Timing of the Early Retirement Decisions of Farming Couples

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Abstract

The retirement decisions of individuals are strongly influenced by spousal retirement, financial incentives and institutional constraints such as access to early retirement benefits. In the European Union (EU), farm retirement is encouraged by early retirement provisions for farmers. As exit from farming determines the characteristics of structural change in agriculture, it is important to find out how spousal retirement and economic incentives affect the timing and type of retirement decisions among elderly farmers. This paper analyses the timing of early retirement decisions of farming couples using duration analysis and different exit channels. The empirical analysis is based on Finnish farm-level panel data for the period 1993-1998. The results suggest that an expected pension particularly advances farm transfers. Farming couples are found to co-ordinate their early retirement decisions. However, farmers are not found to co-ordinate their early retirement according to spousal retirement under other pension schemes.

Keywords: Duration, early retirement, farming couple, farm transfer, succession

1 INTRODUCTION

Over the last ten years, the Finnish agricultural sector has undergone a rapid structural change. The number of farms has decreased from 129,114 in 1990 to 73,714 in 2003, and average farm size has increased from 17.34 hectares per farm in 1990 to 30.52 hectares per farm in 2003 (Information Centre of the Ministry of Agriculture and Forestry, 2003, 2004). Most Finnish farms are run by farm families. One of the constitutional elements of family farming is the farmer's objective to transfer the farm to next generation (Pfeffer, 1989, Gasson and Errington, 1993). However, at the same time with decreasing number of farms, the number of farm successions has also decreased. In earlier studies, both income and economic incentives are found to matter. Gale (1993) also mentioned the role of policies in maintaining the traditional structure of farming.

Despite an increasing farm size, both the importance and share of farm income of farm family's total income have been decreasing whereas those with off-farm income have been increasing. In 1990, farm income contributed to 51% of total farm family income. Wages and salaries from off-farm work and other entrepreneurial activities amounted 21% of farmers' total income. In 2000, the corresponding shares were 39% and 35% (Statistics Finland, 2003).

Increasing off-farm labour participation and off-farm income may also have increased the economic independence of farming couples. An increased economic independence of the spouse may further contribute to the farmer's exit and retirement decisions. Farm income is found to encourage farm successions (Hennessy, 2002), but when the dependency of farm income decreases, probability of farm succession is expected to decrease and the probability of farm exits and closing down the farm to increase (Gasson and Errington, 1993, Pfeffer, 1989; Weiss, 1999, Stiglbauer and Weiss, 2000; Goetz and Debertin, 2001). On the other hand, Kimhi (1994) suggested that parents maximising family welfare may transfer a farm to a successor earlier, if a farmer has an off-farm work.

Besides the income, also the retirement benefits significantly affect individual retirement decisions (*e.g*. Samwick, 1998, Kerkhofs *et al.*,1999, Hernoes *et al*., 2000, Karlstrom *et al*., 2004, Asch *et al,*. 2005). Higher retirement benefits are also expected to increase both farm succession and farm closure probabilities (Pietola *et al*., 2003).

Recently, the joint retirement decisions of couples have received attention. As couples like to spend leisure time together, it is most important for spouses to be able to spend their time in retirement together which is why they co-ordinate their retirement plans accordingly (Blau, 1998, Blau and Riphahn, 1999, Ruuskanen, 2004). Having a retired spouse also increases the value of leisure. Therefore, individuals' retirement decisions are strongly influenced by the retirement decision of the spouse (Gustman and Steinmeier, 2000, Huovinen and Piekkola, 2002). As increasing demand of leisure has been found to increase early retirement (Huovinen and Piekkola, 2002), couples are expected to co-ordinate also their early retirement decisions.

Furthermore, the level and entitlement to various welfare benefits might be affected by whether one or both of the spouses are retired. Because of financial effects, it is important to model retirement decisions of the spouses together (Blau, 1997, 1998). Glauben *et al*. (2004) also found farm succession to be postponed if the farmer's spouse works on the farm. The reason for this might be financial or quite simply, the non-ability of the one spouse alone to take care of all farming activities. On the other hand, Pietola *et al.* (2003) suggested that a farmer is expected to retire earlier if he has a spouse. In the case of early retirement, joint retirement of farming couple may be strongly affected by regulations according to which all entrepreneurs must give up farming activity when one of them is applying for the farmers' early retirement scheme. However, as the dependency of farming household of farm income has diminished, the effect of these regulations may have also decreased.

As the timing of farm retirement plays a crucial role in determining the characteristics of structural change in agriculture (Kimhi and Lopez, 1999), it is important to find out how spousal retirement, economic incentives and off-farm income affect the exit timing from farming among elderly farmers. It is also important to know how the spouses co-ordinate their exit decisions and under what conditions individual retirement decisions result in farm level changes, *e.g.*, farm successions or farm closures.

Furthermore, it is important to establish how public policies, such as early retirement programs, foster these choices. In this study, elderly farmers mean farmers who are sufficiently old to have the option to voluntarily exit from farming using a certain pension benefit scheme.

This study analyses the timing and type of farming couples' early retirement decisions. Analyses are based on a duration model. The duration spell is determined by the number of years between the eligibility of the farmer to the retirement scheme (lower age limit 55 years) and the early retirement of the farmer or spouse. The analysis of farmers' exit decisions concentrates on those within the farmers' early retirement system, whereas retirement of the farmer or spouse under other pension schemes is included as an explanatory variable in the analysis. The farm transfer to a new entrant (farm succession) and farm closure are modelled as separate, mutually exclusive decisions. Exits under other pension schemes are divided into involuntary ones (disability pension, *etc.*) and those by old-age or other forms of pension.

The contribution of this paper to existing literature is that it analyses the impact of expected pension, off-farm income and spousal labour status on elderly farmers' exit decisions. A further contribution is modelling the timing of farmers' retirement decisions by duration analysis, which has been widely used in labour market studies, but not yet that much in modelling the exiting from farming.

The rest of the paper is organised as follows. The farmers' early retirement programmes in Finland and in the EU are described in Section 2. The following Sections 3 and 4 describe the method and the data. Results are presented in Section 5 and the final Section 6 concludes.

2. FARMERS' EARLY RETIREMENT PROGRAMMES

When studying farmers' exit behaviour in different countries, institutional differences and constraints are found to matter (Kimhi and Bollman, 1999; Errington and Lobley, 2002). In the European Union, farmers' early retirement provisions are carried out according to the Rural Development Regulation (EC Council Regulation 1257/1999) of the Common Agricultural Policy (CAP). This regulation aims at securing the income of retiring farmers and to improving the livelihood of farms with continuous operation (HE 1999:131). Because the early retirement system is voluntary, the procedures and practises of the measures applied in the member countries vary substantially. In Ireland, for example, a successor does not have to purchase the farm from his parents or siblings but he has to provide a living for the previous generation from the farm income. This kind of commitment to financial responsibility to former owners is not the case, for example, in Finland. More details about retirement programmes and its practices in the context of EU countries can be found, for example, in Blanc and Perrier-Cornet (1993).

In Finland, farmers' early retirement programmes were first introduced in 1974. Since then, there have been several programmes of short duration including change-of-generation pension, farm closure compensation and early retirement aid for farmers. The aim of these programmes has been to maintain the livelihood of family farms continuing production and thus improving the competitiveness in the agricultural sector. According to these programmes, farmers, aged between 55 and 64, who either ceased production of their farms by selling or leasing agricultural resources to neighbouring farms or transferred their farm to a new entrant, receive retirement benefits corresponding to the disability pension of the farmer. Retirement was also possible by reforestation of the land or by lay-land agreement. The early retirement benefits are farmer-specific and they depend on the level of pension insurance the farmers have purchased over their active farming years (Mela, 2003). Since 1995, Finland has carried out farmers' early retirement programmes within the EU framework for these programmes.

Over the last 30 years, in excess of 67,000 farms have benefited from the farmers' early retirement programmes in Finland. The number of farms involved in the farmers' early retirement programme per year was biggest in the late 1980s and early 1990s. During recent years, the number of farms applying to the programme has been decreasing. In 1990, there were 2,507 farms applying to this programme, but in 2003, the corresponding number was only 604. In Finland, approximately half of the farm transfers utilise the farmers' early retirement scheme. Whereas at the beginning of 1990s, over 2,000 farms were transferred to new entrants annually, by the end of the century, the number of farm transfers was less than half of that. As a result, the share of young farmers has declined and the average age of farmers has increased from 44.8 years to 47.1 years during the last ten years (Pyykkönen, 2001, Mela, 2004).

3. METHOD

3.1 Duration Model

When analysing the survival of the farming couple before the early retirement, the duration spell is the number of years that a farmer or spouse, or both of them, continue farming after the farmer has reached the age of pension eligibility at 55 years. The duration spell is defined by the age of farmer as the older of the spouses is defined as the farmer in the data. Both the eligibility and the age of farmer and spouse are taken into account. This means that the duration spell of a farming couple can vary between a minimum of 1 year and a maximum of 20 years. A spell with a duration of 1 year is assigned if the farmer or spouse retires straight after the farmer reaches the age of 55. The maximum duration of 20 years is assigned if both the farmer and the 10 years younger spouse are eligible to the early retirement scheme but neither of them utilises it before the age of 65. This would mean in the first place that the farmer and then the 10 years younger spouse both had a duration spell of 10 years. The presentation of the duration model below follows Kiefer (1988), Greene (2000) and Woolridge (2002).

In the analysis, T is the length of time before the farmer (or spouse) retires. The duration spell $T \geq 0$ varies in the population and t denotes a particular value of T. The cumulative distribution function (CDF) of T is defined as (Kiefer, 1988)

(1) $$F(t) = P(T \leq t), \qquad t \geq 0$$

where P denotes probability. The probability of surviving past time t is given by the *survival function*

(2) $$S(t) \equiv 1 - F(t) = P(T > t)$$

Given that the spell has lasted until time *t*, the probability that it will end in the next interval of time [*t, t+h*] is

(3) $$P(t \le T < t + h \mid T \ge t)$$

A function for characterising this aspect of the distribution is the *hazard rate*

(4) $$\lambda(t) = \lim_{h \downarrow 0} \frac{P(t \le T < t + h \mid T \ge t)}{h} = \frac{f(t)}{S(t)}$$

when *f(t)* denotes the density of *T,* and for each *t, λ(t)* is the instantaneous rate of leaving per unit of time (Woolridge, 2002). Applied to the early retirement of farming couples, the hazard function gives the probability of early retirement, given that the farmer or the spouse has not retired before.

In the duration analysis, there is a variety of distributions from which to choose for modelling. For example, for the Weibull distribution, the hazard function is either monotonically increasing or decreasing depending on the value of parameter *p*, and for the exponential distribution the hazard function is constant (Kiefer, 1988, Woolridge, 2002). In this study, based on the expected shape of the distribution hazard function with positive duration dependence, Weibull distribution is chosen[2]. Positive duration dependence in this case means that the hazard rate of retirement is increasing in *t*. Thus, a farmer or spouse is more likely to retire at time *t* given he/she has not retired until time *t*. The density function of Weibull-distributed random variable is

(5) $$f(t) = \lambda p(\lambda t)^{p-1} \exp(-(\lambda t)^{p})$$

The corresponding survival function is

(6) $$S(t) = \exp(-(\lambda t)^{p})$$

And the hazard function is

(7) $$\lambda(t) = \lambda p(\lambda t)^{p-1}$$

The parameters λ and *p* can be estimated by the method of maximum likelihood. In this study, the sample period runs from 1993 to 1998. If the early retirement time of the farmer or spouse is not observed or they choose other pension schemes, an observation will be censored (right censoring). Censored observations are incorporated in the log-likelihood function as

(8) $$\ln L = \sum_{\text{uncensored observations}} \ln f(t \mid \theta) + \sum_{\text{censored observations}} \ln S(t \mid \theta)$$

where $\theta = (\lambda, p)$ (Greene, 2000). Since the timing of early retirement is expected to be affected by farm and family characteristics, *etc*., the parametric approach is chosen. In the Weibull model,

(9) $$\lambda_i = \exp(-\beta' x_i)$$

where *i* indexes individuals, x_i includes a constant term and a set of variables which do not change from time $T = 0$ to $T = t$ and β is a parameter vector. Making λ_i a function of a set of regressors is the same as changing the units of measurement in the time axis. The regressors do not affect the duration dependence, which is a function of p, either. Let $\sigma_i = 1/p$ and

(10) $$\delta_i = \begin{cases} 1, \text{if the spell is completed} \\ 0, \text{if the spell is censored} \end{cases}$$ Finally,

(11) $$w_i = p\ln(\lambda_i t_i) = \frac{\ln t_i - \beta' x_i}{\sigma}$$

and the log-likelihood is

(12) $$\ln L = \sum_i \left[\delta_i\left(w_i - \ln(\sigma) - \exp(w_i)\right)\right]$$

The estimates of β and p can be obtained by maximising (12) with respect to β and p (Greene, 2000).

3.2 Time-Varying Covariates

It is assumed thus far that the covariates are constant from the beginning of the measurement period, $T = 0$, to the time of the measurement, $T = t_i$. However, for example the labour status of the spouse or farm income may change over the course of spells. Incorporating these *time-varying covariates* into the duration model is based on Greene (2002) which draws heavily on Petersen (1986a, 1986b).

Let the interval between 0 and t_i be divided as k exhaustive, non-overlapping intervals, $t_0 < t_1 < \ldots < t_{k-1} < t_k$, where $t_0 = 0$ and $t_k = t_i$. The covariates are assumed to stay constant within each of the k intervals, but may change from one interval to next. Let

(13) $h(t > x_j)$ = the hazard function from time t_{j-1} to t_j,

since within that interval, the covariates are constant. Then, from the relationship between the hazard function and the survival rate,

(14) $$h_j = -d \log S(t)/dt$$ and

(15) $$P\left[T \le t_j \mid T \ge t_{j-1}\right] = \exp - \int_{t_{j-1}}^{t_j} h\left(s \mid x_j\right) ds$$

The survival function for the duration of t_k can be written

(16) $$S\left(t_k \mid x_k\right) = \prod_{j=1}^{k} P\left[T \ge t_j \mid T \ge t_{j-1}\right]$$

Finally, the density at t_k is

(17) $$f\left(t_k \mid x_k\right) = h\left(t_k\right) S\left(t_k\right)$$

The log-likelihood function for one observation is

(18) $$\log L_i = \delta_i \log h(t_k \mid x_k) + \log S(t_k)$$

Thus, each observation contributes the survivor function to the log-likelihood function. For uncensored observations, density, evaluated at the terminal point is added. Therefore,

(19) $$\log L_i = \delta_i \log h(t_k \mid x_k) - \sum_{j=1}^{k} \int_{t_{j-1}}^{t_j} h(s \mid x_j) ds$$

3.3 Unobserved Heterogeneity

In duration models, the *heterogeneity* problem may result from an incomplete specification. The most common reason for unobserved heterogeneity is an omitted variable. Heterogeneity can be taken into account in estimating duration models (Kiefer, 1988). A direct approach is to model heterogeneity in the parametric model with a survival function conditioned on the individual specific effect v_i. In this approach, the survival function is treated as $S(t_i|v_i)$. To that is added a model for the unobserved heterogeneity $f(v_i)$. Then

(20) $$S(t) = E_v[S(t \mid v)] = \int_v S(t \mid v) f(v) dv$$

The gamma distribution is often used for this purpose. In the Weibull model, assuming that v has a gamma distribution with mean 1 and variance $\theta = 1/k$ and parameters k and R, then

(21) $$f(v) = \frac{k^R}{\Gamma(R)} e^{-kv} v^{R-1}$$ and

(22) $$S(t \mid v) = e^{-(v\lambda)^p}$$

If the model contains a constant, no generality is lost by assuming that the mean of v is 1. Thus, $E[v] = k/R = 1$ or $k = R$. Now, the unconditional distribution is

(23) $$S(t) = \int_o^{\infty} v S(t \mid v) f(v) dv = [1 + \theta(\lambda t)^p]^{-1/\theta}$$

The variance of v is $1/k$, so $\theta=0$ corresponds to the Weibull model (Greene, 2002). The further the parameter θ deviates from zero, the greater is the effect of heterogeneity.

4. DATA

4.1 Sample

The data on farmers' exit decisions and retirement choices were obtained from the Farmers' Social Insurance Institution (Mela) and complemented by the farmers' income data and information on farmers' children by Statistics Finland. The data are a good representation of elderly farmers in Finland, since the purchasing of pension insurance from Mela is obligatory for all farmers.

The data consist of a sample of 963 farms (*Table* 1). The sample is a random selection of all farmers born between 1929 and 1943 and stratified according to the farmer's age

TABLE 1. Summary Statistics of the Data.

Variable	Mean	Std.Dev.	Min.	Max.
All sample farms, NT=963				
Farmer age (years)	58.9	4.5	47.0	69.0
Spouse age (years * spouse)	53.9	5.2	32.0	68.0
Spouse (0.1)	0.47	0.49	0.0	1.0
Farming years of farmer	28.6	10.2	1.0	59.0
Number of children	2.3	1.7	0.0	17.0
Age of the oldest child (years)	25.7	13.3	0.0	49.0
Arable land area (hectares)	15.4	14.4	0.0	118.0
Forest area (hectare)	51.2	63.1	0.0	856.0
Livestock (0.1)	0.33	0.5	0.0	1.0
North (0.1)	0.63	0.48	0.0	1.0
Farmer's expected pension (€)[a)]	608.4	141.3	0.0	1,213
Spouse's expected pension (€)[a)]	273.2	302.2	0.0	1,220
Agricultural income (€)	7,185	12,229	0.0	127,365
Farmer's off-farm income (€)	1,396	5,007	0.0	88,487
Spouse's off-farm income (€)	1,709	5,410	0.0	58,070
Share of subsidy[b)]	0.90	14.61	0.0	962.4
Farmer early retirement pension (0.1)	0.17	0.37	0.0	1.0
Spouse early retirement pension (0.1)	0.09	0.29	0.0	1.0
Farmer continue (0.1)	0.28	0.45	0.0	1.0
Spouse continue (0.1)	0.26	0.44	0.0	1.0
Farmer involuntary retirement (0.1)	0.15	0.36	0.0	1.0
Spouse involuntary retirement (0.1)	0.19	0.14	0.0	1.0
Farmer old-age pension (0.1)	0.39	0.49	0.0	1.0
Spouse old-age pension (0.1)	0.69	0.25	0.0	1.0
Farms choosing early retirement system, NT=194				
Farmer age (years)	59.4	3.9	50.0	70.0
Spouse age (years * spouse)	55.8	3.9	43.0	66.0
Spouse (0.1)	0.71	0.46	0.0	1.0
Farming years of farmer	30.5	8.4	4.0	53.0
Number of children	2.6	1.9	0.0	17.0
Age of the oldest child (years)	29.1	11.1	0.0	47.0
Arable land area (hectares)	21.3	14.3	0.0	97.0
Forest area (hectares)	52.5	48.8	1.0	338.0
Livestock (0.1)	0.28	0.45	0.0	1.0
North (0.1)	0.64	0.48	0.0	1.0
Farmer's expected pension (€)[a)]	648.9	130.6	0.0	1,213
Spouse's expected pension (€)[a)]	433.7	302.3	0.0	1,220
Agricultural income (€)	8,591	15,795	0.0	127,365
Farmer's off-farm income (€)	491.6	2,997	0.0	36,446
Spouse's off-farm income (€)	880.5	4,215	0.0	44,306
Share of subsidy[b)]	0.34	2.2	0.0	60.3
Farmer early retirement pension (0.1)	0.83	0.38	0.0	1.0
Spouse early retirement pension (0.1)	0.49	0.50	0.0	1.0
Spouse involuntary retirement (0.1)	0.03	0.16	0.0	1.0
Farmer other pension (0.1)	0.10	0.30	0.0	1.0
Spouse other pension (0.1)	0.05	0.22	0.0	1.0

[a)] Expected pension if retired under the farmers' early retirement schemes
[b)] (Subsidy for barley per hectare * land, hectare)/agricultural income per farm

corresponding to the share of all farmers at every age. All sample farmers were active farmers in 1993. The data set forms a balanced panel prior to the retirement and runs from the year 1993 to the year 1998. All farmers in the data set were eligible in the farmers' early retirement scheme during the study period according to his/her age. The oldest farmer was 64 years old in 1993 and youngest one was 55 years old in 1998. Sample farms differ from each other by a number of characteristics such as forest area, location and production line. Thus, they form a heterogeneous group and heterogeneity is accounted for in the estimation. There is no information available on income post retirement.

Almost half (47%) of the farmers in the sample have a spouse. Thus, there are 456 farms operated by couples. The share is much higher on farms choosing farmers' early retirement pension, 71% (*Table* 1). The older member of the farming couple is defined as the farmer and younger as the spouse, since eligibility to the early retirement scheme is determined by the age of the oldest person among the couple. The farmer is on the average 5 years older than the spouse.

A descriptive statistics of the data for all sample farms and those choosing the farmers' early retirement system are presented in *Table* 1. Those farmers and spouses choosing early retirement have more children than those not choosing early retirement. On average, the oldest child is also older on these farms than on other farms. Farms choosing an early retirement pension also are slightly larger than other farms in the sample measured by arable land and forest area. Farms choosing the early retirement system are more often located in northern parts of the country and are other than livestock farms. These farms also have higher farm income and smaller off-farm income than other farms in the sample.

4.2 Variable Definitions

The analysis concentrates on those farms choosing the farmers' early retirement system. A *farming couple* is defined as choosing the farmers' early retirement scheme if either the farmer or the spouse retires, or they both retire, under the farmers' early retirement scheme. Exits under the farmers' early retirement system are further characterised by two discrete occupational choices: (i) exit and transfer of the farm to a new entrant, or (ii) exit and closing down the farm (*Figure* 1). Closing down the farm includes selling or leasing agricultural resources to neighbouring farms, reforestation of the land and lay-land agreements.

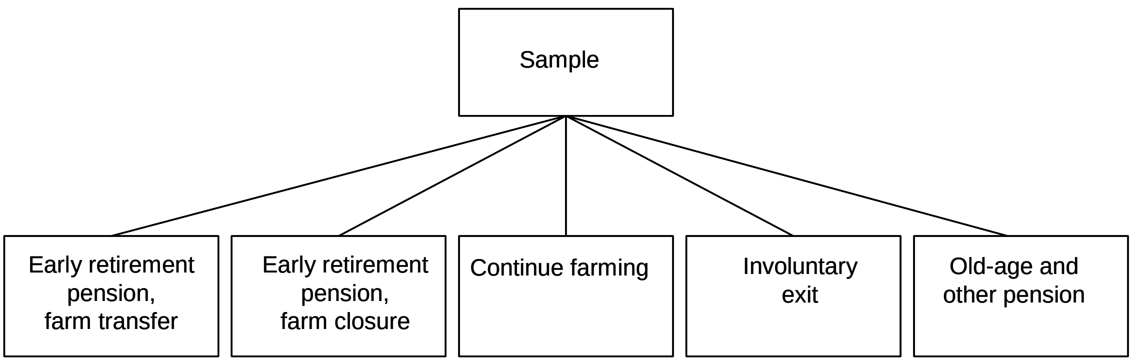

FIGURE 1. Choice of the Pension Scheme in the Study.

Farmer's and spouse's other "pension choices" are included as independent dummy variables in the analysis in order to capture the effect of spousal retirement on the farmers' and the spouses' early retirement decisions. Other pension choice possibilities are: involuntary retirement (disability pension, *etc*.), retirement under other pension scheme (old-age pension, *etc*.) or continuation of farming (*Figure* 1). Since all entrepreneurs must give up farming when one of them is applying for the early retirement scheme, there are no farmers or spouses continuing farming among those farms choosing the farmers' early retirement system (*Table* 1).

Out of the 963 sample farms, on 194 farms (20%) the farmer or the spouse chooses to retire within the framework of the farmers' early retirement pension (*Appendix* A). More than one half of these farms are transferred to a new entrant. Amongst the 456 farms operated by a couple, 137 (30%) apply for the early retirement scheme. Out of these farms, in one third (42) of the cases only a farmer and in one fourth (33) of the cases only a spouse applies for the scheme. In 45% of the cases, early retirement is a joint decision of farming couple. As a total, 17% of the farmers and 21% of the spouses in the sample retire under the farmers' early retirement scheme. A large majority of the spouses (61%) and almost one third (28%) of the farmers continue farming. 15% of the farmers but only 4% of the spouses retire involuntarily. Old-age or other pension scheme is chosen by 40% of the farmers and by 14% of the spouses.

Variables included in the analysis are selected according to the availability of data and *a priori* expectations on the important factors in explaining the timing of retirement. The economic incentive to retire or to continue farming is measured as the expected pension of the farmer and of the spouse if retired under the farmers' early retirement scheme, and by agricultural income. Similarly, off-farm income of a farmer and a spouse are used as explanatory variables in the analysis to reflect higher propensity to exit farming. The sample average is 43% of agricultural income with a large dispersion.

In earlier studies, the probability of transferring the farm to a new entrant has been found first to increase with a farmer's age and then beyond a certain age limit to decrease (Kimhi and Bollman, 1999, Stiglbauer and Weiss, 2000; Kimhi and Nachlieli, 2001). This is especially the case in family successions. On the contrary, the probability of other forms of exit is found to increase with a farmer's age (Kimhi, 1994, Stiglbauer and Weiss, 2000; Kimhi and Nachlieli, 2001, Pietola *et al*., 2003). Also, the number of children living on a farm has been found to increase succession probability (Stiglbauer and Weiss, 2000, Glauben *et al*., 2004). On the other hand, Potter and Lobley (1992) found that farmers without a successor do not have the motivation to expand their farms but tend to reduce their working hours (shadow effect).

The variables concerning farm family are: the age of farmer and spouse, the existence of a spouse, the number of children and the age of the oldest child. In addition, we defined how many years a farmer has been farming.

The bigger the farm, the more likely the succession and less likely the farm closure are found to be (Gasson *et al*., 1988, Stiglbauer and Weiss, 2000, Kimhi and Nachlieli, 2001, Glauben *et al*., 2004, Hennessy, 2002, Pietola *et al.* 2003). In this study, farm size is measured in hectares of arable land and forest area.

Other farm characteristics included in the analysis are variables defining farm location and production line. A dummy variable "Livestock" separates livestock farms (dairy, cattle, pig, poultry, sheep, goat and horse farms) from arable crop farms. Farms are further divided into those located in northern and those located in southern parts of the country. The division is made according to the EU subsidy areas in Finland so that northern area includes areas classified as C2, C3 and C4. The dummy variable is called "North".

In addition, in order to capture the effect of subsidies, a new variable is formed by multiplying the area subsidy for barley per hectare by the farm's land area and dividing the sum by the agricultural income per farm ("Share of subsidy").

5. RESULTS

The survival of farming couples after their eligibility under the farmers' early retirement scheme and before their actual retirement varied between 1 and 16 years. Out of those 194 couples choosing the farmers' early retirement pension, 108 retired by transferring the farm to a new entrant and 86 closed down their farm. The survival time of farming couples when transferring the farm to a new entrant varied between 1 and 15 years and the survival of those closing down their farm varied between 1 and 16 years. The average survival time was shorter on farm transfers (4.41 years) than on farm closures (5.67 years).

5.1 Farm Transfer

The Weibull p parameters for the farming couple survival model before a farm transfer to a new entrant are statistically significant and $p>1$ indicating increasing hazard function and increasing probability of early retirement over time (*Table* 2). The parameter estimate for θ in the Weibull survival model with gamma heterogeneity is statistically significant and it differs from zero. The likelihood ratio test[3], however, shows that Weibull distribution model including unobserved heterogeneity does not significantly differ from the basic Weibull model. The signs of the remaining parameter estimates are robust and do not vary between models due to the inclusion of the heterogeneity parameter. Therefore, it seems that the model with unobserved heterogeneity does not result in a significant improvement on the basic Weibull model.

The factors significantly increasing the farming couple survival probability before a farm is transferred to a new entrant are: the farmer's age, existence of a spouse, forest area, farm income, the spouse's off-farm income, the share of barley subsidy of farm income and the old-age or other pension of the farmer and spouse.

On the other hand, factors significantly decreasing farming couple survival probability are identified to be: the spouse's age, the number of children, the age of the oldest child, arable land area, northern location and expected pension of the farmer and spouse.

5.2 Farm Closure

Weibull p parameter estimates for the survival model before farm closure are statistically significant and $p>1$ indicating increasing hazard function over time (*Table* 2). The parameter estimate for θ is statistically significant and gets a value of 4.99. Based on the likelihood ratio test, the Weibull distribution model incorporating unobserved heterogeneity is not, however, found to be statistically a better specification than the basic Weibull model. The only changes in coefficient signs between the two models caused by the inclusion of unobserved heterogeneity in the model show up in the following parameters: off-farm income of the spouse and involuntary retirement of the spouse. Neither of these variables is found to be statistically significant.

According to the results, the factors significantly increasing the farming couple's survival probability before a farm closure are: the farmer's age, existence of a spouse, the number of children, forest area, the farm being a livestock farm, farm income, the farmer's off-farm income and the old-age or other pension of the farmer. Factors significantly decreasing survival probability on the other hand are: the spouse's age, farming years and a northern location.

TABLE 2. Results from the Duration Analysis (t values in parentheses)[4].

	Farm transfer		Farm closure	
	Basic Weibull	Latent heterog.	Basic Weibull	Latent heterog.
	Coefficient	Coefficient	Coefficient	Coefficient
Constant	-0.3304	-1.0833	-7.2744***	-8.7891***
	(-0.294)	(-0.883)	(-12.716)	(-14.273)
Farmer age	0.1849***	0.1848***	0.1667***	0.1835***
	(25.421)	(24.982)	(21.078)	(22.297)
Spouse age	-0.0585***	-0.0557***	-0.0578***	-0.0642***
	(-6.694)	(-6.045)	(-7.698)	(-6.891)
Spouse	8.6474***	10.1487***	3.2499***	4.1612***
	(8.625)	(8.466)	(3.104)	(2.884)
Farming years	-0.0043	-0.0058*	-0.0049*	-0.0015
	(-1.347)	(-1.757)	(-1.888)	(-0.528)
Number of children	-0.0543***	-0.0616***	0.0847***	0.0597**
	(-4.663)	(-4.576)	(3.782)	(2.618)
Age of the oldest child	-0.0301***	-0.0253***	-0.0033	-0.0007
	(-8.148)	(- 7.168)	(-1.389)	(-0.259)
Land area	-0.0124***	-0.0143***	0.00009	0.0005
	(-7.221)	(-7.192)	(0.052)	(0.255)
Forest area	0.0011**	0.0008*	0.0012**	0.0014**
	(2.775)	(1.943)	(2.450)	(2.662)
Livestock farm	0.0579	0.0553	0.1879***	0.1984***
	(1.316)	(1.137)	(4.058)	(4.187)
North	-0.2326***	-0.1925***	-0.1006**	-0.0934*
	(-4.520)	(-3.560)	(-2.265)	(-.1.849)
Farmer exp. pension,	-1.0383***	-0.9879***	0.0316	0.0119
log	(-6.626)	(-6.025)	(0.791)	(0.273)
Spouse exp. pension,	-0.9286***	-1.176***	-0.0808	-0.1592
log	(-7.585)	(-7.384)	(-0.528)	(-0.740)
Agricultural income,	0.1110***	0.1106***	0.0183***	0.0191***
log	(16.384)	(16.477)	(3.788)	(3.331)
Farmer off-farm income,	0.0098	0.0119	0.0431***	0.0511***
log	(0.936)	(1.226)	(4.980)	(5.945)
Spouse off-farm income,	0.0296***	0.0131	0.0034	-0.0013
log	(3.043)	(1.390)	(0.506)	(-0.171)
Share of subsidy	0.1027***	0.1191***	0.0005	0.0009
	(3.076)	(4.022)	(0.113)	(0.155)
Spouse involuntary retir.	0.0524	0.1015	-0.0491	0.0575
	(0.234)	(0.488)	(-0.311)	(0.266)
Farmer old-age pension	0.7095***	0.6353***	0.3728***	0.2723**
	(6.455)	(5.371)	(3.585)	(2.664)
Spouse old-age pension	0.4287**	0.5121**	0.0474	0.2132
	(2.234)	(2.617)	(0.431)	(1.486)
Sigma (σ)	0.5368***	0.4104***	0.4189***	0.2844***
	(24.993)	(15.681)	(22.331)	(12.550)
Theta (θ)	-	1.6705***	-	4.9893***
		(4.568)		(4.846)
Log-likelihood	-1535.80	-1517.17	-1278.960	-1257.645
Lambda (λ)	0.035	0.0513	0.057	0.0929
Weibull p	1.863***	2.437***	2.386***	3.517***
	(24.992)	(15.681)	(22.332)	(12.549)

5.3 Comparison of Farm Transfer and Closure Cases

When comparing parameter estimates, it is found that the predicted effects of different factors differ between farm transfer and closure only in case of some variables. The age of the spouse is found to advance and the age of farmer is found to delay the timing of early retirement in both retirement alternatives. This is in agreement with earlier findings that after first increasing, retirement and especially succession probability starts to decrease with the farmer's age (Kimhi and Bollman, 1999, Stiglbauer and Weiss, 2000, Kimhi and Nachlieli, 2001, Pietola *et al*., 2003). The existence of a spouse is found to delay both farm transfers and closures. The result of postponing retirement on farms where the spouse is also working on the farm tallies with the earlier findings of Glauben *et al*. (2004). But, the longer the farmer has been farming, the sooner the farm will be closed down.

It is found that the number of children advances farm transfers but delays farm closures. Also this result corresponds with the earlier findings of Glauben *et al*. (2004) who found that the number of family members reduces planned time until farm succession. Also, the age of the oldest child is found to significantly advance farm transfers. This is very understandable: the older the possible successor is, the more likely succession is to take place.

The bigger the farm, the earlier it will be transferred to a successor. This result is consistent with earlier findings of *e.g.* Pietola *et al*. (2003) based on Finnish data. The forest area and agricultural income delay both farm succession and closure decisions. On the other hand, the share of subsidy of farm income delays farm transfers. And, livestock farms are found to be closed down later than other types of farms. In northern parts of the country, both farm transfers and closures take place earlier than in the south.

In earlier studies, pension benefits are found to be significant determinants of retirement probability (*e.g.* Asch *et al.*, 2005). Here, the expected pension of the farmer and spouse are found to advance farm succession but have no effect on the timing of farm closure.

The off-farm income of the farmer has been found previously to both encourage farm successions (Kimhi, 1994) and to accelerate farm exits (*e.g.* Goetz and Debertin, 2001). Here, the results suggest that farmer and spouse off-farm income have qualitatively different effects. Off-farm income of the farmer is predicted to delay farm closures whereas off-farm income of the spouse is predicted to delay farm transfers. Thus, off-farm income of elderly farmers is not found to promote but to slow down the development of farming structure. The result also is consistent with earlier findings of Stiglbauer and Weiss (2000) that the probability of farm succession is lower on part-time farms.

Unlike what was expected, the involuntary retirement of a spouse is not found to affect on the timing of farmers' early retirement. The old-age or other pension of the farmer is found to delay the spouse's retirement in case of both farm transfer and closure. In addition, old-age or other pension of the spouse is found to delay the farmer's early retirement in farm transfers. Thus, farmers and spouses are not found to co-ordinate their early retirement decisions to the spousal retirement under other pension schemes than under the farmers' early retirement system[5]. One reason for this might be that even though the older of the spouses is retiring under an old-age or other pension scheme, the younger spouse continues farming as long as s/he is eligible for the EU subsidy schemes which keep farming financially viable. Another explanation might be that when in good state of health, the retiring spouse continues working on the farm thus enabling the continuation of the farming.

6. SUMMARY AND CONCLUSIONS

In this study, the effect of a spousal retirement decision, economic incentives and farm and family characteristics on timing of farmers' early retirement decisions are analysed. Farmers' early retirement are divided into those transferring their farm to a new entrant and those closing down their farm.

Farm transfers, in general, are found to take place somewhat earlier than farm closures. One should also notice that when studying farm retirement, it is important to analyse retirement decisions of both the spouses, not just those of the farmer. In this study, in 17% of cases, only the spouse applied for the farmers' early retirement scheme. Ignoring the spouse's early retirement would result in biased results due to missing observation on spousal early retirement cases. Also, farm retirements would take place earlier than they actually do.

When comparing farms operated by couples to all sample farms, it is found that applying for an early retirement scheme and especially farm succession takes place more often on the farms with two entrepreneurs. The same applies for the farmers' early retirement choices. In 45% of the farms operated by a couple and utilising farmers' early retirement scheme, both the farmer and spouse apply simultaneously for the early retirement pension.

On those farms where the spouse is also employed on the farm, early retirement takes place later. But, the older the spouse, the earlier the farm is transferred to a new entrant or, alternatively, closed down. Contradicting that, an increasing farmer age delays both farm transfers and closures. This tallies with earlier findings that after first increasing, the probability of farm succession starts especially to decrease beyond certain age.

Besides the farming couple, farm and family characteristics and financial factors are found to matter. The existence of a possible successor significantly affects the timing of early retirement. The number of children advances farm successions, but delays farm closures. And also, the older the oldest child is, the sooner the farm is transferred to a new entrant. Farm size is also found to affect on timing of farmers' early retirement. The bigger the farm, the sooner the farm is transferred to a new entrant.

A high level of farm income delays farmers' early retirement. Depending on the farm income and pension payments paid by the farming couple during the active farming years, a high level of expected pension of farmer and spouse advance farm transfers.

Off-farm income of the spouse delays transfer of the farm to a new entrant and off-farm income of the farmer delays closing down the farm. Postponing retirement results in a delay in transferring of resources to a new entrant or to those farmers expanding their activities. Thus, off-farm income may slow down the structural development in the farming sector.

In earlier studies, spousal retirement is found to strongly influence the individual's retirement decisions. Results of this study support the view with findings of the farming couple's joint early retirement decision. Unlike prior expectations, farmers are not found to coordinate their early retirement according to spousal retirement under other pension schemes.

Appendix A.

Number of sample farms, farmers and spouses according to the choice of pension scheme on all farms and on farms operated by a couple.

All farms	**Farms**	**Farmers**	**Spouses**
Early retirement pension	194	161	95
- Farm transfer	108	91	54
- Farm closure	86	70	41
Continue farming	387	276	277
Involuntary exit	0	147	18
Other pension	382	378	66
Total	963	963	456
Farms with a spouse	**Farms**	**Farmers**	**Spouses**
Early retirement pension	137	104	95
- Farm transfer	76	59	54
- Farm closure	61	45	41
Continue farming	178	170	277
Involuntary exit	0	46	18
Other pension	141	136	66
Total	456	456	456

NOTES

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2. "The results based on other distributions commonly used in empirical analysis such as exponential, log-normal and logistic can be obtained from the author upon request."

3. "χ^2 on the probability that the unobserved variance between individuals is zero, $\theta = 0$."

4. *** a triple asterisk denotes significance at two sided 1% level, ** a double asterisk denotes significance at two sided 5% level, * an asterisk denotes significance at two sided 10% level

5. I have also estimated the farmer survival model including dummy variable spouse's retirement under the farmers' early retirement scheme which showed to be statistically significant, got a negative sign and did not alter the remaining effects. However, due to endogenous nature of the farming couple's early retirement decision the analysis is based on a model excluding the dummy variable.

REFERENCES

Asch, B., Haider, S.J. and Zissimopoulos, J. (2005). Financial incentives and retirement: evidence from federal civil service workers. *Journal of Public Economics* 89: 427-440.

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

Blau, D.M. (1997). Social security and the labor supply of older married couples. *Labour Economics* 4: 373-418.

Blau, D.M. (1998). Labor Force Dynamics of Older Married Couples. *Journal of Labor Economics* 16: 595-629.

Blau, D.M. and Riphahn, R.T. (1999). Labor force transitions of older married couples in Germany. *Labour Economics* 6: 229-251.

Errington, A. and Lobley, M. (2002). Handing Over the Reins: A Comparative Study of Intergenerational Farm Transfer in England, France, Canada and the USA. Contributed paper presented in EAAE 10th Congress in Zaragoza. Article on CD ROM. *Exploring the Diversity in the European Agri-Food System*, EAAE.

Gale, H.F. (1993). Why did the Number of Young Farm Entrants Decline? *American Journal of Agricultural Economics* 75: 138-146.

Gasson, R. and Errington, A. (1993). *The Farm Family Business*. CAB International. Wallingford, UK.

Gasson, R., Crow, G., Errington, A., Hutson, J., Marsden, T. and Winter, D.M. (1988). The Farm as a Family Business: A Review. *Journal of Agricultural Economics* 39: 1-41.

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

Goetz, S.J. and Debertin, D L. (2001). Why farmers quit: A county-level analysis. *American Journal of Agricultural Economics* 83: 1010-1023.

Greene, W.H. (2000). *Econometric Analysis*. New York University. Fourth Edition. Prentice Hall International, Inc. New Jersey, USA.

Greene, W.H. (2002). LIMDEP Version 8.0. *Econometric Modeling Guide*. Volume 2. Economic Software, Inc. Plainview, NY. USA.

Gustman, A.L. and Steinmeier, T.L. (2000). Retirement in Dual-Career Families: A Structural Model. *Journal of Labor Economics* 18: 503-545.

Hakola, T. (2002). Economic Incentives and Labour Market Transitions of the Aged Finnish Workforce. *VATT Research Reports 89*. Helsinki.

HE 1999:131. Government's proposal to parliament for changing the law for farmers' early retirement aid (in Finnish).

Hennessy, T. (2002). Modelling Succession on Irish Dairy Farms. Contributed paper presented in EAAE 10th Congress in Zaragoza, in August 2002. Article on CD ROM. *Exploring the Diversity in the European Agri-Food System*, EAAE.

Hernoes, E., Sollie, M. and Strøm, S. (2000). Early Retirement and Economic Incentives. *Scandinavian Journal of Economics* 102(3): 481-502.

Huovinen, P. and Piekkola, H. (2002). *The time is right? Early retirement and use of time by older Finns*. ETLA, The Research Institute of the Finnish Economy. Series B 189.

Information Centre of the Ministry of Agriculture and Forestry (2003). *Yearbook of Farm Statistics*. SVT. Agriculture, forestry and fishery. Helsinki.

Information Centre of the Ministry of Agriculture and Forestry (2004). Web pages: http://tike.mmm.fi/tiedotteet/mare120504.htm.

Karlstrom, A., Palme, M. and Svensson, I. (2004). A Dynamic Programming Approach to Model the Retirement of Blue-collar Workers in Sweden. *Journal of Applied Econometrics* 19(6): 795-807.

Kerkhofs, M., Lindeboom, M. and Theeuwes, J. (1999). Retirement, financial incentives and health. *Labour Economics* 6: 203-227.

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

Kimhi, A. (1994). Optimal Timing of Farm Transferal From Parent to Child. *American Journal of Agricultural Economics* 76: 228-236.
Kimhi, A. and Bollman, R. (1999). Family farm dynamics in Canada and Israel: the case of farm exits. *Agricultural Economics* 22: 69-79.
Kimhi, A. and Lopez, R. (1999). A Note on Farmers' Retirement and Succession Considerations: Evidence from a Household Survey. *Journal of Agricultural Economics* 50(1): 154-162.
Kimhi, A. and Nachlieli, N. (2001). Intergenerational Succession on Israeli Family Farms. *Journal of Agricultural Economics* 52: 42-58.
Mela (2003). Brochures for Farmers' Early Retirement Aid. Farmers' Social Insurance Institution. Espoo.
Mela (2004). Statistics of Farmers' Social Insurance Institution (Mela). Web pages: www.mela.fi.
Petersen, T. (1986a). Fitting Parametric Survival Models with Time-Dependent Covariates. *Journal of the Royal Statistical Society*, Series C. (Applied Statistics) 14: 219-246.
Petersen, T. (1986b). Estimating Fully Parametric Survival Models with Time-Dependent Covariates. *Sociological Methods and Research* 14: 219-246.
Pfeffer, M. (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 Oude Lansink, A. (2003). Timing and type of exit from farming: farmers' early retirement programmes in Finland. *European Review of Agricultural Economics* 30: 99-116.
Potter, C. and Lobley, M. (1992). Ageing and succession on family farms. The Impact on Decision-making and Land Use. *Sociologia Ruralis* 32: 317-334.
Pyykkönen, P. (2001). Farm successions and farm developing. Pellervo Economic Research Institute *Working Papers* 49: 1-22. Helsinki (In Finnish).
Ruuskanen, O-P. (2004). An Econometric Analysis of Time Use in Finnish Households. *Helsinki School of Economics A-246*. HeSE print.
Samwick, A.A. (1998). New evidence on pensions, social security, and the timing of retirement. *Journal of Public Economics* 70: 2207-236.
Statistics Finland (2003). *Income and Tax Statistics of Agriculture and Forestry* 2000. Helsinki.
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: 6-26.
Weiss, C.R. (1999). Farm Growth and Survival: Econometric Evidence for Individual Farms in Upper Austria. *American Journal of Agricultural Economics* 81: 103-116.
Woolridge, J.M. (2002). *Econometric Analysis of Cross Section and Panel Data*. The MIT Press. Cambridge, Massachusetts. London, England.