Family Composition and Off-Farm Participation Decisions in Israeli Farm Households

By

Ayal Kimhi

ABSTRACT

This article studies the relationship between the off-farm participation behavior of farm operators and their spouses and the demographic composition of the household. I focus on farm families without parents, siblings or partners, and examine the effects of the existence of elderly children of the farm couple. I find that both the father and the mother tend to reduce their participation in off-farm work as the number of elderly children rises. This result holds even after controlling for observed characteristics. I also find that the effect of elderly children stems from considerations related to both farm production and household production.

Key Words: *Off-Farm Participation; Family Composition; Adult Children; Multivariate Probit; Quasi-Maximum Likelihood*.

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The time allocation decision of farmers has long attracted researchers because many farmers divide their labor supply between farm work and off-farm work, a phenomenon that is rarely observed in other sectors of the economy (Shishko and Rostker). Understanding this phenomenon is important for the design of agricultural and rural policy. Many policy instruments aim at improving farm income or reducing its variability. Policy makers often do not fully appreciate the importance of earnings from off-farm sources that supplement farm income and serve as a buffer against farm income fluctuations (Lamb; Mishra and Goodwin). Moreover, any farm-related policy should take into account the ability of farmers to act on the margin between farming and off-farm activities in addition to their actions on the margin between different farm activities. Understanding how farmers allocate their time between farming and off-farm occupations is therefore crucial for designing successful farm policies.

The attempts to analyze farmers' time allocation decisions have thus far been limited to husband and wife only because of two main reasons. One is the lack of sufficient data on the time allocation of other family members. The other is the limitation imposed by available econometric techniques. This research uses data from a family farm survey conducted in Israel, which include the time allocation patterns of all adult farm-family members. Modern econometric techniques enable the joint estimation of a large number of participation and labor supply equations. Hence one purpose of this research is to extend the time allocation analysis to other members of the farming family.

The main purpose of this research is to investigate how time allocation decisions depend on family composition. Farm sectors in developed countries are usually viewed as modern sectors in which business decisions are independent of consumption decisions. However, market imperfections that still exist, especially in rural areas, cause these decisions to be interdependent as in developing countries. The scope of this interdependence is the focus of this study.

Previous research (Kimhi, 1996) has found that farm couples are more likely to work off the farm when the number of other adults in the household increases. This may be explained by the differential income effects resulting from the household's joint budget constraint, and by the time and money costs imposed by different household members. This article builds on the previous work and modifies it in several directions: (a) we use a more recent data set; (b) we focus on farm families without parents, siblings or partners, so the only other adults in the household are children of the farm couple and their spouses; (c) we estimate the off-farm participation equations of the children jointly with the equations of the farm couple.

We find that the effect of household composition on the off-farm participation behavior of farm couples is completely different than indicated by previous research. In particular, the farm couple is less likely to work off the farm as the number of adult children in the household rises. We explore two possible reasons for this behavior, one related to complementarity of farm labor inputs of different family members, and another related to the time burden in household production imposed by adult children. Both explanations are supported by the empirical results.

The following section starts with a survey of previous literature. Then we briefly discuss the theoretical background and the empirical methods adopted for this analysis. The following sections present the data, the empirical results, and extensions. The last section provides conclusions, qualifications, and avenues for future research.

Background and Previous Results

The literature is rich in applications of the agricultural household model to time allocation problems. The traditional approach has been to estimate off-farm participation equations and labor supply equations of farm operators (e.g., Sumner). Later, researchers moved to estimating two-equation models in which the off-farm labor supply equations of husbands and wives are jointly determined (e.g., Huffman and Lange; Tokle and Huffman; Lass and Gempesaw), and found that off-farm labor supply of husbands and wives are positively correlated. Recently, this approach has been extended to include farm work participation equations (Kimhi, 1994) and labor supply equations as well (Kimhi and Lee). Buttel and Gillespie have also found that men's and women's farm and off-farm labor supply decisions are correlated.

However, farm families do not consist of a husband and a wife only. On the contrary, farm families are often larger than non-farm families, including multiple generations who function as an extended family. The importance of within-family succession serves as an incentive for adult children to work together with their parents on the family farm (Kimhi, 1995). Blanc and Perrier-Cornet found that European successors often work as laborers for their parents for ten years or more before receiving ownership. Hence, other adult family members allow the farm operator and spouse to have more flexibility in their time allocation decisions.[1]

This claim is supported by the results of Kimhi (1996), who studied the effect of family composition on the labor participation decisions of Israeli farm couples. The number of other adults (19 to 51 years old) was found to increase off-farm labor participation and decrease farm labor participation of both spouses. It seems that other adults are net substitutes in farm work. The model was estimated separately for households with and without other adults, and the results implied that the time allocation of the farm couple depends significantly on the existence of other adult household members. Overall, these results indicate that joint estimation of the labor supplies of different household members is desirable.

Theoretical Background and Empirical Methods

Models of the time-allocation decisions in family farms are derived from maximizing household utility over household consumption and the leisure of each family member. This is the framework used by Huffman in his comprehensive theoretical survey of farm-household models. Kimhi (1994) suggested a slight modification of the theory to allow for zero farm work.

The Kuhn-Tucker conditions for maximizing this model include an off-farm participation equation for each family member. Each participation equation depends on the characteristics of all household members. It is this dependence that we examine in this paper.

Each off-farm participation equation is modeled as a Probit equation, assuming normally-distributed additive stochastic terms. Participation is explained by exogenous variables that affect household utility, farm income, off-farm income, non-labor income, and available time for all household members. Assuming a general correlation structure between the equations requires joint estimation in order to exploit all available information and provide efficient estimators. This correlation structure could result, for example, from unobserved household-level variables that are common to all equations.

Off-farm participation models with up to two equations were estimated by maximum likelihood (ML) methods in many studies of joint husband-wife work decisions. Multivariate probit ML estimation of more than two equations requires more than two levels of numerical integration, making the task complicated if not impractical. Here, we use the quasi-maximum likelihood approach described by Kimhi (1994). In this approach, restrictions are imposed on the parameters in order to simplify the likelihood function. The restrictions are chosen such that the restricted model satisfies the orthogonality conditions, which are equivalent to the first-order conditions of the restricted ML model. The resulting estimators are consistent although not as efficient as ML.

The method is illustrated here for the case of three equations. Write the participation equations as

(1) $\alpha_i \cdot \mathbf{X}_i + v_i \leq 0$ (i=1,2,3,4),

where strict equality indicates participation. In the first stage, estimate each equation separately by probit. Denote the probit estimators as α^*_i (i=1,2,3,4). In the second stage, maximize a bivariate probit log-likelihood function of the form

(2) $$£_{ij} = \Sigma \ln B(d_i\alpha^*_i\mathbf{X}_i, d_j\alpha^*_j\mathbf{X}_j, d_{ij}\rho_{ij}),$$

with respect to ρ_{ij}, for each possible (i,j) $\in$ {(1,2), (1,3), (2,3)}. Summation is over individuals; B is the bivariate normal probability function; ρ_{ij} is the correlation between v_i and v_j; I_k equals one if participation occurs, zero otherwise; and $d_i=2I_i-1$ and $d_{ij}=d_id_j$. Since maximizing $£_{ij}$ for each possible (i,j) is equivalent to maximizing $£ = £_{12} + £_{13} + £_{23}$, $£$ can be maximized over all the parameters in one stage. This is the most efficient QML estimator subject to the condition that the level of integration is not higher than two. The method is appropriate for any number of equations. The true covariance matrix of the estimators should be calculated as $H^{-1}WH^{-1}$ where H is the matrix of second derivatives of quasi-likelihood function $£$ and W is its gradient outer-product matrix.

Data

The data come from a country-wide farm survey that was conducted in Israel in 1995 (State of Israel, Central Bureau of Statistics). The survey encompassed a representative 10% sample of farms, and included approximately 3000 family farms. Three separate sectors were surveyed: Moshavim (cooperative villages), other Jewish localities, and Arab localities. Note that despite the cooperative structure of Moshavim, these farms can be treated as private family farms for all practical purposes.[2] The survey questionnaire included detailed questions about farm production activities, as well as personal and family characteristics. Regarding time allocation, each family member was asked if he/she engaged in agricultural activities on the farm up to 1/4 of a full-time job, up to 1/2, 3/4, full time, or not at all. A similar question was asked about non-agricultural farm activities, and about off-farm work.

Table 1 includes the definitions of variables used in this study. Among the time allocation variables, we only use a dummy for working/not working in each sector, and ignore the level of work. This is because the vast majority of those who work off the farm do it on a full-time basis. Also, we add together those who work off the farm and those who participate in non-agricultural activities on the farm, because the latter are a very small group. Other personal characteristics that we use are age, a dummy for being born in Israel, a dummy for having an ethnic origin in Asia or Africa (this relates to the respondent or his/her father), and three educational dummies: one for finishing high school, one for having more than high school education, and one for having some level of agricultural education.[3]

A different data set includes off-farm wages for a subset of the survey respondents. That data set is confidential and we do not have access to it, but we were able to obtain predicted off-farm wages for that subset of the sample. We use these predicted wages as explanatory variables, and we also include a dummy for the observations with missing wages although there is no reason to believe that these observations are systematically selected.[4]

Family-related variables include two locality-type dummies (private-Jewish and Arab, excluded group is Moshavim), two location dummies (north and south, excluded location is center), the numbers of children up to age 14 and adolescents up to age 21, and dummies for the number of adults (older than 21 years)[5] in the household: group=1 is for husband and wife only, group=2 is for husband, wife, and one adult child, group=3 is for husband, wife, and two adult children (or an adult child and his/her spouse), and group=4 is for husband, wife, and more than two adult children or spouses. Other types of households, including single-parent households, households with elderly parents, and other forms of extended families, were excluded from the current analysis. There were 1949 families left in the data set comprising of groups 1 to 4.

Variables related to the farm operator include tenure (years since the current owner started operating the farm), and two dummies for method of receiving the farm (succession and purchase; the excluded group are those who received the farm through the settlement agencies). Variables related to farm production include level of specialization, land, capital, and types of products produced. Level of specialization includes two dummy variables, specialized and diversified.[6] Land size includes all the land that is permanently held by the farm.[7] Capital stock is the value of permanent capital and livestock.[8] We also include dummy variables indicating production in each of the following branches: flowers and nurseries, poultry, field crops and vegetables, and cattle.[9] In addition, we include a profitability index in each of these branches.[10]

Results

Table 2 includes descriptive statistics of the personal characteristics of the farm couple and theit oldest adult child, and family and farm attributes.[11] We can see that overall, 55% of the operators and 46% of the spouses work off the farm, while 69% of oldest children do so. However, the fraction of operators and spouses who work off the farm declines with the number of adult children in the household, while the fraction of the oldest children who work off the farm rises. This could simply be an age effect: the ages of operators, spouses, and oldest children rise with the number of adult children, reflecting life-cycle effects. While the parents are already in the age range in which the tendency to work off the farm declines with age, the children are not. Opposite to the results of Kimhi (1996), we do not find that adult children substitute for their parents' farm labor. On the contrary, fathers' farm labor participation rises with the number of adult children, while that of the mother doesn't change monotonically. This could be due to several reasons. First, Kimhi (1996) considered all adult household members, while here we only count children/spouses. Second, only 24% of oldest children work on the farm, reflecting the highly diminished role of agriculture in rural Israel in 1995 relative to 1981.

Finally, these are only raw results; we have to see whether they still hold after we control for observed differences among the households, especially age, in a multivariate analysis.

We first apply quasi-maximum likelihood estimation of the off-farm participation equation to the whole sample, allowing for different intercepts for the different groups of households.[12] The model includes three different equations: for the adult male, for the adult female, and for the oldest adult child. We tried to add an equation for a second adult child, but the model did not converge, probably because the number of observations with more than one adult child was not large enough. Many cases of missing values occurred because respondents did not answer the work participation questions. While we suspect that a large fraction of those thought the questions were not relevant for them because they did not work at all, there is no way to confirm this and, hence, we exclude these individuals from the model by attaching zero weights. A few additional observations were excluded because of missing schooling data.[13]

The results are in table 3. We first observe that the three off-farm participation equations are positively correlated. This could be due to two reasons. First, it could be that unobserved household-specific components are important determinants of off-farm labor participation, even after controlling for all the observed attributes. Second, it could be easier for other household members to work off the farm when one member already does so, for example due to the advantage of carpooling. The group dummies have negative coefficients in the males' equation, but only the coefficient of group 4 is statistically significant. In the females' equation, two of the three group dummies have significantly negative coefficients. These results imply that the tendency of farm couples to work off the farm is smaller when adult children are present. This is similar to the raw statistics in table 2. The tendency of the oldest adult child to work off the farm does not depend significantly on the number of adult children.

Age has a typical inverted U effect on participation probability. Ethnic origin has a significant effect in the children's equation only: children with Asian or African origin are more likely to work off the farm. Education has a positive effect on males' participation, as expected, but does not affect off-farm participation of females or children. Agricultural education is no different than general education. Off-farm wages have positive effects on participation for the male and the female but only the female effect is statistically significant. The effect of wage is negative in the children's equation, with no good explanation for this result. Participation is lower in southern regions, but only for the farm couple.

Participation is more likely in farms purchased from a previous owner, except for the case of females. Perhaps this indicates that some operators purchase farms for residential purposes. The male's off-farm participation declines with the level of specialization. This reflects a higher reservation wage on specialized farms for the male, who is in most cases the farm operator. Landholdings have a significantly positive effect on the female's probability of working off the farm and a negative effect on the children's probability. Capital stock, on the other hand, has a significantly negative effect on the off-farm participation probabilities of all household members, as expected. Males' participation probability was lowest in the presence of flower cultivation, the second lowest in poultry farms, the third in field crop farms, and the highest in cattle farms and fruit farms. The same rankings are observed for females, except that flower farms move to the last category with cattle farms and fruit farms. None of the branch dummies was significant in the children's equation. The profitability indexes have negative effects on off-farm participation in general, although not all of the effects are statistically significant. In Arab farm families, females and children are less likely to work off the farm. This may be due to differences in cultural tradition but also to off-farm labor market discrimination.

Next, we allow all the coefficients of the participation equations to vary across the different groups of households, not only the intercepts. For this, we estimate the model separately in each of the groups. The model of group 1 includes only two equations, so it is a bivariate probit model. The model of group 4 did not converge, probably due to the relatively small number of observations. Hence we estimated the model for groups 3 and 4 together, allowing for a different intercept for each of them. The results are not reported here for the sake of brevity, but we do find that the coefficient estimates vary considerably across the groups of households. In table 4, we compare the actual and predicted off-farm participation probabilities of the different models. The predicted probabilities are derived from each of the two models. "Joint estimation" is the model with equal coefficients for all groups of households except for the intercepts (table 3). "Separate estimation" is the model with all the coefficients different. For each of the models, we also calculate the probabilities at the sample means of the explanatory variables, where the means are taken over the whole sample. This last calculation allows us to isolate the genuine effect of the group, neutralizing the different variable means across groups.

For both males and females, the predicted frequencies follow a pattern similar to that of the actual frequencies, namely a general decline with the number of adult children. This is true for both the joint estimation and the separate estimation. When using the sample means of the explanatory variables to generate predicted frequencies, the trend becomes less monotone, but it is qualitatively similar. The decline in both males' and females' predicted participation frequency with the number of adult children is somewhat more moderate when using the sample means. This means that the decline in the farm couples' off-farm work participation with the number of adult children is due in part to the changes in explanatory variables and in part to genuine effects of the adult children.

Extensions

We found evidence for the existence of a negative effect of the number of adult children in the household on the tendency of the parents to work off the farm. As discussed by Kimhi (1996), this effect could be related to farm production considerations and/or to household production considerations. As an example for the farm-related considerations, it could be that adult children satisfy the need of the household for additional income and the diversification of income, so that parents do not have to split their time and can concentrate on their farm work. As an example for the household-related considerations, it could be that the adult children impose time costs on the parents in household production so that their tendency to work off the farm is reduced. In the following paragraphs, we will try to test these possibilities.

To start with the household-related considerations, we examine whether the number of adult children matters less if they maintain a separate consumption unit. In particular, we interact the group dummies in the "joint estimation" model with a dummy variable that indicates whether the household includes more than one consumption unit. The results (table 5) support the hypothesis that the effect of children is related to household production considerations: the negative effects of the number of adult children on the parents' tendency to work off the farm are statistically significant only when the children live with the parents in the same house and do not maintain separate consumption units.[14]

Moving to the farm-related considerations, we examine whether the number of adult children matters more in active farms. We now interact the group dummies with a dummy variable for active farms. The results (table 5) show that the negative effects of the number of adult children on the parents' tendency to work off the farm are statistically significant only in active farms. This supports the hypothesis that the effect of children is related to farm production considerations as well.

Summary and Conclusions

This article demonstrates that family composition matters for the time allocation decisions of adult members of farm families, even in a developed farm sector such as in Israel. The article takes a deeper look at the phenomenon observed in previous research, that the off-farm labor participation behavior of farm operators and their spouses depends on the demographic composition of the household. Using data from a 1995 family farm survey, we estimate jointly the off-farm participation equations of the farm operator, the spouse, and their eldest adult child. The number of adult children has a negative effect on the off-farm participation of farm couples, especially on that of the female. Variation in off-farm labor participation across the groups of households defined by the number of adult children is due in part to observed differences across the groups, and in part to genuine effects of the number of adult children. This negative effect seems to be related to household production as well as farm production considerations.

These conclusions contradict the results of previous research, but only under several qualifications. First, previous research looked at the effects of the number of all adults in the household, not only children, and included different forms of extended households, other than the relatively simple households considered here. Second, the previous research looked at the joint farm and off-farm labor participation decisions, while here we only examined off-farm participation. Finally, it could be that the effects of household composition changed dramatically from 1981 to 1995. All these qualifications could and should be examined in future research.

Another point that should be tackled in future research is the possible endogeneity of the number of adult children in the household. It could be that adult children's choice to live on the farm with their parents depends on the parents’ labor decisions. For example, mothers who do not work off the farm are more available for child care services that are demanded by their married adult children. Prospects for farm succession could also play a role here. Family history is not available in this data set, hence it is difficult to account for this possible endogeneity. However, we expect to be able to match at least part of the sample with the 1981 data, and this may enable tracing, at least in part, children who left the family farm between the two periods.

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Table 1. Definitions of Variables

Variable	Definition
WORKS OFF FARM	Works off the farm or in on-farm non-agricultural activities
AGE	Age in years
BORN IN ISRAEL	Dummy for being born in Israel
ASIA/AFRICA ORIGIN	Respondent or his/her father being born in Asia or Africa
HIGH SCHOOL	High school graduation being the highest level of education
HIGHER EDUCATION	Educational levels higher than high school graduation
AGRIC. EDUCATION	Having some level of agricultural education
OFF-FARM WAGE	Predicted off-farm monthly income (1000 NIS)
PRIVATE	Dummy for private-Jewish localities
ARAB	Dummy for private-Arab localities
NORTH	Dummy for localities in the north
SOUTH	Dummy for localities in the south
ADOLESCENTS	Number of persons 15-21 years of age in the household
CHILDREN	Number of persons under 15 years of age in the household
GROUP 2	The couple has one adult child (at least 22 years of age)
GROUP 2	The couple has two adult children (or a child and spouse)
GROUP 2	The couple has more than two children or spouses
TENURE	Years since obtaining the farm
SUCCEEDED	Operator received the farm by succession
PURCHASED	Operator received the farm by purchase
SPECIALIZED	One branch accounts for at least 90% of farm value added
DIVERSIFIED	An active farm that is not specialized
LAND	Size of permanently held farm land (dunam=1/4 acre)
CAPITAL	Value of buildings, machinery, equipment, and livestock
FLOWERS	Farm engages in cultivation of flowers
POULTRY	Farm engages in poultry production
FIELD CROPS	Farm engages in cultivation of field crops or vegetables
CATTLE	Farm engages in raising beef or dairy cattle
CATTLE PROFIT	Profitability index in cattle
FRUITS PROFIT	Profitability index in fruits
FLOWERS PROFIT	Profitability index in flowers
VEGETABLE PROFIT	Profitability index in vegetables and field crops
POULTRY PROFIT	Profitability index in poultry

Table 2. Descriptive Statistics

Variable	All	Group 1	Group 2	Group 3	Group 4
Male Operator or Spouse					
WORKS ON FARM	0.68	0.63	0.70	0.75	0.79
WORKS OFF FARM	0.55	0.60	0.55	0.46	0.35
AGE	52.85	48.92	56.86	58.88	59.81
BORN IN ISRAEL	0.57	0.67	0.44	0.43	0.39
ASIA/AFRICA ORIGIN	0.23	0.28	0.19	0.18	0.07
HIGH SCHOOL	0.49	0.49	0.51	0.54	0.42
HIGHER EDUCATION	0.14	0.13	0.16	0.12	0.17
AGRICULTURAL EDUCATION	0.07	0.07	0.10	0.05	0.06
OFF-FARM WAGE	4.85	5.14	4.52	4.62	4.00
Female Operator or Spouse					
WORKS ON FARM	0.39	0.26	0.34	0.31	0.33
WORKS OFF FARM	0.46	0.51	0.44	0.45	0.24
AGE	48.79	44.78	52.46	55.00	56.41
BORN IN ISRAEL	0.60	0.70	0.52	0.45	0.42
ASIA/AFRICA ORIGIN	0.27	0.29	0.27	0.27	0.14
HIGH SCHOOL	0.48	0.49	0.48	0.47	0.43
HIGHER EDUCATION	0.13	0.14	0.13	0.11	0.13
AGRICULTURAL EDUCATION	0.05	0.05	0.04	0.05	0.07
OFF-FARM WAGE	2.45	2.57	2.37	2.37	2.07
Oldest Adult Child or Spouse					
WORKS ON FARM	0.24		0.23	0.22	0.29
WORKS OFF FARM	0.69		0.64	0.73	0.72
MALE	0.69		0.64	0.71	0.72
AGE	28.88		25.79	29.52	32.72
BORN IN ISRAEL	0.95		0.96	0.93	0.95
ASIA/AFRICA ORIGIN	0.39		0.41	0.36	0.42
HIGH SCHOOL	0.53		0.48	0.55	0.57
HIGHER EDUCATIO	0.16		0.15	0.18	0.13
AGRICULTURAL EDUCATION	0.05		0.05	0.05	0.06
OFF-FARM WAGE	3.46		3.08	3.79	3.46

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Table 2. (continued)

Variable	All	Group 1	Group 2	Group 3	Group 4
Family, Operator, and Farm					
PRIVATE	0.08	0.09	0.08	0.07	0.03
ARAB	0.20	0.21	0.17	0.16	0.27
NORTH	0.29	0.29	0.36	0.26	0.27
SOUTH	0.24	0.27	0.23	0.16	0.18
ADOLESCENTS	0.80	0.75	1.03	0.90	0.64
CHILDREN	1.50	1.89	0.68	1.05	1.31
TENURE	28.5	26.1	29.0	33.1	34.4
SUCCEEDED	0.31	0.31	0.28	0.29	0.34
PURCHASED	0.28	0.31	0.27	0.22	0.19
SPECIALIZED	0.49	0.50	0.44	0.47	0.54
DIVERSIFIED	0.25	0.21	0.31	0.31	0.27
LAND	29.8	29.3	31.6	29.0	30.6
CAPITAL	100	90	101	123	116
FLOWERS	0.09	0.10	0.08	0.13	0.05
POULTRY	0.16	0.13	0.20	0.23	0.20
FIELD CROPS	0.27	0.24	0.28	0.28	0.39
CATTLE	0.08	0.09	0.06	0.06	0.08
CATTLE PROFITABILITY	0.11	0.11	0.10	0.12	0.14
FRUITS PROFITABILITY	0.46	0.42	0.53	0.52	0.44
FLOWERS PROFITABILITY	0.10	0.10	0.08	0.13	0.04
VEGETABLE PROFITABILITY	0.29	0.27	0.42	0.22	0.28
POULTRY PROFITABILITY	0.13	0.11	0.16	0.16	0.12
OBSERVATIONS	1949	1052	344	328	225

Table 3. Quasi-Maximum Likelihood Estimation Results

	Adult Male		Adult Female		Oldest Child	
Variable	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
CORR. WITH FEMALE	0.2879	5.2340 **				
CORR. WITH CHILD	0.2179	4.4690 **	0.3816	6.6640 **		
CONSTANT	0.6562	0.6050	-2.9112	-2.5190 **	-2.8001	-1.7350 *
GROUP 2	0.0231	0.1840	-0.2721	-1.9050 *		
GROUP 3	-0.1555	-1.1450	-0.1835	-1.2570	0.1737	1.0600
GROUP 4	-0.4353	-2.7140 **	-0.4931	-2.6760 **	-0.0107	-0.0560
MALE					0.4371	3.0780 **
AGE	0.0648	1.5420	0.1702	3.3110 **	0.2475	2.4900 **
AGE SQUARED	-0.1051	-2.6060 **	-0.2187	-4.2070 **	-0.3515	-2.4290 **
BORN IN ISRAEL	0.0069	0.0610	0.1135	1.0700	-0.0385	-0.1480
ASIA/AFRICA ORIGIN	-0.0873	-0.8030	-0.0858	-0.8180	0.2862	1.8230 *
HIGH SCHOOL	0.3835	3.5140 **	-0.0790	-0.6990	0.1588	1.1250
HIGHER EDUCATION	0.6083	4.3560 **	-0.0050	-0.0350	-0.0361	-0.1800
AGRIC. EDUCATION	-0.2474	-1.3620	0.0709	0.3910	-0.0822	-0.3480
OFF-FARM WAGE	0.0686	1.5900	0.3613	4.8620 **	-0.1066	-2.1990 *
MISSING WAGE	-0.0900	-0.3910	0.6443	2.9170 **	0.2259	0.7940
NORTH	-0.0088	-0.0720	-0.1502	-1.2490	-0.1503	-0.9070
SOUTH	-0.3790	-2.8120 **	-0.2289	-1.6860 *	-0.1764	-0.9490
ADOLESCENTS	0.0465	1.0150	-0.0517	-0.9340	0.0308	0.4700
CHILDREN	-0.0367	-1.4840	-0.0409	-1.3520	-0.0221	-0.5680
TENURE	0.0006	0.2140	0.0012	0.3310	0.0010	0.2220
SUCCEEDED	-0.0383	-0.2670	0.0092	0.0670	0.1724	0.7620
PURCHASED	0.2239	1.8020 *	0.0134	0.1090	0.3391	1.7880 *
SPECIALIZED	-0.6390	-3.8430 **	-0.2064	-1.3290	-0.2507	-0.9370
DIVERSIFIED	-0.4645	-2.1330 *	-0.0130	-0.0610	-0.1987	-0.5840
LAND	0.0433	0.2020	0.5847	2.8360 **	-0.5862	-1.7940 *
CAPITAL	-0.1276	-3.8140 **	-0.0633	-2.3960 **	-0.1939	-4.9120 **
FLOWERS	-0.6452	-2.7520 **	0.1165	0.5080	-0.3964	-1.4950
POULTRY	-0.4763	-3.1420 **	-0.4084	-2.5940 **	0.1991	0.7460
FIELD CROPS	-0.4024	-2.8180 **	-0.3379	-2.3780 **	-0.0532	-0.2840
CATTLE	-0.3319	-1.4480	-0.0228	-0.1070	0.0790	0.3210
CATTLE PROFITABILITY	-0.3712	-2.2670 *	-0.1359	-0.9450	0.0215	0.1100
FRUITS PROFITABILITY	-0.1352	-1.7340 *	0.0725	0.8080	-0.0760	-0.6890
FLOWERS PROFITABILITY	-0.1173	-0.6310	-0.3726	-2.1270 *	0.1382	0.6800
VEG. PROFITABILITY	-0.3582	-4.6520 **	-0.0237	-0.2920	-0.1641	-2.4560 **
POULTRY PROFITABILITY	0.0198	0.2600	0.0010	0.0140	-0.7266	-2.4400 **
PRIVATE	-0.1439	-0.7120	-0.0158	-0.0800	-0.5158	-1.4630
ARAB	0.2258	1.0840	-1.8583	-6.9330 **	-1.2437	-3.5220 **

* coefficient significant at 5%; ** coefficient significant at 1%.

Table 4. Comparing Actual and Predicted Off-Farm Participation Frequencies

	Group of Households				
	1	2	3	4	All
Males					
Actual frequency	0.58	0.53	0.43	0.32	0.53
Joint estimation					
Predicted	0.68	0.62	0.43	0.35	0.60
At the means	0.47	0.48	0.41	0.30	0.44
Separate estimation					
Predicted	0.66	0.59	0.46	0.36	
At the means	0.41	0.49	0.28	0.22	
Females					
Actual frequency	0.46	0.39	0.39	0.20	0.41
Joint estimation					
Predicted	0.67	0.62	0.56	0.35	0.61
At the means	0.65	0.54	0.58	0.46	0.60
Separate estimation					
Predicted	0.66	0.54	0.50	0.38	
At the means	0.61	0.26	0.51	0.32	
Children					
Actual frequency		0.54	0.62	0.63	0.59
Joint estimation					
Predicted		0.73	0.89	0.84	0.81
At the means		0.24	0.77	0.71	0.66
Separate estimation					
Predicted		0.71	0.85	0.79	
At the means		0.64	0.70	0.62	

Note: the actual frequencies are somewhat different from those reported in table 1 because of the different treatment of missing values.

Table 5. Selected Additional Results

Variable	Adult Male		Adult Female		Oldest Child	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
Multiple consumption units						
GROUP 2	0.5449	0.963	-0.0503	-0.089		
GROUP 3	-0.1895	-0.859	-0.0097	-0.040	0.2435	1.090
GROUP 4	-0.1185	-0.514	-0.3121	-1.321	0.2760	1.150
Single consumption unit						
GROUP 2	0.0016	0.013	-0.2825	-1.956 *		
GROUP 3	-0.1353	-0.870	-0.2559	-1.571	0.1735	0.987
GROUP 4	-0.6363	-3.196 **	-0.6754	-2.579 **	-0.1640	-0.754
Active farm						
GROUP 2	-0.0360	-0.261	-0.3356	-2.177 *		
GROUP 3	-0.1609	-1.074	-0.1604	-1.000	0.1770	1.079
GROUP 4	-0.4459	-2.608 **	-0.5876	-3.024 **	-0.0105	-0.055
Inactive farm						
GROUP 2	0.3513	1.162	-0.0924	-0.316		
GROUP 3	-0.1331	-0.452	-0.2777	-0.980	0.1770	1.079
GROUP 4	-0.3852	-0.978	-0.2031	-0.491	-0.0105	-0.055

* coefficient significant at 5%.
** coefficient significant at 1%.

Note: The group coefficients in the children's equations were forced to be independent of farm inactivity, otherwise the model run into convergence problems.

Notes

[1] Hundley extends this argument to self-employed families in general. Butler and Horowitz found no difference in labor participation rates in nuclear and extended households. Gong and van Soest found that the existence of other adult females increases the labor supply of mothers with young children. The interdependence of labor decisions of different household members is also supported by the results of Newman and Gertler.

[2] Kimhi (1998) provides a detailed description of the historical institutional structure of Moshavim. However, by 1995 most Moshavim had very little cooperation left.

[3] The agricultural education dummy is independent of the educational level dummies, in the sense that, for example, finishing agricultural high school qualifies for both the first and the third dummies.

[4] We also estimated the model excluding the observations with missing wages, and the results did not change qualitatively.

[5] It is important to note that the number of adult children include only those who are currently residing on the farm, either as part of the parents' household or as a separate "succeeding" household, hence it has nothing to do with the number of children the parents ever had.

[6] In specialized farms, one branch accounts for at least 90% of total value added. Diversified farms include all other farms with positive production. The excluded group are inactive farms. Value added is "normative", meaning that it was calculated using weights attached to physical measures of production, such as size of crop areas and number of animals.

[7] This could be larger or smaller to the size of land that is actually operated. This variable could easily be thought of as exogenous or at least predetermined (Kimhi, 1998).

[8] The use of capital stock as an explanatory variable could be problematic, due to possible endogeneity (Ahituv and Kimhi). We examined the sensitivity of the results to this problem by using the 1981 capital stock instead. The results did not change qualitatively.

[9] Although a farm could have production in more than one branch, we exclude the dummy for fruits in order to avoid collinearity with the specialization dummies through the inactive farms.

[10] This index measures the value added in this branch relative to the mean value added of all farms in the branch. Since the value added is normative, a higher profitability index basically means that within the branch, this farm is growing crops that have relatively high value added.

[11] We do not show the statistics for adult children other than the oldest, since they were not included in the estimated model, as will be explained below.

[12] The Gauss code for estimating this model is available from the author upon request. The procedure accounts for the different probability weights attached to different households, and for missing values.

[13] It should be emphasized that when data were missing for an individual we excluded that individual only, not the whole household.

[14] We only list the coefficients of the group dummies. Full results are available from the author upon request.