Determinants of the Organic Farmers' Demand for Hired Farm Labor

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This study is designed to determine the significance of organic (and transitioning to organic) farming systems use of hired non-family labor as a function of individual farm structure characteristics, especially as the structure evolves through extensification and alternate target markets. Non-family labor was chosen as the variable of choice due to its independence from organic certification standards and its prevalent use by both conventional and organic farming systems. This is not a study of national market demand for hired labor, but rather an individual farmer's relative demand for non-family hired labor and the magnitude by which their structural characteristics affect this need.

Certified organic food is, by definition, produced by farmers who emphasize the use of renewable resources and conservation of soil and water. USDA organic standards that specify varieties of substances and farming practices which are barred from use in organic production additionally require farm management plans which outline efforts for soil and water conservation with the specific objective of improvement for future generations (USDA 2002). As of 2003, the USDA recognized 8,035 certified organic farm operations in the U.S., comprised of cropland, pasture and livestock productions. Over two million acres and 8.9 million head of livestock and poultry are dedicated to organic farming; quadruple the quantity present a decade earlier.

The 2003 average acreage of an organic operation in the U.S. was 273 acres, compared with a national average for conventionally operated farms of 441 acres (USDA 2003). Survey analysis showed 40% of organic operations as being 100 acres or less and 68% of operations as 300 acres or less implying a large majority of smaller farms and limited large-scale operations (OFRF 2004). Analysis also outlines the prevalence of family-run organic operations, with many surveys from the last decade all displaying between 83% and 87% of organic operations' business structure as being single family or family partnerships (OFRF 1995; 1997; 1999; 2004).

Despite lower average acreage, organic farms are generally accepted as displaying trends of more labor intensiveness than their conventional counter-parts. Characteristic limited use of synthetic inputs requires organic farms to look towards alternative techniques for pest removal, soil additions and conservation, commonly depending on manual practices. Fertilizers are replaced with green manures and nitrogen fixing cover crops, cultivations and hand weeding control invasive plant species, and pests are suppressed by muti-crop rotations within the same year and even ecosystem management which creates a 'build-up' of beneficial/predator insect species. Studies consistently show higher labor demands for all spectrums of organic production compared to conventional methods (Klepper, et al 1977; Lockeretz, Shearer and Kohl 1981; Lockeretz 1997; Jansen 2000; Schneeberger, et al. 2002).

A decomposition of national organic farm data shows a larger percentage of yearly hired organic farm workers (both full and part-time) were family labor rather than non-family employees (OFRF 2004). In regards to the prevailing business structure of single family operations this is to be expected. A bit more explanation is required when taking into account the number of farms hiring non-family workers and the total number of organic farm workers hired. Almost half (45.65%) of organic operations employed no non-family workers for the 2000-2001 growing season (OFRF 2004). Concurrently, the number of non-family workers hired was more than double the amount of family labor utilized. Partial rationalization accepts the theoretical limitations of farm family labor supply, as family members have a finite limit, so do the number of laborers in a family.

Additional concern regards the number of *seasonal* non-family workers as opposed to *yearly* non-family workers. As figure 1.0 shows, *seasonal* organic workers from non-family sources were five times the number hired from family sources.

The specific objective of this study is to examine the current characteristics of organic farms and how variations in these characteristics affect a farm's non-family labor choices. Farm operation information for the 2000-2001 growing season was obtained through the Organic Farming Research Foundation's 4th National Organic Farmer's Survey. Analysis will utilize a step-wise Tobit model to explain the magnitude by which each characteristic affects the number of non-family laborers hired once that choice is made. Data for analysis is divided into three groups based on completeness of survey responses as well as target crop production, determined both by level of production and level of income attributable to target crop. Specific structural characteristics to be examined include (but are not limited to): business structure, number of commodities produced (both organic and conventional), marketing outlets and types of processing implemented, years certified organic, income from organic production, off-farm employment, geographical location and perception of organic markets.

Empirical Model

Considering that the non-family labor variable is censored downward, the determinants of the organic farms' labor hiring decisions cannot be estimated using ordinary least squares (OLS) regression. Fifty four percent of the sample is censored at zero due to the absence of non-family hired labor. The remaining portion of the sample is distributed by quantity of non-family farm labor requirements, either in lieu of family labor or as a complement to it.

A common approach used to address this issue is to use the Tobit model, a censored regression technique that is conducted using maximum likelihood estimation. The Tobit model is generally formulated in terms of an index function (Greene) as shown below:

$$y_i^* = \beta' x_i + \varepsilon_i$$
$$y_i = 0 \quad if \;\; y_i^* \leq 0,$$
$$y_i = y_i^* \quad if \;\; y_i^* > 0,$$

where y_i^*, the index or latent variable, is observed as y_i = max(0, y_i^*). The density of y_i / x_i has a mass point at 0 and is roughly continuous from (0,∞). Linear regression of y_i on x_i will yield inconsistent estimates of β and thus, β is estimated using maximum likelihood.

The basic form of the estimating equation used in this study is:

$$NFL_i = \beta_0 + \beta_1 STRUCTURAL + \beta_2 DEMOGRAPHIC + \beta_3 SIZE + \beta_4 INCOME + \beta_5 MARKETING + \beta_6 EXPERIENCE + \beta_7 PERCEPTION + \beta_8 LOCATION + \varepsilon_i.$$

The dependent variable, NFL_i, is the total number of non-family farm workers hired during the entire production year. This can include seasonal, yearly, part-time or full-time workers. Following is a discussion of the eight categories of explanatory variables used in this study.

Explanatory Variables

STRUCTURAL variables are intended to capture the possible effects of farmland management arrangements, production diversification profile, business set-up, extent of time devoted to the farm business, and influence of off-farm income generating activities on the farms' decisions to substitute family labor with the hiring of non-family farm workers. These variables are:

a. TENURERAT, the tenure ratio calculated as the proportion of owned land to total acreage farmed organically;
b. CROPSGRWN, representing the number of commodities grown;
c. CONVDUM, dummy variable representing the production of conventional commodities taking on a value of 1 for some conventional acres and 0 otherwise;
d. SOLEPROP, dummy variable taking on a value of 1 for single family or sole proprietorships and 0 for other business structures;
e. FULLTIME, dummy variable with value of 1 for full-time farm managers and 0 for part-time farmers;
f. OFFFARM, dummy variable to consider tradeoffs between farm and off-farm income generating activities where the variable is assigned a value of 1 if there is no off-farm employment or investments and 0 for those with some off-farm income generating activities; and
g. VAPERDUM, dummy variable to capture the effect of income derived from value-added products processed by or for the farm, takes on a value of 1 if some value-added products are processed and 0 otherwise.

Farmland control arrangements can potentially influence labor hiring decisions. Farm operators that own larger portions of the land they till are expected to be more inclined to invest more hours working on-farm. These operators likewise are more inclined to engage in full-time farming and would have relatively less involvement in off-farm income generating activities. On the other hand, simpler business structures (such as single proprietorships) are expected to be less inclined to rely on non-family labor than partnership or corporate farms with perhaps larger operations that justify more labor hiring activities. Moreover, Jansen (2000) attributes greater dependence on labor inputs to higher degrees of diversification (mixed farming) and more on-farm processing activities which expand the product base and value added contributions, respectively, of the farm, thus, resulting in higher price premiums.

DEMOGRAPHIC variables included in the estimating equation are the farm operator's age (AGE), gender (GENDER), and an ordered dummy to capture different levels of educational attainment (EDUDUM, 0 for educational attainment at high school level or below, 1 for junior college/trade school and some college education, 2 for completed bachelor's degree and some graduate study work, and 3 for a completed graduate degree). Age and education are crucial factors that influence the scale of organic farming operations considering the knowledge-intensive nature of organic farming operations (Jansen, 2000). Jackson's study, on the other hand, cite differences between men and women in their decisions on the acquisition and disposal of incomes, thus, suggesting that gender divisions in access and control of income can influence the management of organic farming operations, including labor hiring decisions (1994).

SIZE indicators used in this study are the percentages of acreage allocated to organic vegetable and grain farming (PERACRSVEG and PERACRSGR, respectively). These measures were chosen due to the relative relationship of acreage to crops grown, i.e. grains are generally spatially demanding but lax in labor demand, whereas vegetables generally require much less acreage but are relatively labor intensive, even by organic production standards.

INCOME variables include an ordered dummy variable for income generated from organic farming operations (INCDUM) corresponding to classes of income representing roughly one quarter of the sample in each. (0 for organic income of $4,999 or less, 1 if $5,000 to $29,999, 2 for $30,000 to $99,999, and 4 for income contributions of $100,000 and above). Also considered are proportions of total farm income derived from organic production, specifically of vegetables and grains (PERINCVEG and PERINCGR, respectively). Income factors logically enhance the organic farms' capability and flexibility to provide compensation for off-farm laborers and hence offer the farm operators with alternatives to maximize production efficiency and viability.

MARKETING variables consider the effect of two marketing channels, direct to consumer and wholesale, on the farm labor hiring decisions. The percentage of wholesale market sales are captured by the variables PERVEGW and PERGRW for the vegetable and grain operations, respectively. Direct to consumer market sales are likewise represented by PERVEGDTC and PERGRDTC for the vegetable and grain operations, respectively. A study by Rapp (1998) on newly transitioned farms emphasizes the influence of marketing channels on labor hiring decisions. His results indicate that a higher relative share of the organic farms' labor force has been utilized for direct marketing operations.

EXPERIENCE or business maturity variables such as the total years of farming (YRSEXP), the ratio of the total number of years of organic to total farming experience (ORGYRSRAT), and the ratio of certified organic farming to total farming experience (CERTYRSRAT) are included in the analyses. The importance of business maturity on labor hiring decisions is evident in the results obtained by Lampkin (1994). His study concludes that most organic farming operations in the embryonic or transitioning stage often have limited farming skills and are constrained by inadequate capitalization. These constraints define their heavy reliance on labor substitution for capital and mechanized inputs.

PERCEPTION variables were derived from farmers' responses on their outlook for organic production and market conditions from the 2000-2001 growing season. Specific perceptions of interests are product prices (PRICEPERCEP) and market demand (DEMPERCEP). These are ordered dummy variables corresponding to the scale used in the survey questionnaire where 0 is poor, 1 is fair, 2 is good and 3 is excellent prospect for the current year's market conditions.

LOCATION dummy variables are included to capture the influence of geographical location to the farms' labor hiring decisions. The USDA's older classification of production regions which recognized state boundaries in defining the regions is used in this analysis instead of the newer scheme for classifying counties in each state into major farm resource regions (which had overlapping states in certain regions). The ten USDA production regions delineate marked differences in cropping decisions, weather patterns and agronomic decisions across geographical boundaries. In this analysis, the location dummies used are NTHEAST (Northeast), LAKE (Lake States), CORNBELT (Corn Belt Region), NPLAINS (Northern Plains), APPAL (Appalachian), STHEAST (Southeast), DELTA (Delta States), SPLAINS (Southern Plains), and MTNS (Mountain States). The excluded geographical category is the Pacific Region.

This study will consider three model versions of the estimating equation. Aside from applying the estimating equation to all farm observations, two subsets of farm data will be developed based on production of two target crops: vegetable and grain. The rationale for this approach is to isolate the effects of the labor and size requirements of these two dominant enterprises. Vegetable crops are considered to be very labor intensive while grain operations generally entail relatively larger acreage requirements.

In order to reduce the large number of the original set of explanatory variables to a smaller batch of significantly important indicators of off-farm labor hiring decisions, a backward elimination (stepwise) method under the Tobit regression approach in Stata will be applied to all three versions of the estimating model. This procedure starts with a general Tobit regression procedure that considers all eligible explanatory variables. The model undergoes several iterations as one variable after another, identified as one that contributes the least to the model's explanatory power, is dropped from the estimating equation until all remaining variables produce F statistics significant at a specified confidence limit. In this analysis, the qualifying confidence limit used is 10%.

Descriptive Analysis

The empirical analysis is performed with data obtained through the Organic Farming Research Foundation's (OFRF) fourth National Organic Farm Survey. This survey was conducted in spring 2002 collecting nation-wide data on individual organic farmers' 2000-2001 growing season. The survey was distributed to individual farmers and certification agencies that in turn dispersed surveys to their own growers. This survey consists of 1034 participating farmers' responses from forty-four states with an overall response rate of 18%.

The survey instrument consists of eight sections and includes seventy-six questions, both open and close-ended, several with sub-sections. Questions allowed for fill-in type responses, selection of presented categories and 'yes/no' choices which lead to the presence of both qualitative and quantitative data, as is characteristic of surveys. In this study open-ended questions were not utilized in the empirical analysis. Coverage and sampling size are estimated at 90% of the actual population being studied. Errors in measurement derived from inaccurate or unclear responses are variable throughout the sample, ultimately 32% (332 observations) of original data were used for the analysis. The OFRF has conducted four national surveys since 1995 however there has not been an accessible record of time-series data on any particular farm, therefore the most recent data is utilized and restricted to cross-sectional analysis.

Survey sections of primary interest are those regarding structural farm profiles, production and products details, marketing and market conditions, and farm household characteristics. The particular question of relevance to this study's dependent variable concerns the number of laborers hired by an organic operation over the span of one year. Each farm operator was asked to give detailed account of each employee (including themselves) hired for labor directly involved with organic production. Employees were segregated by family status (farm family/household members or non-family workers), time of employment (year-round or seasonal) and hours worked per week (full-time or part-time). Descriptive analyses for the data used are listed by subset in table 1.1.

Econometric Analysis

The stepwise Tobit results obtained for the three regression models are summarized in table 1.2., including coefficient estimates, levels of significance and pseudo R^2. As stated by Johnson and DiNardo, “it may not always be sensible to interpret the coefficients of a Tobit in the say way as one interprets coefficients in an uncensored linear model” (1997). Because a Tobit model is censored at the point y,*, three derivatives are possible, with respect to any one observation, determined by E[$y_i^* | X$], E[$y_i | X$], and E[$y_i | X, y_i > 0$]. As such, most literature recommends a decomposition utilizing the mean value of the independent variable and the expectations of y_i, the observed variable, which accounts for both the conditional expectation (E[$y_i | X, y_i > 0$]) and the ‘unconditional expectation’ (E[$y_i | X$]) (Johnson and DiNardo 1997; Wooldridge 2000). The particular decomposition used in this study sets y = E[$y_i | X, y_i > 0$], therefore the results must be interpreted with respect to those farms that hired a positive number of off-farm workers, rather than all farms included in the sample. This decomposition additionally allows Tobit results to be interpreted as OLS estimates, the marginal effect on the dependent variable resulting from a one unit change in the explanatory variable. These marginal effects as well as the decomposition factor are presented for all significant variables in table 1.3. Discussion is separated into categories by the dataset used.

Complete Dataset

This empirical model utilizes all available observations and contains 29 of the 33 explanatory variables, excluding those variables pertaining to marketing characteristics of target crops. Of these variables, 15 were removed from the regression during the iterations due to a significance level below the 90% confidence level. The remaining variable coefficients are all statistically significant from zero, as shown by a two-sided t-test with at least a 90% confidence level. No demographic characteristics are shown to be significant. Relative to the excluded Pacific region the Lake, Northeast, Cornbelt, Northern Plains and Appalachian regions are all more inclined to hire less non-family labor for all organic operations. Hired labor also decreases for additional percentages in the amount of total farmed land owned. Single families are more apt to hire less labor compared with all other business structures, reaffirming a farm structure dependent on family labor. Additional years of experience and additional crops produced add to the numbers of laborers demanded. Years of experience only slightly increase demand, as it might be inferred experience leads to greater efficiency with only faint needs for non-family labor. Overall income from organic crops has a positive affect; however as the percentage of income derived from grains increases, labor demanded falls slightly. The greatest measure of increased demand is from a percentage increase in the number of acres devoted to vegetable crops.

Vegetable Dataset

Ten out of the 31 variables utilized for this analysis are found to be significant although, again, no demographic characteristics are included in these significant variables. Location relative to the Pacific region has created mixed marginal affects across the states. The Lake region are more inclined to hire less labor whereas vegetable farms in the Mountain region are just as inclined to hire more labor. Only a very slight marginal increase in labor is attributed to an increase in years experience, as well as the percent of vegetable crops sold on wholesale markets. In this vegetable subset alone do both size characteristics have a positive effect on labor demanded, with percentage of acres devoted to grain crops having the larger effect. Income derived from organic operations is consistent in its effect on labor demand as is percentage of farmed acres owned. Income derived from value-added crops processed on or by organic farm specializing in vegetable production is one of the only structural characteristics in these analyses to imply an increase in labor demanded.

Grains Dataset

This analysis consists of 31 explanatory variables, nine of which are significant and two of which were dropped from the regression due to constant values. The marginal effect on labor demand by the percentage of acres devoted to vegetables is greater here than in any other data subset. For each increase in percentage, there is an increase in labor hired by a factor of 68. This can only emphasize the extreme differences in labor requirements among different commodities. Following the previous subsets, both the percentage of acres owned and the amount of income from organic operations have positive influences on non-family farm labor demand. The only experience characteristic which is significant towards a decrease in demand for labor is the ratio of years farming certified organic to total years farming organically on farms primarily producing grain. This can imply a learning curve associated with grain farming not usually found on the large majority of other organic farms. Four location characteristics were significant, all with the inclination to hire less non-family labor than the excluded Pacific region.

Summary and Conclusions

This study provides key insights into factors affecting an organic farm operator's decision to hire non-family farm labor and at what quantities to hire this labor. Not surprisingly income derived from organic production proved to be a significant motivational factor in all cases. Also expected were significant levels associated with location characteristics, however, there is difficulty in distinguishing whether these regions are significant due to some set of physical characteristics (soil, climate, etc.) or whether migrant labor pattern are more accountable. This discrepancy will require further analyses.

The results also show a negative correlation between non-family labor demand and the percentage of organic acres owned by the farm operator, and although the dummy variable for single family operations was negatively significant in only one sample, it does reinforce the picture of a family oriented and family operated farm. Concurrently, the level of diversification available to all farmers does not seem equal. As shown in the grain subset analysis, an increase in production of a contrasting commodity (vegetables) increases labor demand by a magnitude of 68, essentially making this option of diversification impossible. For those farms currently producing vegetables, the same percentage increase in grain production resulted in an increased labor demand by a scale of only 12.

Retreating back to the original sample shows a less bleak outlook. As the number of commodities produced on a farm increases, the demand for non-family labor increases at the exact same rate. For every additional percentage of income derived from value-added products processed by or for the farm, labor demand doubles. Consider now the direction of marketing of organic foods, especially the ease of pre-packaged products and extended shelf-life of packaged goods. The only marketing characteristic of any statistical significance is the percent of vegetables sold wholesale with a positive effect on labor demanded.

Organic farms are indeed family farms but with significant characteristics associated with increases in non-family labor being very specific to operations of higher acreage, or those producing more commodities, with higher incomes and not necessarily more farming experience, there will be an interest in the future of organic goods.

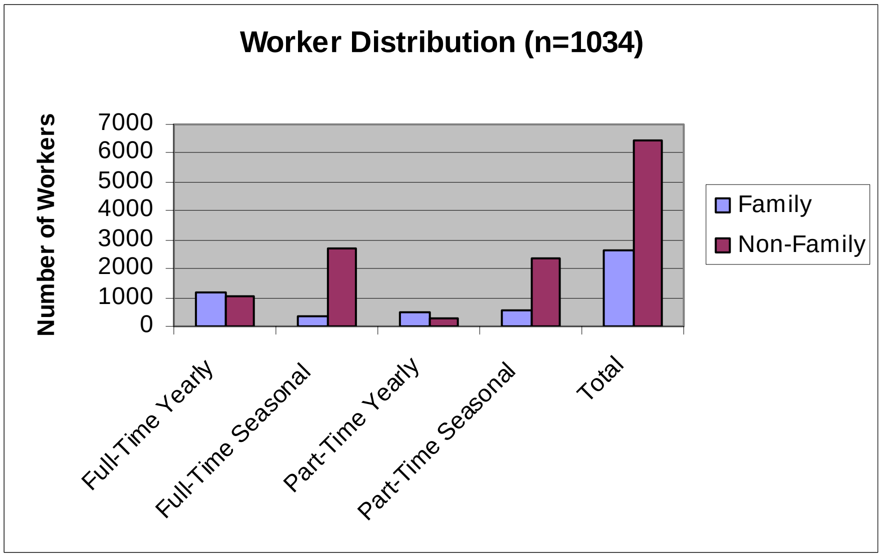

Figure 1.0 Organic Farm Workers' Labor Distribution

Table 1.0 Mean Values and Standard Errors (in Parentheses) of Explanatory Variables

Variable	All		Vegetable		Grain	
CONVDUM	0.1416	(0.3491)	0.0870	(0.2828)	0.1775	(0.3832)
TENURERAT	0.7796	(0.3275)	0.7760	(0.3429)	0.7261	(0.3256)
CROPSGRWN	2.2922	(1.4653)	3.2319	(1.6491)	2.5562	(1.5231)
PERACRSVEG	0.1799	(0.3285)	0.4329	(0.3879)	0.0415	(0.1212)
PERACRSGR	0.3298	(0.3873)	0.1875	(0.3031)	0.6479	(0.2970)
PERINCVEG	28.0655	(40.3528)	67.5199	(35.3664)	15.1799	(31.3003)
PERINCGR	31.7729	(43.3601)	11.2145	(27.1944)	61.8260	(42.3615)
SOLEPROP	0.7229	(0.4482)	0.7464	(0.4367)	0.6864	(0.4653)
SPLAINS	0.0271	(0.1626)	0.0435	(0.2047)	0.0178	(0.1324)
LAKE	0.1265	(0.3329)	0.0942	(0.2932)	0.2367	(0.4263)
STHEAST	0.0060	(0.0775)	0.0072	(0.0851)	0.0000	0.0000
MTNS	0.1054	(0.3076)	0.0870	(0.2828)	0.1006	(0.3017)
DELTA	0.0060	(0.0775)	0.0145	(0.1199)	0.0000	0.0000
NTHEAST	0.2410	(0.4283)	0.3551	(0.4803)	0.2604	(0.4401)
CORNBELT	0.1145	(0.3188)	0.1087	(0.3124)	0.1716	(0.3782)
NPLAINS	0.0602	(0.2383)	0.0145	(0.1199)	0.1124	(0.3168)
APPAL	0.0422	(0.2013)	0.0725	(0.2602)	0.0296	(0.1699)
VAPERDUM	0.4187	(0.4941)	0.4928	(0.5018)	0.3491	(0.4781)
PERVEGDTC	22.5241	(37.6703)	51.2536	(42.0894)	12.8876	(30.4997)
PERVEGW	18.5753	(34.4601)	38.9275	(40.6670)	13.5917	(31.1967)
PERGRDTC	5.7530	(21.4453)	6.3333	(22.7257)	11.3018	(29.0350)
PERGRW	27.3072	(43.6088)	11.0580	(30.1596)	51.8698	(48.3261)
DEMPERCEP	2.0301	(0.8294)	2.2899	(0.7661)	1.9822	(0.7904)
PRICEPERCEP	1.8313	(0.8489)	2.0362	(0.7488)	1.8402	(0.7818)
YRSEXP	20.5437	(12.4197)	16.5870	(9.9750)	23.0414	(12.2656)
ORGYRSRAT	0.6840	(0.3364)	0.8621	(0.2633)	0.5806	(0.3252)
CERTYRSRAT	0.6686	(0.2864)	0.6645	(0.2884)	0.6599	(0.2854)

FULLTIME	0.7048	(0.4568)	0.7246	(0.4483)	0.7396	(0.4401)
OFFFARMDUM	0.5211	(0.5003)	0.5290	(0.5010)	0.4793	(0.5011)
INCDUM	1.5241	(1.0206)	1.3841	(0.9538)	1.7396	(0.9776)
EDUDUM	1.5331	(1.0025)	1.7391	(0.9838)	1.2959	(1.0443)
AGE	50.6145	(11.3713)	48.9783	(10.2626)	49.4320	(10.5310)
GENDER	0.8133	(0.3903)	0.7319	(0.4446)	0.8817	(0.3240)
n=	332		138		169	

Table 1.2 Step-wise Tobit Regression Results

	All		**Vegetable**		**Grain**	
Variable	Coef. Est.	Std. Err.	Coef. Est.	Std. Err.	Coef. Est.	Std. Err.
AGE	R		R		R	
APPAL	-44.3559 [a]	15.4486	R		R	
CERTYRSTAT	R		R		-30.3380 [b]	14.2822
CONVDUM	R		R		R	
CORNBELT	-26.3187 [a]	9.4510	R		-46.0791 [a]	13.7451
CROPSGRWN	3.6248	1.8461	R		R	
DELTA	R		R		DD	
DEMPERCEP	-6.9574 [b]	3.1373	-11.1593	6.1428	R	
EDUDUM	R		R		R	
FULLTIME	R		R		R	
GENDER	R		R		R	
INCDUM	10.3351 [a]	2.6656	20.0052 [a]	5.9517	11.9994 [a]	4.4725
LAKE	-33.1265 [a]	9.1233	-44.6672 [b]	19.2038	-50.3306 [a]	12.1682
MTNS	R		41.1049 [a]	15.9914	R	
NPLAINS	-31.1367 [b]	13.1963	R		-40.3866 [b]	15.9865
NTHEAST	-21.0655 [a]	6.8077	R		-25.4554 [b]	10.6614
OFFFARMDUM	R		R		R	
ORGYRSRAT	R		R		R	
PERACRSGR	R		38.1687	19.7465	R	
PERACRSVEG	19.3779 [b]	7.9978	29.4644 [b]	14.5089	253.6429 [a]	28.8741
PERGRDTC					R	
PERGRW					R	
PERINCGR	-0.1762 [b]	0.0759	R		R	
PERINCVEG	R		R		R	
PERVEGDTC			R			
PERVEGW			0.2342 [b]	0.1154		
PRICEPERCEP	R		R		R	
SOLEPROP	-16.3878 [a]	5.4388	R		-15.9960	8.6414
SPLAINS	R		R		R	
STHEAST	R		R		DD	
TENURERAT	-16.4634 [b]	7.8410	-36.3236 [a]	13.9423	-27.8883 [b]	13.1099
VAPERDUM	9.2581	5.2083	19.4597 [b]	9.6046	R	
YRSEXP	0.6984 [a]	0.2160	1.1444 [b]	0.5303	R	

Log likelihood	-1008.5495	-482.3955	-434.84986
LR Chi-square	118.01	68.32	97.62
Pseudo R2	0.0553	0.0661	0.1009
Number of Obs	332	138	169

R: Denotes a removed variable during regression due to p > .10 (not significant at the 90% confidence level)

DD: Denotes a dropped variable due to constant.

[a, b]: Denote statistical significance at the 99% and 95%, respectively.

Shaded areas denote variables excluded from the regression.

Table 1.3 Marginal Effects and Standard Errors of Significant Variables

	All		**Vegetable**		**Grain**	
Variable	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
NPLAINS [ag]	-7.6651	2.6245			-8.8459	2.8433
TENURERAT	-4.9688	2.3683	-11.5870	4.4834	-7.4945	3.5263
CROPSGRWN	1.0940	0.5568				
PERACRVEG	5.8485	2.4204	9.3989	4.6257	68.1619	8.4322
CORNBELT [ag]	-6.8261	2.1013			-10.2100	2.5302
APPAL [a]	-9.9656	2.5333				
PERINCGR	-0.0532	0.0228				
SOLEPROP [ag]	-5.2514	1.8501			-4.4933	2.5338
VAPERDUM [av]	2.8298	1.6128	6.2336	3.0988		
LAKE [avg]	-8.3353	1.9084	-11.4904	3.9645	-11.4875	2.4028
YRSEXP	0.2108	0.0651	0.3651	0.1710		
INCDUM	3.1192	0.8028	6.3815	1.8629	3.2246	1.1978
DEMPERCEP	-2.0998	0.9507	-3.5597	1.9810		
NTHEAST [ag]	-5.8635	1.7540			-6.3138	2.4724
MTNS [v]			16.3589	7.8005		
PERACRGR			12.1755	6.2720		
PERVEGW			0.0747	0.0371		
CERTYRSRAT					-8.1528	0.6599
Y= E(yols | yols>0)	Y=26.923715		Y=34.741797		Y=26.92372	

[a,v,g] : Denotes dy/dx is for discrete change of dummy variable from 0 to 1 for all, vegetable and grain, respectively.

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