



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

FARM INCOME ENHANCEMENT POTENTIAL FOR SMALL, PART-TIME FARMING OPERATIONS IN EAST CENTRAL OKLAHOMA

Scott Sanford and Luther Tweeten

Abstract

Linear programming and stochastic farm growth simulation models are used to assess the impact of alternative enterprise selection, variation in farm income, inflation, and off-farm income on the growth of small, part-time farms in East Central Oklahoma. Results indicate that alternative rates of inflation or variation in farm income do not significantly impact the operation or expansion of part-time farming operations. Adoption of alternative enterprises on part-time farms can lead to full-time farming operations where expansion initially is aided through use of off-farm income. Small full-time operators could greatly enhance family income by obtaining off-farm employment and income.

Key words: linear programming, growth simulation, part-time farms, specialty enterprises.

Part-time farming may once have been viewed as a temporary expedient for the few but now constitutes the single largest segment of all farms. It is known that many part-time small farm operators do not plan either to become full-time operators of larger units or to become full-time nonfarm residents and workers. Yet, many questions remain about the role and economic prospects of small, part-time farms. What is their potential for becoming viable, commercial farms? What is the role of off-farm income in the transformation? Answers to these and related questions are useful to current or prospective farm operators, to the policymaker interested in preserving the family

farm, to the researcher projecting changes in the structure of agriculture, and to the agricultural specialist developing strategies to assist individual farmers.

OBJECTIVES

In 1981, research was undertaken by Oklahoma State University and Langston University to determine for East Central Oklahoma (ECO) the current structure and future plans for farm operators and the possible impact on future economic viability and structure of alternative enterprise selection and off-farm employment. The specific objective of the study was to test the following three major hypotheses:

- 1) Families on small farms by adopting efficient practices and traditional enterprises can earn an income from farming alone comparable to the county per capita personal income.
- 2) Small, part-time farming operations can be transformed into conventional full-time farming operations while maintaining or increasing total family income.
- 3) Full-time small farms in poverty producing traditional enterprises can raise income above the poverty level by expanding acreage, by farming more efficiently, and by introducing more labor-intensive specialty enterprises.

Another related hypothesis tested was that

Scott Sanford is an Agricultural Economist, Commodity Economics Division, ERS, USDA; and Luther Tweeten is Anderson Professor, Department of Agricultural Economics and Rural Sociology, The Ohio State University.

This research was conducted at Oklahoma State University and was supported by the Oklahoma Agricultural Experiment Station.

Comments of Susan Bentley, Fred Hines, Robert Hoppe, Mike Woods, and four anonymous *Journal* reviewers are appreciated. The authors are solely responsible for any shortcomings of the paper.

Copyright 1988, Southern Agricultural Economics Association.

the incidence of poverty on small farms is not different from that on larger farms.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Anyone analyzing small farms encounters lack of agreement on definitions. Lewis enumerates no less than 42 different definitions for small farms used in various articles and bulletins (p. 86). (For an excellent review of small farm definitions and policy implications see Ghebremedhin and Johnson.) By any definition, the incidence of low income and part-time farming is high in the U.S. Southeast extending from the Coastal Plains of the Carolinas to the Ouachita Highlands of Eastern Oklahoma. The small farm population is diverse (Carlin and Crecink). Larson and Lewis found few common problems among small farms grouped by alternative definitions. The more common characteristics were few assets and small dollar volume of farm products sold.

Definitions of poverty and part-time farming also differ. A common definition of part-time farming entails the operator working 150 days or more off the farm, but some definitions use 200 days or more of off-farm employment. The poverty threshold is usually the federally established standard, which for a family of four was \$10,989 in 1985.

Defining small farms as those with sales of \$20,000 or less, the number of small farms in the United States dropped from 3.6 million in 1960 to 1.5 million in 1980. After dropping sharply for several decades, the relative number of these small farms has increased since 1978 (U.S. Department of Agriculture, 1987). To understand the reversal, disaggregation of data is useful. Tweeten et al. (1980) divided small farms into categories of aged operators (those 65 years old and over), part-time (those working 200 days or more off the farm per year), and others (mainly full-time, able-bodied operators). Since 1959, numbers of small farms with full-time, able-bodied operators have fallen sharply, numbers with aged operators have remained nearly constant, and numbers with part-time operators have significantly increased. Thus, small-farm trends are dominated by growing numbers of part-time operators. Their rise accounts for the increasing proportion of small farms since 1978.

The literature on small and part-time farming in the United States is massive, and

one publication lists 334 citations from 1967 to 1979 alone (U.S. Department of Agriculture, 1980). Only a few studies are noted here that relate to the hypotheses advanced. Small farms have been almost universally associated with low income; federal agencies, including the Cooperative Extension Service, have been accused of denying the small farm an appropriate share of public services (Humphries). In a classic study of small farms in the Ouachita Highlands in Oklahoma, Back and Hurt found that, within current fencelines, farmers producing conventional enterprises even with high-level management and technology were unable to achieve a net farm income above the poverty threshold. Such studies, along with those indicating inability of small farmers to achieve economies of size (Tweeten and Huffman) led to what was characterized by some as the "get big or get out" syndrome. Breimyer concluded that "agriculture - as we've known it - has maybe 10 or 15 years left if tax laws remain the same. One by one, family farms will give it up."

Other analysts were more optimistic and turned their attention to the production of specialty crops for the small farmer. Whatley asserted that "the small farmer must get out of the large farmer's ballpark" and outlined a plan for small farmers to achieve an adequate income through production of specialty crops.

These and other studies provide a rich source of hypotheses, some of which are examined in the current study. Although the study is for one area in Oklahoma, it has characteristics similar to those found in other areas of low income, minority, and small-farm operators in the U.S. Southeast. Supplemented by other studies, it can be a useful source of information about prospects and opportunities for small, part-time farmers.

Because this study is concerned with *potential* for growth, it relies heavily on linear programming to determine enterprise combinations maximizing net farm income which may be consumed or saved to invest in assets generating future income flows. Because linear programming becomes unmanageable when maximizing income subject to the consumption function restraint over a planning horizon of up to 30 years such as used herein, this study relied on linear programming to determine an efficient mix but simulated growth of income over time using a model

developed and tested in an earlier study (Tweeten et al., 1984).

METHODS AND PROCEDURES

Testing the hypotheses stated earlier in the objectives was undertaken with the following steps:

- 1) identification of representative farms based on commitment to farming as measured by allocation of operator labor to farm and nonfarm activities,
- 2) determination by budget and linear programming techniques the income optimizing combinations of conventional and/or alternative enterprise organizations, and
- 3) measurement of the competitiveness of alternative farm enterprise organizations with off-farm job opportunities for available labor as indicated by return-per-unit of labor invested and potential for expansion for representative farms based on simulation or farm-firm growth over time.

TABLE 1. PART-TIME AND FULL-TIME FARM MODEL RESOURCE BASES, EAST CENTRAL OKLAHOMA, 1981

Resource (Units/Period)	Availability	
	Part-Time Farm	Full-Time Farm
Land (acres):		
Cropland	20	493
Pasture or range	60	663
Labor (hours/year):		
Operator	1,226	3,306
Spouse	728	728
Child	600	600
Hired	0	1,800
Machinery (number):		
Motor truck ($\geq .5$ ton)	1	3
Tractor (55 hp.)	1	0
Tractor (≥ 100 hp.)	0	2
Combine (16' head)	0	1
Capital (dollars):		
Provided by owner	0	0
Borrowed operating ^a	17,000	50,000
Borrowed intermediate ^a	56,000	120,000

^a These values represent limits on borrowing and not actual capital usage.

For comparison, a typical-farm scenario was developed for both part-time operators and full-time operators using data from a survey of 372 East Central Oklahoma farm operators.¹ The groups and their definitions are:

Part-Time Operators - respondents working off-farm at least four hours per day for 150 or more days,

Full-Time Operators - respondents working at least four hours per day off-farm for less than 150 days, and

Aged or Disabled Operators - respondents 65 years old or older in the survey year or having 50 percent or greater disability.

According to this scheme, 143 farms or 40 percent were classified as part-time farming operations, 130 farms or 35 percent as full-time farming operations, and the remaining farms as operated by aged or disabled farmers. Of the 143 farms designated part-time, 96 were selected as a data base for development of a part-time farm model. In selecting a subset of the total number of survey respondents that were classified as limited-resource part-time operators, it was decided to use the lower half of the distribution according to farm size in acres. This was done to focus analysis on small-scale and limited-resource farming operations.

Development of the full-time farm model was accomplished using the upper half of the distribution by acreage of the respondents classified as full-time operators. The decision was made to exclude "full-time" farms with too few physical resources to utilize operator and family labor and management.

THE LINEAR PROGRAMMING MODEL

Table 1 presents selected characteristics of the operators and their family and farm. These data were used in a linear programming algorithm (Moehle and Kletke) to determine the net farm income optimizing enterprise selection for the model farm. Two groups of enterprises were evaluated for

¹The survey site consisted of four East Central Oklahoma counties: McIntosh, Muskogee, Okmulgee, and Wagoner. The survey was conducted in the summer of 1981 with the information collected corresponding to the 1980 production period.

optimum net farm income in the part-time and full-time farm models. These groups were:

traditional - those enterprises commonly observed in the survey area and related enterprises - grains, soybeans, hay, pasture, cattle and calves, and

specialty enterprises - 14 vegetable crop activities ranging from no-till asparagus to irrigated watermelon.

The combinations evaluated were: 1) traditional enterprises alone, and 2) traditional and specialty enterprises.

The enterprise budgets utilized were developed by personnel at Oklahoma State University for the climatic and agronomic characteristics of the survey area. Where appropriate, the enterprise budgets were modified to reflect the equipment and resources of the particular model farm under analysis. Specific production practices in the budgets reflect slightly above average management. Roughly translated, this "efficient" level of management represents that which the upper 60 percent of the farmers in the survey area achieve.

The net income figure resulting from the linear programming solution to a particular proxy farm model is a return to equity, risk, unpaid operator and family labor, and management. No land costs are subtracted because all land in the basic initial resource situation is assumed owned by the operator. Prices for output and inputs are consistent with prices received and paid by farmers in East Central Oklahoma in 1984. Commodity prices generally have declined since 1984, hence returns on average have been lower than those shown.

THE FARM GROWTH AND SURVIVABILITY SIMULATION MODEL

The results of the static linear programming solutions are here used as input into a dynamic farm growth and survivability situation model. The simulation model used in this study is an "equilibrium" model utilizing a priori specified real rates of return on resources to estimate income rather than utilizing long-term projections of yields,

prices, and other variables to determine rates of returns (Tweeten et al., 1984, p. 3). It is assumed that yields, prices, and asset values for other variables will, over time, interact and adjust to reflect these specified real rates of return. In this respect, the model is not subject to the error often attending projections of yields, prices, and other variables over extended periods.

The model simulates the growth of a particular farm firm over a 30-year growth horizon. Within this period, the farm firm is allowed to acquire additional land and expand subject to its ability to support a specified family consumption allowance, existing and expected mortgage levels, a down payment requirement, and equity position. Land acquisitions are in 40-acre increments.

Once through the 30-year growth cycle for a farm, a period assumed to correspond with age 35-65 of the operator, the model proceeds to simulate another 30-year growth cycle for a farm with similar initial assets. This is done 100 times with ending values for particular variables reported as averages. A particular strength of the model is its flexibility, permitting analysis of a wide range of resource situations and the impact upon expansion of alternative tax schemes, inflation rates, consumption patterns, and off-farm labor activities.

The detailed information contained in linear programming (LP) solutions to the proxy farm models provides input for the growth simulation model in the form of annual hours of labor, value of livestock and machinery requirements, and the gross dollar values of crop and livestock sales. This last value, when multiplied by an appropriate constant, 7 percent in this study, produces the returns-to-management component of simulated farm income.² Operator equity, the excess of the dollar value of the farm's owned assets over debt, obtained from the LP results, is multiplied by a fixed percent return (4 percent real rate unless otherwise specified) to calculate the returns-to-equity component of simulated farm income. (Presentation of additional simulated farm income components is reserved for a later discussion of variation in farm income.)

For the farm to purchase additional acreage, several conditions must be met.

²Typical professional farm management fees range from 5 percent to 10 percent of landlord's receipts. Extending this to all receipts implicitly assumes the management share is the same for the landlord's and tenant's portions.

First, the net worth/assets ratio must exceed the specified ratio required for land purchase. Second, the farm firm must be able to meet a specified down payment criterion. Last, in the event of a contemplated purchase, the expected cash flow must be sufficient to cover the present mortgage payment on land plus the increase in mortgage payment due to the contemplated purchase. If these criteria are not met, no purchases are made during the year.

The simulation model provides 1) a balance sheet of assets, liabilities, and equity, 2) a summary of sources and uses of personal income, 3) reconciliation of change in equity, 4) operated acreage, and 5) other miscellaneous statistics for each year of the 30-year growth cycle. Additionally, the number of bankruptcies observed is recorded and reported. Bankruptcy of the farm firm is deemed to have occurred in the model when the net worth-to-asset ratio falls below 20 percent.

In addition to the impact of alternative enterprise selection upon farm growth and survivability, the analysis also focuses on the impact of the following variables: labor, family allowance and consumption, inflation rates, and variation in farm income.

Labor

In simulating the part-time farming operation, all available labor not used on the farm (up to 2,808 hours) is assigned an off-farm opportunity cost of \$8.40 per hour. These figures were based upon the part-time operator respondents' survey data and represent a weighted average off-farm wage and work effort by the operator and spouse. Two alternative hypothetical off-farm labor patterns were evaluated. Alternative A, a less restrictive scenario, allowed the part-time operator family flexibility in devoting time to farm or off-farm work. Alternative B allowed either full off-farm income, or no off-farm income – as could be the case where legal or institutional restrictions in the off-farm labor market dictate work schedules or hours.

An additional feature of each labor function was that beyond year 20 of the growth horizon, family labor available for farm or off-farm work was restricted to that supplied by the operator alone. This is consistent with the children growing up and leaving home. At

any time during the farm's 30-year growth period, additional labor could be hired at the rate of \$4.26/hour, provided that all family labor was allocated to farming activity.

Family Allowance and Consumption

Not all income may be directed toward expanding the operator's farm; some must be used for family support. Two levels of autonomous or minimum family consumption were imposed and evaluated individually for their impact upon farm expansion. These were \$19,163 and \$13,688 or 70 and 50 percent, respectively, of the weighted average family income for the four-county survey area (U.S. Department of Commerce, Bureau of Economic Analysis).

When total family income exceeded minimum specified levels, consumption was calculated as 0.7 of marginal disposable income. Recent empirical research concerning farmers' consumption propensities lends support to this treatment of consumption in the model (Richardson and Nixon).

Inflation and Tax Rates

The analysis sought to measure the impact of alternative inflation rates upon farm growth and survivability. Inflation-induced cash-flow problems which can influence firm growth have been well documented (Tweeten). Inflation raises cash costs for interest payments but defers returns which are fully realized as capital gains unavailable to satisfy cash debts unless the land is sold. Inflation also influences farm growth by raising the price of land and decreasing the acreage a given equity will secure. Two inflation rates are analyzed – 6 and 12 percent. The simulation model contains several tax features.³ Tax rates used are those specified by the Economic Recovery Tax Act of 1981.

Variation in Farm Income

Farm income in the model is defined as the sum of management income, equity income, farm labor income, and interest income. The first two have been discussed previously. Farm labor income is determined by multiplying the hours of family farm labor by the \$4.26 hourly farm labor wage. Interest income is the annual income earned on the farmer's unused capital which is assumed deposited in an interest-bearing account. In order to randomize farm income, an error

³The depreciation rate is assumed to be 9 percent which is consistent with replacing machinery about every 12 years. Investment tax credit of 10 percent of the value of new machinery is provided. Interest expenses are treated as business expenses for tax purposes. Income averaging is allowed. Self-employment income tax is determined according to the Social Security Act Amendments of 1983.

term is generated from a standard normal distribution and multiplied times farm income (as calculated above) and a coefficient of variation of farm income. This random element is then added back to farm income, producing a random farm income expressed in dollars. Coefficients of variation in farm income of 50 and 75 percent are used in the analysis. The coefficients were derived from accounting records of Oklahoma farms.

Table 2 presents the variable combinations evaluated for each of the two enterprise groups. These combinations and enterprise groups are then evaluated for alternative farm models.

TABLE 2. SELECTED COMBINATIONS OF COEFFICIENTS OF VARIATION, INFLATION RATES, LABOR FUNCTIONS, AND AUTONOMOUS FAMILY CONSUMPTION LEVELS (EVALUATED FOR EACH ENTERPRISE GROUP), EAST CENTRAL OKLAHOMA^a

Scenario	Control Variable			
	CV ^b	INF ^c	LABFN ^d	AUTCON ^e
	(Percent)	(Percent)		(Dollars)
1	50	6	A	19163
2	75	6	A	19163
3	50	12	A	19163
4	50	6	B	19163
5	50	6	A	13688

^a A full listing of all combinations would be 16 scenarios, with 4 variables and 2 values per variable.

^b Coefficient of variation.

^c Inflation rate.

^d Family farm/off-farm function.

^e Autonomous family consumption level.

SIMULATION RESULTS AND IMPLICATIONS

The results of the East Central Oklahoma (ECO) survey, linear programming solutions, and simulation analysis are discussed relative to the hypotheses previously presented. Results for the various enterprise combinations are discussed first; other options are discussed more briefly.

Hypothesis 1

Current small farm families, by adopting efficient practices and traditional crops, could earn an income comparable to the county per capita personal income.

Linear programming and simulation results indicate that adopting efficient practices and traditional crops will not result in the family earning an income comparable to

the county per capita personal income from its farming efforts alone. The part-time proxy farm linear programming model was analyzed as a full-time operation allowing for labor hiring and land rental. Net farm income was only \$11,662 when traditional enterprises were produced (Sanford, p. 68).

Off-farm income was critical for the small family to achieve the median family income in the survey area, \$27,375. In both the linear programming and simulation results, the family achieved the \$27,375 income goal, but only when off-farm income was maintained at high levels. Simulation results indicate that the \$27,375 goal is attainable in some years by the barest of margins. Achievement of the income goal required some contribution of farming to total family income – off-farm income alone, even at its peak (\$23,606) was insufficient.

Hypothesis 2

Part-time farming operations can be transformed into full-time operations while maintaining or increasing total family income.

The questionnaire revealed that most of today's small farms began small and most of the larger farms began large (Sanford et al., p. 7). Few operators starting on small acreages became commercial farms even after decades on the farm. At issue is whether this low incidence of small farms growing into commercial farms was the result of resource constraints or of other factors such as lack of motivation. To help resolve the issue, growth of the part-time farm model was simulated over a 30-year horizon for each enterprise group. The farm was deemed "transformed" into a full-time operation if off-farm family income was eventually eliminated while maintaining at least the minimum family income requirement of \$13,688 for consumption. Results are presented in scenario 5 of Table 3.

In simulated growth of the part-time, traditional-enterprise farm, off-farm income remained a large proportion of total family income throughout the 30-year period (Table 3). In scenario 5 for year 20, off-farm income averaged over half of total family income and averaged 39 percent of total family income at the end of the growth period. Average ending size was 395 acres. When allowance is made for the initial 80-acre base, these results indicate an average growth of about 315

TABLE 3. ESTIMATED VALUES FOR SELECTED CHARACTERISTICS BY SCENARIOS INCLUDING ENTERPRISE GROUP AND FARM TYPE, EAST CENTRAL OKLAHOMA

Variable and Scenario ^a	Enterprise Group and Year							
	Traditional				Traditional/Specialty			
	Initial	Year 10	Year 20	Year 30	Initial	Year 10	Year 20	Year 30
Part-Time Proxy Farm								
Acreage								
1	93	240	322	389	111	276	398	441
2	120	240	324	395	120	276	400	446
3	89	240	323	360	112	274	296	403
4	93	240	322	383	110	268	398	430
5	88	200	307	390	108	239	363	441
Base ^c	112	222	317	377	115	256	379	419
Off-farm/total income ratio								
1	.80	.59	.52	.39	.75	.50	.40	.10
2	.81	.59	.52	.39	.76	.49	.39	.09
3	.81	.59	.52	.26	.75	.50	.30	.00
4	.81	.59	.51	.38	.75	.51	.39	.11
5	.81	.62	.54	.38	.76	.54	.41	.10
Base	.81	.61	.53	.32	.76	.51	.39	.05
Total family income (\$1,000)								
1	29.4	40.3	45.6	42.9	41.1	56.0	77.6	95.5
2	29.2	40.3	45.7	43.7	31.2	47.8	60.6	46.4
3	29.1	37.8	45.3	33.0	31.3	47.1	52.4	37.6
4	29.3	40.0	46.2	44.0	31.3	46.5	30.3	44.1
5	29.1	38.1	43.8	44.0	30.9	44.0	57.5	44.2
Base	29.2	38.9	44.9	38.9	31.1	46.4	56.0	40.9
Low-Resource Full-Time Proxy Farm ^b								
Acreage	80	119	120	120				
Farm Income (\$1,000)	4.0	6.0	6.1	6.0				
Labor Requirement (hrs. annually)	96.8	144.0	145.2	145.2				
Family Consumption (\$1,000)	2.8	4.2	4.2	4.2				

^a See Table 2 for scenario definition.

^b Assumes inflation rate 6 percent, CV of 50 percent, average propensity to consume of 0.7, and no off-farm labor or limit on autonomous family consumption.

^c Base scenario represents the average for all variable combinations.

acres over the 30-year period. From the linear programming results, it was determined that production of traditional enterprises in the part-time proxy farm model requires an annual average of 3.45 hours of labor per acre. Even at the end of the growth period, the proxy farm growth model required only 1,363 hours of annual labor. The operator could supply labor to the farm and still devote considerable labor to an off-farm job. Production of traditional enterprise alone is not conducive to transforming a part-time farming operation, such as the one analyzed, into a full-time farming operation.

Simulation of the part-time proxy farm model producing both traditional and specialty enterprises yielded different results. Under assumptions of scenario 5, average farm size at the end of the 30-year growth period was 446 acres for an average increase of 366 acres, somewhat higher than for traditional crops alone. The linear programming results indicated that the net farm income optimizing enterprise combination requires an annual average of 6.4 hours of labor per acre. Thus, at the end of the growth horizon, the model farm required 2,854 hours of labor per year. This farm labor requirement is approaching the limit of total (farm plus non-farm) operator labor availability. These results suggest that a combination of traditional/specialty enterprises can fully employ the farm family's labor and transform the part-time operation into a full-time family farm without substantial expansions in acreage. For many operators, management capability will constrain income to less than indicated.

The second portion of the hypothesis – “while maintaining or increasing total family income” has yet to be discussed. Within a specific farm growth simulation, total family income fluctuates randomly inasmuch as it has as one component, a random variable – farm income. Additional features built into the simulation model contribute to income patterns over time. For instance, beyond year 20 of the simulation, off-farm income is restricted to that provided by the operator. These restrictions diminish total family income as off-farm income falls and farm expenses increase due to the hiring of replacement labor. The termination of non-operator family farm labor occurs automatically at year 20, while the timing of decreases in off-farm income usually depends upon other factors, specifically, rate of farm growth and labor intensiveness of the enterprises expanded.

In the case of traditional enterprises, the rate of growth and increases in labor requirements are such that, beginning at year 20, these factors exert a cumulative downward influence on total family income. In most simulations, total family income was observed to peak in year 20 and decrease thereafter. In some cases, total family income increased again in the late years of growth, but rarely exceeded the 20th year high before the culmination of the 30-year growth horizon. Likewise, average expansion beyond

year 20 slowed noticeably. This same phenomenon was apparent in the simulated growth of the traditional/specialty enterprise producing proxy farm model.

The significance of these patterns relative to the hypothesis under consideration is that, while production of specialty crops in conjunction with traditional enterprises may lead to full-time farm operation, total family income may decrease in later years as off-farm income falls. It is likely that a real-world farm operator would elect to attain some compromise equilibrium position with respect to total family income, rather than forego income by attempting to maximize farm size.

Hypothesis 3

Full-time small farms in poverty producing traditional enterprises can raise income above the poverty level by expanding acreage, by farming more efficiently, and by introducing more labor-intensive specialty enterprises.

Two resource bases were evaluated in the analysis of small, full-time farming operations, both consisted of 80 acres: one – unimproved pasture land, the other – 60 acres of improved pasture and 20 acres of cropland.

Linear programming results for the “low-resource” model farm consisting of 80 acres of unimproved (native grass) pasture yielded a net farm income of \$3,168 when only traditional enterprises were produced. Results for the 80 acres consisting of 60 acres of improved pasture and 20 acres of cropland yielded a maximum net farm income of \$9,850. In 1984, a family of three would have had to earn over \$8,250 to rise above poverty level income (U.S. Department of Census, Current Population Reports, p. 31). Clearly, the low resource farm did not achieve this level, while the farm of identical size and improved resources achieved an income in excess of the poverty level from farming alone. It is apparent that not only the level of resources at hand but also the quality of resources are significant factors in avoiding poverty.

When the 80-acre base consisting of 60 acres of improved pasture and 20 acres of cropland was analyzed allowing for production of traditional and specialty crops, a net farm income of \$17,324 was achieved. This figure represents a significant increase over the \$9,850 achieved from production of tradi-

tional crops alone and clearly exceeds the \$8,250 poverty threshold.

The simulation model was run for the low-resource, full-time farming operation producing traditional enterprises. The minimum consumption requirement (\$13,688) was imposed. In all cases, bankruptcy was eventually observed as the farm was forced to draw down equity to finance current consumption. When the simulation was run allowing consumption to be 70 percent of net farm income, irrespective of how low consumption became, the average size farm at the end of the 30-year growth horizon was only 120 acres and at no time produced an income exceeding the poverty level. The average annual consumption obtained under assumptions in the lower panel of Table 3 was only \$4,000.

Clearly, for the low-resource farming operation, expanding via traditional enterprise production and land purchase is not feasible. The presence of cropland enabling production of specialty crops is much more conducive to attaining an acceptable income level and expanding the farm. However, in most cases the farm family's total labor resource is under-utilized and/or not well compensated. The ECO survey data reveal that the full-time operator's part-time counterpart earns almost \$11.00 per hour for off-farm work.

These data suggest the small full-time operator capable of working off-farm could greatly enhance total family income by obtaining off-farm employment and income. For most small, full-time operations in poverty this course represents greater potential for escaping poverty than increasing their level of farming activity or embarking on more labor-intensive and capital-intensive specialty enterprise ventures. It is noteworthy that only 4 percent of part-time operators and a smaller percent of low-income, part-time operators proposed to produce specialty crops to increase farm income (Sanford et al., p. 19). Only 6 percent of all operators of small farms (sales under \$40,000) and an even smaller percentage of small-farm operators with low overall income proposed to increase income by producing specialty enterprises.

The importance of off-farm income is apparent in examining the incidence of poverty on small farms and on larger farms. From the ECO survey data, linear programming, and simulation results, the adjective “small” does not carry any inherent implications regarding the financial position of a

particular farm. Much more important determinants are factors such as land base and enterprise selection, and the presence or absence of off-farm income supplementing farm earnings.

If one were to choose to define "small" farms in terms of acreage alone, then the absolute number of farms in poverty might be higher for small farms than for large farms by the sheer preponderance of small-farm numbers. Using the survey data for all farms and classifying those below the mean average (431 acres) as "small," the "small" farms outnumbered the "large" farms by a ratio of 3:1. The number of farms in poverty in each group was 16 and 10, respectively. These values represented 5.8 percent of the small farms and 10.2 percent of the large farms. Thus, more small farms were in poverty, but individual small farms were only about half as likely to be in poverty as their large counterparts. The overall frequency of poverty among the survey respondents, 7 percent in 1980, was less than the incidence of poverty among all Oklahoma rural farm families in 1979 (U.S. Department of Commerce, Bureau of the Census, p. 53).

Higher incidence of part-time farming distinguishes the ECO survey area from farming in the remainder of the state. Part-time farming and off-farm income keep many small farmers above the poverty level. Among the survey respondents whose farms were 100 acres or smaller, four-fifths were part-time operators. Average off-farm income for these farmers was \$23,606 in 1980. Off-farm income alone was sufficient, in most cases, to elevate total family income above poverty levels.

While the foregoing discussion of poverty on small farms used an acreage definition of "small," similar reasoning applies when defining "small" based upon some measure of scale of farming operation – such as gross farm sales. The majority of farms having low gross farm receipts are part-time operations which, again, have large off-farm earnings. To associate the term "poverty" with this definition of "small" ignores this most important component of total family income and economic well-being.

ADDITIONAL FINDINGS AND IMPLICATIONS

Alternative rates of inflation and alternative coefficients-of-variation in farm income were analyzed for their influence on farm

growth and survivability. Inputs can be measured by comparing growth simulation results for scenarios in which other variables are held constant and the variable of interest allowed to assume alternative values. For instance, regarding the impact of inflation, the appropriate comparison in Table 3 would be between results under scenario 1 and 3. In Table 2, eight pairs of scenarios will have only the variable under consideration differing. A similar procedure would be performed for analysis of the impact of alternative coefficients-of-variation in farm income.

For each enterprise group, the simulation model produced earlier land acquisitions for a farm facing a 6 percent inflation rate than for the same farm facing a 12 percent inflation rate. However, differences due to inflation as a percentage of average ending acreage for the enterprise groups were less than 1 percent. Clearly, inflation rates did not greatly influence expansion opportunities.

Differences among coefficients-of-variation (CV) followed patterns similar to the differences among inflation rates. The impact on average ending acreage was negligible. This result could be expected because farm income is a small proportion of total family income on both types of farms. Unexpected shortfalls in farm income for a particular year can be compensated for by off-farm income. Government policies of maintaining lower inflation or of reducing variation in farm income do not appear to significantly impact the operation or expansion of part-time farming operations similar to those analyzed here. However, the process of going from one policy outcome to another may influence farming in ways not considered herein.

SUMMARY AND CONCLUSIONS

Tests of hypotheses based on data and analyses for this study indicated the following:

- 1) Families on small farms (as defined in this study) producing traditional enterprises with good management and efficient techniques cannot earn an income comparable to the county average. Nonconventional enterprises or off-farm income are possible options to reach the county average income.
- 2) Part-time farming operations cannot be transformed into conventional full-time farming operations while maintaining or increasing family income for

consumption. To become successful full-time farmers, given the representative resources including equity capital and labor on part-time farms, operators and their families must accept considerably lower consumption to save and invest more, must adopt non-conventional specialty enterprises, or must experience the good but highly unlikely fortune of much higher commodity prices than in 1984. Few indicated interest in or capability for the "belt-tightening" low consumption and high-level of management required for specialty crop production.

- 3) That full time farmers in poverty producing traditional enterprises can raise income by expanding acreage, by farming more efficiently, and by introducing more labor intensive specialty enterprises found considerable support from this study. However, any expansion is likely to be unsuccessful unless accompanied by good management and willingness of families to make sometimes difficult changes in enterprise mix and take risks to raise average earnings. Few respondents indicated a willingness to take special classes to improve skills, but a large number indicated a willingness to work with Cooperative Extension Service personnel or others to improve management and raise income.

For those farming operations highly dependent upon off-farm income, the greatest opportunity for enhancement of economic well-being lies in improvement of off-farm jobs and wage rates. The incidence of poverty was not higher for small farms than for large farms because of the sizable off-farm income accruing to families on small farms. For full-time, limited resource operators, farming is likely to provide neither sufficient income for immediate family support nor surplus capital for investment in hope of increasing income in the future. Off-farm job opportunities are capable of supplying both.

The importance of farm income as a supplement to off-farm income for part-time operators in achievement of family income "goals" is clear. Likewise, it is demonstrated that adoption of alternative enterprises on

part-time farms can lead to full-time farming operations when the producer is so inclined and where expansion initially is aided through use of off-farm income.

Most small, part-time farms committed to production of traditional enterprises appear unlikely to alter their current allocation of effort between farm and off-farm work. They enjoy a high off-farm income, supplemented by farm income under favorable conditions, and are capable of absorbing farm losses under adverse conditions. Their small investment in farming and comparatively large off-farm income results in high farm survivability potential.

These findings have significant implications for extension personnel. It is clear that extension efforts to assist farm families need to reach beyond current farm fencelines. Successful programs need to consider the farm family as a earning unit for which farm income may be an important, though not dominant, component.

The use of farm models rather than a case study approach requires the calculation of averages and representative values for certain initial parameters. As a consequence, results and implications must be carefully interpreted and not viewed as universally applicable to all individual farming operations in the survey area. The results apply to Eastern Oklahoma and not necessarily to other parts of Oklahoma, the South, or the U.S.

Linear programming requires specific assumptions about technology, prices, and input and output levels at a given point in time. Measures such as net farm income which are extremely sensitive to these factors must be viewed as relative comparisons for a specific situation and not as projections over time.

In taking advantage of the whole-farm planning capabilities of linear programming, it is necessary to define a specific objective function which, in this research, is profit maximization. Farm ownership and operation, particularly in the case of part-time operators, may entail goals that are neither readily quantified nor necessarily consistent with the profit maximization assumptions (Barlett).

REFERENCES

- Back, W.B., and V. Hurt. "Potential for Agricultural Adjustment in the Ouachita Highlands of Oklahoma." Bulletin B-582. Stillwater: Oklahoma Agricultural Experiment Station, 1961.
- Barlett, P. "Part-Time Farming: Saving the Farm or Saving the Life-Style?" *Rural Sociology*, 51,3(1986):289-313.
- Breimyer, H. "Insurance Companies Turn Aggressive in Farmland Markets." *Progressive Farmer*, (February, 1984):17.
- Carlin, T., and J. Crecink. "Farm Definition and Public Policy." *Amer. J. Agr. Econ.*, 61, 5(1979):933-39.
- Ghebremedhin, T., and W. Johnson. "Small Farm Research and Policy Implications." *So. J. Agr. Econ.*, 17,1(1985):47-56.
- Humphries, F.S. "U.S. Small Farm Policy Scenarios for the Eighties." *Amer. J. Agr. Econ.*, 62,5(1980):879-88.
- Larson, D., and J. Lewis. "Small-Farms Profile." Washington, D.C.: USDA, ESCS, Economic Development and Natural Resource Economics Divisions, 1978(Mimeo).
- Lewis, J. "Implications of Alternative Definitions of a Small Farm." Chapter 6 in *Toward a Small Farm Policy*. Washington, D.C.: National Rural Center Report No. 9, November 1978.
- Moehle, M., and D. Kletke. "OKFARMS: Problem Design and Data Preparation." CSS 19. Stillwater: Department of Agricultural Economics, Oklahoma State University, September 1986.
- Richardson, J.W., and C.J. Nixon. *The Farm Level Income and Policy Simulation Model: FLIPSIM*. Technical Report No. 812. College Station, Texas: Department of Agricultural Economics, Texas A&M University, May 1981.
- Sanford, S. "Farm Income Enhancement Opportunities for Small, Part-Time, and Limited-Resource Farming Operations In East Central Oklahoma." Ph.D. Dissertation, Stillwater: Department of Agricultural Economics, Oklahoma State University, 1986.
- Sanford, S., L. Tweeten, C. Rogers, and I. Russell. "Origins, Current Situation, and Future Plans of Farms in East Central Oklahoma." Research Report P-861. Stillwater: Langston University Agricultural Research and Oklahoma State University Agricultural Experiment Station, November 1984.
- Tweeten, L. "Farmland Pricing and Cash Flow in an Inflationary Economy." Research Report P-811. Stillwater: Department of Agricultural Economics, Oklahoma State University, June 1981.
- Tweeten, L., B. Cilley, and I. Popoola. "Typology and Policy for Small Farms." *So. J. Agr. Econ.*, 12,2(1980):77-85.
- Tweeten, L., T. Barclay, D. Pyles, and S. Ralstin. "Simulated Farm Firm Growth and Survivability Under Alternative Federal Fiscal-Monetary Policies, Initial Size, Tenure, and Uncertainty Conditions." Research Report P-848. Stillwater: Department of Agricultural Economics, Oklahoma State University, May 1984.
- Tweeten, L., and W. Huffman. "Structural Change." Part 1 of *Structure of Agriculture and Information Needs Regarding Small Farms*. Washington D.C.: National Rural Center, 1980.
- U.S. Department of Agriculture. "Small Farms, Family and Part-time Farming in the United States - Quick Bibliography Series." Washington, D.C.: SEA/TIS/National Agricultural Library, April 1980.
- U.S. Department of Agriculture, Economic Research Service. *Economic Indicators of the Farm Sector: National Financial Summary, 1986*. Washington, D.C., 1987.
- U.S. Department of Census, Current Population Reports. "Money Income and Poverty Status of Families and Persons in the United States: 1984." Series P-60, No. 149. U.S. Government Printing Office, Washington, D.C., 1985.
- U.S. Department of Commerce, Bureau of the Census. *1980 Census of the Population. General Social and Economic Characteristics, Oklahoma*. Vol. 1, Part 38. Washington, D.C., July 1983.

U.S. Department of Commerce, Bureau of Economic Analysis. Tapes; Oklahoma, State and County Personal Income Data. Washington, D.C., 1983.

Whatley, B.T. "The Producer." *Science* 84, Washington, D.C.: American Association for the Advancement of Science, July/August, p. 40.