

## Policy Reform and Off-farm Labor Supply by Operators in the Delta Region: A Semiparametric Approach

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*Abstract*

Off-farm employment has been an integral part of the emerging structure of production agriculture in the South. Government farm program payments, farm structure, and strong non-farm economy have important impact on labor allocation, farm and non-farm labor, decision of farm operators. The objective of this investigation was to evaluate the determinants of off-farm labor supply for farm operators in the Delta States. Results show that off-farm work, educational level, presence of teenager, and farm tenure positive and significant impact on ff-farm labor supply by farm operators. On the other hand, farm size, household wealth, decoupled and couple farm program payments, and degree of farm diversification have a negative and significant impact on off-farm labor supply by farm operators. the semiparametreic functional formulation of the farm size and household wealth variables were found to perform better than the linear functional form.

*Key words:* Off-farm labor supply, Delta region, Tobit, semiparametric, government farm program payments, education

## **Policy Reform and Off-farm Labor Supply by Operators in the Delta Region: A**

### **Semiparametric Approach**

#### **A. Introduction**

Historically, farming has been the principal occupation and the primary source of family income in rural America. With the declining number of farms and farmers, the agricultural link to the general economy has tremendously changed over the years. Off-farm employment has been an integral part of the emerging structure of production agriculture. This is particularly true for farms in the South, where farms are small and off-farm opportunities have moved labor out of agriculture. In terms of agriculture the Southeast region (Arkansas, Florida, Georgia, Alabama, parts of Tennessee, Louisiana, and Mississippi), beef and broilers are important livestock products. Fruits, vegetables, and peanuts are grown in this region. Big citrus groves and winter vegetable production areas in Florida are major suppliers of agricultural goods. Cotton production is making a comeback. In the Delta States (Arkansas, Louisiana, and Mississippi), the principal cash crops are soybeans and cotton. Rice and sugarcane are also grown. With improved pastures, livestock production has gained in importance. Families operating small farms usually depend more on off-arm employment than those operating large farms (Mishra et al., 2002).

The fact that nearly 80 percent of total household income originates from off-farm sources, with income from off-farm wages and salaries being the major contributor, is a case in point to the importance of these sources of income to the economic well-being of the household. The closing of the income gap between farm and non-farm households, which has materialized in recent years, has been attributed to the growth in the earnings from off-farm sources (Mishra et al., 2002). The economic diversity of the Southeast

provides a unique window on the US economy as a whole and the opportunities for local workforce. The region's economic output is about \$1.7 trillion. By comparison, the gross domestic product of the nation is about \$13 trillion. Pockets of the region are lagging because of job losses in manufacturing industries, such as textiles, apparel, and furniture making. Fortunately, some of these weaknesses are being offset by growth in higher-wage manufacturing activities. For instance, a highly efficient vehicle assembly and parts manufacturing industry has taken root in this region.

Government farm program payments, farm structure, and strong non-farm economy have important impact on labor allocation, farm and non-farm labor, decision of farm operators. The 2002 Farm Security and Rural Investment Act introduced a number of new commodity program provisions in addition to continuing many programs that existed under prior legislation. The direct "decoupled" payment provide assistance to farmers regardless of production and which may have implications on production and labor allocation by farmers. On the other hand, qualitative arguments suggest that counter-cyclical payments, direct payments, and acreage base and payment yield updating provisions of the 2002 Farm Act could have some influence on production and there by time allocated to farming by operators. The determinants of off-farm labor supply have received considerable attention in recent years. The central question of our analysis pertains to whether 2002 US farm policy reforms may have altered the decisions to work off the farm by farmers in Delta region of the U.S. and in Louisiana. The objective of this analysis is to evaluate the determinants of off-farm labor supply by farm operators in Delta States of the U.S.. The semiparametric approach is more flexible in that it smoothly approximates nonlinearities in the relationship between household net

worth, farm size, and off-farm work by operator. We test the appropriateness of the functional form specification between semiparametric and parametric forms using Hong-White test.

## **Literature Review**

Many economists have noted the changing structure in U.S. agriculture and its implications for farm businesses and farm households. For example, Gebremedhin and Christy (1996) point out that the ownership and control of land and technology plus the distribution mechanisms is becoming increasingly concentrated in the hands of a few farm operators and/or corporations. They further note the risk to the survivability of small farms if this trend continues to grow unabated. Among the strategies adopted by small farm households to insure their economic viability is to participate in off-farm employment. Studies by Newton and Hoppe (2001) point to the importance of this strategy of increased reliance by small farm households on income from off-farm sources. The authors also point to the need of maintaining a healthy rural economy as a prerequisite to the economic viability of these households. Despite the prevailing evidence of its increased importance, Hoppe (2001), however, asserts that off-farm work is not a new phenomenon, since one-fourth to one-third of farm operators worked off-farm in the 1930's and 1940's.

While policies aimed at increasing access to off-farm job opportunities is a viable tool to improve the economic well-being of farm households, past studies have shown that such access is likely to be more important for husbands than for wives, in terms of both participation and earnings potential (LeClere). Ahearn, Perry, and El-Osta (1993) reported similar findings. For example, in 1988, when a spouse was present, the study

found operators somewhat more likely to work off-farm than the spouse (47% versus 42%, respectively). In households where the farm operator worked off-farm, the farms were more likely smaller in terms of gross sales, net farm income, and net worth. A study by Korb shows that younger, better-educated farmers and spouses are most likely to work off farm. In that operator's age and education are both factors that are associated with off-farm employment have been empirically tested and supported in a number of studies (e.g., see Huffman, 1980; Huffman and Lange; Gould and Saupe; Lass et al.; Gunter and McNamara; Lass and Gempeasaw; Huffman and El-Osta; Corsi and Findeis; among others). Yet many studies have also examined the role government payments play in impacting the decision to work off-farm, particularly the type of payments initiated by the 1996 Federal Agricultural Improvement and Reform Act where payments were designed to be "decoupled" from current production decisions (Ahearn et al, 2006; El-Osta et al, 2004). Findings of these studies have demonstrated that receipt of government payments, regardless to whether the payments come from programs which tie payments to current year production or not, tend to decrease the likelihood of farm operators working off the farm. This study will add to the literature by assessing the role of government payments in impacting the off-farm labor allocation decisions of married couples based on four off-farm work strategies; whether only the operator works off-farm, only the spouse works off-farm, both work off-farm, or neither operator nor spouse work off-farm.

### **C. Data and Methods**

Data for the analysis are from the 2005 Agricultural Resource Management Survey (ARMS) conducted annually by the Economic Research Service and the National

Agricultural Statistics Service. The 2003 ARMS survey queried farmers on all types of financial, production, and household activities (such as labor allocation, and consumption expenditures). Specifically, it is used to gather information about the relationships among agricultural production, resources, and the environment. It also helps in the determination of production costs and returns of agricultural commodities and in the measurement of net-farm income of farm businesses. Yet another aspect of ARMS that is an important contribution is the information it provides on the characteristics and financial conditions of farm households, including information on management strategies and off-farm income.

Since the primary interest of this paper is to examine the effects of government payment, both coupled and decoupled, crop insurance, and availability of health insurance on off-farm labor supply of operators in the Delta region of the U.S., we limit our attention to the sample of family farms. After deleting some missing observations, the final sample count is 720. Built on some of the previous studies that examine the off-farm labor supply decision (e.g., Mishra and Goodwin, 1997; Ahearn et al. 2006; Huffman and Lange, 1989; Lim, 2002), the characteristics of the farm operator, farm production, farm financial situation, farm household characteristics, and local economy are hypothesized to be associated with the decision to work off the farm by the operator.

Analyses of labor supply typically adopt one of three empirical approaches, maximum likelihood, two step sample selection method, and Tobit methods. In this study we implement semiparametric estimators appropriate for censored dependent variables to evaluate the level of participation of operators in Delta region and Louisiana in off-farm labor market. We consider a range of specification tests that evaluate the normality

assumption inherent in the maximum likelihood estimation. We also consider semiparametric estimators which yield consistent estimates without requiring strong distributional assumption. Summary statistics and definitions of the variables utilized in the analysis are presented in table1.

#### **D. Results and Discussion**

Results of the estimated models are presented in two sets. Table 2 presents the estimates and marginal effects of the tobit model for the decisions of the operator to work off the farm. The model estimated fit well as indicated by goodness-of-fit statistics in table 2. A cursory look at the results points to the importance of age and educational attainment of farm operator, size of operation, farm tenancy, type of farm, level of farm capitalization from various farm program payments, along with family size and off-farm working experience of the operator. Our results are consistent with the literature, but more powerful than those obtained by others in various regional studies of off-farm labor supply of farm households.

The effects of significant variables on the propensity to work off the farm by the operator are expected and in agreement with some of the findings in previous studies. For instance, our results show the importance of human capital on off-farm work decisions. It appears that the propensity to work off the farm by operators increases with the level of education (*OP\_EDUC*) but decreases with age of the operator (*OP\_AGE*). Results indicate that an additional year of schooling increases annual off-farm work hours by the farm operator by about 60 hours. On the other hand, an additional year in age decreases annual hours of off-farm work by about 22 hours (Table 2). These results are also consistent with earlier findings in the literature (e.g., Huffman, 1980; Mishra and



Goodwin, 1997; Huffman and Lange, 1989). Off-farm work experience is significantly correlated with off-farm labor supply of farm operators. Results in table 2 indicate that additional year off-farm work experience increases off-farm labor supply by 36 hours, annually. More off-farm experience implies a greater accumulation of human capital specific to off-farm work and thus suggests larger relative returns to off-farm work. This result is consistent with earlier findings in the literature (e.g., Huffman, 1980; Mishra and Goodwin, 1997).

Gronau (1973) suggested that women have a comparative advantage in homemaking and child care and thus the presence of children in the household was likely to imply less off-farm work. In this study, number of household members under the age of six (*HH\_SIZE06*) and number of household members between the ages 13-17 (*HH\_SIZE13*) were included in the regression. Results indicate a positive and statistically significant of number of household members between the ages 13-17 (*HH\_SIZE13*) on the off-farm labor supply by farm operators. One possible explanation is that, children in this age group might be able to perform some farm tasks and help out on the farm, compliments the efforts of the farm operator, which in turn allows farm operators to work off the farm where his/her returns are higher working off the farm. This result is consistent with many other studies, such as Mishra and Goodwin (1997).

Inclusion of farm program payments in the off-farm work decision is important since it has been argued that farm program payments increase and stabilize the total income of farm households and hence lessen the need to work off-farm (e.g., Mishra and Sandretto 2001). However, starting with the 1996 Farm Bill, farm program payments can be categorized into decoupled (not tied to the production of commodity crops) and

coupled payments (those that are tied to the commodity crops). The former could be considered as pure income transfer payments. The second type of payment is made if the prices fall below the posted or guaranteed price (El-Osta et al. 2004; Ahearn et al. 2006). One can argue that coupled payments reduce income variability and hence have a negative impact on off-farm work. Government farm program payments and their impact on income and time allocation has been widely studied in the literature. Results from this study show that larger receipt of both decoupled (*F\_DECOUP*) and coupled (*F\_COUP*) farm payments were significantly correlated with less off-farm work by operators. Results in table 2 indicate that an additional \$1,000 in decoupled (*F\_DECOUP*) and coupled (*F\_COUP*) payments decreases off-farm labor supply of operators by 30 and 20 hours, respectively. This result is consistent with other studies (Dewbre and Mishra, 2007; Ahearn, El-Osta, and Dewbre, 2006; El-Osta, Mishra, and Ahearn, 2005). These results may imply that reductions in direct farm payments, as are expected in the development of 2007 farm legislation, may result in increased off-farm work force participation by farm operators.

The size of the farm, measured by value of agricultural production (*F\_SIZE*) variable, was included in the regression to assess the impact of farm size on off-farm labor supply of farm operators in the Delta region of the U.S. It has been argued in the literature that large farms are likely to have full-time farmers, who are involved in production agriculture and are more likely to be working on the farm. The coefficient on *F\_SIZE* is negative and statistically significant at the 1 percent level of significance. Results indicate that an additional \$10,000 increase in agricultural sales decreases off-farm work by 13 hours annually (table 2). This result is consistent with other studies

(Mishra and Holthausen, 2002; Sumner, 1982; Lass and Gempesaw, 1992; El-Osta, Mishra, and Ahearn, 2004). The size of household wealth may have an impact on the off-farm labor supply. For instance, wealthier farmers are less likely to have a need for extra income and wealth helps smooth consumption in times when income falls short of income. The estimated coefficient for household wealth or net worth (HH\_NW) is negative and statistically significant at the 1 percent level of significance. Results indicate that an additional \$10,000 increase in household wealth decreases off-farm labor supply of farmers in Delta region by about 17 hours. Findings suggest that household wealth acts as a substitute for off-farm work. These results are consistent with the findings Mishra and Goodwin, 1997; Mishra and Goodwin, 1998; Mishra and Holthausen, 2002;

Farm tenure influences the decision to participate in off-farm work. Tavernier, Temel and Li (1997) point out the importance of tenure structure on land conversion and suggest implications for off-farm work. In this study dummy variable for full owner (*F\_FOWNER*) and part owner (*F\_POWNER*) were included to assess the impact of tenure on off-farm labor supply of farm operators in the Delta region. Delta region has a higher share of tenants in the U.S. and tenant group was used as the base group in this study. Results indicate that full owners (*F\_FOWNER*) and part owners (*F\_POWNER*) supply more labor to off-farm work compared to the base group (tenants, table 2). One can argue that tenants are less likely to work off the farm since they have already committed themselves to farming by renting land and perhaps their commitment to farming signals their comparative advantage in farming. These results are consistent with the findings of Kimhi 1994; Mishra and Goodwin, 1997; Tavernier, Temel, and Li, 1997.

Finally, the coefficient for diversified farms<sup>2</sup> (*F\_ENTROPY*) is negative and statistically significant at the 10 percent level of significance (table 2). Results indicate that farm operators of diversified farms, those that have more farm enterprises, have higher demand for on-farm labor and thus supply less hours to off farm work. It can also be argued that diversified farms have stable income for farm families, thus reducing the need for off-farm income. Finally, the Delta region grows a variety of crops, from cash grains like soybean, rice and corn, to cotton, sugarcane, and other fruits and vegetables. A dummy variable (*F\_CG*) was included in the regression to assess the impact of farm type such as cash grains on off-farm labor supply of farm operators. Results indicate that operators of cash grain farms supply more labor to off-farm work (table 2). The finding is consistent with the fact that many of these cash grain crops may not demand on-farm labor hours and hence provide the operators with the opportunity to work off the farm. Additionally, these crops receive government payments in case of crop failure and/or price collapse that reduces the risk of poor or variable income.

Two sets of semiparametric analysis were performed assuming that functional form of variables like “*HH\_NW*” and “*F\_SIZE*” are unknown. When these variables are used in the regression, we found that results were similar to that of the tobit model. Coefficients associated with “*HH\_NW*” were found to be insignificant in the model although “*F\_SIZE*” was found to have a significant negative effect. When predicted value of off-farm hour from this semiparametric regression was plotted against the real value (see figure 1), we found that model predicts the value fairly closely below 2000

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<sup>2</sup> Farm diversification is measured by Theil’s entropy index. The index has a value of 0 to 1, with 0 indicating specialization and 1 diversified farms.

hours level. Above 2000 hours off-farm hours, model seriously under predicts the real values.

When we increased the number of variables to be included as nonparametric in the model, we found that coefficients signs changed. These signs are not consistent with the findings from the tobit model and also apriori belief. When predicted values of off-farm hours are predicted against the real values, it was found that the model seriously under predicts especially in the range above 2000 hours of off farm work (Figure 2).

### **Summary and Conclusions**

Off-farm employment has been an integral part of the emerging structure of production agriculture. This is particularly true for farms in the South, where farms are small and off-farm opportunities have moved labor out of agriculture. Government farm program payments, farm structure, and strong non-farm economy have important impact on labor allocation, farm and non-farm labor, decision of farm operators. The objective of this investigation was to evaluate the determinants of off-farm labor supply for farm operators in the Delta States. With no clear functional form of farm size and household net worth variables and its impact on off-farm work hours, we considered the semiparametric formulation of farm size and household net worth and its impact on off-farm labor supply of farm operators.

Results show that education of the farm operator along with off-farm work experience, and tenure have positive and significant impact on the hours worked off-farm by farm operators in the Delta region. Further, government farm programs, in particular, both decoupled and coupled farm payments were significantly correlated with less off-farm work by operators. Results indicate a negative and significant impact of farm size,

degree of diversification, and household wealth on off-farm work by farm operators in the Delta region. Finally, the semiparametric functional formulation of the farm size and household wealth variables were found to perform better than the linear functional form.

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**Table 1: Definition and summary statistics of variables used in the analysis**

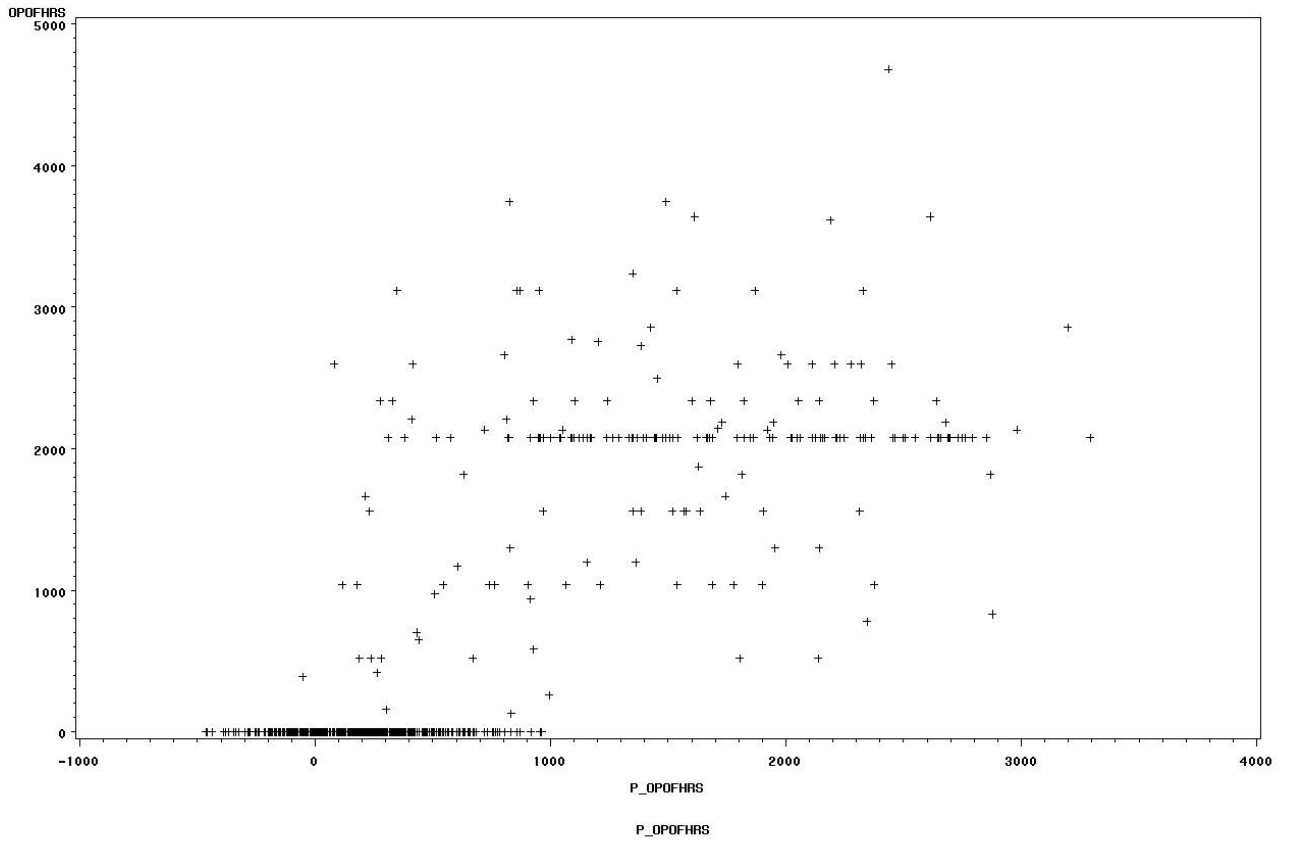
<b>Variable</b>	<b>Definition</b>	<b>Mean</b>	<b>Std. Dev.</b>
<b><i>Dependent Variables</i></b>			
OP_OFW	Annul off-farm work hours	644.38	1010.09
<b><i>Operator Characteristics</i></b>			
OP_AGE	Age of operator (years)	55	12.52
OP_OFEXP	Off-farm work experience of the operator	4.90	9.99
OP_INSUR	=1 if the farm operator received health insurance through off-farm work	0.21	0.40
OP_EDUC	Years of formal education, operator	12	1.23
<b><i>Family Characteristics</i></b>			
HH_SIZE06	Number of household members under age 6	0.11	0.44
HH_SIZE13	Number of household members between 13 and 17	0.41	0.08
HH_NW	Household net worth (\$1,000)	1129.50	1700.43
<b><i>Farm Characteristics</i></b>			
F_DECOUP	Decoupled farm program payments	20,080.51	47,950.69
F_COUP	Coupled farm program payments	20,111.32	63,056
F_CRPPAY	Conservation reserve payments	1,160.62	7,105.81
F_FOWNER	=1 if the farm if full owned (share)	0.41	0.49
F_POWNER	=1 if farm is partially owned (share)	0.42	0.49
F_SIZE	Farm size, value of agricultural output sold (\$1,000)	516.88	748.88
F_CROP	=1 if cash grain farm (share)	0.22	0.41
F_INSUR	=1 if the farm has crop insurance	0.76	0.42
F_ENTROPY	Entropy measure of farm diversification	0.13	0.11
<b><i>Local Economic Conditions</i></b>			
F_MILES	Population of labor market area, lagged 1 year (percent)	23.16	17.03
<hr/>			
<i>Sample size</i>	Farm operator households in Delta region (Arkansas, Louisiana, and Mississippi)		720

**Table 2: Tobit estimates of off-farm labor supply decision of farm operators in Delta region, 2005**

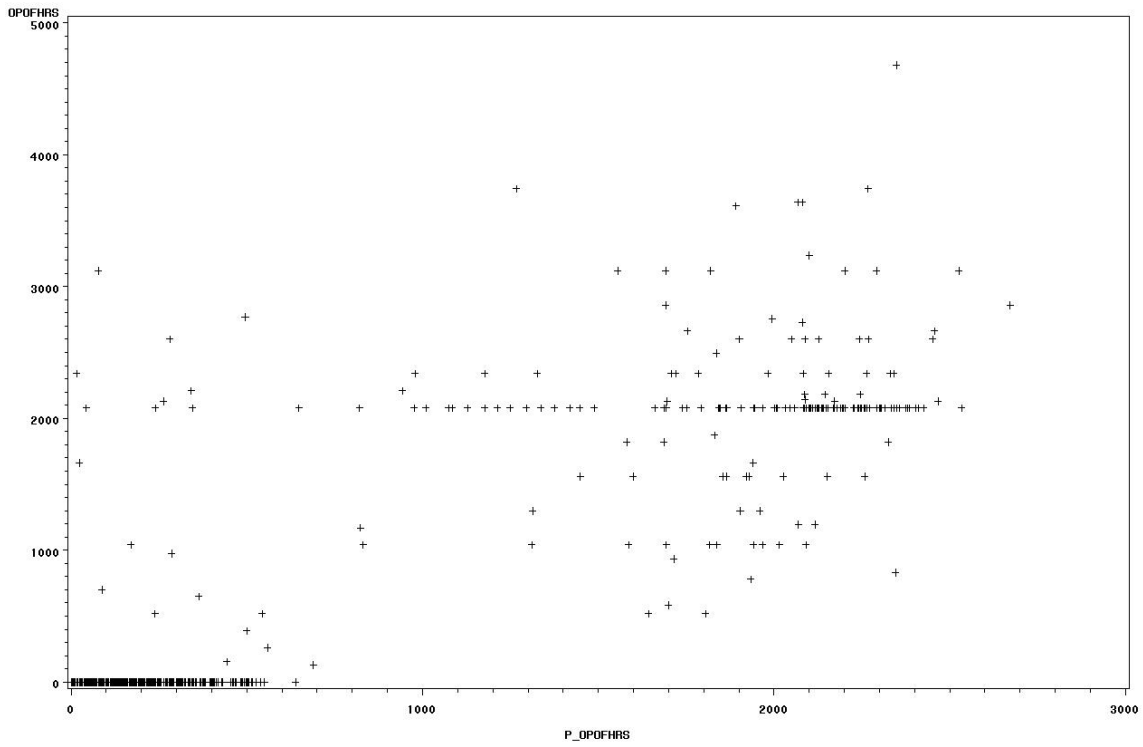
Variable	Parameter estimate	Marginal effects
Constant	883.54 (857.88)	
OP_AGE	-49.96*** (6.36)	-21.98
OP_EDUC	134.96*** (51.49)	59.38
OP_OFEXP	83.87*** (6.15)	39.90
OP_INSUR	44.28 (142.33)	19.51
HH_SIZE06	-15.48 (167.50)	-6.81
HH_SIZE13	171.70* (89.69)	75.54
HH_NW	0.38*** (0.11)	-0.17
F_FOWNER	1180.52*** (363.52)	491.92
F_POWNER	1263.57*** (368.81)	611.46
F_SIZE	-3.08*** (0.36)	-1.36
F_CRPPAY	-0.04 (0.05)	-0.020
F_DECOUP	-0.06*** (0.02)	-0.030
F_COUP	-0.03** (0.01)	-0.020
F_CROP	218.95 (312.13)	100.22
F_INSUR	-418.23 (284.46)	-198.37
F_ENTROPY	-1199.67* (653.97)	-527.82
F_MILES	-2.11 (3.39)	-0.93
LR Chi-squared (p>chi squared)	667.99*** (0.0000)	
Likelihood ratio test	-2105.72***	
Pseudo R <sup>2</sup>	0.15	

\* Significant at 10%. \*\* Significant at 5%. \*\*\* Significant at 1%.

## Semiparametric graphs



**Figure 1. Off-farm work hours and predicted off-farm work hours under semiparametric model (2 variables using semiparametric formulation)**



**Figure 2. Off-farm work hours and predicted off-farm work hours under semiparametric model 2 (more variables using semiparametric formulation)**