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SOME DETERMINANTS OF NONFARM INCOME OF FARM PEOPLE

by

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The average farm family receives one-fourth or more of its total net income from nonfarm employment or as returns from nonfarm investments.[1/] In real terms this component of personal income, both on an aggregate basis and on a per-farm-family-worker basis, has fluctuated over time (figure 1). As a proportion of the total net income flow to farm people, it has fluctuated within a narrow range with little or no secular movement (figure 2).

Isolation of the important economic forces that influence the size of this income flow will increase our understanding of the determinants of the personal income of farm people. In addition, it will yield insights into the functioning of the aggregate market for farm labor, and show in a limited way how agriculture is integrated with the total economy.

In this note we propose to develop a conceptual model which explains the income that farm people receive from nonfarm sources, present statistical estimates of a part of this model, and discuss briefly the implications of the statistical results.

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1/ United States Department of Agriculture, Major Statistical Series, Volume 3, Agr. Handb. No. 118, p. 4.

Figure 1. Real Nonfarm Income of Farm People (1954 dollars).

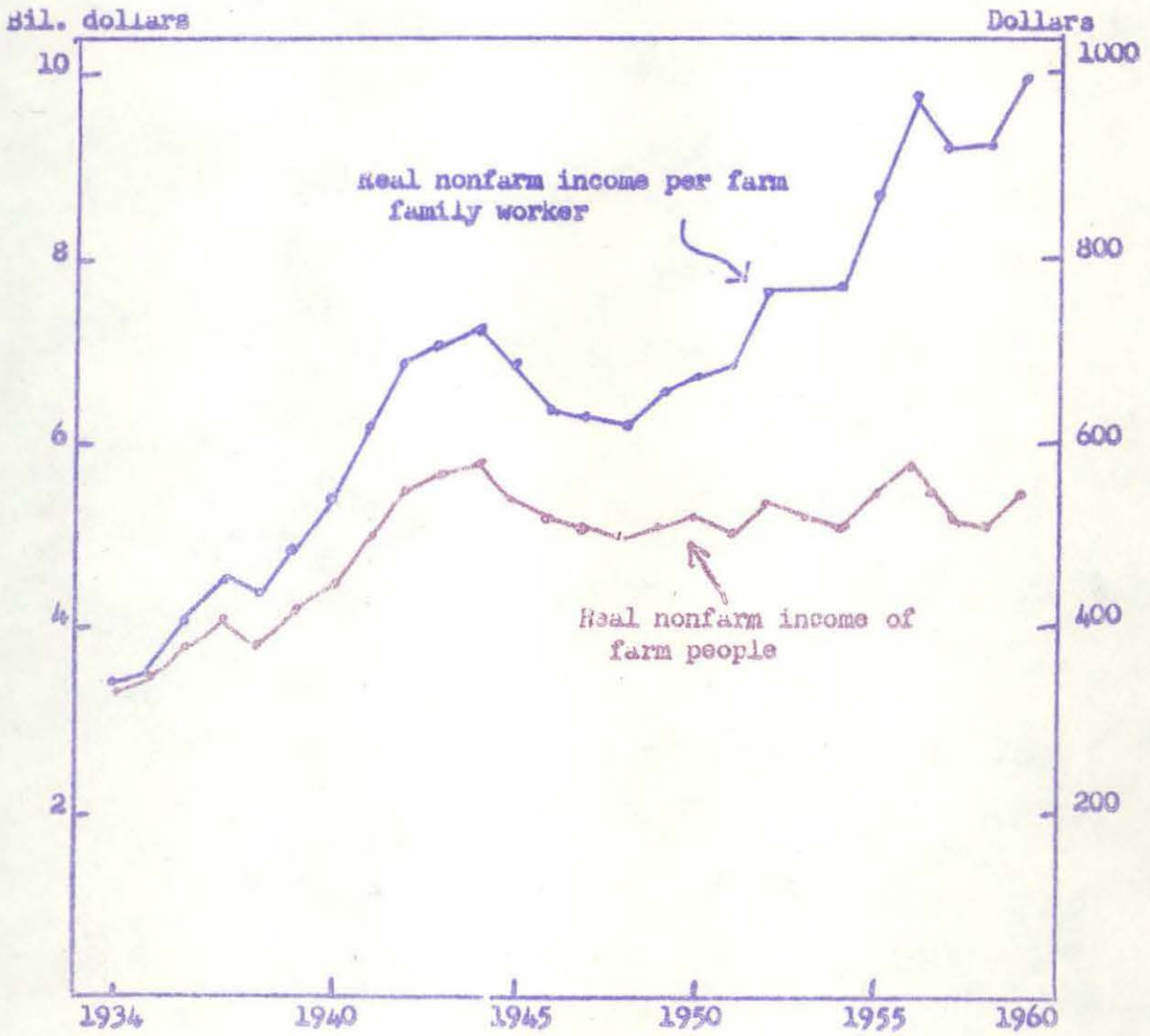
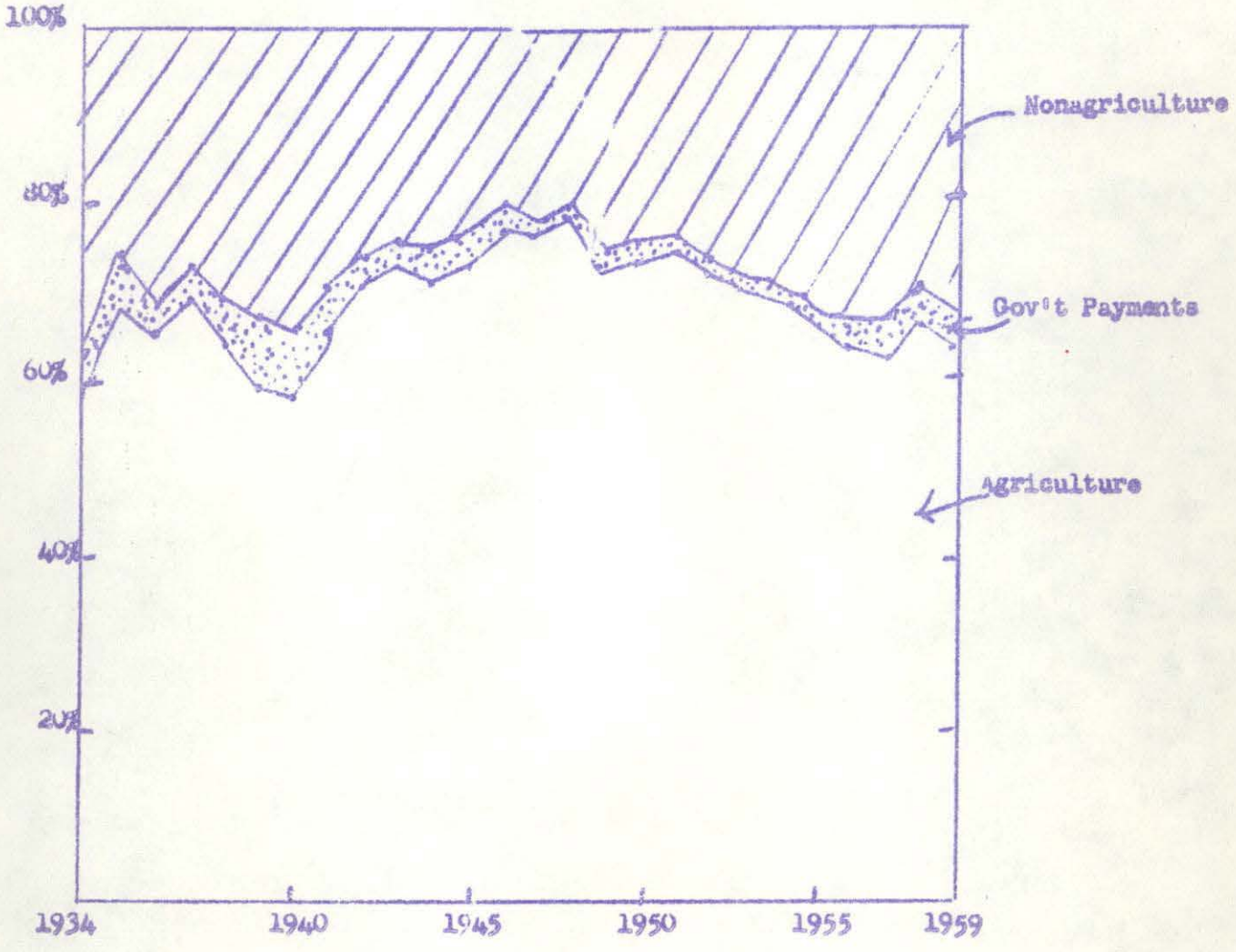


Figure 2. Proportion of Income of Farm People from Various Sources.



A Conceptual Model

A major part of the income earned by farmers from nonfarm sources is from nonfarm employment.[2/] Though the nonfarm income component of farm people includes dividend payments, royalties, and rents, these represent a small fraction of the total, and may be rather insensitive to current economic conditions. Hence in our model we will concentrate on off-farm wages as the chief determinant of the nonfarm income of farm people.

By examining the problem from the standpoint of the returns to farm people in the nonfarm sector, a two-equation model in which nonfarm employment and the return to labor in the nonfarm sector are simultaneously determined can be used as a point of departure. This can be stated compactly as:

$$D: \quad Y_1 = \alpha_1 + \beta_1 Y_2 + \gamma_1 X_1 + u_1$$

$$S: \quad Y_1 = \alpha_2 + \beta_2 Y_2 + \gamma_2 X_2 + u_2$$

where:

Y_1 = the quantity of farm family labor employed by the nonfarm economy;

Y_2 = the real return (per unit of time) per-farm-family-worker in the nonfarm economy;

X_1 = a vector of variables representing the demand for labor by the nonfarm sector;

X_2 = a vector of variables representing the supply of labor offered to the nonfarm sector by farm-family-workers;

[2/] Farmers' Expenditures for Farm Living and Production with Tables on Off-Farm Income, 1955, Volume III, part 11, 1954 Census of Agriculture, U. S. Departments of Agriculture and Commerce, December 1956, p. 49. For 1955, income received by farm-operator families was from the following sources; nonfarm work by farm operator, wife, and other family members, 67.8 percent, nonfarm business, 14.4 percent; interest, dividends, royalties and trusts, 6.5 percent; other 11.3 percent.

and u_1 and u_2 are random error terms with the usual statistical properties.

The variables Y_1 and Y_2 are endogenously determined subject to the exogenous variables contained in the vectors X_1 and X_2. The specification of variables included in the vectors X_1 and X_2 will be discussed below.

This structural model, useful as it is for understanding the determinants of nonfarm income, cannot be estimated directly. We have no information available on the quantity of labor supplied to the nonfarm sector except at 5-year intervals from the Census of Agriculture. However, estimates of nonfarm income can be put on a per-farm-family-worker basis as an approximation to the Y_2 variable. Transforming the structural model into its reduced forms will result in a relationship in which nonfarm income per-farm-family-worker is determined by the exogenous variables contained in the vectors X_1 and X_2. This equation can be estimated directly by ordinary least squares, and will yield insights into the determinants of nonfarm income.

Exogenous variables determining the nonfarm demand for labor. Some measure of the overall demand for labor in the nonfarm sector is desired in an aggregate model of this kind. Perhaps the most immediate reflector of the demand for labor in the nonfarm economy is the percentage of unemployment of the civilian labor force. This is a proxy for the "tightness" of the aggregate labor market and reflects conditions primarily in the nonfarm market for labor. Economists have generally assumed that unemployment, per se, does not develop in the agricultural labor market, where wage rates have a high degree of flexibility, although underemployment does.

The rate of change of gross national product is another indication of the demand for labor in the nonfarm sector of the economy. If the economy is viewed secularly as requiring a long term transfer of labor resources to

the nonfarm sector, the rate of change of gross national product reflects in part, at least, the demand for these labor resources by the nonfarm sector.

Gross national product is a measure of aggregate economic activity. As the aggregate economic activity expands, incentive exists for labor to transfer from the farm to the nonfarm sector. The converse holds for declines in aggregate economic activity. Both of these statements are predicated on the assumption that the secular resource problem is one of transferring labor resources out of agriculture.

Exogenous variables determining the supply of labor to the nonfarm sector. Economic forces that shift the agricultural demand for labor to the right or left tend to shift the supply of labor to the nonfarm sector in the opposite direction. In a recent analysis of the market for hired labor, real farm prices were found to be a major shifter of the demand for labor curve in agriculture.[3/] This suggests the introduction of real farm prices as one variable in the X_2 vector. Increases in real farm prices should reduce the incentive to find work in the nonfarm sector of the economy, while decreases in real farm prices, which reduce the demand for labor in agriculture, should increase this incentive.

In addition to this economic variable, there has been a change in the structure of the agricultural labor market over time. The automobile has made the labor force more mobile. This is particularly important when considering the multiple job holdings of farm people earning income in the nonfarm sector.

An index of mobility was computed by dividing the number of automobiles on farms by the number of farm family workers. This provides a rough measure

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3/ Schuh, G. E., "An Econometric Investigation of the Market for Hired Labor in Agriculture", Journal of Farm Economics, forthcoming.

of the ability of members of the farm labor force to commute to nonfarm jobs. Ceteris paribus, the more mobile the agricultural labor force, the more opportunity to earn income in the nonfarm sector. Secularly, this reflects a lateral shifting of the supply curve of labor to the nonfarm sector. In practice this variable probably will reflect all of the factors associated with a more highly integrated economic system.

The Statistical Model and Data

On these considerations the statistical model to be fit by ordinary least squares is the following:

$$Y_2 = \pi_0 + \pi_1 X_1 + \pi_2 X_2 + \pi_3 X_3 + \pi_4 X_4 + u_1$$

where:

Y_2 = nonfarm income per farm family worker, deflated by the consumer price index.

X_1 = the index of prices received by farmers for all products, deflated by the index of prices paid by farmers for items used in production.

X_2 = the mobility index, measured by the number of automobiles on farms divided by the number of farm family workers.

X_3 = the percentage change in gross national product from year t-1 to year t in constant dollars.

X_4 = the percentage of the civilian labor force unemployed.

The model is fit linearly in the absolute values or the index of the absolute values. The coefficients are designated by π's to indicate that a reduced form for a structural model is being estimated. All variables

are entered as current values except for GNP which is the percentage change in GNP from year t-1 to year t.

Two of the data series merit additional comment. With the rapid decline in the farm population and the agricultural labor force since 1929, it seemed desirable to put nonfarm income on a per capita basis. Alternatives included per farm operator, per-farm-family -worker, or per member of the farm population. The model was put on a farm-family-worker basis, since this measures more directly the proportion of the farm population actually engaged in work activity. This ignores the fact that part of the nonfarm income of farm people is earned by people not participating in farmwork; but lack of information precluded a more accurate basis of division.

Published estimates of income of farm people from nonagricultural sources are not derived from currently reported data as are most estimates related to farm income and expenses. Instead, they are tied to benchmark estimates obtained from sample surveys for several scattered years, and are interpolated or extrapolated for other years on the assumption that changes in the farm population's share of total nonagricultural income are proportionate to changes in the farm population as a percentage of the total population.[4/] The benchmark surveys are on the basis of 1934-36, 1941, 1946, 1949, 1950, and 1955. Though this method of constructing the data series leaves something to be desired in terms of accuracy, there is nothing in the synthesis of the data that would have forced the statistical results obtained below.

4/ United States Department of Agriculture, Major Statistical Series, Volume 3, Agr. Handb. No. 118, p. 4.

Statistical Results and Analysis

The statistical results, together with the correlation matrix are presented in Table 1. In Model I the coefficients for three of the variables are highly significant and have the expected sign. The fourth variable, the percentage change in gross national product, is not significant at usually accepted levels, although it has the expected sign and a coefficient that is larger than its standard error. The model explains a large part of the variation in the dependent variable. The Durbin-Watson test for serial correlation in the residuals is inconclusive.

In Model II the gross national product variable is omitted. Coefficients for the remaining variables are quite stable, and the model explains almost as much of the variation in the dependent variable as does Model I. The coefficients of all variables in Model II are highly significant.

In a sense both the rate of change of gross national product and unemployment are measuring different dimensions of the same economic forces. Presumably a more rapidly expanding economy, with a given level of unemployment, would provide more nonfarm income opportunities for farm people. However, the measurement of this variable leaves something to be desired. The ideal measure would be the rate of change of gross national product within the current year. Information on this is available only for the postwar period. Since turning points in economic activity come at various times of the year, measuring the change on a year-to-year basis probably does not tell the whole story.

On these considerations Model I is accepted as a basis for explaining nonfarm income per-farm-family-worker, despite the lack of significance for the coefficient of the gross national product variable. Predicted values from this model are compared with the observed values in figure 3.

Table 1. Regression Coefficients and Standard Errors For Models Explaining Nonfarm Income of Farm People, 1934-59; Nonfarm Income per-Farm-Family-worker the Dependent Variable.

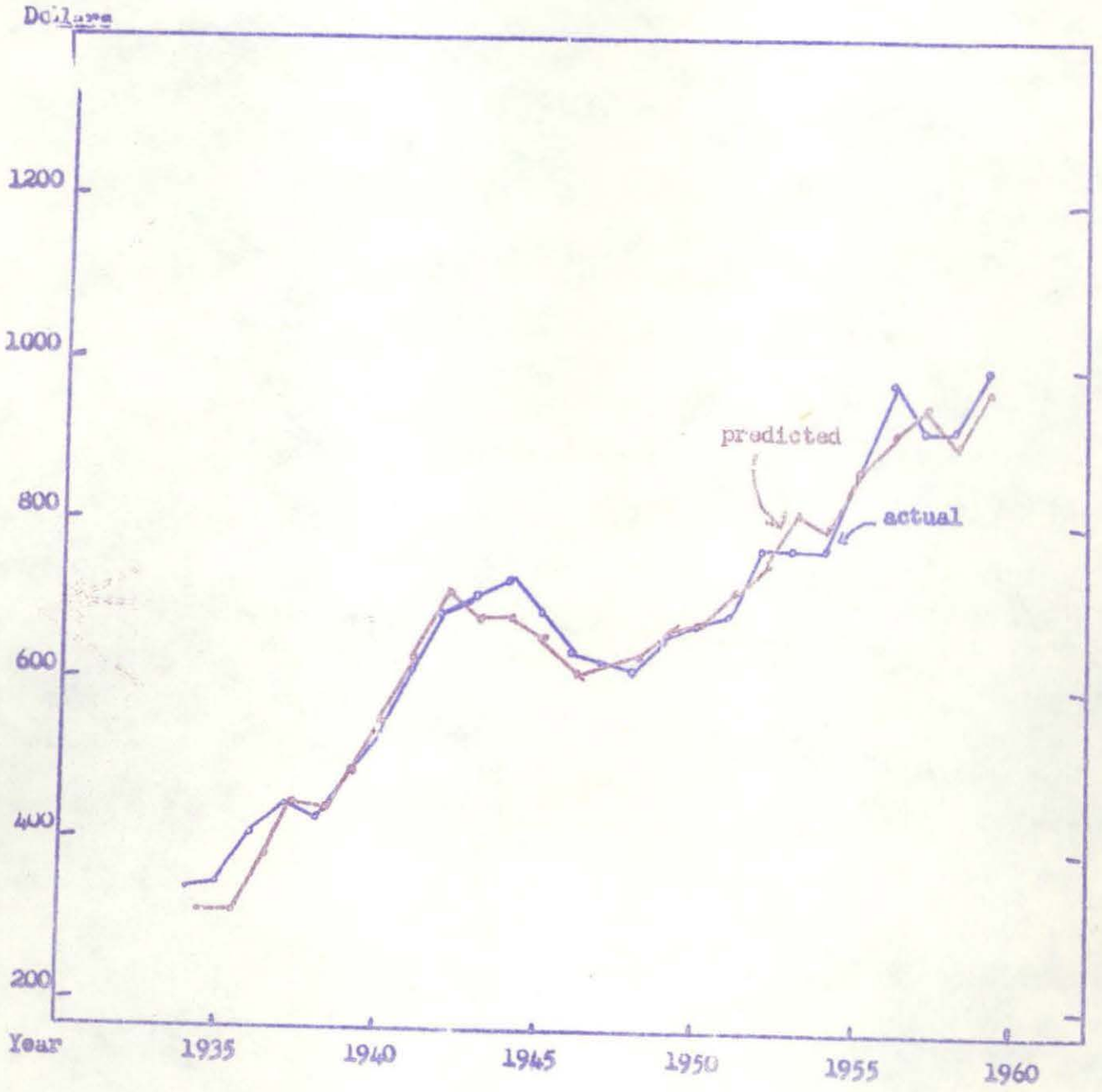
		Supply Shifters		Demand Shifters		
Model	Constant	Real Farm Prices	Mobility	Δ GNP	Unemployment	R^2
1	54.8	-.336 (.117)	.097 (.014)	.011* (.009)	-.153 (.031)	.982
2	60.1	-.356 (.116)	.094 (.013)		-.156 (.031)	.980

* Not significant at usually accepted levels.
d' = 1.53

Correlation Matrix

Real Prices	1.00	-.094	-.126	-.628
Mobility		1.00	-.272	-.664
Δ GNP			1.00	.264
Unemployment				1.00

Figure 3. Real Nonfarm Income Per Farm Family Worker.



These results emphasize that the welfare of farm people is determined in part by economic forces in the nonfarm sector of the economy. In addition they indicate that at least part of these effects are transmitted directly through the factor markets. And, finally, they indicate the importance of the automobile and its attendant social capital in roads, bridges, and other transportation facilites in increasing the income opportunities of the labor force.

Concluding Comments

In real terms, nonfarm income is an important and comparatively volatile component of the personal income of farm people. The analysis presented above has been of necessity highly aggregative in nature. More detailed analysis of this component of the income of farm people is limited by the scarcity of data.

During the depression many studies were made of part-time farming.5/ Presumably this was oriented towards developing income opportunities when none existed in the nonfarm sector of the economy. Perhaps a wise use of current Experiment Station resources would involve an allocation to a similar study of part-time urban employment. Labor market information on the availability of part-time jobs, the skill levels required, and the adjustment problems might possibly contribute as much to the solution of the farm income problem as information on how to improve the organization of existing farm units.

5/ This point is made, together with a cursory examination of the pertinent literature, by Leonard Salter, Jr., in A Critical Review of Research in Land Economics, The University of Minnesota Press, Minneapolis, 1948.

Table 2. Data used in Calculating Coefficients for Regression Equation Used to Predict Real Nonfarm Incomes per-Farm-Family-Worker Shown in figure 3, and Predicted Values, 1934-59.

Year	Parity ratio	Mobility	Change in GNP	Unemployment	Nonfarm Income per-Farm-Family-Worker	Predicted Value[1/]
	X_1	X_2	X_3	X_4	Y_2^*	$\hat{Y}_2$
1934	75	348	194	217	34	32.2
1935	88	369	204	201	35	32.5
1936	92	399	233	169	41	39.3
1937	93	438	159	143	45	45.9
1938	78	466	54	190	43	45.3
1939	77	468	181	172	49	50.0
1940	81	499	187	146	54	55.7
1941	93	540	257	99	62	63.6
1942	105	587	220	47	69	71.6
1943	113	543	212	19	71	68.9
1944	108	524	171	12	73	69.4
1945	109	526	88	19	69	67.2
1946	113	525	0	39	64	61.7
1947	115	536	99	39	63	63.2
1948	110	526	138	38	62	64.5
1949	100	556	99	59	66	67.1
1950	101	553	187	53	68	68.4
1951	107	577	175	33	69	71.7
1952	100	603	134	31	77	76.4
1953	92	625	144	29	77	81.6
1954	89	646	84	56	77	79.9
1955	84	671	181	44	87	86.9
1956	82	722	121	42	98	92.1
1957	82	750	119	43	92	94.7
1958	85	765	82	68	92	90.9
1959	83	780	168	55	100	96.6

1/ Equation:

$$\hat{Y}_2 = 54.8389 - .3363X_1 + .0969X_2 + .0111X_3 - .1532X_4$$

*Hundreds.

Sources of data:

Y_2, real nonfarm income per-farm-family- worker: income of the farm population from nonagricultural sources (U. S. Department of Agriculture, Agriculture Handbook No. 118, Volume 3, p. 45, and subsequent Farm Income reports) deflated by the consumer price index (1947-49 = 100) and by the number of farm family workers (Agriculture Handbook No. 118, Volume 7, p. 9, and subsequent Farm Labor reports).

X_1, real farm prices: the parity ratio taken from Agriculture Handbook No. 118, Volume 1, p. 70, and subsequent issues of Agricultural Prices.

X_2, the index of mobility: number of automobiles on farms (U. S. Department of Agriculture, Changes in Production and Efficiency, July 1961, p. 31) divided by the number of farm family workers.

X_3, rate of change in Gross National Product: percentage change in constant (1954) dollar from year t-1 to year t, the Survey of Current Business. These calculations were coded to eliminate negative numbers and decimals by adding 10 and multiplying by 10.

X_4, the rate of unemployment in the total economy: Bureau of the Census. Historical data are reproduced in W. S. Woytinsky, Employment and Wages, p. 398.