j;x) = \lambda_{0j}\left\{t_j \exp\left[-x\beta_j\right]\right\}\exp\left[-x\beta_j\right]$, where j denotes the respective event (Kalbfleisch and Prentice 1980, p. 170). Rearranging this equation gives a better understanding of the effects of the covariates. We normalize the 'observed' hazard rate according the following expression: $\frac{\lambda_j(t_j;x)}{\lambda_{0j}}\exp\left[x\beta_j\right] = t_j \exp\left[-x\beta_j\right] \Leftrightarrow \tau_j = t_j \exp\left[-x\beta_j\right]$. As can easily be seen, this model specifies the effect of the covariates to be multiplicative on t (rather than on the hazard function). That is, we assume a baseline hazard function to exist and the effect of the regression variables to alter the rate at which an individual proceed along the time axis. That is, if $\exp\left[x\beta_j\right] = 1$ then $\tau_j = t_j$ and

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

time passes at its 'normal' rate. If $\exp\left[x\beta_j \right] > 1$, then time is accelerated and the failure would occur earlier. If $\exp\left[x\beta_j \right] < 1$, the opposite holds.

Rearranging $\tau_j = t_j \exp\left[-x\beta_j \right]$ into $t_j = \tau_j \exp\left[x\beta_j \right]$, allows to directly measure the impact of x on the time of failure of an event j. That is a positive coefficient of β_j postpones the expected failure time and vice versa for a negative parameter estimate. It often turns out to be more convenient (Cleves et al. 2004) to estimate the following log-linear specification of the ACT-Model: $\ln\left(T_{ij}\right) = X_{ij}\beta_j + \ln\left(\tau_j\right);\ j = \left(succession; exit\right)$.

Here, T_{ji} denotes the expected failure time, measured in years until the event occur. X_{ij} are event-specific variables and β_j are the parameter to be estimated. Testing for different distributions of the random 'quantity' τ_j we find Weilbull to be the most appropriate distribution, thus $\tau_j \sim p t_j^{p-1} e^{\alpha}$. Treating the failure time other than j as censored we can separately estimate the failure time of each event j (Prentice (1979, p. 168). The results of the econometric analysis for the timing of succession as well as the timing of exit are reported in table 3 and table 4.

Both estimation models are significant at the 1% level or better as measured by the F-Test. As expected, a comparison of table 3 and table 4suggests different variables to be significantly related to the timing of the two competing events.

Table 3: Results of the Econometric Model on the Timing of Succession

Variable	*SYMBOL*	Param.	(z-value)
Farmers age	*AGE*	1.557	(4.03)
Farmers age² / 100	*AGE2*	-3.313	(-4.56)
Farmers age³ / 1000	*AGE3*	0.218	(4.83)
Profits	*PROF*	-0.002	(-2.14)
Change in farmed land	*CHFL*	-0.021	(-2.51)
Net borrowed capital	*NBC*	-0.001	(-2.97)
Land rent	*RENT*	-0.002	(-3.09)
Successor's criteria	*SUCC*	0.082	(1.83)
Personal criteria	*PERS*	-0.109	(-2.72)
Tax criteria	*TAX*	0.012	(0.32)
Constant	α	-19.403	(-2.86)
	p	2.289	

LogL:	-163.505	RLogL:	-263.145
LR(DF):	199.281 (10)	N:	209
R^2_{MF}:	0.379	R^2_{MF}:	0.333
R^2_{ML}:	0.615	R^2_{CU}:	0.668
AIC:	1.679	BIC:	-725.431

The age of the farm operator (*AGE*) turns out to be of particular importance for the failure time of both events. We find a significant non-linear relationship between the farm operator's age and the timing of succession. Succession is accelerated first as the age of the farmer increase, and than delayed.[4] This might be the result of bargaining between the farmer and the potential successor. As discussed in Kimhi (1997), the farmer has an incentive to indicate his willingness to hand over at an relatively early age to lure the successor into waiting. Once the potential successor has credibly

[4] A similar pattern is reported in Glauben et al. (2002).

committed himself, he can delay his retirement decision. The exit-time does not involve such bargaining processes and no non-linear relationship is observed.

In contrast to other studies, the present analysis is based on accounting data to measure financial and other characteristics of farms. We find several of these variables to influence succession (table 3). For a given age of farm operator, farm succession is significantly accelerated as farm profits (*PROF*) as well as the marginal returns of land (*RENT*) increase. Further, farmers with a relatively high level of debt (*NBC*) and a high farm growth rate in the past (*CHFL*) tend to transfer the farm earlier. Successful farms clearly hold out the best prospects of providing the successor with a high and secure income. One should thus expect the willingness of the heir to take over the farm as soon as possible to increase. On the other hand, it is at least plausible – though hardly a tight deduction – that a healthy financial performance of the farm is an indication of a good farm operator who would not tend to delay the transfer decision. Viewed from the farm operator's perspective only, Kimhi (1997) argues that it is not possible to state whether succession will be earlier or later in the presence of binding borrowing constraints. Finally, if the farm operator attaches high importance to factors characterizing his own personal situation (*PERS*), such as his own health status, he tends to delay handing over the farm. In contrast, if the operator is more altruistic and attaches more weight to the successor's situation (*SUCC*), such that the successor insists to take over the farm, farm succession will be accelerated.

Table 4: Results of the econometric model on the timing of closure

Variable	*SYMBOL*	Param.	(z-value)
Farmer's age	*AGE*	-0.064	(-5.38)
Number of daughters	*CF*	-0.141	(-2.11)
Farmed land	*FL*	0.013	(5.80)
Cash crop farms (root crops)	*CCRC*	-0.635	(-3.64)
Cash crop – pig production farms	*CCPIG*	-0.490	(-2.80)
Technical Efficiency	*TEFF*	2.581	(4.75)
Personal criteria	*PERS*	0.202	(2.62)
Tax criteria	*TAX*	-0.083	(-1.31)
Bond to farm	*BOND*	-0.232	(-3.02)
Financial Situation	*FINAN*	0.231	(3.86)
Constant	α	3.494	(4.36)
	p	4.106	

LogL:	-27.657	RLogL:	-69.295
LR(DF):	83.276 (10)	N:	209
R^2_{MF}:	0.601	R^2_{MF}:	0.428
R^2_{ML}:	0.329	R^2_{CU}:	0.678
AIC:	0.379	BIC:	-997.126

The timing of closing down and exiting from the farm business is also significantly related to farm characteristics and personal attitudes (table 4). As expected, farm owners' of large farms (*FL*) as well as farms characterized by a high level of technical efficiency (*TEFF*) tend to retire later. As argued in Miljkovic (2000), efficient farmers tend to suffer less from "harm of work" and thus retire later. Further retirement is accelerated for relatively specialized enterprises, as cash-crop and cash crop/pig production farms (*CCRC, CCPIG*). To be successful, specialized farms usually need more modern technical know-how, and the willingness to acquire this know-how tends to decline with age. Finally a low value for the farmer's subjective affection to the farm (*BOND*) significantly reduces the time until retirement. On the other hand, a high agreement of the respondents with some survey personal statements (*PERS*) would enforce farmers to retire later. Finally, a high contentedness with the financial situation (*FINAN*) induces later retirement.

4. Summary

A distinguishing feature of agriculture is the predominance of family businesses and the way in which this structure is replicated by the transfer of farms between generations of the same family. Whereas researches in the field of family business agree, that the intergenerational transfer decision is one of the most important issue that family firms face, only few studies have investigated these issues econometrically so far.

This work examines family and farm characteristics affecting the choice and the timing of intergenerational farm transfers using survey data which are linked to individual accounting data for 272 farm household in Northern Germany. Within a probit approach, we examine whether specific farm and family characteristic as well as some subjective attitudes are related to the likelihood of succession within a given observation period. In a second step, we go beyond the existing literature by applying a competing risk approach which is specified as an "accelerated failure time" model to study the timing of farmers' retirement decision and thus the timing of either succession or exit from farming.

Farm characteristics significantly influence succession considerations. The likelihood of succession increases with farm profits and the amount of own farm land. Further, the number of household members living on farm also significantly influences succession plans. The probability of succession first increases with the age of the operator and then decline again. Tradition also plays an important role in farm succession considerations in Germany. Farms that have been "in the hand" of the same family for at least five generations show a significantly higher probability of being transferred to the next generations within the same family. Finally, different (subjective) attitudes of the farm operators towards farming and family succession that are condensed in the factor values significantly contribute the explanation of the succession decision.

Regarding the timing of farm operator's retirement, we find some farm and family characteristics to have an impact on the two competing destinations (family succession or exit from farming). While, for example, we find a significantly non-linear relationship of farm operator's age and the timing of succession, the timing of closing the firm shows a significant linear relationship to farmers' age. The non-linear pattern on succession time indicates that succession is first accelerated as the age of the farmer increase, and than delayed. For a given age of farm operator, farm succession is significantly accelerated as profits and the marginal returns of land increase, while farm owners' of large farms as well as farms characterized by a high technical efficiency tend to close down business later.

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Appendix

Table A1: Surveyed Attitudes and Resulting Factors

Close bond to farm (*BOND*)	Negative attitude towards being farmer (*FARM*)	Financial situation (*FINAN*)	Restrictions of further farm growth (*GROW*)
Farmer by tradition +	Too much work on farm +	Reasonable income from farming +	Leasing contracts missing +
Would like to stay on farm +	Successor can't find a partner +	Difficult financial situation +	Conditions restrict farming +
Old age support important +		Investments necessary +	
Farm should stay within family +			

Table A2: Surveyed Criteria for the Timing of Succession and Resulting Factors

Personal criteria (*PERS*)	Successors criteria (*SUCC*)	Tax criteria (*TAX*)
Own age +	Successor's age +	Income tax +
Own health +	End of apprenticeship +	Gift tax +
Don't like to farm anymore +	Successor insists on transfer +	
Criteria for pension payment +	Successor's family circumstances +	
	Young farmer programs +	

Table A3. Definition and Description of Variables – AFT-Model

Variable	*SYMBOL*	Mean	Std. Dev.	Min	Max
Timing of succession (years until planned transfer)	*TSU*	7.219	4.558	1	25
Timing of exit (years until planned exit)	*TEX*	10.364	6.953	2	25
Farmer's age	*AGE*	53.000	6.819	34	73
Profits from farming (1000 EUR)	*PROF*	59.629	51.550	-64.734	409.736
Farmed land (ha)	*FL*	109.771	84.892	14.590	661.210
Change in farmed land (ha)	*CHFL*	1.444	5.024	-21.920	27.610
Net land rent (EUR/ha)	*RENT*	308.403	440.920	0.000	5588.333
Net borrowed capital (1000 EUR)	*NBC*	130.687	171.578	-307.707	1095.646
Technical efficiency (0-1)	*TEFF*	0.873	0.112	0.530	1.000
Dummy variable cash crop farms with mainly root crops	*CCRC*	0.177			
Dummy variable farms with cash crops and pig production	*CCPIG*	0.067			
Number of daughters	*CF*	1.033	0.917	0	3
Factor value „successor's criteria"	*SUCC*	-0.110	0.964	-2.005	2.144
Factor value „personal criteria"	*PERS*	-0.110	1.022	-2.402	2.651
Factor value „tax criteria"	*TAX*	-0.061	1.012	-2.554	1.988
Factor value „bond to farm"	*BOND*	-0.095	0.970	-1.919	2.484
Factor value „financial situation"	*FINAN*	-0.008	1.048	-2.123	2.625