Intergenerational Succession on Family Farms: Evidence from Survey Data

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Abstract

This study examines family farms and characteristics affecting farm succession. Based on a farm survey, three aspects of succession are analysed in the paper: the probability of family succession; the likelihood of having a successor designated; and the timing of succession. Large and specialised farms are more likely to be transferred within the family and to have appointed a successor. The number of family members, as well as the experience of farm operator, is also significantly related to the succession behaviour. The probabilities of succession, and of having a successor, first increase with age and then decline again. Furthermore, timing of succession is delayed as the farm holder ages, suggesting most farm operators' succession plans to be inconsistent over time. In addition, we find a significant interrelationship between the different aspects of succession indicating that decisions on family succession, the designation of a successor, as well as the timing of succession, are not separable.

Keywords

farm succession, survey data, econometric analysis.

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1. Introduction

A characteristic feature of the farming sector, as opposed to most sectors of the economy, is that enterprises are traditionally passed on within the family.[1] Whereas the study of farm succession already has a long tradition in the Rural Sociology literature (Gasson and Errington, 1993; Blanc and Perrier-Cornet, 1993) agricultural economists have devoted surprisingly little attention to this topic. Furthermore most of the economics literature is normative, focusing on the issue of optimal planning and financing of inter-generational transfers (Boehlje and Eisengruber, 1972; Tauer, 1985; Reinders et al. 1980). Only a few studies aim at proposing reasons for the predominance of inter-generational succession in the farm sector. Pesquin, et al. (1999), point out that intra-family succession enables the family to realise 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. In addition, it allows parents to rely on the farm for old-age support and therefore to partly overcome binding borrowing constraints (Kotlikoff and Spivak, 1981; Kimhi and Lopez, 1997). Pesquin, et al. (1999), mention additional advantages of intra-family farm succession such as 'smooth' transition, reduction in transfer cost and lower transfer taxes. By focusing on the transfer of human capital across generations, Laband and Lentz (1983) as well as Rosenzweig and Wolpin (1985) add that the existence of returns to land-specific experience creates incentives for children to work on the family farm when young. Human capital is acquired in childhood as a by-product of growing up. This farm-specific human capital increases the value of the transferred physical asset; the young thus are the highest market bidders for their parents' land.

In the 1990's, some empirical work on farm succession in agricultural economics was undertaken. Summarising this literature is difficult, however, for two reasons. First, empirical studies have been carried out in many different regions, and the arrangements, legal rules, and social customs in passing on holdings from one generation to the next vary substantially between these regions.[2] Second, the existing literature analyses different dimensions of succession, making a comparison of results difficult. By focusing on the <u>timing of farm succession</u>, 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. Furthermore, farms are transferred earlier in more recently established villages and when the operator is also working off the farm. Kimhi's empirical results support the idea that timing of farm succession is determined by altruistic parents seeking to maximize family welfare in the future. Using survey data for 469 Maryland farmers, Kimhi and Lopez (1997) also find that farm owners' plans with respect to the timing of retirement are systematically related to farm and personal 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. They conclude that retirement and succession considerations in family farms are not separable.

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[1] Laband and Lentz (1983), for example, find that farmers are nearly nine times more likely to have followed in their fathers' footsteps that the other self employed workers, and thirty times more likely to follow their fathers than the average worker in their sample. In fact, this inter-generational succession can be considered a constituent element of family farms: "the final distinguishing feature of an ideal type of farm family business is that business ownership and management are handed down within the family" (Gasson and Errington, 1993, p. 39). Similarly, Pfeffer (1989) argues: " an essential aspect of family farming is the perpetuation of this form of agricultural production across generations" (p. 428).

[2] Surveys on the different conditions for farm successions in various countries are available in Blanc and Perrier-Cornet (1993) as well as Errington (1999).

Focusing on the designation of a successor, Kimhi and Nachlieli (2001) investigate the impact of family and farm characteristics on the probability of having declared a successor. They use survey data for 127 farm families in Israel and report a significant and positive relationship between a farm operator's age and the probability of declaring a successor. Likewise, a higher education of the farm operator increases the likelihood of finding a successor within the family.

Analysing 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. Again, a significant life-cycle pattern in the farmers' succession behaviour is reported.

In contrast to the existing literature, the present paper is devoted to analysing the different dimensions of intra-family succession simultaneously within the same region. Using farm survey data for Upper Austria, we examine whether specific family and farm characteristics are related to the three dimensions of succession behaviour: (a) the probability of succession; (b) the likelihood of having declared a successor; as well as (c) the timing of succession. Additionally, we go beyond the existing literature by investigating the inter-relationship between these three aspects of succession. A farm operator's succession plans, for example, might not be independent from his efforts to designate a successor, and vice versa. Similarly, the existence of a successor might influence the farm operator's plans with respect to the timing of succession. Section 2 briefly describes the data. Section 3 reports the empirical results and section 4 offers conclusions.

2. Data

Our analysis of inter-generational succession is based on a survey of 1,650 Upper Austrian farm households in 1993. Only farm operators aged 45 or above have been surveyed. The respondents were asked about their succession plans. In particular, they indicated which of the following four alternatives best describes their situation: (a) farm succession is certain and a farm successor is already determined; (b) farm succession is likely but a successor has not yet been determined; (c) farm succession is rather unlikely but a potential farm successor is available; or (d) farm succession is uncertain and no successor is available. To analyse farm succession econometrically, statements (a) and (b) are summarized as 'farm succession is certain or likely' (*SUCC* = 1) and statements (c) and (d) are summarized as 'farm succession is unlikely or uncertain' (*SUCC* = 0). Analogously, to examine the probability of having a successor designated we combine statements (a) and (c) to 'farm successor is available or designated' (*DESIG* = 1) as well as (b) and (d) to 'farm successor is not available or not designated' (*DESIG* = 0). **Table 1** shows the classification of all 1,650 farms into the four different categories.

Table 1: Expectations on Intra-Family Succession in Upper Austrian Farm Households

	SUCC = 0	*SUCC* = 1	Total
DESIG = 0	141	230	371
DESIG = 1	354	925	1,279
Total	495	1,155	1,650

More than 50% of all respondents reported that farm succession is likely or certain and a farm successor is available or already has been determined. Only fewer than 10% of the respondents consider succession to be unlikely and had no successor available or designated.

In addition, the respondents were asked about the expected timing of successions, measured in years until the proposed transfer of the farm (*TIME*). Unfortunately, 19% (314) of the farm operators surveyed did not respond to this question. The number of observations for this variable thus decreases to 1,336.[3]

The data set also includes information on the farm, as well as some family characteristics such as age, sex, schooling, and the off-farm employment status.[4] The "Annual Standard Gross Margin" (*SGM*) as well as the number of livestock (*LU*) is used as a measure of the farms' earnings capacity.[5] The Annual Standard Gross Margin is an imputed measure of farm income based on the quantity and types of products produced on the farm, given average commodity prices and input costs in the area. The "livestock units" (LU) is an index defined according to the live weight of an animal. A live weight of 500 kg (1,102 pounds) corresponds to one livestock unit. Unfortunately, more appropriate management variables (e.g., farm profits, household income, and wealth) are not available. **Table 2** reports descriptive statistics of all variables used in the empirical analysis.

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3 Chances are that the refusal to answer this question is related to personal and farm characteristics. In this case, selection biases in the econometric model on the timing of farm succession might be encountered. Although estimation results of a sample-selection tobit model actually report significant effects of farm and household characteristics on the probability of responding to this question, a significant selection effect can not be observed (see **Table A.1**. in the appendix).

4 This information has been obtained by matching the farm survey data to a farm census in Upper Austria. We are grateful to Ernst Fürst for preparing and providing this data set.

5 Upper Austria is one of three major agricultural regions in Austria and is particularly devoted to dairy products. While 19% of all farms are located here, those farms own 29% of all livestock in Austria.

Table 2: Definition and Description of Variables

Definition	Symbol	All Farms Mean (Std.Dev.) [Minimum] {Maximum}	Farms with *SUCC* = 1 Mean (Std.Dev.) [Minimum] {Maximum}	Farms with *SUCC* = 0 Mean (Std.Dev.) [Minimum] {Maximum}	Farms with *DESIG* = 1 Mean (Std.Dev.) [Minimum] {Maximum}	Farms with *DESIG* = 0 Mean (Std.Dev.) [Minimum] {Maximum}
Dummy variable for farm succession (1 = farm succession is certain or likely, 0 = else)	*SUCC*	0.700 (0.458) [0] {1}	1 (0) [1] {1}	0 (0) [0] {0}	0.723 (0.448) [0] {1}	0.620 (0.486) [0] {1}
Dummy variable for designation of a farm successor (1 = farm successor designated or available; 0 = else)	*DET*	0.775 (0.418) [0] {1}	0.801 (0.400) [0] {1}	0.715 (0.452) [0] {1}	1 (0) [1] {1}	0 (0) [0] {0}
Timing of succession (years until the proposed transfer)	*TIME*	6.008 (3.963) [0] {21}	5.716 (3.900) [0] {21}	6.956 (4.021) [1] {19}	5.528 (3.737) [0] {19}	7.966 (4.253) [1] {21}
Standard gross margin (100.000 EURO), (Sum of the standard gross margins of nine different products; calculated using average yields, prices and costs)	*SGM*	0.311 (0.229) [0.008] {2.669}	0.337 (0.240) [0.008] {2.669}	0.251 (0.187) [0.009] {1.381}	0.324 (0.237) [0.001] {2.669}	0.269 (0.192) [0.008] {1.381}
Livestock units (100 units)	*LU*	0.234 (0.182) [0.000] {1.372}	0.253 (0.185) [0.000] {1.372}	0.190 (0.165) [0.000] {1.200}	0.245 (0.184) [0.000] {1.372}	0.196 (0.169) [0.000] {1.200}
Leased out land (hectare)	*LEASE*	0.383 (2.669) [0.000] {42.800}	0.254 (2.160) [0.000] {42.800}	0.685 (3.571) [0.000] {40.700}	0.267 (1.919) [0.000] {39.000}	0.785 (4.340) [0.000] {42.800}
Dummy variable for subjective credit load (1 = farm operator considers credit load to be high, 0 = else)	*CREDIT*	0.087 (0.282) [0] {1}	0.081 (0.272) [0] {1}	0.103 (0.304) [0] {1}	0.079 (0.270) [0] {1}	0.116 (0.321) [0] {1}
Hirschmann-Herfindahl-Index (The *HHI* is defined as the sum of the squared shares s_j of nine different products: $HHI = \sum_{j=1}^{9} s_j^2$.	*HHI*	0.584 (0.163) [0.258] {1.000}	0.584 (0.162) [0.275] {1.000}	0.586 (0.165) [0.258] {1.000}	0.583 (0.159) [0.258] {1.000}	0.589 (0.173) [0.293] {1.000}
Dummy variable for part time farming: (1 = more than 50% off-farm income, 0 = else)	*PT*	0.378 (0.485) [0] {1}	0.363 (0.481) [0] {1}	0.412 (0.493) [0] {1}	0.373 (0.484) [0] {1}	0.394 (0.489) [0] {1}

Table 2 to be continued

Table 2 continued

Age of Farm operator (years)	*AGE*	53.822 (5.776) [45] {80}	53.700 (5.368) [45] {79}	54.105 (6.628) [45] {80}	54.067 (5.521) [45] {80}	52.976 (6.518) [45] {79}
Farm operator's experience (years as a farm owner) / 100 (years)	*EXPER*	0.244 (0.093) [0.000] {0.930}	0.247 (0.095) [0.000] {0.930}	0.237 (0.087) [0.000] {0.480}	0.249 (0.094) [0.000] {0.930}	0.226 (0.084) [0.000] {0.570}
Number of male family members in the farm household between 15 and 30 years of age	*FAM-M*	0.902 (0.980) [0] {6}	1.048 (0.984) [0] {5}	0.560 (0.882) [0] {6}	0.983 (0.977) [0] {6}	0.623 (0.940) [0] {4}
Number of female family members in the farm household between 15 and 30 years of age	*FAM-F*	0.681 (0.838) [0] {5}	0.721 (0.849) [0] {5}	0.586 (0.802) [0] {3}	0.742 (0.858) [0] {5}	0.469 (0.725) [0] {3}
Dummy variable for farm operators marriage status (1=married, 0=unmarried)	*MARR*	0.875 (0.331) [0] {1}	0.908 (0.289) [0] {1}	0.796 (0.403) [0] {1}	0.905 (0.293) [0] {1}	0.768 (0.423) [0] {1}
Dummy variable for farm operator's sex, (1=female, 0= male)	*GENDER*	0.149 (0.356) [0] {1}	0.148 (0.355) [0] {1}	0.152 (0.359) [0] {1}	0.155 (0.362) [0] {1}	0.129 (0.336) [0] {1}
Dummy variable for hardship zone 3 and 4 (unfavourable and most unfavourable production conditions)	*HARD*	0.085 (0.279) [0] {1}	0.071 (0.257) [0] {1}	0.117 (0.322) [0] {1}	0.089 (0.285) [0] {1}	0.070 (0.256) [0] {1}
Regional dummy variable 1 (city of Linz, Steyr and Wels)	*R1*	0.012 (0.109) [0] {1}	0.013 (0.113) [0] {1}	0.010 (0.100) [0] {1}	0.009 (0.092) [0] {1}	0.024 (0.154) [0] {1}
Regional dummy variable 2 (Braunau and Schärding)	*R2*	0.152 (0.359) [0] {1}	0.152 (0.359) [0] {1}	0.154 (0.361) [0] {1}	0.151 (0.358) [0] {1}	0.156 (0.364) [0] {1}
Regional dummy variable 3 (Eferding)	*R3*	0.024 (0.152) [0] {1}	0.019 (0.137) [0] {1}	0.034 (0.182) [0] {1}	0.024 (0.154) [0] {1}	0.022 (0.145) [0] {1}
Regional dummy variable 4 (Freistadt, Rohrbach and Urfahr)	*R4*	0.199 (0.400) [0] {1}	0.188 (0.391) [0] {1}	0.226 (0.419) [0] {1}	0.192 (0.394) [0] {1}	0.224 (0.417) [0] {1}
Regional dummy variable 5 (Gmunden and Vöcklabrück)	*R5*	0.158 (0.365) [0] {1}	0.151 (0.358) [0] {1}	0.176 (0.381) [0] {1}	0.159 (0.366) [0] {1}	0.156 (0.364) [0] {1}

Table 2 to be continued

Table 2 continued

Regional dummy variable 6 (Grieskirchen)	*R6*	0.085 (0.280) [0] {1}	0.080 (0.271) [0] {1}	0.099 (0.299) [0] {1}	0.092 (0.290) [0] {1}	0.062 (0.241) [0] {1}
Regional dummy variable 7 (Kirchdorf and Steyr)	*R7*	0.128 (0.334) [0] {1}	0.142 (0.349) [0] {1}	0.095 (0.293) [0] {1}	0.137 (0.344) [0] {1}	0.097 (0.296) [0] {1}
Regional dummy variable 8 (Linz and Perg)	*R8*	0.112 (0.316) [0] {1}	0.123 (0.329) [0] {1}	0.087 (0.282) [0] {1}	0.109 (0.311) [0] {1}	0.124 (0.330) [0] {1}
Regional dummy variable 9 (Ried i.i.)	*R9*	0.052 (0.222) [0] {1}	0.050 (0.218) [0] {1}	0.057 (0.231) [0] {1}	0.052 (0.223) [0] {1}	0.051 (0.221) [0] {1}

In contrast to empirical studies analysing the determinants of family succession on the basis of census data (such as Kimhi, 1994 and Stiglbauer and Weiss, 2000), farm surveys derive an advantage from the fact that detailed and direct information can be obtained on the respondents' subjective evaluation of the succession situation. A sub-sample of farm operators (where *DESIG* = 1 and *SUCC* = 0) were asked to specify why they consider farm succession to be uncertain (or unlikely). This direct evidence (summarized in **Table A.2.** in the appendix) can serve as a background for interpreting the results of the econometric analysis to be reported in the following section.

3. Results

The results of the econometric analysis are shown in **Table 3**. Columns [1] and [2] report parameter estimates of a bivariate probit model on the probability of family-succession as well as the designation of a successor. Column [3] has the results of a tobit model on the timing of farm succession. The estimation models are statistically significant at the 1% level or better, as measured by the likelihood ratio test. The predictive power of models [1] and [2] when it comes to classifying observations into the four categories (*SUCC* = 0/1 and *DESIG* = 0/1) differs between the individual categories. The models in columns [1] and [2] correctly classify 69.7% and 72.4% of all observations. Whereas 88.5% (86.5%) of all cases with certain succession (with a successor designated) are correctly predicted, the percentage of families reporting uncertain succession (no successor designated) being correctly classified is substantially lower with 26.1% (23.9%).

Table 3: Results of Econometric Models on the Probability of Succession, the Designation of a Successor, and the Timing of Succession

Dependent Variable:	*SUCC* [1]		*DESIG* [2]		*TIME* [3]	
Independent Variable (Symbol)	Param.	(t-value)	Param.	(t-value)	Param.	(t-value)
Constant	-4.568	(-2.00)	-7.896	(-3.47)	230.372	(6.76)
Standard Gross Margin (*SGM*) /100.000	0.811	(3.05)	0.394	(1.30)	-0.257	(-0.65)
Livestock Units (*LU*)/100	0.681	(2.37)	0.227	(0.75)	-3.602	(-0.07)
Leased out Land (*LEASE*)	-0.027	(-1.90)	-0.023	(-1.67)	0.365	(0.10)
Credit Load (*CREDIT*)	-0.257	(-2.07)	-0.164	(-1.35)	0.220	(0.88)
On-Farm Specialisation (*HHI*)	0.317	(1.45)	-0.055	(-0.24)	1.451	(3.21)
Part-time Farm (*PT*)	0.123	(1.43)	-0.047	(-0.50)	0.041	(0.22)
Age of Farm Operator (*AGE*)	0.149	(1.83)	0.239	(2.89)	-9.737	(-5.39)
Age of Farm Operator Squared (AGE^2)/100	-0.139	(-1.94)	-0.192	(-2.62)	13.843	(4.39)
(Age of Farm Operator)^3 (AGE^3)/1000					-0.654	(-3.59)
Farm Operator's Experience (*EXPER*)/100	0.881	(1.76)	0.504	(0.89)	-2.256	(-2.56)
Number of Male Fam. Memb. (*FAM-M*)	0.276	(7.53)	0.055	(1.06)	-0.238	(-3.08)
Number of Female Fam. Memb. (*FAM-F*)	0.040	(0.89)	0.154	(3.12)	-0.283	(-3.21)
Marriage Status (*MARR*)	0.288	(2.47)	0.302	(2.08)	0.498	(1.71)
Gender of Farm Operator (*GENDER*)	0.197	(1.84)	0.277	(2.11)	-1.085	(-4.52)
Hardship Zone (*HARD*)	-0.295	(-2.26)	0.337	(2.28)	0.467	(1.53)
Regional Dummy Variable 1 (*R1*)	0.225	(0.65)	-0.501	(-1.44)	1.243	(1.87)
Regional Dummy Variable 2 (*R2*)	-0.216	(-1.37)	0.087	(0.54)	0.457	(1.48)
Regional Dummy Variable 3 (*R3*)	-0.458	(-1.86)	0.330	(1.19)	1.312	(2.43)
Regional Dummy Variable 4 (*R4*)	-0.144	(-0.92)	0.071	(0.46)	0.008	(0.03)
Regional Dummy Variable 5 (*R5*)	-0.155	(-0.99)	0.203	(1.26)	0.392	(1.27)
Regional Dummy Variable 6 (*R6*)	-0.436	(-2.51)	0.275	(1.48)	0.252	(0.69)
Regional Dummy Variable 7 (*R7*)	0.123	(0.74)	0.178	(1.00)	0.679	(2.14)
Regional Dummy Variable 8 (*R8*)	0.081	(0.48)	-0.045	(-0.27)	0.639	(1.99)
Regional Dummy Variable 9 (*R9*)	-0.318	(-1.58)	0.059	(0.27)	0.348	(0.88)
Succession Likely (*SUCC*)			0.868	(2.03)	-0.551	(-1.83)
Successor Designated (*DESIG*)					-0.382	(-0.99)
Disturbance Correlation (ρ)		-0.485	(1.99)			
Sigma (σ)					2.575	(51.53)
Log-Likelihood			-1,698.872			-3,152.054
Restricted Log-Likelihood			1,880.252			-3,730.555
Likelihood Ratio Test (DF)			362.760 (47)			1,157.002 (26)
R^2 McFadden (Veal/Zimmermann)			0.096 (0.246)			0.155 (0.512)
% Correct predictions		69.76		72.42		
% Correct predictions of "ones" ("zeros")	88.48 (26.06)		86.47 (23.98)			

Remarks: The number of observations is 1,650 in models [1] and [2] and 1.336 in model [3]. The variables *SUCC* and *DESIG* in model [3] have been instrumented. DF are degrees of freedom.

Comparing the results of columns [1] and [2] suggests that the probability of succession is influenced significantly by a number of economic characteristics of the farm, whereas the socio-economic attributes of the farm family (e.g., age of farm operator, number of family members) strongly influence the likelihood of having a successor appointed.

According to **Table 3**, an increase in farm size increases the probability of farm succession, the parameter estimates for both the standard gross margin (*SGM*), and for livestock units (*LU*) are positive, and significantly different from zero in column [1]. For a hypothetical farm,[6] a 10% increase in *SGM* (in *LU*) raises the probability of succession by 0.89%-points (0.59%-points). Large farms hold out the best prospects of providing a potential successor with a reasonable and secure income. These results are confirmed by questionnaires directly evaluating the farm operator's assessments. A low farm income ranks as the single most important reason for farm succession to be uncertain in Upper Austria (see **Table A.2.** in the appendix). Similarly, Gasson et al. (p. 23, 1988) conclude: "one of the main reasons for children not taking over the family farm is that the farm is too small". With respect to the probability of having a successor designated, as well as the timing of succession, however, the farm size variables did not contribute significantly to the explanatory power of the model (see columns [2] and [3] of **Table 3**).

The probability of succession, as well as the likelihood of having nominated a successor, significantly declines with the amount of land leased out. The absence of a successor might reduce the incentives for expanding capacity, and leasing out a large share of farm land (*LEASE*) could then be a reasonable strategy to reduce working hours and make life easier. The timing of succession is not significantly related to this variable, however. Furthermore, farms strained with a high credit load (*CREDIT*) are found to have a significantly lower probability of succession. Again, the likelihood of having a successor appointed, as well as the timing of succession, are not influenced by this variable.

Empirical studies of Potter and Lobley (1992), as well as Stiglbauer and Weiss (2000), suggest a negative relationship between on-farm diversification and the probability of farm succession. The results reported in columns [1] and [2] do not support this hypothesis. Neither the probability of succession nor the likelihood of having a successor designated is significantly related to the Herfindahl-Hirschmann Index (*HHI*). Column [3] of **Table 3**, however, suggests that succession is postponed on specialised, as opposed to diversified farms. The parameter estimate of *HHI* is positive and significantly different from zero.

The issue, whether part-time farming is a stable phenomenon, or constitutes the first step on the way to farm exits, is a very controversial one in agricultural economics. Kimhi and Bollman (1999) and Kimhi (2000) found that the exit probability decreases with the extent of off-farm work in Canada and Israel. On the other hand, Pfeffer (1989) suggests that part-time farmers in Germany had lower expectations of continuing the farm in the future. Similarly, Weiss (1997 and 1999) and Roe (1995) report positive effects of the existence of off-farm work on the probability of exits. Stiglbauer and Weiss (2000) find that the probability of family succession decreases, whereas the probability of non-family succession, as well as the probability of exit, increases with the amount of off-farm work. When asked directly, farm operators frequently refer to the good off-farm income opportunities for the potential successor (47%), as well as the high working load associated with additional off-farm work (39%), as important reasons for farm succession being uncertain (see **Table A.2.** in the appendix). Yet results of the econometric analysis reported in **Table 3** do not reveal a

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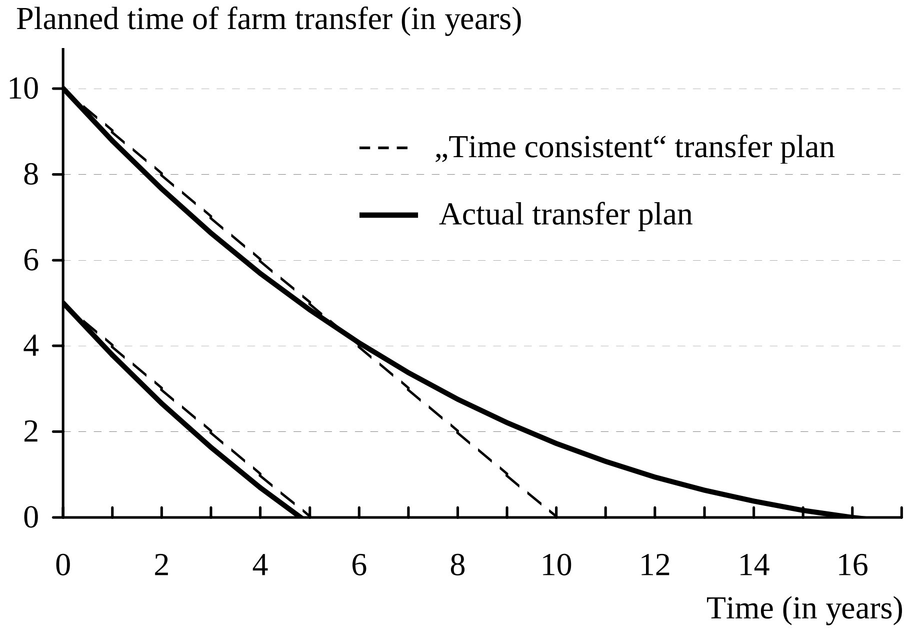
6 A hypothetical farm is characterised by taking mean and mode values of exogenous continuous and dummy variables, respectively. The probabilities of succession and declaration of a successor for this hypothetical farm are 68.9% and 86.9% respectively.

significant impact of part-time farming on family succession plans. In none of the three equations estimated does *PT* contribute significantly to the explanatory power of the model. These results do not give support to the notion that part-time farming stabilizes overall farm income, thereby reducing the likelihood of farm exits in the process of inter-generational succession.

With regard to the socio-economic characteristics of the farm operator and his or her family, the age of the farm operator (*AGE*) turns out to be of particular importance. The probability of succession first increases with the farm operator's age, reaches its maximum at 53 years of age and then declines again. A similar non-linear pattern can be observed with respect to the probability of having designated a successor, the highest probability in this case occurs at 62 years of age. 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). 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).

The farm operator's age also significantly influences the timing of succession (see column [3] in **Table 3**). Here again the relationship is non-linear. To facilitate interpretation of timing in establishing a succession, a "time path for farm transfers" is shown in **Figure 1** calculated on the basis of the parameter estimates of column [3] in **Table 3**.

Figure 1: Calculated Time Path for Farm Transfer of a Hypothetical Farm



A farm operator who is 45 years of age and reports that he plans to hand over the farm in 5 years (10 years) would retire at the age of 50 (55). Given that the farm operators' retirement plans are consistent over time, the time of retirement should come closer by one year as the farm operator's age increases by one year. The two 45° (broken) lines represent this relationship. The parameter estimates reported in **Table 3** however, imply that the retirement plans to be expected as the farm operator's age increases by one year actually deviate from these lines. The timing of succession is delayed as the age of the farm operator increases, ceteris paribus. This effect is negligible in cases where the proposed time of the farm transfer is near (as a comparison between the two lines for a farm operator planning to retire in 5 years indicate). However, in the second example, the deviation between the two lines is substantial. Whereas the farm operator originally reported wanting to hand over the farm in 10 years, he will revise his plans repeatedly and actually retire at the age of 61 (instead of 55). These results point to a time-inconsistency in the farm operator's retirement plans.

Given that more experienced farmers (*EXPER*) will be able to run their farm more successfully, we would expect to find the willingness of a successor to take over these farms to increase as well. **Table 3** supports this argument. For a given age of the farm operator, an increase in the farmer's experience significantly increases the likelihood of succession and reduces the time until the farm is handed over. The parameter estimate in column [1] however is significantly different from zero at the 10% level only. Differences in the farm operator's experience do not significantly influence the likelihood of having declared a successor (see column [2] of **Table 3**).

Following previous empirical studies (Pfeffer, 1989; Stiglbauer and Weiss, 2000), we find the number of family members living on the farm to significantly influence succession considerations. The probability of succession as well as the likelihood of having somebody appointed as a successor is significantly higher for farms where the farm operator's child (*FAM-M*, and *FAM-F*), as well as his or her partner (*MARR*), also lives on the farm. For a hypothetical farm, the probability of succession increases by 9.01%-points as the number of male family members living on the farm increases by one. The likelihood of having a successor appointed increases by 3%-points for each additional female family member. With regard to the timing of succession, Kimhi (1995) and Kimhi and Nachlieli (2001) expect the number of children to delay the succession decision, "as it generates competition among the potential successors that hurts their bargaining position. The number of sons is expected to have a stronger effect than the number of daughters, due to the concept of sons as preferred successors" (Kimhi and Nachlieli, 2001, p. 49). This hypothesis can not be supported for the farms surveyed. On the contrary, the number of male or female family members reduces the planned time until farm transfer. Succession will be postponed, however, on farms where the farm operator's partner also is working on the farm. For female farm operators (*GENDER* = 1) we find the likelihood of succession as well as the probability of having declared a successor to be significantly higher. Furthermore, farm successions in these farms take place earlier, ceteris paribus.

Regional differences have been controlled for by using several regional dummy variables (R_1 to R_9 as well as *HARD*). Farms located in less favoured areas (*HARD* = 1) report a significantly lower probability of succession, which is confirmed by Weiss and Stiglbauer (2000). Surprisingly however, these farms report a higher likelihood that a specific successor has already been determined (see columns [2] of **Table 3**).

To evaluate the relationship between the two dimensions of farm succession (*SUCC* and *DESIG*), we carried out a number of estimation experiments along the lines suggested in Maddala (1983).[7] According to the results reported in **Table 3**, the likelihood of having

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[7] Maddala (1983) discusses alternative simultaneous-equations models with discrete endogenous variables. A general specification for a two-equation model would be: $y_1^* = \gamma_1 y_2 + \boldsymbol{\beta_1' X_1} + \varepsilon_1$ and $y_2^* = \gamma_2 y_1 + \boldsymbol{\beta_2' X_2} + \varepsilon_2$, with $E[\varepsilon_1] = E[\varepsilon_2] = 0$, $Var[\varepsilon_1] = Var[\varepsilon_2] = 1$ and $Cov[\varepsilon_1, \varepsilon_2] = \rho$. The unobservable variables y_1^* and y_2^* are related to the observable variables y_1 and y_2 as follows: $y_1 = 1$ if $y_1^* > 0$ and is zero otherwise; $y_2 = 1$ if $y_2^* > 0$ and is zero otherwise. Maddala shows that this model is logically consistent if and only if γ_1 or γ_2 is equal to zero. To find the appropriate

declared a successor is significantly higher in farms where succession is certain or likely (*SUCC* = 1). The estimated correlation coefficient (ρ) measuring the correlation between the disturbances of equations [1] and [2] is negative and significantly different from zero at the 5%-level. In column [3] of **Table 3**, we observe a significant impact of the probability of succession (*SUCC*) on the timing of succession. Not surprisingly, farms will be transferred earlier if farm succession is likely, ceteris paribus. We thus conclude that the different dimensions of farm succession analysed here are inter-related. Exclusively focusing on one dimension of farm succession and ignoring their inter-relationship only provides an incomplete picture of the process of farm succession.

4. Summary

Farming is dominated by family forms of production, where business ownership and management are handed down within the family. Due to a strong reliance of family farming on inter-generational succession, the existence or absence of successors can be an indication of the long-run prospects of the survival of family farms.[8] This study examines the family and farm attributes affecting family succession. On the basis of a farm survey, three aspect of succession are analysed: (a) the probability of family succession; (b) the likelihood of having a successor designated; and (c) the timing of succession. A bivariate probit model is estimated on the first two dimensions of the succession process, a tobit model is estimated on the timing of succession.

Farm characteristics significantly influence succession considerations to the extent that they affect the value of the farm for the potential successor. Larger and highly specialised farms are more likely to be transferred and to have appointed a successor. The number of family members living on the farm also significantly influences succession plans. The probability of succession, as well as the likelihood of having designated a successor, first increases with the age of the farm operator and then declines again. Furthermore, the timing of succession is delayed as the age of the farm operator increases. This result suggests that the farm operators' plans reported in farm surveys are inconsistent over time. The reported succession time will be biased downwards. In addition, we find a significant inter-relationship between the different aspects of succession indicating that the decisions on family succession, the designation of a successor, as well as the timing of succession, are not separable.

There is, however, a problem in distinguishing cause and effect with respect to some of the explanatory variables used in the empirical models. A small farm, for example, might be less attractive for a potential successor, reducing the likelihood of succession. Yet the causation could also be reversed. Sociological studies suggest that farm operators without successors lack the incentive and the motivation to expand their enterprise. Instead they would gradually run down their farm in an attempt to reduce working hours and make life easier.[9] Again, farm size and the likelihood of farm succession would be positively correlated. Differentiating empirically between the two explanations would require analysing individual

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specification for a model with two endogenous variables *SUCC* ($\equiv y_1$) and *DESIG* ($\equiv y_2$), we first estimate three different models. In model (1) we assume $\gamma_1 = \gamma_2 = 0$ and thus no direct relationship to exist. Model (2) assumes $\gamma_1 = 0$ whereas model (3) has $\gamma_2 = 0$. A likelihood ratio test does not reject model (1) against model (3). However, model (1) is rejected against model (2). We thus consider model (2) the most appropriate specification, the results of this specification are reported in columns [1] and [2] in **Table 3**.

8 On the basis of linked census data, Weiss (1999) found a highly significant positive effect of succession on farm survival.

9 Kimhi, Kislev and Arbel (1995) refer to this as the „shadow of succession effect".

farms over a longer time period (panel data) and is not possible on the basis of cross-section survey data.

An important point is that the farm survey used only considers the farm operator's point of view and does not pay enough attention to the children's intentions. The extent to which the farm operator's plans materialise, however, might be related to farm and family characteristics, thus introducing biases into empirical results from farm surveys. The combination of farm surveys with the investigation of actual succession decisions is therefore an important area of future work to improve our understanding of family succession and the survival of family farms.

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Appendix:

Table A.1: Results of Sample Selection Tobit Model on the Timing of Succession

Dependent Variable:	*REPORT*		*TIME*	
Independent Variable (Symbol)	Parameter	(t-value)	Parameter	(t-value)
Constant	-7.264	(-3.16)	229.964	(6.97)
Standard Gross Margin (*SGM*) /100.000	0.296	(1.27)	-0.535	(-1.11)
Livestock Units (*LU*)/100	0.491	(1.70)	-0.496	(-0.76)
Leased out Land (*LEASE*)	-0.035	(-2.74)	0.053	(0.94)
Credit Load (*CREDIT*)	0.043	(0.311)	0.254	(0.95)
On-Farm Specialisation (*HHI*)	0.113	(0.48)	1.308	(2.67)
Part-time Farm (*PT*)	0.034	(0.36)	0.019	(0.10)
Age of Farm Operator (*AGE*)	0.305	(3.73)	-9.536	(-5.33)
Age of Farm Operator Squared (AGE^2)/100	-0.286	(-3.97)	13.178	(4.08)
(Age of Farm Operator) ^{3} (AGE^3)/1000			-0.595	(-3.05)
Farm Operator's Experience (*EXPER*)/100	0.493	(1.03)	-2.719	(-2.66)
Number of Male Fam. Memb. (*FAM-M*)	0.117	(2.70)	-0.347	(-2.74)
Number of Female Fam. Memb. (*FAM-F*)	0.072	(1.44)	-0.345	(-3.05)
Marital Status (*MARR*)	0.183	(1.53)	0.067	(0.20)
Gender of Farm Operator (*GENDER*)	-0.134	(-1.21)	-1.105	(-4.00)
Hardship Zone (*HARD*)	-0.661	(-5.05)	1.075	(1.45)
Regional Dummy Variable 1 (*R1*)	0.301	(0.65)	1.075	(1.45)
Regional Dummy Variable 2 (*R2*)	-0.553	(-2.81)	0.775	(1.46)
Regional Dummy Variable 3 (*R3*)	-0.556	(-1.92)	1.778	(2.49)
Regional Dummy Variable 4 (*R4*)	-0.511	(-2.63)	0.296	(0.58)
Regional Dummy Variable 5 (*R5*)	-0.458	(-2.32)	0.663	(1.39)
Regional Dummy Variable 6 (*R6*)	-0.974	(-4.67)	0.973	(1.04)
Regional Dummy Variable 7 (*R7*)	-0.003	(-0.01)	0.612	(1.79)
Regional Dummy Variable 8 (*R8*)	-0.378	(-1.85)	0.809	(1.87)
Regional Dummy Variable 9 (*R9*)	-0.455	(-1.88)	0.634	(1.19)
Lamda (λ)			-1.924	(-0.79)
Log-Likelihood		-716.769		-3,143.974
Restricted Log-Likelihood		-802.992		-3,734.820
R^2 McFadden (Efron) [Veal/Zimmermann]		0.107 (0.118) [0.192]		
% Correct predictions		82.18		
% Correct predictions of "ones" ("zeros")		98.57 (12.42)		

Remarks: The variable *REPORT* is set equal to one if the farm operator responded to the question on the time until the proposed transfer of the farm and is zero otherwise.

Table A2: Ranking of Motives for Uncertain Farm Succession

Farm succession is uncertain because …	I strongly agree absolute (in %)	I partly agree absolute (in %)	I disagree absolute (in %)	I don't know absolute (in %)
… the working load on the farm is too high	82 (28)	100 (34)	94 (32)	22 (7)
… farm income is too low	173 (55)	93 (30)	31 (10)	15 (5)
… of the bad financial performance of the farm	31 (10)	47 (16)	203 (68)	18 (6)
… of good income opportunities of successor in the non-farm economy	140 (47)	62 (21)	47 (16)	51 (17)
… of the double working load in a part-time farm (work on and off the farm)	117 (39)	67 (22)	77 (26)	40 (13)
… necessary investment are too large	57 (19)	78 (26)	141 (47)	21 (7)
… uncertain political environment in the farm sector	163 (53)	57 (18)	45 (15)	44 (14)
… health reasons	9 (3)	17 (6)	237 (80)	35 (12)
… no partner is available	47 (16)	18 (6)	124 (42)	105 (36)
… the partner does not want to work in the farming sector	16 (6)	14 (5)	117 (41)	140 (49)
… lack of interest in the farming sector	33 (11)	80 (27)	134 (45)	48 (16)

Remarks: These questions have been addressed to farm operators reporting that a successor has been designated but succession is uncertain.