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Farm and Off-Farm Work Decisions

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Farm and Off-Farm Work Decisions

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Faced with changing economic conditions, farm operators have dramatically increased the rate at which they divide their work time between self-employing farm work and the wage labor market, a situation which best can be described as multiple labor market participation. By the time the Rural Income Maintenance Experiment began in 1969, over 54 percent of all operators in the United States had off-farm sources of income, primarily from wage work. (This and subsequent national statistics are derived from the U.S. Bureau of the Census, Census of Agriculture, 1969). This figure had grown almost 10 percentage points from the end of the previous decade. Furthermore, there are strong negative correlations between the sales levels of farms and both the rate of multiple market participation and the attachment to the wage market of those who participated in it.

With respect to wage market participation, the Rural Experiment's sample is quite consistent with the national averages. Over 33 percent of the Experiment's Iowa farm operators and 58 percent of the North Carolina operators had wage jobs at some time during the three experimental years. The comparable national averages for operators with the same farm sales levels as the Iowa and North Carolina samples were approximately 37 and 50 percent, respectively. These figures underestimate the level of multiple labor market involvement among farm families. If the labor market activities of both husbands and wives are considered, in almost 50 percent of Iowa farm families and 78 percent of North Carolina families either the farm operator, his wife, or both held wage jobs. However, even for those families who were active in both labor markets, wage work provided only a secondary source of income. For the Iowa families participating in both markets, only about 23 percent of all earned income derived from wage work, and the comparable figure for North Carolina families is 48 percent. The comparable national averages for farm families with the same farm sales levels as the Iowa and North Carolina samples were approximately 26 and 55 percent, respectively.

This description of the labor market activities of farm families indicates clearly that a study of their labor supply must consider activity in both the self-employment and the wage labor markets. This study analyzes the effects on farm family labor supply of the introduction of an experimental negative income tax (NIT) program. Following the above discussion, it will focus on both labor markets. Theoretical considerations related to the study are presented next, and this is followed by a summary of the actual analysis. The final section of this paper discusses the main findings, and places them in the perspective of the overall farm-related analysis of the Rural Experiment.

THEORETICAL OVERVIEW

In a simple world in which a farm operator is paid the value of his marginal product, receives no nonpecuniary benefits or costs from work activities, faces no market imperfections or institutional constraints, and does not respond to the labor market activities of other family members, the theory underlying multiple labor market participation is quite clear. This theory, which is fairly well documented in the literature (e.g., Lee; Olsen), has as its foundation the notion that farm operators, like other rational business managers, will allocate resources in such a manner that maximizes the value of the marginal product of each resource unit. Of course, operators' own labor is one such resource. The unique aspect of this labor, however, is that the standard assumption of diminishing marginal productivity does not apply to all of its applications: in the wage market, labor is usually rewarded as if its marginal product were constant. Thus, farm operators are faced with the following utility maximizing condition for their labor:

$$VMP_F = \overline{w} = MRS_{L \cdot Y} \tag{1}$$

where VMP_F is the value of marginal product of an operator's time spent in his own production process when all other inputs are held constant; $\overline{w}$ is his market wage rate; and $MRS_{L \cdot Y}$ is his marginal rate of substitution of income for leisure.

The key to understanding the implications of equation (1) lies in the assumptions of diminishing marginal productivity of labor in the self-employing farm operation and constant marginal productivity in wage work. These suggest an ordering of time allocation: as long as VMP_F exceeds $\overline{w}$, an individual allocates all work hours to the farm operation, thereby depressing VMP_F. At the point at which VMP_F falls to equal $\overline{w}$, he channels his remaining work effort to the wage market, stopping all work when the final condition of equation (1), $\overline{w} = MRS_{L \cdot Y}$, is met. Of course corner solutions in which VMP_F equals $MRS_{L \cdot Y}$ at values greater than $\overline{w}$ are also common. In such cases, farm operators maximize utility by stopping work before they enter the wage market at all.

According to this theory, any change in income that treats the return to labor in each market exactly the same leaves the equilibrium quantity of farm work unaffected. This result is particularly important for predicting the affects of introducing an NIT program. The income guarantee provision, G, of such a program does not alter the return to labor at all, while the tax rate, t, alters all returns equally. The new equilibrium condition between labor markets, $(1-t)VMP_F = (1-t)\bar{w}$, implies switching from farm to wage work at exactly the same number of farm hours as before the introduction of the tax. In this case, changes in time allocation result from changes in the wage work-leisure equilibrium point, which is dictated by the last equality in equation (1). Since $\bar{w}$ and $MRS_{L \cdot Y}$ are altered differently by the provisions of the NIT program, equilibrium can be restored only by reductions in wage work. Of course, if all wage work is exhausted before equilibrium is restored, the residual adjustment will occur in farm work. Finally, if the corner solution with no wage work exists, the full burden of restoring the equilibrium rests in reducing farm work.

The preceding discussion leads to the appealing conclusion that, to discern the impact of an NIT program on individuals' work in both the farm and wage markets, the analysis can be confined to the latter, unless a corner solution is reached. However, instead of narrowing the focus to wage work, it can be shown that this "conclusion" is merely a testable hypothesis, and not one that can be defended rigorously. The expansion of the theory evolves from the possibility that non-income utility differences and differential imperfections between the labor markets exists.

Non-income utility differences between farm and wage work are directly associated with an individual's performing the tasks which comprise his different jobs and with his actual or perceived roles in the job settings. It is commonly believed that farm operators prefer farm work for reasons over-and-above the income it produces. This belief is based on the mystique of farmers' "love of the soil" and self-employed persons' feelings about determined work schedules and supervision. Restructuring the analysis so that the utility maximizing framework reflects potential utility differences between labor markets leads to the following equilibrium condition:

$$VMP_F + d = \bar{w} = MRS_{L \cdot Y} - MRS_{HO \cdot Y} \qquad (2)$$

where d, which reflects the differences in marginal returns resulting from worker preferences, is technically the difference between the marginal rate of substitution of farm work and income, $MRS_{HF \cdot Y}$, and of wage work and income $MRS_{HO \cdot Y}$. If our belief concerning their preference for farm work is correct--d is positive--operators utility maximizing mix of work should include enough farm work to drive VMP_F below $\bar{w}$.

Differential market imperfections can take many different forms. First, tax rules, both experimental and nonexperimental, provide workers with the ability to legitimately or illegitimately manipulate self-employment income to their own advantages. Workers may transform such income into a form treated preferentially by the tax laws; they may defer income or expenses to a more opportune time; or they may simply misreport income and expenses. Second, constraints on work schedules can prevent complete hours adjustments. In addition to the usual institutional constraints associated with the length of a wage work day, farm operators are limited with respect to which parts of a day or year they can spend off their farms. If they farm on a sharing basis, they may be further constrained by the size or the nature of the farm operation that is available to them. Finally, long-term investment activities may inhibit short-run job market adjustments. Such activities are usually associated with the farms, and they may increase farm work above the equilibrium level that is suggested by equation (1). However, the opposite is possible: if operators have visions of long-run careers in the wage market, they might increase wage work at the expense of farm work (VMP_F would rise above $\bar{w}$). All of these examples of market imperfections are consistent with equation (2).

The implication of all of the considerations summarized in equation (2) is that the ordering of time allocation discussed in conjunction with equation (1) cannot be accepted as a general description of such allocation. Certainly, it cannot be assumed that the guarantee and tax provisions of an NIT program leave the level of farm work unaffected. Furthermore, labor market decisions may be simultaneously determined since they may well vary with such factors as the level of farm work, the level of wage work, the ratio of the two, and/or the level of non-work income. Since work of any type is usually assumed to be an inferior good, a net decrease in work effort can still be expected. However, the source of this decrease is uncertain. On the basis of the above discussion, it seems plausible that the level of farm work may increase for experimentals relative to controls, while the levels of both wage work and total work decline. These results are also possible if, due to consumption factors, farm work is a normal good. Of course, other scenarios are also possible.

This entire situation is further complicated by potentially interdependent labor market decisions among family members. As has been demonstrated (Killingsworth; Kerachsky and Mallar), such interdependence makes the direction of NIT effects on a given family member theoretically ambiguous.

THE ANALYSIS

Due to the theoretical ambiguities which are summarized above, the empirical investigation follows an approach which imposes few restrictions on the estimated experimental NIT effects. The analysis is based on a four equation simultaneous system. The three central equations are labor supply equations for the farm operators' farm work, their wage work, and their wives' wage work. (Wives' farm work and other family members' work are assumed to be independent of this system.) To insure consistent estimates of experimental effects, the non-experimental portions of the equations are fully specified, including proxy variables for the marginal return to work and income, life-cycle and other demographic variables, and the work effort and marginal returns to work associated with the other market and/or the spouse. The portions of the equations which are designed to capture the effects of the experiment were variously specified as simple experimental status variables and complex interactions of status with demographic characteristics. More will be said about the experimental variables later. The fourth equation in the system is a farm labor demand equation which, together with the endogenous marginal return to farm work variable, completes the system. Since the experimental NIT program is not expected to alter the farm production relationship, there is no experimental component of this equation, and it will not be discussed further in this paper.

The ease with which individuals may enter the wage market suggests that the sample relevant to this evaluation includes all farm operators and their wives. However, this broad sample must be adjusted somewhat due to two sample differences. The first involves the geographic regions. Important differences in farming are evident between North Carolina and Iowa involving such things as the types of crops and livestock, the scales of the enterprises, the capital/labor ratios, and, perhaps most important, the nature of tenancy. Other differences are evident in the stocks of human capital and the nature of the wage market (i.e., the extent to which it is directly associated with agriculture). Because of these differences, the samples in the two regions exhibit different structural relationships, and they are analyzed individually. The second sample difference relate to life cycle. Particularly in Iowa, many young and old farm operators are engaged in or are anticipating the intergenerational transfer of farm assets. Therefore, they qualified for the experimental sample on the basis of small current income and wealth which is often not characteristic of their normal income and wealth. Furthermore, these same two groups face wage market opportunities which differ from those of the middle-aged group. These include easier access to training and careers for the younger group and retirement alternatives to work for the older group. Because the characteristics of these three broad groups could lead to very different experimental responses, and because of the small number of young and old observations, the analysis is confined to the middle-aged group--families in which the head is between the ages of 30 and 59 at the start of the experiment.

Another sample adjustment is permitted by the panel nature of the data. The basic cycle of a farm operation is one year, so the period of analysis is defined accordingly. Except in unusual cases, each family is observed for three years. An error-components model, which increases the degrees of freedom over the number of totally independent observations while minimizing the bias of the estimates, is used to pool these multiple observations on each family. The final analysis sample and its distribution by experimental treatment status is shown in Table 1.

Since not all farm families participated in wage work, the analysis is divided into two parts. In the first, the annual hours of operators' farm work (HF) are evaluated together with the decision of operators and wives to enter the wage market (HOB and HOBW, respectively). Annual hours of farm work are constructed from the four one-week observations of hours recorded for each year. The binary wage work variables are derived from individuals' recall of wage work activities for entire quarters. The second part includes only those families which participated in both markets, and it evaluates the hours of farm work together with the hours of operators' and wives' wage work (HO and HOW, respectively). HO and HOW are conditional on at least one spouse having positive wage hours, so one spouse may still have zero hours. Further refinement of this conditional concept

TABLE 1

NUMBER OF OBSERVATIONS BY

TREATMENT STATUS

(North Carolina/Iowa)

Guarantee As Percent Of Poverty Level	Tax Rate			
	0%	30%	50%	70%
0%	143/149			
50%			26/27	
75%		19/36	46/35	15/12
100%			40/25	

would require larger samples. While the estimation of equations with binary and bounded conditional dependent variables could be improved with appropriate maximum likelihood techniques, the complication of pooling and simultaneity require that a least squares technique be used.

Several versions of the labor supply equations were estimated with different specifications of both the nonexperimental and the experimental variables in the equations. This exercise demonstrated that the estimated experimental effects on farm work are quite stable, while those on the wage work of both spouses generally are not. A representative set of estimates of experimental effects is presented in Table 2. These estimates are taken from reduced-form equations, so they reflect both the direct effects of the experiment on the respective labor supply variables as well as the indirect effects induced by changes in the other labor supply variables. Except for the two binary wage market participation variables, the labor supply variables are expressed as natural logs. The basic experimental status variable, TREAT, has a value of one for experimental families and zero for control families. Alone, its estimated coefficient is the first-year effect of the median experimental plan (50 percent tax rate and 75 percent guarantee). TYR2 and TYR3 have values of one for experimentals for the second and third years of the experiment, respectively, and zero otherwise. The second and third-year effects of the median plan are determined by adding the appropriate year's estimated coefficient to the coefficient estimated for TREAT. TX/DEV is the percentage point difference between an experimental family's tax

TABLE 2

REGRESSION COEFFICIENTS FOR EXPERIMENTAL EFFECTS

ON FARM FAMILY LABOR SUPPLY

	North Carolina					
	All Farm Families			Multiple Market Participants		
	ln HF	HOB	HOBW	ln HF	ln HO	ln HOW
TREAT	-.1020	.0270	.0876	-.1326	.1361	1.3126
	(.1250)	(.0854)	(.0848)	(.1586)	(.6441)	(.6155)**
TYR2	.2707	-.0176	-.0679	.3647	-.6992	-.8732
	(.1592)*	(.1033)	(.1038)	(.1953)*	(.7332)	(.7105)
TYR3	.5090	-.0307	-.2670	.5552	-.8381	-2.3948
	(.1646)***	(.1072)	(.1077)**	(.2086)***	(.7896)	(.7642)***
TX/DEV	.0108	-.0043	-.0028	.0139	-.0266	.0220
	(.0058)*	(.0042)	(.0041)	(.0074)*	(.0315)	(.0299)
GR/DEV	.0023	-.0065	-.0049	.0016	-.0248	-.0390
	(.0035)	(.0025)***	(.0024)**	(.0041)	(.0177)	(.0167)**

	Iowa					
	All Farm Families			Multiple Market Participants		
	ln HF	HOB	HOBW	ln HF	ln HO	ln HOW
TREAT	.0278	.1761	.0566	.0528	1.2629	-1.7756
	(.0738)	(.0848)**	(.0856)	(.1341)	(.7728)	(.8732)**
TYR2	.0090	-.1412	-.0154	-.0459	-.5877	.2152
	(.0777)	(.0998)	(.0954)	(.1586)	(.9143)	(1.0332)
TYR3	.0859	-.0907	.0067	.0892	-.6397	1.6276
	(.0788)	(.1010)	(.0967)	(.1577)	(.9090)	(1.0271)
TX/DEV	-.0060	.0018	-.0031	-.0053	.0807	-.0428
	(.0037)	(.0039)	(.0041)	(.0054)	(.0308)**	(.0349)
GR/DEV	-.0050	-.0029	-.0052	-.0016	-.0458	.0090
	(.0027)*	(.0029)	(.0030)*	(.0035)	(.0203)**	(.0229)

The numbers in parentheses are standard errors.

* t-statistic is significant at the .10 level.

** t-statistic is significant at the .05 level.

*** t-statistic is significant at the .01 level.

rate and the median rate of 50 percent. It is set to zero for controls. GR/DEV is defined similarly for experimental family's guarantee as a percent of their poverty level. The experimental effects for those in nonmedian plans are calculated by multiplying the deviation from the median tax rate and guarantee (times 100) by the respective estimated coefficients. These products are then added to the estimated median plan effect.

The results for North Carolina form a reasonable pattern. The trend for farm operators is toward more farm work and less wage work, while that for wives is less pronounced. In all cases, the first-year is characterized by generally insignificant effects that counter these trends. Only the experimental effects on farm work and wives' wage work show patterns of statistical significance at the .10 level of less. The North Carolina results that are most sensitive to changes in the model specification are those for wives' wage work. In fact, the effects on wives' conditional hours are the only ones which respond dramatically to changes in the other categories of labor supply: when the indirect experimental effects that operate through HF and HO are constrained to zero, it is revealed that the average direct effect on HOW is strongly negative. The average annual effects that are estimated from Table 2 without regard to statistical significance are presented in Table 3. The figures presented for wage work represent changes in unconditional hours. It is important to note that, while there are strong patterns of experimental effects on labor supply, the average effect of the median plan on total family labor supply is zero. Finally, while the effect

TABLE 3

AVERAGE ANNUAL EXPERIMENTAL EFFECTS

ON FARM FAMILY LABOR SUPPLY

	North Carolina		Iowa	
	Absolute Differentials[a]	Percent Differentials[b]	Absolute Differentials[a]	Percent Differentials[b]
Farm Operators				
Hours of farm work	+186	+13.8	+141	+5.9
Hours of wage work	-258	-35.1	+559	+204.5
Employment in wage work	+.011	+1.8	+.099	+34.2
Total hours of work	-72	-3.5	+700	+26.3
Wives				
Hours of wage work	+72	+5.2	-27	-73.3
Employment in wage work	-.024	-3.9	+.054	+17.5
Farm Operators and Wives				
Total hours of work	0	0	+673	+24.9

[a]These differentials are calculated as the adjusted experimental group mean minus the adjusted control group mean. Adjusted means are derived from the full sets of regression results and the average sample characteristics. The differentials directly reflect the effect on a "typical" sample member enrolled in the median experimental plan.

[b]These differentials are the percent change from the adjusted control group mean to the adjusted experimental group mean.

on the farm hours of multiple market participants is not summarized in Table 3, it is virtually identical to that for the entire farm sample.

The results for Iowa, which are also presented in Tables 2 and 3, seem less reasonable at first glance. The only experimentally-induced disincentive that is evident is on HOW, and, while this is large in percentage terms, working wives in the Iowa sample report very few hours. The effects on farm operators' farm and wage work are positive, and those on the latter are particularly large and significant. However, two observations help to place these results in a better perspective. First, the positive wage effects generally diminish over time. So, as with the North Carolina results, there is evidence that the first year reflects an adjustment to the new program rather than the longer-term, normal response. Second, the large positive effects on HO result from the indirect effects of changes in HF and HOW. In fact, the average direct effect on HO is negative. Thus, while the overall pattern of results is unusual, it is consistent with the generalized theories of multiple labor market participation and family labor supply. Once again, the average effect on multiple market participants' farm hours is very similar to that for the entire farm sample.

The small number of observations in most nonmedian plans suggests that the estimated effects of changes in the NIT parameters may be unreliable. However, interesting results do emerge. Changes in the tax rate produce no pattern of effects. This is consistent with the standard theory, since such changes should result in conflicting substitution and income effects. Changes in the guarantee, on the other hand, produce a pattern of negative and often significant effects. Again, this is consistent with the theory, since only an unambiguous income effect is produced.

CONCLUSION

It does not seem to be enough to summarize the labor supply results and to discuss what patterns of results emerge and how they correspond to the theory. In addition, it is important to step back to determine what these results mean and how they fit into the overall pattern of farm-related experimental effects. While the changes in wage work can be translated directly into family income and, therefore, welfare, because of the constant return to such work, changes in self-employing farm work cannot.

The most direct way to determine the farm-related effects of the experiment on family welfare is to analyze farm profit, directly. This was done by Evans in a companion study to this one. He determined that the experimentally-induced farm work increase is accompanied by a decrease in profit of 15 to 17 percent in both regions. While some of this decrease probably results from the incentives experimental farm operators had to misreport profit and income, the magnitude of the effects and the strong time trends leaves little doubt that there is some decrease in profit. In another companion study, Saupe reinforces Evans' findings by demonstrating an experimentally-induced decline in sales. However, this decline is often small and it is not true of all enterprises. Furthermore, the analysis is seriously complicated by the farm sharing arrangements. Despite the problems with these two studies, it seems clear that farm-related experimental effects did not improve family welfare, and they probably reduced it. Together with the wage work results, this implies a certain reduction in family welfare in North Carolina, and an ambiguous effect in Iowa.

One apparent paradox remains. If the farm hours results are accepted, and there seems to be no serious reason why they should not be, how can they be reconciled with the profit and sales results? In his study of profit and hours, Evans also explored the concept of work effort, which reflects managerial ability and the intensity of activity (for a discussion of this concept, see Leibenstein). He estimates that experimental and control farm operators are equally price efficient (i.e., they are equally profit-maximizing in their use of variable farm inputs), but that experimental operators are less technically efficient (i.e., they produce less output from a given bundle of inputs). Consequently, while experimental operators spend more time on their farms, they are less careful managers. A more optimistic view is that these operators may devote time to farm improvements and other investment activities which may increase production and profit in the long run, while having unfavorable effects in the short run. There is very limited evidence that the latter may have been occurring.

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