AN ECONOMETRIC ANALYSIS OF OFF-FARM LABOR PARTICIPATION AMONG U.S. FARM FAMILIES, 1977-1998.

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Abstract

Analyses of a sample of U.S. farm families based on March Current Population data for 1977-98 show that off-farm work decisions are made jointly by farm couples. Demographic differences across households are shown to have very important effects, while traditional farm policies appear less likely to influence off-farm work decisions.

1. Introduction

Since World War II, there have been declines in farm employment in most developed countries (Barkley, 1990; Findeis, 1998; Weiss, 1998). The change in the share of farm jobs as a proportion of total employment reflects structural changes being witnessed in agriculture. In the U.S., the change in the structure of production agriculture is manifested in a number of ways including a declining number of farms and a reduction in the total land in farms, with a corresponding increase in average farm size[1] (Gebremedhin and Christy, 1996).

One of the important effects of the changing structure of production agriculture in the United States, as well as in other developed countries, is the decline in labor utilization in farming in the last fifty years. Bollman, Whitener, and Tung (1995) reported that in the U.S. and Canada, capital/labor input ratios have steadily increased as capital is substituted for labor. Also, labor inputs are said to have declined as chemical and machinery inputs have increased. In reporting annual changes in U.S. farm labor input (total, self-employed and hired labor) over the 1984-94 period, Ahearn, Yee, Ball, and Nehring (1997) showed that labor inputs used in U.S. production agriculture declined an average of 2.73 percent annually. They show that self-employed labor and hired farm labor declined an average 2.88 percent and 2.27 per annum, respectively. Jean (1996), in a comparative study of off-farm labor employment of farm families in France, Canada, Poland, Tunisia, and Brazil, notes that many farm families rely on local off-farm labor markets for their survival. The decreasing need for agricultural labor, in conjunction with other "pull factors" in the off-farm or external labor market, tend to cause farm families to pursue non-farm employment opportunities[2]. Labor formerly engaged in farming has adjusted into off-farm work, either through farm exit or through increased participation in multiple job-holding, both on-farm and off-farm.

Over time, off-farm income has increased in importance for many farm families in the U.S. For instance, in 1960, net farm income constituted 47.2 percent of average farm household total income, while off-farm income accounted for about 53 percent. By 1997, the proportion of total household income

[1] A farm had been variously defined in the past, but the current definition, which was first used for the 1974 census, is any place from which agricultural products worth $1,000 or more were produced or sold, or normally would have been sold, during the census year (USDA, Census of Agriculture, 1992).

contributed by net farm income had declined to 11.4 percent, while income from off-farm sources accounted for the balance of 88.6 percent (USDA, ERS 1999[c]). The increasing dependence on off-farm employment witnessed in recent decades has important implications for the level and stability of farm household incomes. The economic well-being of farm families earning negative or low net farm incomes has been increasingly dependent on dual employment, both on the farm and off-farm by farm family members. Larson (1976) posited that off-farm income has improved the relative incomes of farm families and has reduced the income disparity between farms, benefiting low-income families the most. Gardner (1992) complements this assertion by observing that for many small U.S. farms in the 1950s, off-farm employment accounted for the main source of farm household income.

Given the growing importance of off-farm income to farm families in the past four decades, there is a need to rethink what policies will stabilize and raise farm family incomes. As pointed out above, there has been a dramatic change in the U.S. farm sector, characterized by a decline in on-farm employment accompanied by a reduction in the average share of net farm income in total farm household income. Over time, more and more farm family members have become employed off-farm to supplement their farm income, thereby reducing the variability of household income (Schultz, 1980). Lass, Findeis, and Hallberg (1991) and Huffman and El-Osta (1997) noted that off-farm employment and multiple job-holding by farm households are not peculiar to the United States only, but also are established phenomena in other Western countries.

The off-farm work participation of farm households has attracted increased research attention in the past two decades and many factors have been hypothesized to influence the off-farm work participation decision and off-farm labor supply of farm families (Corsi and Findeis, 2000; Huffman and El-Osta, 1997; Kimhi, 1996; Tokle and Huffman, 1991; and Huffman and Lange, 1989). Other empirical studies that have investigated factors affecting wage work participation include Woldehanna *et al.*, 2000; Mishra and Goodwin , 1997; Alwang and Stallmann, 1992; Tokle and Huffman ,1991; Tokle, 1988; Reddy, 1987; among others.

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[2] These include factors such as off-farm wages (or the net returns from non-farm self-employment) that exceed marginal net returns to farm labor, improved transportation and information networks which lower associated with some off-farm employment.

This paper uses the March Current Population Survey data spanning a 21-year period and for the U.S., thereby providing cross-sectional variation as well as variations over time. In view of the issues outlined above, the objectives of this paper are (a) to identify factors influencing off-farm work participation among farm men, (b) to identify factors that affect off-farm work participation decisions among farm women, and (c) to determine whether or not off-farm work participation decisions by farm couples are jointly made. Section 2 discusses the theoretical framework and model specification for off-farm work participation decisions of farm households in the U.S. Data and estimation methods are discussed in section 3. In section 4, we discuss the results, while section 5 closes with the study summary and conclusions.

2. Theoretical Framework and Model Specification

The farm household model is the basis of the theoretical framework used for this study, following the household model as developed by Singh, Squire, and Strauss, 1986; and later modified by Huffman, 1991; and Huffman and El-Osta, 1997. The labor supply decisions of members of farm operator households are derived from a behavioral model that permits both farm and off-farm work (Huffman, 1991). The optimal time allocation by farm married couples between leisure, on-farm work, and off-farm work is obtained by the following optimization problem, assuming that the decision unit considered is a risk-neutral single-family farm household with one utility function and that the operator's and spouse's times are heterogeneous:

$$\text{Maximize } U = U(T_L^o, T_L^s, C; Z^o, Z^s, \boldsymbol{t}) \tag{1}$$

Subject to the following constraints:

$$\overline{T}^i = T_f^i + T_m^i + T_L^i, T_m^i \geq 0 \qquad \text{i=o, s} \tag{2}$$

$$P_c C = \sum_i W_m^i T_m^i + (P_q Q - W_x X) + V \tag{3}$$

$$Q = Q(T_f^o, T_f^s, X; Z^o, Z^s, \boldsymbol{f}) \tag{4}$$

where:

U = farm household's utility (or welfare function);

T_L^o = operator's (o) hours of leisure;

T_L^s = spouse's (s) hours of leisure;

C = goods and services purchased in the market;

Z^o = operator's human capital;

Z^s = spouse's human capital;

$\boldsymbol{t}$ = other factors such as life-stage and number of children;

$\overline{T}^i$ = total time endowment (in hours) for the operator and spouse (i = o, s);

T_f^i = time allocated to farm work (i = o, s);

T_m^i = time allocated to off-farm work (i = o, s);

P_c = price of consumption good, C;

W_m^i = hourly wage for non-farm work (i = o, s);

P_q = price of farm output, Q;

W_x = price of purchased farm inputs, X, including hired farm labor;

$(P_qQ\text{-}W_xX)$ = net farm income;

$\boldsymbol{f}$ = location specific characteristics such as local climate and soils;

V = unearned or passive income.

Equation (2) represents the total time endowment available to an individual, where time not spent working is consumed as leisure time. The constraint imposed on T_m^i is to reflect the possibility that optimal off-farm work hours for an individual might be zero in any period. This model assumes that the time allocated to farm work is positive for each individual, i.e., $T_f^i > 0$. Equation (3) represents the total income of the farm household as the sum of off-farm wages, net farm income, and income from sources other than from off-farm employment or farming, i.e., passive income. The constraint represented by equation (3) assumes that all income is spent on the purchase of goods and services, i.e., no saving is assumed.

In addition, a third constraint incorporated in the model is the farm production function as shown in equation (4). Although most farms produce a variety of outputs, the model assumes that one (aggregate)

output *Q* is produced using the operator's and spouse's farm time and purchased inputs *X*, including hired farm labor. The efficiency of farm production is assumed to be dependent upon human capital, Z^i, of the farm operator and spouse. This might include formal schooling or prior farming experience. Other exogenous farm characteristics are represented by f in equation (4), for example, annual precipitation and soil characteristics.

On the demand side, the offered wage for non-farm work, i.e., W_m^i where i=o, s, in equation (3), represents the off-farm labor demand being faced by the operator (or spouse). This wage is assumed to depend on the individual's stock of human capital (Z^i) and job or locational characteristics, such as local labor market conditions (*N*), local cost-of-living (*L*), and locational amenities (A), but not on the amount of current off-farm work hours (Topel and Ward, 1988; Kenny and Denslow, 1980; Tokle and Huffman, 1991). An equilibrium is established between local labor markets by mobility of both human capital (embodied in workers) and employers. That is, there exist compensating wage differentials for important personal, local labor market, and local amenity factors (Rosen, 1986; Topel and Ward, 1988). The implicit off-farm labor demand function is as stated below:

$$W_m^i = W_m^i(Z^i, N, L, A) \qquad \text{i=o, s.} \tag{5}$$

Substituting the farm production (3.7) function into the cash income constraint (3), and re-arranging, a combined cash income-technology constraint is obtained as follows:

$$\sum_i W_m^i T_m^i + [P_q Q(T_f^o, T_f^s, X; Z^o, Z^s, f)] - W_x X + V - P_c C = 0 \tag{6}$$

Combining equations (1), (2), and (6), the corresponding Lagrangian function is:

$$\text{Max. L} = U(T_L^o, T_L^s, C; Z^o, Z^s, t)$$

$$+ l\,[\sum_i W_m^i T_m^i + [P_q Q(T_f^o, T_f^s, X; Z^o, Z^s, f)] - W_x X + V - P_c C\,]$$

$$+ g^i\,[\bar{T}^i - T_f^i + T_m^i + T_L^i] \qquad \text{i = o, s} \tag{7}$$

Assuming an interior solution for all allocations except for a possible corner solution for off-farm work ($T_m^i \geq 0$), the Kuhn-Tucker conditions to maximize (1) subject to (2) and (6) are given by the following (Huffman, 1991):

$$\lambda[P_q \partial Q/\partial X - W_x] = 0 \tag{8}$$

$$\lambda P_q \partial Q/\partial T_f^i - \gamma^i = 0 \tag{9}$$

$$\lambda W_m^i - \gamma^i \le 0,\ T_m^i \ge 0, T_m^i(\lambda W_m^i - \gamma^i) = 0 \tag{10}$$

$$\partial U/\partial T_L^i - \gamma^i = 0 \tag{11}$$

$$\partial U/\partial C - \lambda P_c = 0 \tag{12}$$

$$\bar{T}^i - T_f^i - T_m^i - T_L^i = 0 \tag{13}$$

$$\sum_i W_m^i T_m^i + [P_q Q(T_f^o, T_f^i, X; Z^o, Z^s, \phi)] - W_x X + V - P_c C = 0 \tag{14}$$

where i=o, s, and λ and γ^i are the Lagrangian multipliers for income and for the marginal utility of human time, respectively.

Equation (9) to (11) give the marginal conditions for optimal time allocation by the farm operator and spouse. If $W_m^i < \gamma^i / \lambda$, then an individual's time is allocated between leisure and on-farm work so that $(\partial U/\partial T_L^i)/\lambda = P_q \partial Q/\partial T_f^i$ and $T_m^{i*} = 0$, and there is no off-farm work. If $W_m^i = \gamma^i / \lambda$, then an individual's hours are allocated among leisure, on-farm work, and off-farm work so that

$$(\partial U/\partial T_m^i)/\lambda = P_q \partial Q/\partial T_f^i = W_m^i \tag{15}$$

When $W_m^i = \gamma^i / \lambda$, an interior solution occurs and the decision regarding optimal production of Q is separate from the optimal consumption decisions (including farm input demand, X) (Strauss, 1986; Huffman, 1991). This is because all input and output prices are determined in the external market. Equations (8)-(10) can be solved jointly to derive demand functions for operator's and spouse's farm labor and purchased farm inputs. The demand functions for hours of on-farm work and purchased inputs are summarized as:

$$T_f^{i*} = G_{T_f^i}(W_m^o, W_m^s, W_x, P_q, Z^o, Z^s, \phi),\ \text{i=o, s} \tag{16}$$

$$X^* = G_x(W_m^o, W_m^s, W_x, P_q, Z^o, Z^s, \phi). \tag{17}$$

Combining (6), (11), (12), (16) and (17), the demand functions for operator's and spouse's leisure are given as:

$$T_L^{i*} = G_{T_L^i}(W_m^o, W_m^s, P_q, V, W_x, P_c, Z^o, Z^s, \boldsymbol{t}, \boldsymbol{f}) \text{, i = o, s.} \quad (18)$$

Then using the time allocation constraint (13) for the operator and spouse and substituting equation (16) and (18) for T_L^{i*} and T_f^i, the off-farm supply functions are obtained:

$$T_m^{i*} = \overline{T} - T_L^{i*} - T_f^{i*} = G_{T_m^i}(W_m^o, W_m^s, P_c, V, W_x, P_q, Z^o, Z^s, \boldsymbol{t}, \boldsymbol{f}) \quad (19)$$

When $W_m^i < \boldsymbol{g}^i / \boldsymbol{l}$, then optimal T_m^i = 0, and the farm production decisions are not separable from household consumption decisions. Solving equations (6), (8), (9) and (11)-(13), the demand functions for operator and spouse's on-farm work hours are given by:

$$T_f^{i**} = G_{T_f^{i**}}(P_q, P_c, W_x, V, Z^o, Z^s, \boldsymbol{f}) \text{, i = o, s.} \quad (20)$$

Therefore, the implicit demand functions for on-farm work time are different for farm families that do not work off-farm than for those that do. Note that P_c and V enter (20) but not (16), while W_m^o and W_m^s enter (16) but not (20).

The decision of an individual to participate in the labor force can be determined by comparing his/her "reservation wage" to the wage offered in the labor market. The reservation wage at which an individual enters the labor market can be determined by setting hours of work in a labor supply equation to zero and solving for the wage (Tokle, 1988). The individual will participate in off-farm work if his/her reservation wage (W^r) is less than wage offered (W^m) in the market. The probability of being in the labor market is thus

$$Pr\ (W^m > W^r) \quad (21)$$

Given the dis cussion above, the empirical models to estimate the probability of wage work for farm spouses are specified as follows. For a farm spouse[1]:

[1] The regional models do not include regional dummies.

$$Pr(D_i=1) = F[\beta_0 + \beta_1 \text{AGE}_i + \beta_2 \text{AGE}_i\text{SQ} + \beta_3 \text{LSHIGH}_i + \beta_4 \text{SCOLLEGE}_i + \beta_5 \text{COLLEGE}_i + \beta_6 \text{BCOLLEGE}_i + \beta_7 \text{CHILD6} + \beta_8 \text{OLDCHILD} + \beta_9 \text{RFEARN} + \beta_{10} \text{RFINCOTH} + \beta_{11} \text{AVEGEPAY} + \beta_{12} \text{INDLIVE} + \beta_{13} \text{INDCROP} + \beta_{14} \text{INPRALL} + \beta_{15} \text{RLANDVAL} + \beta_{16} \text{MSA} + \beta_{17} \text{NEAST} + \beta_{18} \text{SOUTH} + \beta_{19} \text{WEST} + \beta_{20} \text{TIME} + \beta_{21} \text{TIMESQ} + \beta_{22} \text{COINCID}] + \varepsilon_i$$

where i = male, female; Pr($D=1$) is the probability that the individual will participate in wage work; F[ ] is the normal distribution function.

3. Data and Estimation Methods

The main source of data for this study is the Current Population Survey March Supplement (March CPS). The CPS is conducted monthly by the Bureau of the Census and is the source of the official U.S. federal statistics on employment and unemployment (CPS, 1983). The March Demographic File (March Supplement) is more detailed than the regular monthly surveys[3]. Each month about 57,000 households (selected through probability sampling), based on area of residence, are interviewed monthly to give representative samples of the nation as a whole and other specified regions. The CPS is the only publicly available data set large enough to provide reasonably reliable estimates for the U.S. farm population.

Other economic data from various sources are appended to the CPS data. The appended data were obtained from the Economic Research Service (ERS), the National Agricultural Statistical Service (NASS) of the U.S. Department of Agriculture, the Bureau of Labor Statistics (BLS), and from the Regional Economic Information Service (REIS) whose database is produced by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce. Also, business cycle data were obtained from the Conference Board.

The sample consists of U.S. families that reported farm incomes from the 48 contiguous states (with the exception of farm families in Alaska and Hawaii). The analysis was further restricted to married farm couples with a husband and wife present, following Tokle and Huffman, 1991. Only farm couples, who are household heads, are included in the sample, since they are the basic decision-making units concerning consumption and production in farm households. Information on eligible sampling units are pooled from 1977 to 1998, excluding data for 1985 due to invalid data problems in the CPS for that year.

Data over the twenty-one year period ensure that variation over time, as well as cross-sectional variation, exists. The final sample consists of 11,294 working-age farm couples in the U.S. Off-farm labor participation models for farm operators and spouses are estimated for the entire U.S. and by CPS region: Northeast, North Central, South and West.

The labor participation models for husband and wives in American farm families are first estimated separately using binomial probit. Then the models are estimated jointly for husband and wife using a bivariate probit model. Table 1 defines variables included in the participation model, while summary statistics of explanatory variables are presented in Tables 2 and 3. The estimated models include individual characteristics (age, age-squared, educational attainment); family or household variables (number of children in different age categories); farm-related variables (input and output price indexes, farm program payments); asset income and farm real estate values, as well as variables representing the region and the national economy. Women's age and education variables were excluded from the bivariate probit analysis owing to the high correlation with the husband's age and education variables (see Gould and Saupe 1989).

[3] In addition to the basic monthly CPS questions, interviewers ask supplementary questions in March about money received in the previous calendar year, educational attainment, household and family characteristics, marital status and geographical mobility.

Table 1: Source, Level, Description and Operationalization of Explanatory Variables.

Variable	Source/Level	Description
Age	CPS/Individual	Age of the individual in years.
Agesq	CPS/Individual	Age squared.
Lshigh	CPS/Individual	Binary variable (0,1) with 1 indicating attainment of some schooling but not a high school degree.
Scollege	CPS/Individual	Binary variable (0,1) with 1 indicating some college education but not a college graduate.
College	CPS/Individual	Binary variable (0,1) with 1 indicating four years of college, i.e., a college graduate.
Bcollege	CPS/Individual	Binary variable (0,1) with 1 representing more than four years of college education.
Child6	CPS/Family	Number of own children less than six years of age.
Oldchild	CPS/Family	Number of own, never married children between 6 and 18 years of age, inclusive.
Gender	CPS/Individual	Binary variable (0,1) with 1indicating a woman.
Rfincoth	CPS/Family	Real family asset income representing total income from sources such as interest, dividends, Social Security income, and all other income in year t-1. Values in 1982-84 dollars.
Rfearn	REIS/State	State-level variable for the ratio of a state's farm earnings to non-farm earnings in year t-1. Values in 1982-84 dollars.
Indlive	USDA, NASS/U.S.	U.S.-level variable representing index of prices received by farmers for livestock and products in year t-1. Includes meat animals, dairy products, poultry and eggs and other livestock products.
Indcrop	USDA, NASS/U.S.	U.S.-level variable indicating index of prices received by farmers for all crops in year t-1 including food grains, feed grains and hay, cotton, tobacco, fruits and nuts, vegetables , potatoes and all other crops.
Avegepay	USDA, NASS/U.S.	U.S.-level variable representing all program payments per farm in real terms, in year t-1. These include only those government subsidies. Values in 1982-84 dollars.

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Table 1. Continued

Variable	Source/Level	Description
Indprall	USDA, NASS/U.S.	U.S.-level variable for index of prices paid by farmers for all production expenses. Includes production items, services, taxes and other production expenses.
Rlandval	USDA, ERS/U.S.	State-level variable representing real value per acre of farm real estate in year t-1. Values in 1982-84 dollars.
Coincid	Conference Board/U.S.	A national-level variable representing the index of coincident economic indicators is included to show the effect of the business cycle. The components of this index are net employment of nonagricultural workers, industrial production, personal income and manufacturing and trade sales.
MSA	CPS/ Household	A location variable showing whether or not an individual resides in a Metropolitan Statistical Area or not. A value of 1 is assigned if a household resides in a metropolitan area and a zero value is given otherwise.
Neast	CPS/ Household	A regional, binary variable (1,0) with 1 indicating residence in the Northeast region.
South	CPS/ Household	A regional, binary variable (1,0) with 1 indicating residence in the South.
West	CPS/ Household	A regional, binary variable (1,0) with 1 indicating residence in the West. The reference group includes households located in the North Central region[4].
Time	--/--	A yearly time trend variable, with value 1 for the first year, 2 for the second year, and so on.
Timesq	--/--	Time trend squared.
Pr (D_m)	Individual	Dependent binary variable (1,0) for men in the labor participation model with 1 indicating off-farm wage work participation.
Pr (D_f)	Individual	Dependent binary variable (1,0) for women in the labor participation model with 1 indicating off-farm wage work participation.

Note: Consumer price indexes were obtained from the Bureau of Labor Statistics (BLS).

[4] The Northeast region includes the New England and Middle Atlantic Divisions as defined by the Bureau of the Census. The North Central region comprises the East North Central and West North Central Divisions. The West includes the Mountain Division and the Pacific Division. The South comprises the East South Central, West South Central, and South Atlantic Divisions.

Table 2: Summary Statistics of Individual Characteristics for Off-Farm Labor Participation Sample of U.S. Couples, 1977-98.

Variable	North-east	North Central	South	West	Overall
Characteristics of Males					
Age (years)	45.55	45.18	46.58	45.28	45.75
Age squared ($x10^{-2}$)	22.00	21.74	22.98	21.81	22.22
Education of Males (%)					
Not a high school graduate	29.02	29.34	33.76	21.29	29.26
High school graduate	41.96	38.91	32.70	30.93	34.43
Some college	17.98	19.32	17.87	27.86	20.11
College graduate	11.04	7.54	9.20	12.00	9.43
Beyond college	10.90	4.89	6.47	7.92	6.77
Characteristics of Females					
Age (years)	42.97	42.78	43.49	42.40	42.99
Age squared ($x10^{-2}$)	19.64	19.56	20.13	19.19	19.71
Education of Females (%)					
Not a high school graduate	23.69	21.35	28.09	18.86	23.57
High school graduate	38.02	43.32	37.99	33.14	40.04
Some college	16.53	22.06	19.95	28.88	21.84
College graduate	12.04	8.27	8.43	11.51	9.05
Beyond college	9.72	5.00	5.54	7.61	5.50

Table 3: Summary Statistics of Farm, Economic and Regional Characteristics for Off-Farm Labor Participation Sample of U.S. Farm Couples, 1977-98.

Variable	North-east	North Central	South	West	Overall
Farm Incomes/Characteristics[a]					
Farm/non-farm earnings ratio	0.01	0.04	0.02	0.02	0.03
Real family asset income ($x10^{-2}$)	45.73	29.29	39.03	45.63	36.18
Real government payments per farm ($x10^{-2}$)	26.40	27.76	26.24	27.48	27.09
Real land value per acre ($x10^{-2}$)	17.30	10.15	8.99	7.80	9.94
Indexes of Prices Received and Paid[b]					
Livestock	89.12	88.26	87.68	89.02	88.22
Crops	98.98	97.49	96.91	98.67	97.55
Total production expenses	88.77	85.25	84.52	87.03	85.49
Regions (%)					
Northeast	100.00	0.00	0.00	0.00	7.31
North Central	0.00	100.00	0.00	0.00	43.59
South	0.00	0.00	100.00	0.00	35.40
West	0.00	0.00	0.00	100.00	13.70
Time	11.01	9.73	9.52	10.30	9.83
Time trend squared	161.72	128.40	126.90	142.04	132.17
Coincident economic indicators index	81.52	79.07	78.66	80.19	79.26

[a] All dollar figures are in 1982-84 $.
[b] Base year is 1990-92.

4. Empirical Results

The results of the univariate and bivariate analyses are presented in Tables 4 and 5, respectively. Also, regional models, consisting of the Northeast, North Central, South, and West regions, were estimated (see Table 6 for summary results). This serves to explicitly observe any differences in the way in which the independent variables affect the probability of off-farm work participation decisions by the sampled farm families across the four regions. Many of the explanatory variables are found to influence the probability of off-farm work consistent with *a priori* expectations. However, some of the variables deviate from *a priori* expectations either in terms of statistical significance or direction of influence.

The estimated cross-equation coefficient of the disturbances (correlation coefficient) in the bivariate model is 0.232 for the sampled farm couples and is significantly different from zero at the 1 percent level.

The implications of this result are: (a) the random disturbances in married couples' off-farm work participation decisions are influenced in the same direction by unmeasured effects (or random shocks), and (b) the wage work participation decisions of married males and females in the U.S. are not statistically independent. Hence, the bivariate probit results will be used to explain the model. The estimated coefficient for men's age shows a positive relationship between off-farm work participation and the explanatory variable, age. This implies that as age increases, the likelihood of off-farm work increases for men. At the same time, the variable representing a quadratic relationship between off-farm work and age, i.e., age-squared, is negatively correlated with the dependent variable. This indicates that as the age of the male advances beyond a certain point, the likelihood of participating in off-farm work decreases. This may suggest that labor productivity at off-farm work increases at young ages, and then declines as the individual approaches retirement age.

The age after which off-farm work participation begins to decline is 33.5 years for males. This result is similar to the results reported for Tokle and Huffman's analysis of U.S. farm couples using the CPS sample from 1978 to 1982. They found that the maximum effect occurred for farm and rural non-farm males at ages 26.2 and 33.2 years, respectively. The marginal coefficients for the age and age-squared variables indicate that a unit increase in a man's age increases his likelihood of working off-farm by 1.7 percent, while after the age of about 34 years the likelihood of off-farm work decreases by 2.5 percent for every unit change.

The estimated coefficients for education beyond high school for men are positive and statistically significant, suggesting that as a male farm spouse attains a higher level of education, his likelihood of working off-farm tends to increase. As an individual receives more years of schooling, he/she acquires more skills, thereby enhancing chances of being hired in the labor market. In other words, additional education increases a person's offered wage. The marginal effects in Table 4 show that a male spouse who has some college education, is a college graduate, or has more than four years of college education is 5.6 percent, 10.6 percent, and 28.4 percent more likely to work off the farm relative to a person with a high school education.

The results for men are similar to the univariate estimates for women in Table 3: a woman who has not graduated from high school is 5.6 percent less likely to participate in off-farm work relative to a

high school graduate. Women attaining some college, having graduated from college or having a graduate education are found to be 4.7 percent, 15.4 percent, and 38.1 percent more likely to work off-farm than their high school graduate counterparts. These findings are consistent with previous studies (Reddy, 1987; Reddy, Findeis, and Hallberg, 1988; and Tokle and Huffman, 1991, among others).

Table 5 also shows that an increase in the number of children aged below six years reduces the likelihood of off-farm work by women. Interestingly, the sign on this variable coefficient for men is also negative and statistically significant at the 5 percent significance level. This rather surprising result is likely due to the changing role of couples in families, in general, and in farm households, in particular. It might be more economically rational to have the husband take care of children at home while the wife works off-farm, a phenomenon which breaks the stereotype that restricts women exclusively to child-rearing responsibilities. This result contradicts earlier studies on off-farm work participation of married couples, but finds support in the observation of the Bureau of the Census that there are about two million stay-at-home fathers in the U.S. (Center Daily Times, 2000). These results imply that the presence of additional pre-school aged children at home raises the reservation wage of both parents. The sum of the marginal effects for an additional child under six years for a farm couple, on average, is 4.6 percent, as shown in Table 5.

The estimated coefficient representing residence in a metropolitan area has a positive relationship with the likelihood of off-farm work for both men and women. This suggests a relative availability of more non-farm job opportunities in cities than in non-metropolitan areas. The magnitude of this effect is shown in Table 5 by the partial derivative: residence in a metropolitan area (MSA) increases the likelihood of off-farm work by 12.5 percent for the farm couple.

The coefficients of the variable representing the ratio of farm earnings to non-farm earnings within a state document negative relationships with the likelihood of off-farm work for both men and women. These results imply that as the value of this ratio increases, the likelihood of farm couples working off-farm decreases. This is expected because it reflects the importance of the farm sector, *ceteris paribus.*

The variable indicating the total income from sources other than farming and off-farm wages and salaries (family asset income) is negatively correlated with off-farm work participation for women. It shows that female farm spouses are less likely to work off-farm as total family asset income grows.

Table 4: Univariate Binomial Probit Estimates of Off-Farm Labor Participation Decisions by U.S. Farm Couples, 1977-1998.

Variable	Estimated Coefficients		Marginal Effects	
	Men	Women	Men	Women
Individual/Family Characteristics				
Age (years)	0.041***	0.005	0.016***	0.002
	(4.290)	(0.474)	(4.290)	(0.474)
Age squared (x 10^{-2})	-0.066***	-0.041***	-0.026***	-0.016***
	(-6.157)	(-3.700)	(-6.157)	(-3.699)
Education (reference: high school graduate)				
Not a high school graduate	-0.033	-0.140***	-0.013	-0.056***
	(-1.022)	(-4.067)	(-1.022)	(-4.067)
Some college	0.157***	0.119***	0.063***	0.047***
	(4.602)	(3.662)	(4.602)	(3.663)
College	0.281***	0.388***	0.112***	0.154***
	(6.155)	(8.427)	(6.1551)	(8.428)
Beyond college	0.750***	0.960***	0.30***	0.381***
	(13.159)	(14.006)	(13.155)	(14.022)
Number of children under 6	-0.081***	-0.377***	-0.032***	-0.150***
	(-3.780)	(-16.753)	(-3.780)	(-16.758)
Number of children between 6 and 18	-0.026**	-0.087***	-0.010**	-0.034***
	(-2.137)	(-7.015)	(-2.137)	(-7.014)
MSA (reference: non-metro)	0.317***	0.036	0.126***	0.014
	(9.786)	(1.092)	(9.785)	(1.092)
Farm Incomes/Characteristics				
Farm/non-farm earnings ratio	-2.109***	-0.685**	-0.841***	-0.272**
	(-6.275)	(-2.033)	(-6.275)	(-2.033)
Real family asset income (x 10^{-2})	-0.003	-0.071***	-0.001	-0.028***
	(-0.240)	(-5.176)	(-0.240)	(-5.177)
Real government payment per farm (x 10^{-2})	0.169	0.412**	0.067	0.163**
	(1.009)	(2.424)	(1.009)	(2.424)
Real land value per acre (x 10^{-2})	0.001*	-0.230	0.167*	-0.091
	(1.762)	(-0.959)	(1.762)	(-0.959)

Continued on next page

Table 4: Continued

Variable	Estimated Coefficients		Marginal Effects	
	Men	Women	Men	Women
Index of Prices Received by Farmers				
Livestock	-0.011***	-0.001	-0.004***	-0.001
	(3.328)	(-0.157)	(-3.328)	(-0.157)
Crops	-0.002	0.003	-0.001	0.001
	(-0.501)	(0.913)	(-0.501)	(0.913)
Index of Prices Paid by Farmers				
Total production expenses	0.002	-0.011	0.001	-0.004
	(0.180)	(-1.053)	(0.180)	(-1.053)
Regions (reference: North Central)				
Northeast	-0.071	-0.040	-0.028	-0.016
	(-1.284)	(-0.718)	(-1.284)	(-0.718)
South	0.208***	-0.023	0.083***	-0.009
	(6.671)	(-0.732)	(6.671)	(-0.732)
West	0.052	-0.100***	0.021	-0.040***
	(1.454)	(-2.807)	(1.454)	(-2.807)
Time trend	-0.049	0.026	-0.020	0.010
	(-1.205)	(0.627)	(-1.205)	(0.627)
Time trend squared (x 10^{-2})	0.12	-0.054	0.048	-0.022
	(1.047)	(-0.462)	(1.047)	(-0.462)
Coincident economic indicators index	0.021***	0.021***	0.008***	0.008***
	(3.126)	(3.105)	(3.126)	(3.105)
Intercept	-1.022**	-0.408	-0.407**	-0.162
	(-1.995)	(-0.791)	(-1.995)	(-0.791)
Chi-squared	1,048.3***	1,376.3***		
Degrees of freedom	22	22		
Percent correct predictions	62.27%	64.65%		
Sample size	11,294	11,294		

(.) t-ratios
*** Significant at 1%
** Significant at 5%
* Significant at 10%.

Table 5: Bivariate Binomial Probit Estimates of Off-Farm Labor Participation Function for U.S. Farm Couples, 1977-1998.

Variable	Estimated Coefficients		Marginal Effects
	Men	Women	
Individual/Family Characteristics			
Age of male (years)	0.0411***	-	0.017***
	(4.323)	-	(4.323)
Age of male squared (x 10^{-2})	-0.062***	-	-0.025***
	(-5.776)	-	(-5.777)
Education (reference: high school graduate)			
Not a high school graduate	-0.022	-	-0.009
	(-0.676)	-	(-0.676)
Some college	0.139***	-	0.056***
	(4.102)	-	(4.103)
College	0.263***	-	0.106***
	(5.800)	-	(5.801)
Beyond college	0.707***	-	0.284***
	(12.554)	-	(12.566)
Number of children under 6	-0.046**	-0.100***	-0.013
	(-2.1162)	(-5.593)	(-1.489)
Number of children between 6 and 18	-0.014	0.005	-0.006
	(-1.185)	(0.434)	(-1.241)
MSA (reference: non-metro)	0.322***	0.070**	0.125***
	(9.936)	(2.188)	(9.744)
Farm Incomes/Characteristics			
Farm/non-farm earnings ratio	-2.121***	-0.598**	-0.819***
	(-6.299)	(-1.807)	(-6.040)
Real family asset income (x 10^{-2})	-0.009	-0.092***	-0.002
	(-0.618)	(-13.696)	(-0.256)
Real government payment per farm (x 10^{-2})	0.154	0.236	0.048
	(0.916)	(1.439)	(0.720)
Real land value per acre (x 10^{-2})	0.004*	-0.208	0.183**
	(1.771)	(-0.887)	(1.908)

Continued on next page

Table 5: Continued

Variable	Estimated Coefficients		Marginal Effects
	Men	Women	
Index of Prices Received by Farmers			
Livestock	-0.011***	-0.002	-0.004***
	(-3.418)	(-0.735)	(-3.358)
Crops	-0.002	0.005	-0.001
	(-0.480)	(1.462)	(-0.702)
Index of Prices Paid by Farmers			
Total production expenses	0.002	-0.012	0.002
	(0.203)	(-1.174)	(0.377)
Regions (Reference: North Central)			
Northeast	-0.069	-0.004	-0.028
	(-1.257)	(-0.067)	(-1.264)
South	0.210***	-0.009	0.085***
	(6.727)	(-0.292)	(6.859)
West	0.056	-0.050	0.025*
	(1.577)	(-1.437)	(1.791)
Time	-0.048	0.042	-0.022
	(-1.163)	(1.050)	(-1.327)
Time trend squared (x 10^{-2})	0.116	-0.036	0.049
	(1.006)	(-0.314)	(1.063)
Coincident economic indicators index	0.021***	0.014**	0.001***
	(3.107)	(2.122)	(2.832)
Intercept	-1.134**	-0.653	-0.419***
	(-2.205)	(-1.405)	(-2.041)
Disturbance correlation RHO(1,2)	0.232***		
	(15.267)		
Degrees of freedom	22		
Percent correct predictions	80.25%		
Sample size	11,294		

(.) t-ratios
*** Significant at 1%
** Significant at 5%
* Significant at 10%

Table 6: Summary of Bivariate Probit Results of Off-Farm Labor Participation Models for the U.S. Regions.

Variable	Northeast		North Central		South		West	
	Men	Women	Men	Women	Men	Women	Men	Women
Individual/Family Characteristics								
Age (years)			+		+		+	
Age squared (x 10^{-2})			-		-		-	
Education (reference: high school graduate)								
Not a high school graduate								
Some college	+		+					
College	+		+		+		+	
Beyond college	+		+		+		+	
Number of children under 6		-		-			-	-
Number of children between 6 and 18								
MSA (reference: non-metro)	+	+	+		+	+	+	
Farm Incomes/Characteristics								
Farm/non-farm earnings ratio								-
Real family asset income (x 10^{-2})				-	-	-		
Real government payment per farm (x 10^{-2})	-					-	+	
Real land value per acre (x 10^{-2})			-	-				
Index of Prices Received by Farmers								
Livestock	-				+			
Crops						+		
Index of Prices Paid by Farmers								
Total production expenses								
Time							-	
Time trend squared (x 10^{-2})							+	
Coincident economic indicators index		+			+			
Intercept					-			

\+ Statistically significant positive estimated coefficient.
\- Statistically significant negative estimated coefficient.

The variable representing the value of farmland per acre has a positive coefficient for men only and is statistically significant at the 10 percent level.

This indicates that the likelihood of off-farm work among men is higher as the average value of farmland increases. Also, the variable representing the index of prices received for livestock and livestock products is negatively correlated to off-farm work participation of male farm spouses: as prices received in the livestock sector increase, the likelihood of off-farm work declines, confirming a priori expectation.

The coincident economic indicators index variable shows a positive correlation with off-farm work participation for both men and women. This result suggests that the probability of off-farm work increases among farm families as the coincident economic indicators index increases. The result obtained here is consistent with the fact that the availability of more job opportunities and better pay, off-farm, will likely attract people from the farm sector into the off-farm labor market, as the general economy becomes more buoyant.

Finally, the results show that male farm family members residing in the South tend to have a higher probability to work off-farm relative to residents of the North Central region. This result likely indicates continued dependence of North Central farm families on farming as their main source of income. The indicated higher rate of off-farm labor participation in the South might be due either to the prevalence of small-holder farmers in this region or to the greater availability of off-farm job opportunities.

5. Summary and Conclusions

This paper examines the determinants of farm labor participation decisions of U.S. farm families over the period 1977 to 1998. It also attempts to determine whether or not farm couples jointly make such decisions. This paper constitutes a contribution to many past research efforts directed at understanding the labor supply of farm families by its use of a two-worker, husband and wife model and covering a time period of approximately two decades which has the potential for providing better insights into gender differences that might exist in the behavioral patterns regarding the work/no-work decision process. Many similar past studies made use of a single-worker model and where a two-worker model was used, the period of coverage was usually limited to a maximum of four years.

Statistics have shown a steady increase in the off-farm labor participation of American farm women since at least the late 1970s, while the participation rates of U.S. farm men in off-farm work have remained relatively stable over the same period (1977-97). The results indicate that farm couples jointly make off-farm work participation decisions in the U.S. Both descriptive and regression analyses show that education and age are very important factors that positively affect the decision to work off-farm for both men and women. Age is also found to have a quadratic effect on men's labor participation decisions.

Higher educational attainment of American farm couples, is indicated to increase the likelihood of working off-farm. Results indicate that the probability of off-farm wage work participation among farm families in the U.S is lower in states where farming is more prevalent. Also, results show that an increase in prices received by farmers for livestock and allied products makes off-farm work participation less attractive to male farm spouses in the U.S. The study also expectedly shows that a stronger economy increases the probability of off-farm labor participation by American farm couples. Finally, variables representing region of residence strongly indicate that individuals residing in both the South and West are more likely to participate in off-farm work relative to residents in the North Central region.

The findings of this study have demonstrated that the decision to participate in off-farm work is jointly made by farm couples in the U.S. There is also ample evidence to support the increasing importance of off-farm income to farm households in the U.S. Consequently, there is the need to initiate and sustain policies that enhance the abilities of individual farm family members to secure off-farm employment. This is particularly important in view of the fact that off-farm income forms a significant part of farm household income in the U.S. The findings of this study also suggest that investment in human capital is important for enhancing the welfare of farm families.

Statistics show that the off-farm labor participation rates of U.S. female farm spouses have consistently increased over the past two decades, while those of male farm spouses remained relatively steady over the same period. There has been an increasing incidence of American male spouses playing the role of caregivers for children, thereby providing greater opportunities for mothers to participate more actively in the off-farm labor market.

Findings also suggest a need to develop separate programs that meet the requirements of the different regions in the U.S. It is obvious that the issue of low net farm income is of utmost economic

importance in regions where there are limited off-farm employment opportunities or where farming activities are relatively more important to households such as in the case of the North Central region, as identified in this study.

There is also evidence suggesting that a more buoyant economy is likely to increase the probability of off-farm wage work by American farm couples. This is likely the case if the marginal return to their on-farm hours is less than the prevailing wage rate in the off-farm labor market, *ceteris paribus.* As a result, an extended period of economic prosperity may pose a serious danger to the farming sector by way of re-allocation of labor from farming to non-farm employment. Should this scenario occur, then it will be necessary to evolve and strengthen farm programs that would sustain the farming interest of the farm population so as to maintain a viable agricultural sector alongside a prosperous, larger non-farm economy.

Bibliography.

Ahearn, M., J. Yee, E. Ball, and R. Nehring (1997): "Agricultural Productivity in the United States." *Agricultural Information Bulletin 740*. USDA, Economic Research Service. Washington, DC.

Aldrich, John H. and Forest D. Nelson (1984): "Linear Probability, Logit, and Probit Models. Series: Qualitative Applications in the Social Sciences." Sage Publications, Inc, 95pp.

Alwang, J. and J.I. Stallmann (1992): "Supply and Demand for Married Labor: Rural and Urban Differences in the Southern United States." *Southern Journal of Agricultural Economics* 24 (2): 49-62.

Barkley, A.P. (1990): "The Determinants of Migration Out of Agriculture in the United States, 1940-85." *American Journal of Agricultural Economics* 72: 567-73.

Bollman, R., L. Whitener, and F. Tung (1995): "Trends and Patterns in Agricultural Structural Change: A Canada-U.S. Comparison." In *Farms, Families, and Farming Communities*: A special issue of the *Canadian Journal of Agricultural Economics*. D. Harrington, L. Whitener, R. Bollman, D. Freshwater, and P. Ehrensaft (Eds).

Binger, Brian R. and E. Hoffman. Eds (1997): "Time Allocation, Labor Supply, and Labor Markets." In *Microeconomics with Calculus* (2nd Edition). Addison-Wesley. Pp 455-481.

Bureau of Labor Statistics (1999): Producer Price Indexes. U.S. Department of Labor. http://stats.bls.gov.

Bureau of Labor Statistics (1999): "Consumer Price Index-All Urban Consumers. Series" ID: CUUR0000SA0. http://146.142.4.24/cgi-bin/surveymost.

Census of Agriculture (1992): "Historical Highlight: 1992 and Earlier Census Years." Volume 1, Geographic Area Series, Part 1 U.S. Department of Commerce. Bureau of the Census, 463pp.

Corsi, Alessandro and Jill L. Findeis (2000): "True State Dependence and Heterogeneity in Off-Farm Labour Participation." *European Review of Agricultural Economics* 27 (2): 127-152.

CPS, March (1983): Inter-University Consortium for Political and Social Research. 2nd ICPSR Edition, Spring 1984, 126pp.

Findeis, J.L. (1998): "Labor Adjustment in Agriculture: Implications for Policy Reform in the NAFTA Countries." A report prepared for Working Party on Agricultural Policies and Markets of the Committee for Agriculture Joint Working Party of the Committee for Agriculture and the Trade Committee. Directorate for Food, Agriculture, and Fisheries. Trade Directorate, 51pp.

Gardner, Bruce L. (1992): "Changing Economic Perspectives on the Farm Problem." *Journal of Economic Literature* 30 (1): 62-101.

Gebremedhin, Tesfa and Ralph D. Christy (1996): "Structural Change in U.S. Agriculture: Implications for Small Farmers." *Journal of Agriculture and Applied Economics* 28: 57-66.

Gould, Brian W. and William E. Saupe (1989): "Off-Farm Labor Market Entry and Exit." *American Journal of Agricultural Economics* 74 (4): 960-969.

Gujarati, Damodar N (1997): "Regression on Dummy Dependent Variables: The LPM, Logit, Probit, and Tobit Models." In *Basic Econometrics (Third Edition)*. McGraw-Hill International Editions, Economic Series. Pp. 540-583.

Huffman, Wallace E. and Mark D. Lange (1989): "Off-Farm Work Decisions of Husbands and Wives: Joint Decision Making." *The Review of Economics and Statistics* 71: 471-480.

Huffman, Wallace E. (1980): "Farm and Off-Farm Work Decisions: The Role of Human Capital." *The Review of Economics and Statistics* 62:14-23.

Huffman Wallace E. (1991): "Agricultural Household Models: Survey and Critique." In *Multiple Job-holding Among Farm Families*. M.C. Hallberg, Jill L. Findeis and Daniel A. Lass (Eds). Pp. 79-111.

Huffman, Wallace E. and Hisham El-Osta (1997): "Off-Farm Work Participation, Off-Farm Labor Supply and On-Farm Labor Demand of U.S. Farm Operators." *Staff Paper Number 290*. Department of Economics and Department of Mathematics, Iowa State University, 23pp.

Jean, Bruno (1996): "Family Farming, Farm Labour and Rural Employment: Who Works Where? An International Comparison." *Canadian Journal of Agricultural Economics* 44 (4): 411-419.

Kenny, Lawrence W. and D.A. Denslow, Jr. (1980): "Compensation Differentials in Teachers' Salaries." *Urban Economics* 7: 198-207.

Kimhi, Ayal (1996): "Off-Farm Work Participation of Israeli Couples: The Importance of Farm Work Participation Status." *Canadian Journal of Agricultural Economics* 44 (4): 481-490.

Larson, Donald K. (1976): "Impact of Off-Farm Income on Farm Family Income Levels." *Agricultural Finance Review* 36: 7-11.

Lass, A.D., J.L. Findeis, and M.C. Hallberg (1991): "Factors Affecting the Supply of Off-Farm Labor: A Review of Empirical Evidence." In *Multiple Job-holding Among Farm Families*. M.C. Hallberg, Jill L. Findeis and Daniel A. Lass (Eds). Pp. 239-262. Iowa State University Press, Ames, Iowa 50010.

Mishra, Ashok K. and Barry K. Goodwin (1997): "Farm Income Variability and the Supply of the Supply of Off-Farm Labor." *American Journal of Agricultural Economics* 79 (3): 880-887.

R.E.I.S (1999): "Total Cash Receipts From Marketing: Personal Income." (Computer File). www.fisher.lib.virginia.edu/reis

Reddy, V.K., J. L. Findeis, and M.C. Hallberg (1988): "Determinants of Off-Farm Labor Participation and Impacts on Income Distribution Among U.S. Farm Families." Bulletin 868. December 1988. College of Agriculture, Experiment Station. The Pennsylvania State University, 20pp.

Reddy, Venkateshwar K. (1987): "Determinants of Off-Farm Labor Force Participation and Income Distribution Among U.S. Farm Families." A Master's Thesis in the Department of Agricultural Economics and Rural Sociology, The Pennsylvania State University, 110pp.

Rosen, Sherwin (1986): "The Theory of Equalizing Differences." *Handbook of Labor Economics, Volume 1*. O. Ashenfelter and R. Layard (Eds). North-Holland Publishing Co. Pp 641-92.

Schultz, T. Paul (1980): "Estimating Labor Supply Functions for Married Women." In *Female Labor Supply: Theory and Estimation*. J.P. Smith (ed.), Princeton: Princeton University Press. 384pp.

Strauss, John (1986): "The Theory and Comparative Static of Agricultural Household Models: A general Approach." In *Agricultural Household Models*. Singh I, L. Squire, and J. Strauss (Eds). Baltimore, MD: Johns Hopkins University Press. Pp. 71-91.

The Conference Board (1999): “Leading Economic Indicators and Related Composite Indexes: Lagging Index.” (Computer File). http://www.tcb-indicators.org.

Tokle, J.G. and W.E. Huffman (1991): “Local Economic Conditions and Wage Labor Decisions of Farm and Rural Non-farm Couples.” *American Journal of Agricultural Economics* 73 (3): 652 - 670.

Tokle, Joanne Geigel (1988): “An Econometric Analysis of Family Labor Supply Decisions and Household Incomes, 1978-82.” A Ph.D Dissertation in the Department of Economics, Iowa State University, 156pp.

Topel, R.H. and Michael P. Ward (1988): "Job Mobility and Careers of Young Men." *Working Paper Number 2649*. National Bureau of Economic Research. Cambridge, MA.

U.S. Bureau of the Census (1990): "Current Population Survey, March 1990 Tape Technical Documentation." Washington, DC: U.S. GPO.

USDA (1999[a]): “ Number of Farms, Land in Farms, and Average Farm Size: United States.” (Computer File) http://USDA.mannlib.cornell.edu/mor_start.html .

_____ (1999[b]): “Farm Operator Household Income Compares Favorably with All U.S. Households.” Economic Research Service. (Computer File). http://www.econ.ag.gov.

_____ (1999[c]): “Operator Household Income Back to 1960.” In *Farm Business Economics Briefing Room.* Farm Costs and Returns Survey. (Computer File). www.econ.ag.gov/briefing/Farm

_____ (1999[d]): “Structural and Financial Characteristics of U.S. Farms, 1994: 19th Annual Family Farm Report to Congress.” Economic Research Service. (Computer File). www.econ.ag.gov.

_____ (2000): "Agricultural Prices, 1999 Summary." (Computer File). www.nass.usda.gov

U.S. Department of Commerce (1978): "The Current Population Survey: Design and Methodology." *Technical Paper Number 40*. Bureau of the Census.

Weiss, Christoph (1998): “Farm Employment Adjustment and Recent Policy Reform: A Review of Empirical Evidence for Europe.” A report prepared for Working Party on Agricultural Policies and Markets of the Committee for Agriculture Joint Working Party of the Committee for Agriculture and the Trade Committee. Directorate for Food, Agriculture, and Fisheries. Trade Directorate, 15pp.

Woldehanna, Tassew, Alfons Oude Lansink, and Jack Peerlings (2000): "Off-Farm Decisions on Dutch Cash Crop Farms and the 1992 and Agenda 2000 CAP Reforms." *Agricultural Economics 22 163-171*.