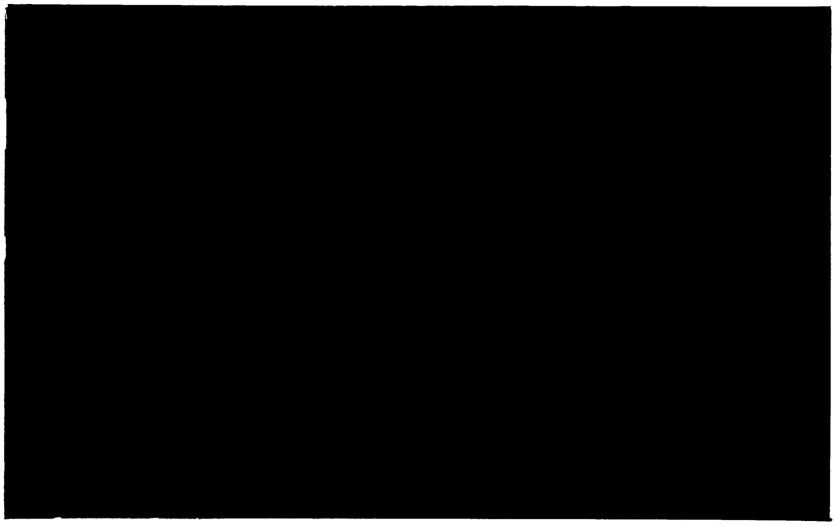
[redacted]

Working Paper

DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS
SYMONS HALL
UNIVERSITY OF MARYLAND
COLLEGE PARK 20742



PART-TIME FARMING VERSUS SPECIALIZATION OF FARM OPERATORS IN FARM OR OFF-FARM WORK: A MULTINOMIAL LOGIT ANALYSIS

by

Ayal Kimhi

Department of Agricultural and Resource Economics
University of Maryland
College Park, Maryland 20742

Working Paper No. 91-20

September 1991

Part-Time Farming Versus Specialization of Farm Operators in Farm or Off-Farm Work: a Multinomial Logit Analysis

by

Ayal Kimhi*

---

* Visiting Assistant Professor, Department of Agricultural and Resource Economics, University of Maryland. This is a revised version of Agricultural Economics Research Paper No. 89:20, University of Chicago. Financial support from the Century program at the University of Chicago and from the Center for Agricultural Economics Research at the Hebrew University is gratefully acknowledged. The research has benefitted from discussions with Gary Becker, Yair Mundlak, Kevin Murphy and Yoram Weiss, and from comments by participants of the Applications workshop and the Agricultural Economics workshop in Chicago, and Agricultural Economics seminars at the University of Maryland and the University of Minnesota. Haim Regev and Meir Rothchild from the Central Bureau of Statistics in Israel deserve special thanks for providing the data set used in this research. All errors are the sole responsibility of the author.

Part-Time Farming Versus Specialization of Farm Operators in Farm or Off-Farm Work: a Multinomial Logit Analysis

This paper presents a theoretical framework for the analysis of farmers' time allocation, in which farm operators are not restricted to work on the farm, and off-farm wages are not necessarily exogenous. Using Israeli data, we estimate a generalized multinomial logit model in which the choices are working only on the farm, allocating the time between farm and off-farm work, or working only off the farm. The latter choice is generally neglected in models of this kind. The results show that the estimated coefficients of the indirect utility function are significantly different for those off-farm workers who also work on the farm and those who don't. The distinction between these two groups of farmers not only improves the precision of estimation; they also enable us to support the working hypothesis, that part-time farming is defined on a daily basis and that off-farm wages are increasing in the number of working hours.

Many farmers divide their time between farming and off-farm employment. The fraction of farmers who work off the farm has been between 20 and 50 percent in many countries. These include both developed economies, e.g. the U.S. (Huffman), Canada (Bollman), Australia (Robinson et al.), or Europe (Robson et al.), and less developed countries, e.g. India (Rosenzweig) or Java (Benjamin).[1]

Occupational choice studies generally assume linear earning functions, and by this rule out the possibility of multiple job-holding. Heckman & Sedlacek (p. 1093), for example, state that "Indifference (between jobs) occurs on a set of measure zero..." Gronau uses decreasing "wages" in home production to explain Women's time allocation. Similarly, the farm-household literature (Singh et al.) assumes decreasing marginal product of labor in agriculture. Many part-time farming studies, such as those of Sumner, Simpson & Kapitani, Lopez (1986), Huffman & Lange, Lass et al., Gebauer, and Jacoby, have used this assumption.

All these studies, however, maintained another crucial assumption: that the farm-operator always works on his farm. This assumption is not consistent with empirical findings that the majority of part-time farmers work full-time off the farm (Oliviera) and that a non-negligible fraction of farm operators report that they don't work on farm (Kimhi).

This paper suggests a symmetric treatment of farm and off-farm work, both theoretically and empirically. We show that when general earning functions are assumed in both sectors (farm and off-farm), it is possible that some farm operators will not work on the farm.

Concentrating on the participation problem, the combination of two discrete choices results in four possibilities: working on farm only; working both on and off the farm; working off-farm only; and not working at all. For each possibility we derive an indirect utility function, and show how to estimate its parameters with a generalized multinomial logit model, knowing the optimal choice. We estimate the model using data from Israel, and use the results to test the hypothesis that off-farm work decisions of farmers are independent of their farm work decisions.

Theoretical Model

This model relies on the farm-household framework. It deals with one-person households and ignores the division of labor within the family. It also abstracts from compensating differentials between occupations. Each farmer maximizes utility of consumption and leisure subject to time and budget constraints.

The maximization problem is:

$$\max_{Th,c,Tf,Tm} \quad u(Th\ ,\ c)$$

s.t.

1. $c \leq \pi(p;Tf,A) + y(Tm;b) + i$
2. $Th + Tf + Tm \leq T$
3. $Tf \geq 0$
4. $Tm \geq 0$

where:

Th = time spent on home activities

c = aggregate consumption good, whose price is a numeraire.

p = price vector of net outputs of the farm.

Tf = farmer's time used on the farm.

A = vector of fixed farm inputs and other profit shifters.

Tm = farmer's off-farm hours of work.

b = personal characteristics and other earnings shifters.

i = non-labor, off-farm income.

y is the earning function in non-agricultural occupations,[2] where y_1 is positive but not necessarily independent of Tm.[3] π is the conditional variable profit function, as suggested by Lopez (1982), which is defined by :

$$\pi(p;Tf,A) = \max_{q} \{\langle p,q\rangle : (q,Tf,A) \in \tau\}$$

where q is a net output vector and τ is the technology set. This formulation allows for multi-product, multi-input production processes. Technically, there is no distinction between prices and other profit shifters. Therefore, we can simplify notation by writing: $\pi(Tf;a) \equiv \pi(p;Tf,A)$; $a = (p,A)$.

We use the Kuhn-Tucker theorem to characterize the optimal behavior of the farmer. We construct the lagrangian :

$$\pounds = u(Th,c) + \sigma\cdot[\pi(Tf;a) + y(Tm;b) + i - c] + \mu\cdot(T-Th-Tf-Tm) + \\ + \delta\cdot Tf + \phi\cdot Tm$$

which has to be maximized over choices of Th, c, Tf and Tm, and minimized over σ, μ, δ and ϕ. Assuming that the first derivatives of the utility function go to infinity as the respective arguments approach zero, the conditions for an optimum are:

(1) $u_1 - \mu = 0$

(2) $u_2 - \sigma = 0$

(3) $\sigma \cdot \pi_1 - \mu + \delta = 0$

(4) $\sigma \cdot y_1 - \mu + \phi = 0$

(5) $\delta \geq 0 \quad ; \quad Tf \geq 0 \quad ; \quad \delta \cdot Tf = 0$

(6) $\phi \geq 0 \quad ; \quad Tm \geq 0 \quad ; \quad \phi \cdot Tm = 0$

(7) $\pi(Tf;a) + y(Tm;b) + i - c = 0$

(8) $T - Th - Tf - Tm = 0$

Dividing (1) by (2), we get μ/σ as the shadow price of leisure in terms of consumption, to be denoted "Wh". If labor is not supplied at all, so that Tf=Tm=0, then (3) and (5) imply that $\pi_1 \leq Wh$; (4) and (6) imply that $y_1 \leq Wh$.

If labor is used on the farm, then $Tf > 0$ and by (5), $\delta = 0$. (3) implies that $\pi_1 = Wh$ in this case. If labor is used in off-farm work, then $Tm > 0$ and by (6), $\phi = 0$. In this case, (4) implies that $y_1 = Wh$.

If the farmer works both on and off the farm, then $\pi_1=y_1=Wh$. Given this interior solution, the system (1)-(8) is reduced to (1)-(4) in which $\delta = \phi = 0$. A solution exists for this system, in the form of Th^*, c^*, Tf^*, Tm^*, σ^* and μ^* as functions of a, b, i and T.

The second order conditions for this case are:

$$(9) \qquad (\pi_{11} + y_{11})\cdot(u_{22}\cdot Wh^2 - 2\cdot u_{12}\cdot Wh + u_{11}) + \sigma\cdot\pi_{11}\cdot y_{11} \geq 0$$

$$(10) \qquad \pi_{11} + y_{11} \leq 0$$

The interpretation of (10) is that the internal solution for the allocation of time between the two occupations is optimal. (9) implies that the indifference curve is more convex than the budget constraint around the optimum, which ensures the optimality of the total time worked. An interesting implication of (10) is that the convexity of either profits or earnings is not ruled out (provided that the other function is concave "enough").

If the farmer does not work off the farm, then the first order conditions are (1), (2), (3) in which $\delta=0$, and (4) in which $Tm=0$. The second order condition for this case is:

$$(11) \qquad u_{11} + \sigma\cdot\pi_{11} + Wh^2\cdot u_{22} - 2\cdot Wh\cdot u_{12} \leq 0$$

If the farmer does not work on his farm, the result is symmetric: the first order conditions are (1), (2), (3) in which $Tf=0$, and (4) in which $\phi=0$. The second order condition is :

$$(12) \qquad u_{11} + \sigma\cdot y_{11} + Wh^2\cdot u_{22} - 2\cdot Wh\cdot u_{12} \leq 0$$

These results depend heavily on the absence of fixed costs of various kinds. For example, if there exists a cost associated with travel to off-farm work, the farmer might not work off-farm even when his marginal earnings are higher there.

The indirect utility function is derived by the following procedure. (3) and (4) can be solved, respectively, to get:

(13) $Tf^{*} = Tf(a;\mu/\sigma,\delta/\sigma)$

(14) $Tm^{*} = Tm(b;\mu/\sigma,\phi/\sigma)$.

Then, from (7) and (8), respectively, we get:

(15) $c^{*}(a,b,i;\mu/\sigma,\delta/\sigma,\phi/\sigma) = i + \pi(Tf^{*};a) + y(Tm^{*};b)$

(16) $Th^{*}(a,b,T;\mu/\sigma,\delta/\sigma,\phi/\sigma) = T-Tf^{*}-Tm^{*}$.

Using (1) and (2), we solve for μ/σ and write the reduced forms as:

(17) $c^{*} = c(a,b,i;\delta/\sigma,\phi/\sigma)$

(18) $Th^{*} = Th(a,b,T;\delta/\sigma,\phi/\sigma)$.

and derive the indirect utility function:

(19) $v(a,b,i,T;\delta/\sigma,\phi/\sigma) = u(c^{*},Th^{*})$.

Empirical Model and Estimation Procedure

It is clear that the indirect utility function is conditioned on δ/σ and ϕ/σ, which are unobserved other than whether they are zero or not. In the case in which they are positive, they can be expressed as $P_f(a,b,i,T)+\varepsilon_f$ and $P_m(a,b,i,T)+\varepsilon_m$, respectively, where $E(\varepsilon_f|a,b,i,T)=E(\varepsilon_m|a,b,i,T)=0$, $P(\cdot)$ are projections and $E(\cdot)$ are expectations. Inserting these expressions into (19), we get for the four possible discrete choices:

(20) $v_1 = v(a,b,i,T;0,P_m(a,b,i,T)+\varepsilon_m)$ (farm only)

(21) $v_2 = v(a,b,i,T;0,0)$ (on and off farm)

(22) $v_3 = v(a,b,i,T;P_f(a,b,i,T)+\varepsilon_f,0)$ (off-farm only)

(23) $v_4 = v(a,b,i,T;P_f(a,b,i,T)+\varepsilon_f,P_m(a,b,i,T)+\varepsilon_m)$ (not working).

Linearizing the system as a first order approximation, we get:

(24) $v_j = a\cdot\alpha_j + b\cdot\beta_j + \gamma_j\cdot i + \delta_j\cdot T + \varepsilon_j;$ $j=1...4.$

where the parameters $(\alpha,\beta,\gamma,\delta)$ are different for each j, and the errors ε are comprised of projection and approximation errors. Assuming that the errors are distributed as independent type-I extreme value, we can estimate the model using the universal multinomial logit model (Amemiya p. 307).

The Population and the Data

The population of interest here is comprised of family farms in Israeli Moshavim. Moshavim is the Hebrew name (in plural form) for cooperative villages. In each Moshav, membership is by family; each of which maintains its own household, farms its own allocation of land and earns its income from what it produces. Only matters of mutual concern are handled collectively. This structure is different from that of the better known Kibbutz collectives. In the latter, the family has no economic or social role; membership is individual, all property is community-owned, and work and consumption are equally shared by all members.

41 percent of Israeli farm population lived on Moshavim, in 1981 (State of Israel). They held 40% of agricultural land, 56% of the capital stock, and were responsible for 46% of the value of production. Only about 3% of the output was produced in private farms. The other half belonged to the Kibbutzim.

The Moshav is taking advantage of economies of scale by dealing collectively with purchasing, marketing, investments and credit, and operating as a member in regional and national organizations (Zusman). It is also responsible for education and social activities, and acts as a municipal entity. In order to finance its activities, the Moshav taxes its members. These taxes are based in part on user fees, when applicable, but most of them are on a per-family basis. Each Moshav is supplying credit to its members. Therefore it has to control their income flows by organizing the marketing activities. Getting credit relies mainly on mutual liability and guaranty contracts that are signed between a Moshav and all its members. Similar contracts are signed between Moshavim and their regional and national organizations. This institution helps to enforce the cooperative norms. Its application depends mainly on social pressure, though, and its effect weakens when the majority of family income comes from off-farm sources.

The data set is based on a sample of around 500 Moshav farms which were surveyed in 1976. 382 of those farms were also identified in at least one of the two current censuses of agriculture, 1971 and 1981, and these form the data set used here. Each farm is observed in at least two points in time. However, in many cases the farm operators are not identical across time periods. Therefore, we cannot treat this data set as a panel.

The data set contains information on personal characteristics of the farm operators, the farming activities, the allocation of time of the operator and his family (in qualitative terms),[4] and characteristics of the Moshav. After incomplete observations were disposed of, 916 observations were left. Table 1 summarizes the information on the time allocation of the farm operators.[5]

Estimation and Results

Very few observations were in the "not working" situation. These were excluded from the estimation. In the multinomial logit framework, if the indirect utility is a linear combination of the explanatory variables, only differences between coefficients of a variable in two equations are identified. In practice, we normalized the coefficients of equation 3 (off-farm only) to zero. The coefficients of the other equations are interpreted as differences.

The relatively small number of observations forced us to pool the three periods of observations and treat them as independent observations, ignoring the fact that in many cases we had multiple observations on the same person in different periods. This is equivalent to estimating the model for each time period separately, while imposing equal parameters across time periods. However, we included birth year as well as age in the set of explanatory variables, in order to identify cohort effects. Holding birth year constant, the age coefficient measures the difference in probabilities of person A who was born in time T_0, between observations at T_1 and $T_1+\delta$. Holding age constant, the birth year coefficient measures the difference in probability between the same person A who is observed at T_1, and person B who was born in time $T_0+\delta$ and is observed in time $T_1+\delta$. The difference between the coefficients of birth year and age measures the difference in probability between person A and person B, when both are observed in time T_1. This is the net cross sectional age effect.

We also included an index of the terms of trade of agriculture, as a variable that is constant across farmers but changes over time. This is a more informative variable than an alternative set of year dummies. Other explanatory variables include a dummy for high school or higher education, family size, land, capital, a dummy for having a dairy farm, distance to town, and a dummy for mountain regions. Table 2 includes descriptive statistics of these variables.

The multinomial logit model was estimated by the relevant application of Gauss (version 1.49); the results are presented in table 3. Other than distance to town, all the variables were significant in at least one of the equations. The estimated coefficients are sometimes hard to interpret since (a) they are actually differences between parameters of two equations; and (b) they measure infinitesimal changes while the explanatory variables often change discretely. Therefore, we used the coefficients to calculate the changes in the probabilities of being in each one of the three situations, after a discrete change in each explanatory variable. These are reported in table 4.

Analysis of these effects shows that some of the variables affect off-farm versus on-farm employment. This is characterized by effects of opposite signs on the "farm only" situation and on the other two situations, in which the farmer works off the farm, concurrently or not with farm work. These variables include education and family size, which affect the probability of working off the farm positively, and on the other hand land size, capital stock and "dairy farm", which affect it negatively.[6] These results are consistent with those of other studies which have modeled the decision to work off the farm.

The other variables seem to affect part time farming versus specialization either in farming or off-farm work. These variables deserve a more detailed discussion, since with the exception of Kimhi, there is no other example in the literature in which specialization in off-farm work is explicitly modeled.

Age affects the probability of part-time negatively. Older farmers tend to specialize in farming, while the young tend to be part-time farmers. Age does not significantly affect the probability to specialize in off-farm work.[7] This may be due to the total decline in labor supply with age. It can also be related to the life-cycle of the farm as a business, or the division of labor within the household.

Distance to town is negatively correlated with part-time farming. This is a proxy for the fixed costs of daily travel to work. Behind every study of farmers' off-farm work, there has been the dilemma whether a part-time farmer is a farmer who works part of every working day off the farm, a few full days every week, or a number of full weeks per year. We see that distance increases the probability to specialize in an off-farm job as well as in agriculture. This doesn't make sense if the off-farm wage rate is independent of the number of hours worked per day. It is plausible if wages in off-farm jobs are rising in the number of hours worked.[8] The income effect works in the direction of increased labor supply in both sectors, as long as the number of travels to work doesn't change. An increase in the fixed cost of travel makes full-day off-farm jobs more desirable than part-day jobs, and that's why the number of off-farm specializers increases. Therefore, the result supports the view that part-time farming is defined in terms of daily allocation of time between on and off farm employment, rather than weekly or seasonally only.[9]

When moving to the mountain regions, other things equal, farmers tend to be part-time farmers rather than work full-time off the farm, while their tendency to work only on the farm remains almost the same. This can be a result of various factors: (a) Agriculture is less profitable in the mountains, so farmers seek other sources of income. (b) On the other hand, wages are significantly lower in these areas, so they are less likely to find a satisfactory full-time off-farm job. (c) Social and cultural differences between the populations of the different regions are also likely to play a role here.

An index of terms of trade in agriculture is used here as an informative substitute for year dummies. It declined by about 4.5% from 1971 to 1975, and by an additional 25% from 1975 to 1981. This change contributed positively to the probability of being a part-time farmer and negatively to the probability of specializing, which is consistent with the changes over time in the fractions of farmers in these categories (table 1. Remember that non-workers are excluded, so that the 1981 figures are in fact higher).

Summary and Conclusions

Our theoretical model treated farm work and off-farm work symmetrically. Farmers were allowed not to work on the farm, and off-farm wages were allowed to be endogenous. In order to test the importance of these properties, we used Israeli census data to estimate a multinomial logit model. The equations in the model represented indirect utility functions conditioned on being in one of three states: working only on the farm; working both on and off the farm; or working off-farm only.

The empirical results show that participation decisions of Moshav farmers in Israel are sensitive to personal and family characteristics, to farm attributes and to other factors related to the location of their farm. The results are consistent with the views that the relevant unit for the allocation of time is a single day, and that increasing endogenous wages provide an incentive to work full-time rather than part-time off the farm. These conclusions would not have been possible without the distinction of farm operators that don't work on the farm from the majority of them who do.

Notes

1. Fractions are not comparable across countries due to differences in definitions. For example, Bollman indicates that the inclusion of those who reported no days of work off the farm but positive off-farm income, would have increased the fraction of part-time farmers from 34% to over 50%. See also Gasson.

2. The case of a farmer that works on other farms as a second job is ruled out here. Hayghe & Michelotti report that only about 7.5% of U.S. farm operators had an agricultural off-farm job in 1970, while in Canada this fraction was 20% for 1971 (Bollman). In our 1975 sample, 11.3% of farm-operators worked on other farms. Benjamin reports that 13.4% of his sample's households had a male employed in an off-farm agricultural job.

3. f_i is the partial derivative of the function f with respect to its i'th argument.

4. For each family member, it is reported whether he was employed (during the year) on the farm and\or off the farm, on a full time or part time basis. The farm-operator is defined as the family member who is responsible for economic and farming activities.

5. There is some confusion with respect to the 1981 data. They seem to over-represent non-farming families (Kimhi), even though all

1981 observations were identified in the 1975 survey, which was not supposed to include these families.

6. It may be legitimately claimed that the last three are endogenous. However, Allocation of land within the Moshav is historically determined; changes in land size can be made in exceptional cases by forming partnerships or by illegal rental agreements. Capital stock is a proxy for production capacity here, which is assumed to be exogenous in the short run in which our model is defined. Dairy farming is subject to restrictive production quotas; the fact that dairy farming has been the most stable and profitable branch of agriculture over the long run has made these quotas valuable, so it is unlikely that any farmer will dispose of his quota due to short run considerations. The analysis can be thought of as conditional on farm structure. This has been implicitly done in other studies as well, e.g. Oliviera.

7. In fact, standard errors of these effects are unknown, and therefore a formal significance test was not performed.

8. We have shown in the empirical analysis that this does not violate the second order conditions, as long as farm profits are concave enough in farm labor supply.

9. The distance variable might, of course, be in part a proxy for regional variation that is not captured by the mountain dummy.

References

Amemiya, T. (1985). *Advanced Econometrics*. Cambridge: Harvard University Press.

Benjamin, D (1988). *Household Composition and Labor Demand: A Test of Rural Labor Market Efficiency*. Working Paper #244, Industrial Relations Section, Princeton University.

Bollman, R.D. (1979). *Off-Farm Work by Farmers*. Ottawa: Statistics Canada.

Gasson, R. (1991). "Part-Time Farming: A Note on Definitions - Comment." *Journal of Agricultural Economics* 42:200-1.

Gebauer, R.H. (1989). *Non-farm Labour Supply: Empirical evidence from West Germany*. Department of Agricultural Economics, University of Gottingen.

Gronau, R. (1977). "Leisure, Home Production, and Work- the Theory of the Allocation of Time Revisited." *Journal of Political Economy* 85:1099-123.

Hayghe, H.V. & Michelotti, K. (1971). "Multiple Jobholding in 1970 and 1971." *Monthly Labor Review* 94:38-45.

Heckman, J.J. & Sedlacek, G. (1985). "Heterogeneity, Aggregation and Market Wage Functions: An Empirical Model of Self-Selection in the Labor Market." *Journal of Political Economy* 93:1077-125.

Huffman, W.E. (1980). "Farm and Off-Farm Work Decisions: The Role of Human Capital." *Review of Economics and Statistics* LXII:14-23.

_____ **& Lange, M.D.** (1989). "Off-Farm Work Decisions of Husbands and Wives: Joint Decision Making." *Review of Economics and Statistics* LXXXI:471-80.

Jacoby, H.G. (1989). *A Shadow Wage Approach to Estimating a Labor Supply Model for Peasant Households: an Application to the Peruvian Sierra*. Ph.D. Dissertation, University of Chicago.

Kimhi, A. (1991). *The Relevance of the Extent of Farm Work to the Analysis of Off-Farm Labor Supply of Farmers*. Working Paper No. 91-11, Department of Agricultural and Resource Economics, University of Maryland.

Lass, D.A., Findeis, J.L. & Hallberg, M.C. (1989). "Off-Farm Employment Decisions by Massachusetts Farm Households." *Northeastern Journal of Agricultural and Resource Economics* 18:149-59.

Lopez, R.E. (1982). "Applications of Duality Theory to Agriculture." *Western Journal of Agricultural Economics* 7:353-65.

______ (1986). "Structural Models of the Farm Household That Allow for Interdependent Utility and Profit Maximization Decisions." in *Agricultural Household Models : Extensions, Applications and Policy*, eds. I. Singh, L. Squire & J. Strauss. Baltimore: The John Hopkins University Press.

Oliveira, V.J. (1990). *Nonfarm Employment of Farm Operators, Hired Farmworkers, and Unpaid Farmworkers*. Agricultural Economic Report No. 624. Washington, D.C.: ERS, USDA.

Robinson, C., McMahon, P. & Quiggin, J. (1982). "Labour Supply and Off-Farm Work by Farmers: Theory and Estimation." *Australian Journal of Agricultural Economics* 26:23-38.

Robson, N., Gasson, R. & Hill, B. (1987). "Part-Time Farming - Implications for Farm Family Income." *Journal of Agricultural Economics* 38:167-90.

Rosenzweig, M. (1980). "Neoclassical Theory and the Optimizing Peasant: An Econometric Analysis of Market Family Labor Supply in a Developing Country." *Quarterly Journal of Economics* XCIV:31-55.

Simpson, W. & Kapitani, M. (1983). "The Off-Farm Work Behavior of Farm Operators." *American Journal of Agricultural Economics* 65:801-5.

Singh, I., Squire, L. & Strauss, J. (1986). "The Basic Model: Theory, Empirical Results And Policy Conclusions." in *Agricultural Household Models : Extensions, Applications and Policy*, eds. I. Singh, L. Squire & J. Strauss. Baltimore: The John Hopkins University Press.

State of Israel, Central Bureau of Statistics (1985). *The Village in Israel*. Publications of Agriculture and Rural Census 1981, No. 2. Jerusalem, Israel.

Sumner, D.A. (1982). "The Off-Farm Labor Supply of Farmers." *American Journal of Agricultural Economics* 64:499-509.

Zusman, P. (1988). *Individual Behavior and Social Choice in a Cooperative Settlement, The Theory and Practice of the Israeli Moshav*. Jerusalem, Israel: Magnes Press.

Table 1: Time Allocation of Sample Farm Operators (percent)

	1971		1975		1981	
not working	0		1		14	
on-farm only	60	100	57	100	47	100
full time		95		65		81
part time		5		35		19
off-farm only	15	100	11	100	16	100
full time		94		95		88
part time		6		5		12
on and off farm	25	100	31	100	23	100
full on & full off		0		4		0
full on & part off		11		20		11
part on & full off		56		58		68
part on & part off		33		18		21
number of farms	216		380		320	

Table 2: Variables Used in the Estimation

1. Quantitative

	Mean	S. D.	Range	Units
AGE	47.2	12.49	18-77	years
BIRTH YEAR	28.7	12.37	-2-63	calendar year
LAND SIZE	30.7	24.74	1-240	dunams[a]
CAPITAL STOCK[b]	90.0	107.70	0-1216	$1000 (1987)
FAMILY SIZE	5.5	2.84	1-16	heads
DISTANCE TO TOWN[c]	9.1	7.99	0.9-47.4	miles

2. Qualitative

	Percent
WORKING ON-FARM ONLY[d]	57%
WORKING ON AND OFF THE FARM[d]	29%
WORKING OFF-FARM ONLY[d]	14%
HIGH-SCHOOL OR HIGHER EDUCATION	42.5%
MOUNTAIN REGION	28.7%
DAIRY FARM[e]	24.0%

3. Other

	1971	1975	1981	Units
TERMS OF TRADE	0	-4.5	-28.1	percents, difference from 1971 index

Notes: Number of Observations: 854

[a] 1 dunam = 0.23 acre.
[b] Gross, normative value.
[c] Straight line distance to nearest town of over 25000.
[d] Of all working farm operators.
[e] Having a positive number of milk cows.

Table 3: Multinomial Logit Maximum Likelihood Estimates

	ON-FARM ONLY		PART-TIME	
CONSTANT	-14.160274	(-1.6)	-26.445769	(-2.9)
AGE	0.197754	(1.6)	0.348052	(2.8)
BIRTH YEAR	0.165786	(1.4)	0.367341	(3.0)
EDUCATION	-0.805678	(-2.8)	-0.325487	(-1.1)
LAND SIZE	0.031670	(3.6)	0.014510	(1.6)
CAPITAL	0.329951	(8.5)	0.290927	(7.5)
DAIRY FARM	1.039912	(2.1)	0.643020	(1.2)
FAMILY SIZE	-0.116015	(-2.6)	-0.078107	(-1.7)
DISTANCE TO TOWN	-0.010178	(-0.6)	-0.029452	(-1.7)
MOUNTAIN	1.314653	(3.7)	1.665972	(4.6)
TERMS OF TRADE	0.088000	(2.2)	0.144454	(3.6)

-2*Log Likelihood: 1251.406770

Notes: Coefficients of the "off-farm only" group were normalized to zero. t-statistics in parentheses.

Table 4: The Effects of Discrete Changes in the Explanatory Variables on the Probabilities of the Three Situations

	CHANGE	ON ONLY	BOTH	OFF ONLY
AGE	+10 years	8.33	-7.59	-0.74
EDUCATION	0 to 1	-10.25	4.94	5.31
LAND SIZE	double	8.90	-4.90	-4.00
CAPITAL STOCK	double	9.39	-2.72	-6.67
DAIRY FARM	0 to 1	10.11	-3.49	-6.62
FAMILY SIZE	+20%	-1.20	0.18	1.02
DISTANCE TO TOWN	double	1.70	-3.21	1.51
MOUNTAIN AREA	0 to 1	0.65	11.90	-12.55
TERMS OF TRADE	+20 points	-5.79	13.72	-7.94

Note: Changes in the probabilities are expressed in percentage points.