# PART-TIME FARMING: PRODUCTIVITY AND SOME IMPLICATIONS OF OFF-FARM WORK BY FARMERS

**Surendra P. Singh and Handy Williamson, Jr.**

The technological revolution in agriculture has produced a structural transformation in farming that has changed the face of rural America. With improved technology and long-term U.S. economic growth, one major adjustment has been a reallocation of labor between farm and non-farm labor markets. After 1948, long-term economic forces created prospects of higher incomes in the non-farm sector. As a result, a large proportion of both white and black families ceased farming and took non-farm jobs. However, a number of other farm families have continued to work their farms, but have also taken off-farm jobs to supplement their income. Krasovec describes part-time farming as a regular two-fold occupation of the head of the family. That person may, on the one hand, be working permanently in non-agricultural industries either as an employee or as an independent craftsman, merchant or member of a profession, and on the other, in agriculture on a holding not large enough to justify a full-time occupation.

Throughout the U.S., the number of part-time farmers who depend principally upon off-farm sources of income has been increasing rapidly. Nationally, the percentage of farm operators reporting any days off the farm (off-farm work) rose from 33.9 percent in 1950 to 54.9 percent in 1974. The increasing number of part-time farmers is particularly noteworthy, as the total number of farm operators has declined during this period. Today, nearly two out of three farm families receive more than half of their income from non-farm sources. Moreover, for farmers with annual gross sales of less than $20,000, non-farm income accounts for more than 80 percent of total family income (Buttel and Newby, p. 233). Thus far, the growth of part-time farming has received only scant official attention. Much of their output is confined to specialty agricultural produce, and their share of the total market is relatively small. In the past, part-time farming was considered as a transitional phenomenon between primarily agricultural and industrial economies. However, with continued growth, it is now considered by some to be a permanent phenomenon.

One of the major management problems of a farmer is the combination and utilization of various resources in such a way as to obtain the greatest possible return. The resource combination yielding the highest dollar returns under a given set of price and production conditions may bring low returns under a different set of conditions. Various factors may affect the number and mix of farm enterprises on part-time farms, and consequently, may create significant changes in the factor productivities and production efficiencies (Bateman). If part-time farmers are using agricultural resources less efficiently,[1] aggregate production could suffer with increase in their number or resources controlled by them. The need for analyzing the effects of part-time farming on agricultural production and rural development has been stressed by many in the past (Bateman; Reinsel; Schneeberger and West). The purpose of this paper is to: (1) determine possible differences between production functions on part-time and full-time farms, (2) determine differences in productivity levels as means to appraise resource allocative efficiency, and (3) discuss some implications of off-farm work by farmers.

## PREVIOUS RESEARCH

The terms "part-time farming" and "part-time farmers" were perhaps first introduced and elaborated in a relatively comprehensive study in Massachusetts by Rozman in 1930 (Fuller and Mage, p. 6). Rozman defined a part-time farmer as a farm operator who spent two or more months per year in off-farm work. Since this study was completed, part-time farming has been the theme of several research efforts. It has been and is being studied by researchers belonging to various disciplines and, therefore, is the subject of some controversy. The concept varies accord-

The authors are, respectively, Associate Professor, Department of Rural Development; and Director of Cooperative Agricultural Research Program, Tennessee State University.

The authors are indebted to Dr. F. S. Bagi for his help in analyzing the data and for helpful comments on an earlier draft of the article. The authors also appreciate the constructive comments from the three anonymous Journal reviewers. However, authors are solely responsible for any shortcomings. Research leading to this paper was funded, in part, by SEA/CR, U.S. Department of Agriculture, through Tennessee State University.

[1] As indicated by one anonymous reviewer, some part-time farmers might have goals other than profit maximization. The primary income on these farms is generated off the farm, and the farmer may be fulfilling needs other than economic with his farming activity.

ing to the likes and dislikes of the researcher and, possibly, data at hand. Several lines of research can be recognized. However, two general hypotheses emerge from the available literature. The first hypothesis, which may be called "push-pull," is explained by structural changes in U.S. agriculture. The second hypothesis tends to explain part-time farming as a typical response to industrialization and urbanization.

Most of the literature on part-time farming in the U.S. was published in the 1930s, 1950s, and 1970s. During each wave of interest, similar questions were asked and answered. Salter and Diehl, in a survey article, characterized part-time farming research in the 1930s as being "static and descriptive" and stressed the problems arising from lack of comparable definitions of a part-time farmer. The article recommended more dynamic and analytical research.

The studies published in the 1950s and early 1960s can generally be classified into one of three categories: (1) general descriptive-type studies (Bauder; Fugitt; Galloway), (2) sociological studies (Fliegel; OECD), and (3) resource use or efficiency studies (Jensen and Sundquist; Reinsel; OECD). In the 1970s, several studies, such as Bollman; Hanson and Spitze; Huffman; Singh and Bagi, added to the knowledge and concept of part-time farming and off-farm income. However, studies are needed to provide a better understanding of the incidence, characteristics, and aspirations of part-time farmers in various regions. There is also need for studies to determine the extent to which a part-time farm's production costs and input-output coefficients differ from those of a full-time farm and to investigate further the implications (Carlin and Ghelfi; Bateman).

## PRODUCTION EFFICIENCY DIFFERENCES BETWEEN PART-TIME AND FULL-TIME FARMS

### Data and Methodology

Primary data used in this paper were obtained in an enumerative survey of rural farm families in two countries of western Tennessee in 1977–78. The statistical analysis is based on data collected from 193 randomly selected farm families representing 5.6 percent of all farm operators in the two-county area.[2] Out of a total of 193 farm operators, 107 were classified as full-time, and 86 were classified as part-time.[3] Personal interviews were conducted with farm operators and data were obtained on selected farm operations in the previous year.

One method by which the economic efficiency of farms can be analyzed is in the production function framework. The economic efficiency consists of two components—technical, and allocative or price efficiency. Overall economic efficiency, therefore, is a function of both price and technical efficiency, and a firm is completely efficient economically only if it minimizes cost per unit of output (Hall and LeVeen; Holland). Absolute as well as relative allocative efficiency can be analyzed in the production function framework. However, technical efficiency is quite sensitive to the specification of the production function. If one assumes, without testing, that the underlying production function is linear homogeneous, he may be led to believe that the differences in allocative efficiency and in the configuration of input and output prices are responsible for any differences in yields and factor intensities, while actually the answer lies in the technological differences among the distinct group of farms (Barnum and Squire). Therefore, in this study, we first examined the assumptions of linearity and homogeneity of the production function describing the nature of our sample farms. The assumption of linearity is satisfied if the elasticity of (returns-to-) scale is unity. Hence, we estimated returns-to-scale, tested the homogeneity assumption, and then proceeded to analyze the technical and allocative efficiencies of the selected farms.

In order to analyze the technical[4] and allocative efficiencies on the selected farms, the following log-linear Cobb-Douglas production function was fitted:

$$(1)\quad \text{Ln } Y = \text{Ln } C + \ln D + \alpha_1 \ln L + \alpha_2 \ln N + \alpha_3 \ln K + \alpha_4 \ln F + \alpha_5 \ln XL + B_1 (\ln L) {*}D + B_2 (\ln N) {*}D + B_3 (\ln K) {*}D + B_4 (\ln F) {*}D + B_5 (\ln XL) {*}D + u$$

where

Y = the value of crops, crop by-products,

[2] For detailed data collection procedures and methodology, see Singh and Bagi.

[3] For the purpose of this study, a part-time farm is defined as a "farm operated by an individual or partnership where the operator spends less than 50 percent of his working time on the farm (does not consider farming to be principal occupation)." This was the definition used in the 1974 agriculture census to classify farms. At the time of interview, the enumerator read the definition of a part-time farm and, if necessary, explained it to the operator. After the operator understood the definition, the answer was noted, and the farm was classified as full- or part-time.

[4] The economic efficiency has two components: technical and allocative efficiency. One of the anonymous reviewers correctly pointed out that, if all relevant inputs are adequately measured, the technical efficiency coefficient will always be equal to one. But there may be errors of observation and measurement in output across farms. The symmetrical random disturbance has been added to equation (1) to take care of the errors of observation of measurement on Y. However, the "technical efficiency" coefficient also can be less than 1; and it may be variable across farms as a result of favorable as well as unfavorable external events, such as topography, soil type, machine performance, luck, and the will and effort of the farmer (Aigner et al.). A one-sided, normal error term, in addition to u, can take care of such factors; but the estimation of such a model would require complicated estimation methods. Therefore, our aim is a comparative analysis of the two farm groups, rather than an estimation of the "technical efficiency" coefficients.

livestock products, and value added of the livestock, in dollars, per farm

L = land operated in acres, per farm. It includes the rented-in area and excludes the rented-out area from the area owned.

N = number of labor hours used per annum on individual farms; this includes family labor and hired labor, if any.

K = the dollar value of the flow of capital services from farm machinery and equipment. Included are annual depreciation charges, repair, and operating expenses (i.e., gas, oil, etc.).

F = the dollar value of fertilizer, lime, pesticides, and herbicides, etc.

XL = feed, fodder, and veterinary expenditures, and other miscellaneous expenses, in dollars, per farm

u = a random disturbance term that is assumed to be normally distributed with mean zero (Eu=0), and finite variance ($Eu^2=\sigma^2$)

D = a dummy variable, zero for part-time farms, and unity for full-time farms

In the first step, equation (1) was estimated in its original form, using OLS. But in the final analysis, only statistically dummy variables were included, along with the conventional inputs.

**TABLE 1.** OLS Estimates of Cobb-Douglas Production Functions for Selected Full-Time and Part-time Farms in West Tennessee[a]

| | Variable | Type of Farm | | |
|---|---|---|---|---|
| | | All Farms | Full-Time | Part-Time |
| C | Constant | 4.0086<br>(12.9937) | 3.4263<br>(7.6126) | 4.7401<br>(10.7061) |
| $x_1$ | Land | .3332<br>(4.8258) | .4164<br>(4.4055) | .1972<br>(1.9365) |
| $x_3$ | Labor | .3232<br>(6.7074) | .3270<br>(4.6270) | .2980<br>(4.4972) |
| $x_5$ | Capital | .2170<br>(4.7098) | .1253<br>(2.3253) | .2120<br>(4.4205) |
| $x_7$ | Fertilizer + CHM | -.0183<br>-(0.4468) | .1722<br>(3.0076) | -.0138<br>-(0.3426) |
| $x_9$ | Feed + Med | .0786<br>(3.3980) | .0211<br>(0.7799) | .0819<br>(3.3835) |
| $x_{25}$ | $(x_5)$ D | -.10455<br>-(1.6801) | | |
| $x_{27}$ | $(x_7)$ D | .1824<br>(3.0430) | | |
| $x_{29}$ | $(x_9)$ D | -.0507<br>-(1.7710) | | |
| $R^2$ | | .6858 | .6985 | .5729 |
| DW | | 1.9147 | 1.9725 | 1.9666 |
| SSR | | 106.813 | 63.0345 | 41.2148 |
| SER | | 0.7619 | .7900 | .7178 |
| n | | 193 | 107 | 86 |
| R.S. | | .9337 | | |

Figures in the parentheses are the estimated t-ratios

[a] the output elasticities for the part-time farms are given by the $\alpha_i$'s, and the corresponding output elasticities for the full-time farms can be calculated as the sum of the $\alpha_i$'s and $B_i$'s. The associated t-ratios can be estimated as: t-ratio $(\alpha_i+B_i) = (\alpha_i+B_i)/\{Var(\alpha_i) + Var(B_i) + 2\ Cov\ (\alpha_i, B_i)\}^{1/2}$

DW = Durbin-Watson Statistic, SSR = Sum of Squared Residuals

SER = Standard Error of the Regression, n = the number of observations

R.S. = Returns to scale, sum of the output elasticities of all inputs.

## RESULTS

### Technical Efficiency

The results are presented in Table 1. These results show that part-time and full-time farm groups are represented by the factor-biased production function. More specifically, these results show that the output elasticities of capital (K), fertilizer (F), and expenses on livestock (XL) are significantly different for the two groups of farms.[5] Therefore, an estimation of the pooled sample of the part-time and full-time farms will give misleading results.

The next logical step would be to determine whether the two groups of farms make equally efficient allocation of the factors of production. However, a rigorous comparison of the allocative efficiencies of any two groups of farms require that they are: (1) characterized by constant returns-to-scale, (2) represented by the same or neutral technologies, and (3) facing the same configuration of input and output prices. But the results in Table 2 show that both groups of farms have coefficients of returns-to-scale that are slightly less than unity. However, the difference is not significant at 5-percent level, and, hence, the hypothesis of constant returns-to-scale cannot be rejected. The data have been collected from two contiguous counties and, thus, there is very little chance that the two groups may face different configuration of input and output prices. On the other hand, the results in Table 1 show that the two groups of farms are represented by two separate factor-biased production functions. Therefore, our results will reflect both technical and allocative efficiencies and not the latter alone.

### Allocative Efficiency

The tests of allocative efficiency are performed by estimating the following equations for the Cobb-Douglas production function:

[5] This interpretation is based on the results of all farms (pooled sample) in Column 1 of Table 1. There are two methods of testing the equality between sets of coefficients in two linear regressions, one is the so-called Chow Test (Chow, 1960), and the other is the use of the Dummy Variables (Bagi; Maddala; Gujarati). The Chow Test is quite sensitive even to a mild degree of heteroscedasticity and multicollinearity. The Dummy Variable approach provides all information necessary to test the equality between sets of coefficients in two linear regressions in one run; in Chow's approach, one must run three different regressions (Bagi). Therefore, we have used the Dummy Variable approach, and the results are given in Column 1 of Table 1. (Columns 2 and 3 are presented to reinforce the validity of the results of the Dummy Variable approach). In the Dummy Variable approach, a significant coefficient of the interaction between a conventional input and the Dummy Variable (i.e., $X_i$ D) is proof in itself that the coefficient of $X_i$ is significantly different in the two groups.

$$MVP_{jp} + \alpha_{jp} (\bar{Y}_p/\bar{X}_{jp}) = k_{jp}p_{jp}$$

$$MVP_{jF} = (\alpha_{jp} + B_{jF}) (\bar{Y}_F/\bar{X}_F) = k_{jF}p_{jF}$$

where, the subscript p stands for part-time farms and F stands for full-time farms, MVP is the marginal value productivity, $\bar{Y}$ is the mean of the value of gross farm output, $X_j$ is the mean of the j th factor of production, $\alpha_{jp}$ and $(\alpha_{jp} + B_{jF})$ are the output elasticities of j th input for the part-time and full-time farm groups, respectively. The t-ratio corresponding to output elasticity of j th input on full-time farms can be calculated as follows:

$$\text{t-ratio of } (\alpha_{jp} + B_{jF}) = (\alpha_{jp} + B_{jF})/\{\text{Var}(\alpha_j) + \text{Var}(B_j) + 2\,\text{Cov}(\alpha_j, B_j)\}^{1/2}$$

The dependent variable Y is measured in dollar terms instead of quantity terms in this paper. Therefore, the marginal value productivity (MVP) and marginal productivity (MP) are equal. Furthermore, some inputs (i.e., K, F, XL) are also measured in dollars instead of quantity units, therefore, in case of these inputs, $MVP_j$ is equal to $K_j$. The estimates of the relative allocative efficiency coefficients are given in Table 2.

The j th factor of production is over-utilized if $K_j < 1$, and under-utilized if $K_j > 1$, while $k_j = 1$ implies that absolute efficiency has been achieved in the allocation of this particular factor of production. If $k_{jp} = k_{jF}$, then the part-time and full-time farms are equally efficient in (using) allocating that resource. Therefore, data in Table 2 show that: (a) both groups make very intensive use of livestock expenses; (b) the part-time farms make very intensive use of fertilizer;[6] while the full-time farms slightly under-utilize it; (c) the part-time farms under-utilize capital, whereas the full-time farms slightly over-utilize it; (d) labor remains under-utilized on both types of farms, but much more so on the full-time farms; and (e) the part-time farms make intensive use of land, while the full-time group make almost optimal use of land. In brief, we can say that the part-time farm group makes relatively more intensive use of all inputs, except capital, as compared to the full-time farm group.

The part-time farm group produces lower value of output per acre as compared to the full-time farm group (Table 4). Data given in Table 3 show that the part-time group operates, on an average, a farm about half the size of the full-time group. The part-time farm group also uses less capital and fertilizer per acre as compared to the full-time farms, but the former group uses more

**TABLE 3.** Mean Value of Output and Inputs per Farm, Selected Farms in West Tennessee

| Items | Type of Farm: Full-Time | Part-Time | All Farms |
|---|---|---|---|
| Output ($) | 33,613.30 | 10,883.38 | 23,484.94 |
| Farm Size (Acres) | 221.85 | 117.85 | 175.51 |
| Labor Used (Hrs.) | 657.92 | 394.56 | 540.56 |
| Flow of Capital ($) | 4,170.20 | 1,689.01 | 3,064.59 |
| Fertilizer and Chemicals ($) | 4,936.65 | 1,896.94 | 3,582.17 |
| Livestock Expenses ($) | 1,860.21 | 1,494.17 | 1,697.10 |
| Number of Farms | 107 | 86 | 193 |

**TABLE 2.** Output Elasticity, Marginal Productivity and Estimates of Relative Allocative Efficiency Coefficients, Selected Part-Time and Full-Time Farms in West Tennessee

| Variable | PART-TIME FARMS | | | | FULL-TIME FARMS | | | |
|---|---|---|---|---|---|---|---|---|
| | OUTPUT ELASTICITY | AVERAGE PRODUCTIVITY | MARGINAL PRODUCTIVITY | ALLOCATIVE EFFICIENCY | OUTPUT ELASTICITY | AVERAGE PRODUCTIVITY | MARGINAL PRODUCTIVITY | ALLOCATIVE EFFICIENCY |
| Land (Acres)[a] | .3332 | 92.35 | 30.77 | .64 | .3332 | 151.51 | 50.48 | 1.05 |
| Labor (Hours)[b] | .3232 | 27.58 | 8.91 | 2.97 | .3232 | 51.09 | 16.51 | 5.50 |
| Capital ($) | .2170 | 6.44 | 1.40 | 1.40 | .1125 | 8.06 | 0.91 | 0.91 |
| Fertilizer ($) | -.0183 | 5.74 | -0.11 | -0.11 | .1641 | 6.81 | 1.12 | 1.12 |
| Livestock EXP. ($) | .0786 | 7.28 | 0.57 | 0.57 | .0279 | 18.07 | 0.50 | 0.50 |

[a] The average land rent paid by the farmers who rented-in land was $48.18 per acre. Land rent of the sample owner-operated farms was also calculated at $48.18 per acre.

[b] The minimum wage rate during 1977, when data were collected, was $2.90 per hour. Adjusting for some skilled farm machinery operators we have used $3.00 as hourly wage rate in above calculations.

[6] Many part-time farmers have beef cattle operations and fertilize their pastures. This fertilizer does not effect agricultural production directly, and, therefore, it may make measurement difficult, giving the impression that farmers are operating in Stage III of production. This is one possible explanation of the insignificant negative fertilizer coefficient.

labor, and livestock expenses per acre than does the latter group (Table 4). These results suggest that part-time farms tend to specialize in livestock production (beef cattle and hogs), while the full-time farms allocate a relatively larger proportion of land to crops.

To summarize, part-time and full-time farms are significantly different. The two groups are represented by factor-biased production functions, and the productivity of capital, fertilizer, and livestock expenses are significantly different for these two groups. The allocative efficiency of inputs also differs between these two groups. The part-time farms make relatively more intensive use of all inputs, except capital. The part-time farms tend to put more emphasis on livestock (beef cattle and hogs). Similar findings were also reported by Woodworth et al. in a study conducted in central and western Tennessee. This probably is explained by the fact that a certain amount of part-time farmer's labor is committed to off-farm employment and hence cannot provide regular care needed for more labor-intensive cropping and dairy operations. Therefore, the rigidity of non-farm work requirements may dictate the selection of farm enterprises that do not require large amounts of labor and attention. Briefly, the results indicate that part-time farmers are not more inefficient in allocation of resources and production of food than are full-time farmers in the same area.

## SOME IMPLICATIONS OF OFF-FARM WORK BY FARMERS

Carlin and Larson reported that increases in income from wages and salaries has been the most important factor accounting for the financial improvement of farm families. Off-farm income has narrowed the income gap between farm and non-farm families. While income from off-farm employment is the major source of off-farm income for farm families in each farm size group, its absolute and relative importance is greatest for those families with low to moderate farm income. Accordingly, it is this group through which off-farm employment exerts its greatest impact on the structure of agriculture and rural communities (Jones). Nevertheless, agricultural policies are formulated without any distinction between full-time and part-time farms. Neither are there any regulations in force or measures taken that are applicable to full-time or part-time farms alone. The following are some implications of off-farm work by farmers that may have some bearing on the major policy issues in agriculture and rural development.

**TABLE 4.** Mean Value of Output and Inputs per Acre, Selected Farms in West Tennessee

| Items | Type of Farm | | |
|---|---|---|---|
| | Full-Time | Part-Time | All Farms |
| Output ($) | 151.51 | 92.35 | 133.81 |
| Labor Used (Hrs.) | 2.97 | 3.35 | 3.08 |
| Flow of Capital ($) | 18.80 | 14.33 | 17.46 |
| Fertilizer and Chemicals ($) | 22.25 | 16.10 | 20.41 |
| Livestock Expenses ($) | 8.38 | 12.68 | 9.67 |
| Number of Farms | 107 | 86 | 193 |

Part-time farming may alter agricultural production in a region. Many part-time farmers arrange their farming operation to fit in with their off-farm employment. In 1974, operators of animal specialty farms, beef cattle, hogs, etc., and fruit and tree nut farms reported working off-farm more frequently than did farm operators of other types of farms. A part-time operator may have to specialize in one type of operation (e.g., beef cattle and hogs) and avoid enterprises such as dairy and cotton, while the full-time operator tends to be more diversified (Carlin and Ghelfi, p. 273). Moreover, the production from part-time farms is insignificant relative to feeding the world, yet it is of sufficient size to affect prices in local markets (Fuller and Mage, p. 161).

In principle, there is no distinction between part-time and full-time farms in price support programs. A problem could arise if a large percentage of production of many commodities is controlled by people who have substantial income from off-farm sources. This might reduce the part-time farmer's sensitivity to price changes between products and lead to lack of flexibility in their production patterns. It can be argued then that the government's ability to bring about agricultural adjustments through prices, or other monetary measures, would be reduced. Part-time farming is affected by many other factors and to determine any definite relationship between part-time farming and price supports requires further investigation.

Part-time farmers are usually in a better position to finance investments on the farm because of regular cash incomes from off-farm jobs. For example, many part-time farmers have the resources to purchase and develop superior breeding stock, which filters down to the commercial operator (Fuller and Mage, p. 161). Part-time farmers may be able to supply land for expanding farmers. A trend can be observed in regions near industrial centers, where part-time farmers are more inclined to rent land to expanding full-time farmers.

The phenomenon of part-time farming has important implications for economic and social policies for rural areas. Through this system, a gradual adjustment of agricultural resources takes place. Part-time farming may also help maintain a minimum population in the countryside and conserve a cultivated landscape (which enhances its value for recreation). From an economic standpoint, everyone from carpenters to storekeepers benefit from the purchasing power of these farmers. Basically, two kinds of contributions can be postulated: direct, when a part-time farmer performs tasks that are an integral part of the commercial structure of the local community; and indirect, in which he/she stimulates both income and employment multipliers. Part-time farming may also help provide security to rural communities in times of economic recession.

## CONCLUSIONS

The number of part-time farmers who depend principally upon off-farm sources of income has been increasing throughout the U.S., even though total numbers of farms have declined. The results of this study indicate that part-time and full-time farms exhibit significant differences. Additionally, part-time farms are no less efficient in allocation of resources and in the production of food than are full-time farms. Thus, the observation that an individual is a part-time farmer does not, in itself, indicate anything about the productivity of that farm unit.

Part-time farming is an important feature to consider in discussions of the major policy issues in agriculture and rural development. There are some economic and social benefits to be obtained from part-time farming; however, it is not yet clear whether positive measures need to be taken to encourage part-time farming. According to Jones, many farm families do not earn the income that is realistically feasible for them to earn. Jones attributes this to the lack of adequate information, including information regarding appropriate changes in farm organization and operation. Public policies designed to assist small farmers must recognize the potential return a farmer may receive from allocating his resources to off-farm work. Policymakers need to begin thinking about possible strategies that public policy could incorporate with respect to part-time farming.

## REFERENCES


Aigner, D. J., C. A. K. Lovell, and P. Schmidt. "Formulation and Estimation of Stochastic Frontier Production Function Models." *J. Econometrics* 1(1977):21–37.

Bagi, F. S. "On Testing the Equality Between Sets of Coefficients in Two Linear Regressions." Paper presented at the Annual Meeting Eastern Economic Association, Philadelphia, Pa., April 9–11, 1981.

Barnum, H. N. and L. Squire. "Technology and Relative Economic Efficiency," unpublished paper, World Bank, August 1976.

Bateman, W. L., O. L. Walker, and R. A. Jobes. "On Part-Time Farming." *S. J. Agr. Econ.* 6(1974):137–42.

Bauder, Ward W. *Characteristics of Families on Small Farms.* University of Kentucky, Kentucky Agr. Exp. Sta. Bull. 644, June 1956.

Bollman Ray D. "Off-Farm Work by Farmers: An Application of the Kinked Demand Curve For Labor." *Canadian J. Agr. Econ.* 3(1979):37–60.

Buttel, Frederick H. and Howard Newby, eds. *The Rural Sociology of the Advanced Societies.* Montclair, N.J., Allanheld Osmum & Co. Publ., Inc., 1980.

Carlin, T. A. "Farm Families Narrowed the Income Gap in the 1960's." *Agr. Fin. Rev.* 33(1972):22–26.

Carlin, T. A. and L. M. Ghelfi. "Off-farm Employment and The Farm Sector." *Structure Issues of American Agriculture,* Washington, D.C.: USDA/ESCS, Agricultural Economic Report 438, November 1979.

Chow, G. C. "Tests of Equality Between Sets of Coefficients in Two Linear Regressions." *Econometrica* 28(1960):591–605.

Fliegel, F. C. "Aspirations of Low-Income Farmers and Their Performance and Potential for Change." *Rural Sociology* 24(1969):205–14.

Fugitt, G. V. "A Typology of the Part-Time Farmer." *Rural Sociology* 26(1961):39–48.

Fuller, A. M. and J. A. Mage, eds. *Part-Time Farming: Problem or Resource in Rural Development.* Proc. First Rural Geography Symposium, University of Guelph, June 1975.

Galloway, Robert E. *Part-Time Farming in Eastern Kentucky.* University of Kentucky, Kentucky Agri. Exp. Sta. Bull. 646, June 1956.

Gujarati, D. "Use of Dummy-Variables in Testing for Equality Between Sets of Coefficients in Two Linear Regressions: A Note." *Amer. Statis.* (1970):50–52.

Hall, Bruce F., and Philip E. LeVeen. "Farm Size and Economic Efficiency: The Case of California, *Amer. J. Agr. Econ.* 60(1978):589–600.

Hanson, R. J. and R. G. F. Spitze. "Increasing Incomes of Farm Families Through Dual Employment." *Agr. Fin. Rev.* 35(1974):59–64.

Holland, David. "Production Efficiency and Economics of Size in Agriculture," in *Paper VI of the National Rural Center Small Farms Project, 1980.*

Huffman, Wallace E. "Farm and Off-Farm Work Decision: The Role of Human Capital." *Rev. Econ. Statis.* (1980):14–23.

Jensen, J. R. and W. B. Sundquist. *Resource Productivity and Income For a Sample of West Kentucky Farms.* University of Kentucky, Kentucky Agr. Exp. Sta. Bull. 630, June 1955.

Jones, Dewitt. "Off-Farm Earnings and Small Farms." In *Paper V of the National Rural Center Small Farms Project, 1980.*

Krasovec, S. "The Future of Part-Time Farming." Proc. 12th International Conference of Agricultural Economists. London: Oxford Press, 1966.

Larson, Donald K. "Impact of Off-Farm Income on Farm Family Income Levels." *Agr. Fin. Rev.* 36(1976):7–11.

Maddala, G. S. *Econometrics.* New York: McGraw Hill Book Company, 1977.

OECD Agricultural Policy Reports. *Part-Time Farming.* Paris, 1977.

Reinsel, Edward I. "Off-Farm Income of People, Involved in Farming." *S. J. Agr. Econ.* 2(1970):115–19.

Salter, L. A., Jr., and L. F. Diehl. "Part-Time Farming Research." *J. Farm Econ.* 22(1949):581–600.

Schneeberger, K. C. and J. A. West. "Marginal Farms—A Micro Development Opportunity." *S. J. Agr. Econ.* 4(1972):97–100.

Singh, S. P. and F. S. Bagi. *Summary Report—Farm Resource Productivity on Small and Part-Time Farms in Selected Areas of Tennessee.* CARP Special Report, Tennessee State University, October 1980.

Woodworth, R. C., S. L. Comer, and R. J. Edwards. *A Comparative Study of Small, Part-Time, Retirement and Large Farms, Three Counties in Central and West Tennessee.* Tennessee State University, Bull. No. 38, February 1978.