Do Caring Services Affect Off-Farm Work? Evidence from Italy

Cristina Salvioni, Dario Sciulli and Giuliana Parodi*

Abstract

The article investigates the determinants of the off-farm work decision in Italian farm households, highlighting the role of caring services.

Assuming that the household simultaneously decides over the optimal allocation of time of each of its members, a multivariate probit model is used to estimate the off-farm participation equations and to control for possible correlation among them. Evidence of correlation between spouse and descendant equations are found.

Results suggest that policy actions geared at encouraging the off-farm participation of farm household members ought to enhance the availability and accessibility of caring services and increase the level of education of household members.

Keywords: *Off-farm work participation, multivariate probit, household behavioural models, caring services*

Introduction

Pluriactivity concerns a progressively greater share of farm households in all industrialized countries, and in fact off-farm incomes play an increasingly important role in the determination of farm household global income (OECD, 2003; Eurostat, 2002; Huffman and El Hosta, 1997).

In the last decades participation has been enforced by the increasing participation of women in the labour market. More generally, the diffusion of capital intensive technological innovations has usually reduced the amount of labour required both in the farm and in the domestic production processes, therefore making labour time available for more productive off-farm activities. The decreasing need for on farm and domestic labour has operated in conjunction with "demand pull factors". The increase in the educational level of the agricultural population[1], and especially of females, has eased the outflow of this excess labour force out of the agricultural sector and its absorption in off-farm sectors.

Farm households often use multiple job-holding by their members as a strategy to spread on different activities the income risk stemming from farm income variability and to improve both their income and lifestyle.

A better understanding of off-farm participation decisions could be useful for further implementation of Common Agricultural Policy reform. Two of the challenges ad-

* Corresponding author: Cristina Salvioni, Università G. d'Annunzio, Faculty of Economics – DASTA, viale Piandaro, 42, I-65127 Pescara (Italy)
Phone: +39 – 085 4537585, Fax: +39 – 085 4546411, Email: salvioni@unich.it
Dario Sciulli, University of the Azores and CEEAplA
Giuliana Parodi, DMQTE University "G. d'Annunzio" of Pescara, Italy

dressed by the rural development policy are in fact the presence in rural areas of a) income lower than the average, mainly due to an ageing working population and great dependency on the primary sector, and b) higher unemployment relative to the rest of the territory. To know what variables affect off-farm participation decisions can, for example, allow the policymaker to select the best policy measures to increase the pluriactivity of farm households in order to increase global household income. In addition, some studies (e.g. Weiss, 1997 and 1999) have found that off-farm work has a positive influence on the exit probability of farmers from agriculture. As a consequence, a better knowledge of the rules that regulate off-farm participation can help in understanding the speed of structural adjustment in farm sector.

Studies concerning off-farm work have mainly concentrated on direct factors, such as personal, socio-demographic and farm characteristics affecting off-farm participation, controlling for possible correlation in the decisions of household members. However, studies in other fields of economic research have argued that indirect factors may contribute to explain participation decisions of household members. In particular, the presence of household members needing care (i.e. children, disabled and not self-sufficient elderly persons) appears to play an important role in labour supply decisions within the household (see Anderson and Levine,1999; Apps and Rees, 2004; Del Boca and Vuri, 2006; Parodi and Sciulli, 2006). In fact, if publicly provided caring services are insufficient, care has to be provided by the family, in the form either of costly external helpers, or of relatives.

The focus of this paper is to investigate the off-farm participation decisions[2] in Italian farm households by using a reduced-form multivariate probit model; the main contribution of the paper is to investigate whether caring activities contribute to explain off-farm work decisions. With this aim in mind we explicitly introduce the presence of elderly household members performing caring activities as an explanatory variable of off-farm participation[3]. This explanatory variable allows us to control for situations in which there is a substitution effect in domestic work between these individuals and the other household members under analysis.

Our analysis assumes that the household simultaneously decides over the optimal allocation of time of each of its members, so that the decision of each member are not contingent upon the decision of the other family members, following the original formulation by Huffman (1996). Under this assumption of simultaneity we estimate off-farm work equations by making use of a multivariate probit model[4] that allows to control for the presence of unobserved factors that may cause correlation in the participation equations, preventing unbiased and/or inconsistent estimates.

The paper is organized as follows. In the following section we present the theoretical background and the empirical methods used to investigate the determinants of off-farm participation. In section 3 and 4 we present the data used in the application and the empirical results. A concluding comment is contained in the final section.

Theoretical background and econometric specification

During the last two decades there has been an increasing volume of empirical research on the issue of off-farm participation.

The farm household model originally formalized by Singh, Squire, and Strauss (1986) is the basis of the theoretical framework used to tackle the labour supply and the

participation decisions problem. The labour supply and participation decisions of farm households are originally derived by Huffman and Lange (1989), whose model implies solutions derived from a set of simultaneous equations[5]. In this paper we use that model, adding decisions concerning the eldest child (descendant from now on) to the original formulation where decisions concerned solely the members of the couple, i.e. operator and spouse; the addition of the third member increases the number of the equations, but does not alter the fundamental structure of the model[6].

In this paper we are concerned with off-farm participation; therefore of the whole model we only consider the condition that identifies participation in off-farm work. If for any member of the Household there is an interior solution, i.e. hours worked off-farm are positive, the off-farm market wage is higher than the Household off-farm reservation wage for that member, i.e. $(W_M > W_R)_g$; this is also the condition of participation in off-farm work:

$$M_g > 0 \text{ if } (W_M > W_R)_g \text{; or } M_g > 0 \text{ if } (W_M - W_R)_g > 0 \qquad (1)$$
$$M_g = 0 \text{ otherwise}$$

where W_M is off-farm market wage, W_R is off-farm reservation wage, and M is the probability of participation in the off-farm labour market.

For each household member the decision to work off-farm depends on the relationship between the off-farm wage, and the Household off-farm reservation wage for that household member. The reservation wage is not observable, neither is the difference $(W_M - W_R)_g$ which is therefore a latent variable, Y_g*.

The theoretical model referred to above implies that the optimizing solutions are simultaneously determined, therefore the multivariate probit (MVProbit) is an appropriate estimating technique. In order to give operational meaning to the above condition of participation, as in conventional participation theory it is assumed that the latent variable is a stochastic function of individual and market characteristics. More formally for each household member we estimate:

$$y_{io}^{*} = \beta_o x_{io} + \varepsilon_{io} \quad \text{where} \quad y_{io} = \begin{cases} 1 & \text{if} \quad y_{io}^{*} > 0 \\ 0 & \text{otherwise} \end{cases} \qquad (2)$$

$$y_{is}^{*} = \beta_s x_{is} + \varepsilon_{is} \quad \text{where} \quad y_{is} = \begin{cases} 1 & \text{if} \quad y_{is}^{*} > 0 \\ 0 & \text{otherwise} \end{cases} \qquad (3)$$

$$y_{id}^{*} = \beta_d x_{id} + \varepsilon_{id} \quad \text{where} \quad y_{id} = \begin{cases} 1 & \text{if} \quad y_{id}^{*} > 0 \\ 0 & \text{otherwise} \end{cases} \qquad (4)$$

where x_{ig} is a matrix of covariates identical among household's members, and β_g is a vector of parameters. Besides:

$$E[\varepsilon_{io}] = E[\varepsilon_{is}] = E[\varepsilon_{id}] = 0$$
$$Var[\varepsilon_{io}] = Var[\varepsilon_{is}] = Var[\varepsilon_{id}] = 1$$
$$Cov[\varepsilon_{io}, \varepsilon_{is}] = \rho_{os}; Cov[\varepsilon_{io}, \varepsilon_{id}] = \rho_{od}; Cov[\varepsilon_{is}, \varepsilon_{id}] = \rho_{sd}$$

Assuming normally distributed additive stochastic terms, each off-farm probability of participation equation can be modelled as a probit equation in which the probability of participation is explained by exogenous variables that affect household utility and available time for all household members.

In order to control for unobserved factors which may determine some correlation in the error terms of the estimated equations and to provide unbiased and consistent estimates, we use a multivariate joint probit approach. The model is estimated using a simulated maximum likelihood (SML) estimator (in particular the Geweke-Hajivassiliou-Keane (GHK) simulator is used) which, under standard condition is consistent as the number of observations and the number of draws tend to infinity, and is asymptotically equivalent to the true maximum likelihood estimator as the ratio of the square root of the sample size to the number of draws tends to zero (Cappellari and Jenkins, 2003). We cluster the standard errors by household in order to address the lack of independence of multiple observations from the same cross-sectional unit by using the Huber-White estimator..

For each of the three subjects the probability of participating off-farm is unconditional on the probability that each of the other two subjects does or does not participate in off-farm work, except for the presence of unpredictable factors of correlation, that we preliminary test using a multivariate joint probit approach; for each of the three subjects conditions (1) and therefore (2-3-4) above stand, where now *g* can take up one of three values, i.e. *g= o, s, d.*

The results previously obtained within a MVprobit approach are not univocal. Within this framework some studies have not found any evidence of correlation in the decision (Lass and Gempesaw, 1992; Bharadwaj and Findeis, 2003; Oluwole and Findeis, 2001); some others have found that couples jointly make off-farm work participation decisions (Tokle and Huffman, 1991; Lim-Applegate et al., 2002), and more recent studies have found evidence of correlation in the decision of the farm operator, the spouse and their eldest adult child (Kimhi, 2004).

Data

The data used for this study have been taken from a survey on the socio-economic characteristics of Italian agriculture conducted in 1996 by the Italian Institute for the Studies of Agricultural Markets (ISMEA) in Italy. This data set is unique, in the sense that it is the only set of data providing information on the time use of each household member, that is the information we use to control for possible interactions between caring services and off-farm participation.

The ISMEA survey is a stratified survey (by European Size Unit-Esu[7] and Farm Typology-Ote[8]). It collects information from 1881 farms, 1777 of whom are household farms. The sampling has been based on the Agricultural Census conducted in 1991 by the Italian National Statistical Institute, and it is censored at the cut-off point of farms with an economic dimension greater than 4 ESU. This criterion has been adopted with the aim of excluding those enterprises where the agricultural activity is either marginal or dismissed. The sample is statistically representative at macro-regional level (North, Centre and South).

The survey data is merged with official statistics of the unemployment rate at provincial level, used as a proxy for local labour market conditions. In the following analysis

we make use of a sub-sample of 528 households of couples with both members as well as the eldest child in working age.

Following previous research we use four categories of explanatory variables to specify the model for off-farm participation decision: individual, household, farm, and local market characteristics. The empirical definitions of the variables and the descriptive statistics are available in table 1.

Individual attributes include age, gender dummy, and years of education[9]. Household attributes include information on demographic (number of children of pre-school and school age) and economic characteristics (household non labour income). In addition, the information on the time use of each member of the household is used to construct a variable (Substitutes from now on) indicating the presence of household members more then 60 years old who contribute to domestic activities and to the care of children and elderly relatives. We use this variable to control for the possibility of a substitution effect in domestic work between the substitutes and the other household members under analysis.

Farm attributes include variables indicating the farm specialisation in labour intensive productions (fruit and flowers, dairy cattle, beef cattle, wine, where the implied basecategory is non labour intensive productions), potential farm economic size (Esu), altitude, and logarithms of the value of land (Land); this latter variable is used to control for a possible wealth effect. Regional location dummies were also included (Centre dummy is our basecategory). Farm sales and farm size variables were excluded from the off-farm participation equations due to potential simultaneity with the operator's off-farm work decisions. Finally, local unemployment rate is the labour market condition indicator.

Results

Estimation results from the MVprobit model are presented in table 2. The MVprobit model permits us to jointly estimate the three separate participation equations, controlling for the presence of unobserved factors which may cause some correlation among them. The likelihood ratio test statistic for the hypothesis that the three equations (operator, spouse and descendant) are independent is not rejected but we also find a significant (at 10% confidence level) and positive correlation of the error terms between the spouse's equation and the descendant's equation. The positive sign of the correlation coefficient suggests that the random disturbances in the spouse's and descendant's equations are influenced in the same direction by unmeasured effects.

As a further check we also estimate a univariate probit model for the operator's equation and a bivariate probit model for the other two equations (table 3). Previous estimates are confirmed both in the signs and in the magnitude, and a significant correlation (at 10% confidence level) between the error terms of the spouse's equation and the descendant's equation is confirmed. The existence of a significant correlation in the spouse's and descendant's equations also supports the importance of the joint estimation procedure to prevent biased and inconsistent estimates. However, since the results arising from the MVprobit model and the Probit plus Bi-probit model are very similar, for brevity we only comment the results obtained from the MVprobit specification.

At a first glance, (table 2) we note that the observed participation rates in the off-farm work market is overall rather low. As expected the operators' is the lowest

Table 1. Descriptive Statistics

		Operators				Spouses				First Descendents			
		Participant		Non-Participant		Participant		Non-Participant		Participant		Non-Participant	
Variables	Definition	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age	age	49.53	4.12	50.64	6.33	44.95	6.01	47.44	6.09	24.96	4.13	22.88	5.36
Female	1 if female	0.000	0.000	0.022	0.147	0.946	0.229	0.982	0.134	0.544	0.502	0.478	0.501
Schooling	years of schooling	9.063	3.943	6.637	3.561	10.216	4.808	6.607	3.162	11.809	2.882	11.039	3.206
Nchild05	number of children aged 0-5	0.063	0.246	0.032	0.208	0.135	0.419	0.026	0.184	0.059	0.293	0.030	0.196
Nchild614	number of children aged 6-14	0.406	0.756	0.224	0.497	0.189	0.462	0.238	0.521	0.162	0.507	0.246	0.518
Substitute	1 if presence of substitute	0.063	0.246	0.077	0.295	0.081	0.363	0.075	0.286	0.147	0.497	0.065	0.247
North	farm located in northern region	0.188	0.397	0.361	0.481	0.297	0.463	0.354	0.479	0.426	0.498	0.339	0.474
Centre	farm located in center region (base)	0.281	0.457	0.228	0.420	0.135	0.347	0.238	0.426	0.221	0.418	0.233	0.423
South	farm located in southern region	0.531	0.507	0.411	0.493	0.568	0.502	0.407	0.492	0.353	0.481	0.428	0.495
Plain	farm located in plain zone (base)	0.719	0.457	0.784	0.412	0.838	0.374	0.776	0.417	0.721	0.452	0.789	0.408
Hill	farm located in hill zone	0.250	0.440	0.143	0.351	0.135	0.347	0.151	0.358	0.176	0.384	0.146	0.353
Mountain	farm located in mountain zone	0.031	0.177	0.073	0.260	0.027	0.164	0.073	0.261	0.103	0.306	0.065	0.247
Oteoff	specialization in flowers and fruit	0.188	0.397	0.127	0.333	0.297	0.463	0.118	0.323	0.147	0.357	0.128	0.335
Otedairy	specialization in raising dairy cattle	0.031	0.177	0.125	0.331	0.081	0.277	0.122	0.328	0.147	0.357	0.115	0.320
Otebeef	specialization in raising beef cattle	0.063	0.246	0.024	0.154	0.027	0.164	0.026	0.161	0.044	0.207	0.024	0.153
Otewine	specialization in wine production	0.094	0.296	0.087	0.282	0.135	0.347	0.084	0.277	0.059	0.237	0.091	0.288
Esu1	european size unit 4-8 (base)	0.625	0.492	0.204	0.403	0.297	0.463	0.224	0.417	0.309	0.465	0.217	0.413
Esu2	european size unit 8-16	0.188	0.397	0.282	0.451	0.324	0.475	0.273	0.446	0.353	0.481	0.265	0.442
Esu3	european size unit over 16	0.188	0.397	0.514	0.500	0.378	0.492	0.503	0.501	0.338	0.477	0.517	0.500
Land	value of land in logarithms	138.41	117.47	396.28	707.97	509.14	1016.48	370.96	658.81	234.38	229.59	402.27	731.08
No_labour_income	value of non labour income	1875.00	6036.18	2556.63	5505.09	956.76	3491.30	2632.77	5644.12	3798.35	6704.86	2325.65	5322.79
Urate	provincial unemployment rate	0.148	0.056	0.130	0.074	0.146	0.055	0.130	0.074	0.127	0.078	0.131	0.073

Source: our elaboration on ISMEA data

Table 2. MVprobit estimation

	MVprobit Model								
	Operators			Spouses			First Descendants		
Covariates	b	r. s.e.		b	r. s.e.		b	r. s.e.	
Age	1.806	0.510	***	0.069	0.201		0.512	0.179	***
Age square	-0.018	0.005	***	-0.001	0.002		-0.009	0.004	**
Female	-3.638	0.420	***	-0.967	0.457	**	0.049	0.157	
Schooling	0.139	0.029	***	0.124	0.029	***	0.017	0.025	
Nchild05	0.071	0.504		0.313	0.378		0.537	0.265	**
Nchild614	0.310	0.176	*	-0.321	0.225		0.141	0.177	
Substitute	0.441	0.352		1.026	0.521	**	0.431	0.242	*
North	-0.444	0.318		0.398	0.296		0.345	0.203	*
South	-0.494	0.375		0.340	0.367		-0.170	0.304	
Mountain	0.050	0.492		-0.324	0.372		0.254	0.285	
Hill	0.477	0.262	*	0.044	0.256		0.197	0.218	
Oteoff	0.015	0.342		0.498	0.259	*	0.305	0.223	
Otedairy	-0.514	0.525		0.152	0.350		0.119	0.229	
Otebeef	0.792	0.477	*	0.411	0.501		0.267	0.466	
Otewine	0.042	0.370		0.481	0.285	*	0.029	0.302	
Esu2	-0.971	0.304	***	0.111	0.246		-0.118	0.196	
Esu3	-0.966	0.257	***	-0.275	0.229		-0.494	0.210	**
Land	-2.80E-03	6.91E-04	***	1.72E-04	1.13E-04		-4.58E-04	2.61E-04	*
HH no labour income	-6.88E-07	2.64E-05		-5.25E-05	4.45E-05		1.17E-05	1.36E-05	
Urate	0.839	2.311		1.740	2.131		1.731	1.889	
Constant	-46.331	12.850	***	-2.847	4.679		-8.231	2.158	***
Log-likelihood	-359.45								
Observed Participation	6.06%			7.01%			12.88%		
Correlation									
rho_os	0.121	0.154							
rho_od	0.097	0.131							
rho_sd	0.235	0.132	*						
LR test of rho_os = rho_od = rho_sd = 0	Prob>chi2 = 0.334								

Source: our elaboration on ISMEA data
*** Significant at 1%
** Significant at 5%
* Significant at 10%

(6.06%), the spouses' is 7.01%; finally, descendants show the highest value, i.e. 12.88%; this suggests that while the members of the couple are settled in their tasks, younger members of the Household are more open to the new experience of off-farm participation, and of acquiring the necessary new skills.

Evidence about personal characteristics (age, gender and educational level) is consistent with that of the main literature on labour market participation. In this sense, we find that the probability of participation is affected by age, except that in the case of the spouse. According to the results this variable positively influences participation, but with a decreasing rate, that is age has a typical inverted U effect on the response variable. The peak in off-farm work is reached respectively at 50.2 years for the operators and 27.6 years for the descendants.

Significant coefficients both for the operator and the spouse show that being female reduces the probability of participating in the off-farm labour market, confirming the well-known evidence of lower participation rates among women with respect to males all things being equal.

Years of schooling are significant and positive but only in the operator's and the spouse's equations. This evidence could be produced either by a demand factor, i.e. skilled workers have a higher probability of being hired if compared to unskilled ones, and/or by a supply factor, i.e. workers with lower education are less likely to offer their work given their expectations of lower incomes.

With respect to variables connected to the household composition, two effects are usually found, one negative and the other positive. Previous empirical evidence (Killingsworth and Heckman, 1986) shows that the presence of pre-school aged children tends to reduce the participation of relatives when child care services are not adequately supplied. Also, Apps and Rees (2004) show that with the arrival of children, both parents, but especially the mother, work much longer hours in total (market and domestic) rather than, as may be expected, using the capital market to smooth consumption. Much of that working time is spent on home child care, and it declines with the age of the children.

Table 3. *Probit and Bivariate Probit Model estimates*

	Probit Model			Biprobit Model					
	Operator			Spouses			First Descendents		
Covariates	b	r. s. e.		b	r. s. e.		b	r. s. e.	
Age	1.763	0.511	***	0.074	0.201		0.495	0.177	***
Age square	-0.018	0.005	***	-0.001	0.002		-0.009	0.004	**
Female	-	-		-0.981	0.451	**	0.042	0.157	
Schooling	0.141	0.029	***	0.125	0.029	***	0.018	0.025	
Nchild05	0.042	0.500		0.313	0.377		0.525	0.262	**
Nchild614	0.307	0.177	*	-0.318	0.223		0.123	0.179	
Substitute	0.460	0.361		1.026	0.523	**	0.426	0.244	*
North	-0.440	0.317		0.395	0.292		0.353	0.204	*
South	-0.499	0.376		0.338	0.365		-0.183	0.304	
Mountain	0.082	0.502		-0.330	0.372		0.236	0.286	
Hill	0.465	0.262	*	0.038	0.252		0.198	0.218	
Oteoff	0.017	0.338		0.480	0.259	*	0.295	0.222	
Otedairy	-0.499	0.525		0.151	0.350		0.104	0.230	
Otebeef	0.795	0.481	*	0.397	0.499		0.255	0.463	
Otewine	0.059	0.367		0.473	0.296		0.016	0.300	
Esu2	-0.969	0.305	***	0.111	0.245		-0.123	0.197	
Esu3	-0.962	0.259	***	-0.275	0.229		-0.492	0.210	**
Land	-2.78E-03	6.98E-04	***	1.70E-04	1.13E-04		-4.61E-04	2.60E-04	*
HH no labour income	-6.81E-08	2.64E-05		-5.29E-05	4.58E-05		1.13E-05	1.37E-05	
Urate	0.872	2.325		1.764	2.127		1.796	1.886	
Constant	-45.258	12.875	***	-2.932	4.686		-8.024	2.140	***
Log-likelihood	-79.98			-279.83					
				rho_sd	0.262	*			
				Wald test of rho_sd=0			Prob>chi2=0.056		

On the other hand, the presence of children increases the household consumption levels and it may imply the search for extra off-farm income by adult members of the household (Ellis, 1996). Our results are consistent with the predictions of the latter effect. In particular, we find a positive effect on the operators' participation in off-farm work as the number of children aged 6 to 14 increases and also a positive correlation between the descendants' participation and the number of pre-school aged children. Our findings support the hypothesis that operators and descendants increase their off-farm participation in order to meet the increasing needs deriving from the presence of children.

With regard to spouses a negative and scarcely significant (p-value is equal to 15%) relationship seems to exist between the spouses' participation and the number of children aged 6-14. This evidence, even if rather weak, indirectly confirms that the presence of household's members needing care may prevent the labour market participation of individuals that are typically devoted to care.

A stronger evidence of how caring services affect labour market participation is found when taking into account the effect of the presence of Substitutes. Our estimates show a strong and positive effect of the Substitute variable on the probability that spouses participate in off-farm work; they also show a significant and positive effect on the labour market participation of the descendants. These findings can be interpreted as follows: the presence of substitutes does not affect the Household decision about the participation in the labour market of the main income earner, i.e. the operator; however, it affects the Household decision about the participation in the off market of the secondary components of the Household members, i.e. the spouse and the eldest child. The presence of substitutes, who perform household and caring work presumably at zero costs, makes the off-farm participation of the spouse and of the eldest child more likely, as their participation is not constrained by the costs of hiring caring services[11]. Operational suggestions of active labour market policies can be derived from these estimates: adequate free provision of public caring services would create a positive effect on the participation of spouses and descendants who are members of families where no substitutes are available[12]

Demand pull effects seem not to affect participation, either in the North, where the unemployment rate is relatively low, or in the South, where the unemployment rate is relatively high; the estimates are calculated with respect to the Centre, which is our basecategory.

Altitude seems to affect participation: a positive and significant effect for the operator's equation is found for farms located in hills compared to farms located in planes. This result can be explained in terms of higher profitability of farms located in planes and, as consequence, of a lower need to increase farm income with off-farm sources.

With regard to farm specialization, we found a positive effect, contrary to expectations, of the specialization in the production of flowers and vegetables and of wine, on the spouse participation; and also of the specialization in beef cattle production on the operators participation. The potential economic dimension of the farm (ESU) has a very significant and negative effect on operators and descendants, while it does not influence spouses' participation.

The value of land variable shows a significant, and negative effect both in the operator's and in the descendant's equation, possibly indicating the presence of a wealth effect; also, the value of land may be interpreted as the value of tied up capital, which re-

quires on farm work; therefore a higher value of land is likely to be positively correlated with on farm work, decreasing the probability of participating in the off-farm labour market.

Conclusions and directions for future work

We highlight the main results of our estimates, and their policy implications for the purpose of encouraging off-farm participations of members of rural households.

Using a MVprobit model we find a significant and positive correlation between the spouse's and the descendant' equations, highlighting the importance to control for possible presence of correlated unobserved factors to avoid biased and inconsistent estimates.

A second finding concerns the role of caring services in affecting off-farm work. Our estimates show a significant and positive effect of the presence of substitutes, i.e. old household members contributing to domestic activities and to caring activities, on the probability that spouses and descendants participate in off-farm work. Operational suggestions for active labour market policies can be derived from this finding: consistently with the findings of the literature quoted in the introduction, increasing the availability and accessibility of caring services is proposed to create a positive effect on the off-farm participation of spouses and descendants in families where no substitutes are available; this is particularly important in remote areas, where the costs of alternative caring services is comparatively high.

According to our third finding, education appears to be positively and significantly correlated with the off-farm participation of the operator and of the spouse; therefore any policy geared at improving the level of education is likely to increase the off-farm participation of the household members .

Finally, according to the results of our estimates, the probability of off-farm participation of operators and of descendants is inversely related to the value of the farm land and to the potential economic dimension of the farm business..

In view of the importance of the topic considered, further research is commendable. In particular, an estimation of the number of hours allocated to farm and off-farm work is desirable. Further work should also explicitly consider the problem of disequilibrium; contrary to the assumption of this paper, no off-farm participation could reflect lack of job opportunities rather than an optimising solution. In addition, further investigation with particular reference to descendants, would allow us to acquire a better understanding of the conditions for the intergenerational continuity of the farm.

Notes

[1] The low educational level and qualification of agricultural labour force have in the past limited the exit of workers out of the agricultural sector towards more productive sectors.

[2] Note that throughout the paper we assume that there are no demand constraints in off-farm work, so that the decision to participate off-farm coincides with being employed off-farm; this definition obviously differs from the usual definition of participation rate, where both the employed and those looking for employment in a particular labour market are considered as participants.

[3] Developing a theoretical model of time allocation to domestic production is beyond the scope of this work. Recent developments in this field can be find in Chiappori, 1997 and Del Boca and Vuri, 2006.

[4] Benjamin and Kimhi (2006) implicitly assume that household decisions are taken sequentially; under that hypothesis they show that the multivariate probit approach suffers of some inconsistency problems.

[5] Interactions in the optimizing decisions of the household members' could be taken into consideration, but this situation ought to be explicitly modelled. For examples, the household members could be classified as leader and follower and the model explicitly may envisage that the choices of the follower depend on the choices of the leader, with a mechanism similar to the one assumed in the Stackelberg oligopoly model. Alternatively, time could be introduced in the reaction functions of the two agents, by explicitly introducing a temporal element in the reaction functions, which at each moment allows to consider how each agent acts on the knowledge of what the other agent has done in a previous moment (Varian, 1992).

[6] We implicitly assume that farm decisions are not separable from household decisions. This hypothesis is supported by earlier empirical work on several developed countries (Lopez, 1984; Elhorst, 1994; Sonoda and Maruyama, 1999; Fall and Magnac, 2004).

[7] The European Size Unit (ESU) is the indicator used by FADN to measure the economic size of farms. It is based on the standard gross margins (SGM) attributed to the farm, that is on the potential gross margins producible in a farm with given structural characteristics. In 1995: 1ESU = 1200 ecu = 920.95 euro.

[8] This is the classification by Type of Farming used by FADN; it is based on the prevalence of a crop or animal production on total SGM.

[9] Even if the theory suggests to include all the personal characteristics of the household members in all participation equations, we estimate a specification without cross age and education effects, in order to avoid multicollinearity problems stemming from the high correlation we observed across these variables.

[10] 5% of the spouses in our sample are males.

[11] See Del Boca and Vuri (2006).

[12] The public provision of caring services appears to be particularly needed in rural areas, where, because of geographical distance, the cost of private caring services is likely to be particularly high.

References

Anderson, P.M. and P.B. Levine (1999) "Child Care and Mother's Employment Decisions", NBER Working Paper n. 7058.

Apps P. and R. Rees (2004) "The Household, Time Use and Tax Policy", CESifo Economic Studies, Vol. 50, 3/2004, 479–500.

Benjamin, C and A. Kimhi, (2006) "Farm work, off-farm work, and hired farm labour: estimating a discrete-choice model of French farm couples' labour decisions", European Review of Agricultural Economics, 33 (2): 1-23.

Bharadwaj L. and J. L. Findeis. (2003) "Off-farm Work Among Farm Women: Motivations, Earnings, and Benefit Receipt", Paper prepared for presentation at Annual Meeting of the American Agricultural Association, Montreal, Canada , July 27-30, 2003.

Cappellari L. and S.P. Jenkins "Multivariate probit regression using simulated maximum likelihood", Stata Journal, StataCorp LP, vol. 3(3): 278-294.

Chiappori P.A. (1997) "Introducing Household Production in Collective Models of Labor Supply"The Journal of Political Economy, Vol. 105, No. 1:191-209.

Corsi, A. and C. Salvioni (2006) "Off- and On-Farm Labour Participation in Italian Farm Households", CHILD Working Paper n. 22/2006.

Del Boca D. and D. Vuri (2006) "The Mismatch between Employment and Child Care in Italy: the Impact of Rationing", CHILD Working Paper n. 8/2006.

Elhorst, J.P. (1994). Firm-Household Interrelationships on Dutch Dairy Farms. European Review of Agricultural Economics 21: 259-276.

Ellis F. (1996) "Peasant economics". Cambridge University press, UK: Cambridge.

Eurostat (2002) "Incomes of Agricultural Sector Households", Luxembourg.

Fall, M., and T. Magnac (2004). How Valuable Is On-Farm Work to Farmers? American Journal of Agricultural Economics 86: 267-281.

Huffman W.E (1996) "Farm Labor: Key Conceptual Measurement Issue on the Route to Better Farm Cost and Return Estimates", Iowa State Staff Paper n.280.

Huffman, W.E e H. El-Hosta (1997) "Off-farm work participation, off-farm labour supply and on farm labour demand of US farm operators", Iowa State Staff Paper n. 290.

Huffman, W. E., and M. D. Lange (1989) "Off-farm Work Decisions of Husbands and Wives: Joint Decision Making", Review of Economics and Statistics 81 XXI: 471-80.

Killingsworth M.R. and J.J. Heckman (1986) "Female Labor Supply: A Survey", in O. Ashenfelter, R. Layard (eds.) Handbook of Labor Economics, North-Holland.

Kimhi, A. (2004) "Family composition and off-farm participations in Israeli farm households", American Journal of Agricultural Economics 86: 502-512.

Lass, D. A., and C. M. Gempesaw (1992) "The Supply of Off-farm Labor: A Random Coefficients Approach", American Journal of Agricultural Economics 74: 400-411.

Lim-Applegate, H., G. Rodriguez and R. Olfert, (2002) "Determinants of Non-Farm Labour Participation Rates Among Farmers in Australia", The Australian Journal of Agricultural and Resource Economics 46: 85-98.

Oluwole A.B and J. L. Findeis, (2001) "An Econometric Analysis of Off-farm Labour Participation among U.S. Farm Families, 1977-1998", Paper prepared for presentation to the American Agricultural Economics Association 2001 Annual Meeting. Chicago, Illinois.

OECD (2003). Farm Household Incomes. Paris.

Parodi G. and D. Sciulli (2006) "Disability in Italian Households: Income, Poverty and Labour Market Participation", Applied Economics, forthcoming.

Tokle, J.G. and W.E. Huffman (1991) "Local Economic Conditions and Wage Labor Decisions of Farm and Rural Nonfarm Couples", American Journal of Agricultural Economics. 73: 652-670.

Varian, H.R. (1992) Microeconomic Analysis, 3rd Edition, W.W. North & Company, New York.

Weiss, C. R. (1997) "Do They Ever Come Back Again? The Symmetry and Reversibility of Off-farm Employment", European Review of Agricultural Economics 24(1): 65-84.

Weiss, C. R. (1999) "Farm Growth and Survival, Econometric Evidence for Individual Farms in Upper Austria", American Journal of Agricultural Economics 81(1): 103-116.