Spousal Effect and Timing of Farmers' Early Retirement Decisions

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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, succession
JEL Classification: J26, Q12, C41

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 72,054 in 2004, and average farm size has increased from 17.34 hectares per farm in 1990 to 31.40 hectares per farm in 2004 (Information Centre of the Ministry of Agriculture and Forestry, 2003, 2005). 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, number of farm successions has been decreasing during the last ten years. 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 (Pyykkönen, 2001). Together with the increasing number of farms closing down their operation, this has resulted to the structural change described above.

The decision not to continue to farm often takes place when the farm should be transferred from one generation to the next (Pfeffer, 1989). Not only the farm successions (Weiss, 1999), but also the well-timed retirement are crucial for the sustainability of family farms (Kimhi and Lopez, 1999). However, most of the earlier studies on farm retirement (with the exception of Kimhi, 1994; Pietola *et al.,* 2003 and Glauben *et al.,* 2004) analyse the type rather than the timing of retirement. As the timing of farm retirement is expected to significantly determine the characteristics of structural change in agriculture, it is important to find out, how different farm and family factors affect the timing of elderly farmers' retirement decisions. Furthermore, it is important to establish how public policies, such as early retirement programs, foster these choices. For example, when comparing intergenerational transfers in different countries, Errington and Lobley (2002) found that the managerial responsibility for a farm is handed over earlier in France than in England. This is because France, unlike England, applies the early retirement and installation elements of the CAP (Common Agricultural Policy). 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.

According to the earlier findings, the probability of farm succession is expected to decrease and the probability of farm exit and closing down the farm to increase when the dependency of farm income decreases (Gasson and Errington, 1993; Pfeffer, 1989; Weiss, 1999; Stiglbauer and Weiss, 2000; Goetz and Debertin, 2001; Hennessy, 2002). On the other hand, the results of Kimhi (1994) suggest that parents maximising family welfare may transfer a farm to a successor earlier, if a farmer has an off-farm work. In Finland, both the importance and share of farm income of farm family's total income have been decreasing despite that the farm size has increased. At the same time, the importance and share of off-farm income of farm family's total 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). This study analyses the influence of increasing off-farm labour participation and economic independence from farming on timing of farming couples early retirement decisions.

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 (Blau, 1998; Blau and Riphahn, 1999; Ruuskanen, 2004). Therefore, individual retirement decisions are expected to be strongly influenced by the retirement decision of the spouse (Gustman and Steinmeier, 2000; Huovinen and Piekkola, 2002). 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. According to Pietola *et al*., (2003) retirement benefits are expected to significantly affect the timing of farm retirement. As the level and entitlement to various welfare benefits might be affected by whether one or both of the spouses are retired (Blau, 1997, 1998), it is important to model retirement decisions of the farmer and spouse together. It is also important to know how spousal retirement affect the exit from farming among elderly farmers and how the spouses co-ordinate their exit decisions. Furthermore, it is important to find out under what conditions individual retirement decisions result in farm level changes, *e.g.*, farm successions or farm closures.

This study analyses the timing of farming couples' early retirement decisions. The contribution of this paper to the existing literature is that it analyses the impact of expected pension, off-farm income and spousal labour status on timing of elderly farmers' exit decisions. A greater understanding of farm retirement also contributes to more knowledge of the forces influencing structural change of farming sector. 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 duration spell is determined by the number of years between the first year the farmer is eligible in the early retirement scheme (lower age limit 55 years) and the retirement of the farmer or spouse. The analysis concentrates on farm retirement 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 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. Institutional features

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 of the CAP (EC Council Regulation 1257/1999). This regulation aims at securing the income of retiring farmers and to improving the livelihood of farms with continuous operation. Because of not being mandatory, the early retirement scheme is not implemented in all member countries. Also, the procedures and practises of the measures applied in the member countries vary substantially (Caskie *et al.*, 2002; Bika, 2004).

In Finland, farmers' early retirement programmes were first introduced in 1974. Since then, there have been several programmes of short duration aiming at maintaining the livelihood of family farms continuing production and thus improving the competitiveness in the agricultural sector. Since 1995, Finland has carried out farmers' early retirement programmes within the EU framework for these programmes. During the study period 1993-1998, the programmes operated included: change-of-generation pension, farm closure compensation and early retirement aid for farmers. 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).

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 the 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 2004, the corresponding number was only 688. In Finland, approximately half of the farm transfers utilise the farmers' early retirement scheme (Mela, 2005).

3. Method

Previous studies on farmers' exit decisions have used *e.g.* multinomial logit (Stiglbauer and Weiss, 2000), probit (Kimhi and Bollman, 1999; Kimhi and Nachlieli, 2001) or bivariate probit models (Glauben *et al.*, 2004). Earlier studies on spousal retirement behaviour and retirement decisions, on the other hand, have used among others competing risk duration models (*e.g.* Blau and Riphahn, 1999; Hernoes *et al.*, 2000; Hakola, 2002) and dynamic models (*e.g.* Blau, 1997, 1998; Kerkhofs *et al.*, 1999). In this study, duration analysis is considered as a suitable means for analysing the timing of farming couples' early retirement. The timing of retirement is analysed separately to those farms transferred to new entrants and to those closed down. This is because the timing of retirement is expected to differ between different retirement alternatives.

3.1 Duration model

When analysing the timing of farming couple's 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 the 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 duration spells 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 $T \geq 1$ varies in the population and t denotes a particular value of T. The cumulative distribution function (CDF) of T is defined as (Kiefer, 1988)

$$F(t) = P(T \leq t), \qquad t \geq 1 \tag{1}$$

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

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

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

$$P(t \leq T < t + h \mid T \geq t) \tag{3}$$

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

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

when $f(t)$ denotes the density of T, and for each t, $\lambda(t)$ 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. 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

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

The corresponding survival function is

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

And the hazard function is

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

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

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

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,

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

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

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

Finally,

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

and the log-likelihood is

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

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

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

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

$$h_j = -d \log S(t) / dt \tag{14}$$

and

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

The survival function for the duration of t_k can be written

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

Finally, the density at t_k is

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

The log-likelihood function for one observation is

$$\log L_i = \delta_i \log h\left(t_k \mid x_k\right) + \log S\left(t_k\right) \tag{18}$$

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

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

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

$$S(t) = E_v\left[S(t \mid v)\right] = \int_v S(t \mid v) f(v) dv \tag{20}$$

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

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

and

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

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

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

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. The sample is a random selection of all farmers born between 1929 and 1943 and stratified according to the farmer's age 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 the 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.

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

4.2 Variable definitions

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. 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, death, *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).

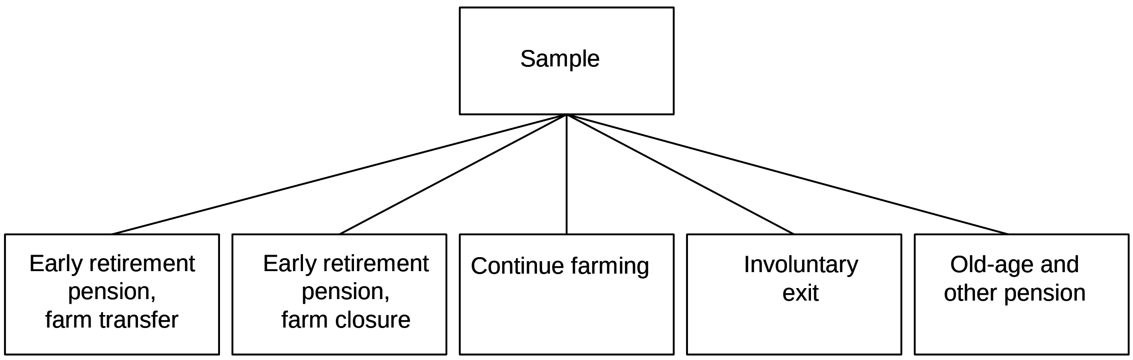

Figure 1. Choice of the pension scheme in the study.

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* 1). 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. According to earlier findings, retirement benefits are expected to significantly affect the timing of farmers' retirement decisions (*e.g*. Asch *et al,*. 2005; Pietola *et al*., 2003). 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. This may arise a concern of endogeneity of the regressors used. However, the early retirement benefits are pre-determined depending on the level of pension insurance the farmers have purchased over their active farming years and can not be affected any more shortly before the retirement. 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. In average, the off-farm income of the farming couple corresponds to the 43% of their 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 (*e.g.* Kimhi and Nachlieli, 2001). Also, the number of children is expected 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). Pietola *et al.* (2003) also suggested that a farmer is expected to retire earlier if he has a spouse and Glauben *et al*. (2004) that farm succession will be postponed if the spouse is also working on the farm. 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, it is defined, how many years a farmer has been farming. Because of the data restrictions it is not possible to make further division between those children who are living or working on the farm and those who are not. Since the early retirement scheme does not discriminate between family- and non-family successors, non-existence of children is not modelled.

The bigger the farm, the more likely the succession and less likely the farm closure are found to be (*e.g.* Gasson *et al*., 1988; Kimhi and Nachlieli, 2001; Hennessy, 2002). 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 on farm retirement decisions, 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 number of years that farming couples continued farming 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 duration spell of farming couples when transferring the farm to a new entrant varied between 1 and 15 years and the duration spell of those closing down their farm varied between 1 and 16 years. The average duration spell was shorter on farm transfers (4.41 years) than on farm closures (5.67 years) (mean survival in *Table* 2).

5.1 Model performance

The Weibull *p* parameters for the duration models before a farm transfer to a new entrant or a farm closure are statistically significant and $p>1$ indicating increasing hazard functions and increasing probability of early retirement over time (*Table* 2). The parameter estimates for θ in the Weibull survival models with gamma heterogeneity are statistically significant and differ from zero. The likelihood ratio test (χ^2 on the probability that the unobserved variance between individuals is zero, $\theta = 0$), however, shows that Weibull distribution models including unobserved heterogeneity do not significantly differ from the basic Weibull models. The signs of the remaining parameter estimates are robust and do not vary between models due to the inclusion of the heterogeneity parameter in case of farm transfer model. Therefore, it seems that the model with unobserved heterogeneity does not result in a significant improvement on the basic Weibull model when modelling timing of early retirement. Nevertheless, heterogeneity is suggested to be significant determinant and it shows up in case of farm closure model 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 so in fact the heterogeneity does not make a difference here either.

5.2 Parameter estimates

When comparing parameter estimates, the predicted effects of different factors differ between farm transfer and closure only in case of some variables. The age of the spouse advances and the age of farmer delays the timing of early retirement in both retirement alternatives. This is in agreement with earlier results that after first increasing, retirement and especially succession probability starts to decrease with the farmer's age (*e.g.* Kimhi and Bollman, 1999; Kimhi and Nachlieli, 2001). Contradicting to the earlier findings of Pietola *et al.* (2003) but according to the results of Glauben *et al.,* (2004), the existence of a spouse is found to delay both farm transfers and closures. 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. But, the longer the farmer has been farming, the sooner the farm will be closed down.

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 significantly advances 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. The result indicates that bigger the dependency on farm income is the later retirement takes place. 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 significantly enhance retirement (*e.g.* Pietola *et al.*, 2003). Here, the expected pension of the farmer and spouse are found to significantly 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 pace at which structural change of farming sector occurs. 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 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 (In order to study this dependency closer, 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). 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 spouse receiving pension benefits continues working on the farm thus enabling the continuation of the farming.

Table 2. Results for the duration models for the early retirement (t values in parentheses).

	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, log	-1.0383***	-0.9879***	0.0316	0.0119
	(-6.626)	(-6.025)	(0.791)	(0.273)
Spouse exp. pension, log	-0.9286***	-1.176***	-0.0808	-0.1592
	(-7.585)	(-7.384)	(-0.528)	(-0.740)
Agricultural income, log	0.1110***	0.1106***	0.0183***	0.0191***
	(16.384)	(16.477)	(3.788)	(3.331)
Farmer off-farm income, log	0.0098	0.0119	0.0431***	0.0511***
	(0.936)	(1.226)	(4.980)	(5.945)
Spouse off-farm income, log	0.0296***	0.0131	0.0034	-0.0013
	(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)
Mean survival	4.407	4.407	5.674	5.674
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)

*** 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

6. Summary and conclusions

In this study, the effects of economic incentives and farm and family characteristics on timing of farmers' early retirement decisions are analysed. The findings of the study contribute to the existing literature by analysing the effects of off-farm income and spousal retirement on the timing of farm retirement. The results also give new information on the factors affecting the structural change of farming sector.

Since the type and timing of farm retirement is expected to significantly affect the farm survival, 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. This result should be taken into account also when carrying out future studies on farm retirement.

When comparing the 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. 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. But, unlike prior expectations, farmers are not found to co-ordinate their early retirement according to spousal retirement under other pension schemes.

Besides the farming couple, also farm and family characteristics and financial factors are found to matter. In accordance with the earlier results, farm size is found to significantly advance farm successions. The result of bigger farms being transferred to the next generation earlier suggests that farmers' early retirement systems are very important on maintaining the livelihood of family farming sector.

The results suggest 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. The result should be taken into account also when reforming farmers' early retirement schemes. Like suggested by Pietola *et al.,* (2003), the lower age limit of the scheme should not be raised in order to reach the desired effects on the development of farming structure. Another factor significantly advancing farm transfers is the expected pension of retiring farmers. Together with retirement age limit, the level of pension benefits is expected to have a major impact on timing of farm successions and thus on future development of farming structure.

Like anticipated, off-farm income of the farming couples is found to influence on timing of farm retirement. 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 change in the farming sector.

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Appendix 1.

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