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FARM SIZE AND FEDERAL INDIVIDUAL INCOME TAX PROGRESSIVITY IN AGRICULTURE

by

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The purpose of this paper is to investigate the progressivity of the federal income tax system for a selected sample of Pennsylvania dairy and beef farmers. There is some disagreement among economists as to whether the federal individual income tax system is progressive or proportional with respect to adjusted gross income (AGI) (Boadway and Waldasin). In a survey of Indiana farmers reporting tax returns filed in 1978 and 1979, Baker and Lapp found that effective average tax rates did not increase for increases in farm size as measured by cash operating income. The progressive nature of the tax system was negated by the use of various investment tax credits (ITC).

In this study two measures of average tax rates were used. The first was the ratio of the income tax obligation divided by AGI (ATRBC), and the second was the income tax obligation after subtracting all individual tax credits including the ITC divided by AGI (ATRAC). This latter measure is generally referred to as the effective average tax rate. The AGI was used as a measure of income because AGI is the concept in tax law that is closest to what economists mean by total income (Pechman and Okner). In 1981, AGI amounted to 80 percent of personal income while taxable income was about 68 percent of AGI, or about 54 percent of personal income.

The relative importance of farm size and share of farm taxpayers' income earned from farming to income taxes and the tax rates they pay has been subject to speculation. Are average nominal income tax rates (ATRBC) paid by individuals identifying themselves as farmers progressive, regressive, or unrelated to farm size? Does the proportion of AGI that farmers earn from farming operations influence their average nominal individual income tax

rates and tax liabilities? Further, do taxpayers engaged in different types of farm enterprises pay identical or different income tax rates after adjustments for tax credits permitted under federal tax laws?

To generate some preliminary answers for these questions, several OLS regression models have been formulated for use in studying the two dependent variables ATRBCs and ATRACs. Two sets of explanatory variables are needed. The first set, X, includes measures of farm size, sources of income, and type of farm enterprise. The second set, Z, includes other exogenous variables that may affect the tax rates such as the number of individual exemptions claimed, whether the taxpayer itemized deductions, and status of the taxpayers such as married couple filing jointly, or single head of household to account for different statutory tax rate schedules. The form of the linear estimating model whose coefficients are presented below in Table 2, would be:

$$a_o + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + B_1Z_1 + B_2Z_2 + B_3Z_3 + B_4Z_4 + u$$

where:

X_1 = farm size measured by farm cash operating receipts as adjusted for changes in crop inventories

X_2 = farm size squared

X_3 = dummy--1=less than 50 percent of total net income earned from farming

X_4 = dummy--1=50 to 80 percent of total net income earned from farming

X_5 = dummy==1=working spouse deduction, and 0=otherwise

Z_1 = dummy--1=taxpayer itemized deductions, and 0=otherwise

Z_2 = number of personal exemptions claimed

Z_3 = number of personal exemptions squared

Z_4 = type of taxpayer--1=single return or unmarried head of household, and 0=joint return

u = normally distributed error vector with mean 0 and variance σ^2.

The coefficients to be estimated are the "a"s and "B"s.

Area of Study and Data Description

Farm level data were taken from the Pennsylvania Farmers Association's financial and tax record keeping service for the 1984 calendar year. The farms selected were sole proprietorships that filed a federal individual income tax return and had a taxable income (Form 1040, line 37) of at least the zero bracket amount (ZBA). Farms with a taxable income of less than the ZBA amount ($2,300 for single and $3,400 for joint returns) were excluded from the analysis because they paid no income tax. However, they may have elected to pay the minimum self employment tax. The farms studied are thus a selected sample and may not be representative of all farms that paid an income tax, statewide. The sample was segregated by enterprise type, giving a total of 663 dairy and 64 beef farm taxpayers.

Mean values of the variables used in the analysis are shown in Table 1. Farm size was measured as farm cash operating receipts plus adjustment for change in crop inventories. The average size of the dairy farms was $112,565, while the beef farms were smaller at $73,235. One reason why beef farms were smaller is that most were part-time operations. Two-hundred and sixteen (32.5 percent) of the dairy farm proprietors realized less than 50 percent of their total net income (before taxes) from the farm, while 316 (47.7 percent) earned more than 80 percent of total net income from the farm.

The average tax rate before tax credits was larger on beef farms as compared to dairy farms. On average, 24 to 28 percent of farms took itemized deductions. Twenty-nine percent of the dairy and 42 percent of the beef farms took the working spouse deduction (WSD), which had a maximum amount at

Table 1. Number of Farms by Enterprise Type and Mean Values of Farm and Tax Characteristics, Pennsylvania Farm Taxpayer

	Farm Enterprise Type	
	Dairy	Beef
Number of farms	663	64
Farm cash operating receipts ($)	112,565	73,235
Actual average tax rate before credits (%)	8.32	10.42
Actual average tax rate after credits (%)	3.09	6.45
Farms that itemize deductions (%)	24	28
Source of net income (No. farm)		
Less than 50% from farm	216	45
50 to 80% from farm	131	5
More than 80% from farm	316	14
Working spouse deduction (%)	29	42
Average number of exemptions	3.50	3.29
Type of return files (No. Farms)		
Single	24	2
Joint	637	62
Single head of household	2	-

$3,000 in 1984. The larger number of beef farms taking the WSD is an indication that many were part-time operations. The average number of exemptions ranged from 3.29 to 3.50 across the two groups. Nearly all farms sampled filed a joint return.

A tax model was developed to calculate, from the raw individual taxpayer tax data, all line entries on the Federal Income Tax Form 1040 and all necessary accompanying forms and schedules (Grisley and Jenkins). The Pennsylvania state and local income tax liabilities were not calculated. To insure that the tax model was accurate, actual Form 1040 line entries for a subsample of farms was checked for consistency. In all cases the calculated line entries were identical or close to the actual line entries on the Form 1040 filed with the Internal Revenue Service. The data calculated from the tax model were used in the regression model described earlier. In addition, the tax model was modified to simulate change for three tax provisions; accural accounting in lieu of cash basis accounting, elimination of the 60 percent exclusion on capital gain income [redacted] (primarily culled breeding livestock), and class life-ADR depreciation instead the current ACRS depreciation. The ADR method of calculating depreciation, used prior to 1981, more closely resembles the real rate of economic depreciation than depreciation calculated under the ACRS method. These changes were made to study the hypothetical progressivity of the tax system for farmers after eliminating some of the more important tax preferences that farmers are allowed.

Results

Briefly, our working hypotheses are that the farm size variable should be positively associated with nominal tax rates (ATRBC) because AGI should rise with farm size, other things equal. The farm size squared term should

be negative because the ATRBC should increase at a decreasing rate for increases in AGI. The ATRBC should rise as nonfarm income increases because this income is relatively more difficult to shelter from the federal individual income tax. Hence coefficients on part-time farming and working spouse deductions should be positive. Given the nominally progressive structure of the individual income tax, it is reasonable to expect that the coefficients on farm size and relative importance of nonfarm income variables should be positive, after adjusting for tax credits (ATRAC), but the coefficients should be smaller than when ATRBC is the dependent variable. When partitioning the data set into subsamples by enterprise type, we expect different coefficients but cannot predict, a priori, the direction of the difference.

The parameter estimates of the regression model by type of farm are shown in Table 2. The values of R-squared for all equations were low, ranging from .10 to .33 but all F-values were significant at the .05 probability level or above. For dairy farms with ATRBC as the dependent variable, the coefficient for farm size was significant and had the positive sign expected, although the squared term for farm size was not significant. The coefficients for nonfarm income reflected by the WSD and the dummy variable for part-time farmers earning less than 50 percent of their total net income from farming were significant and had the positive signs as expected. The intermediate-time dummy variable was not significant. These results imply that the nominal tax rate was progressive with respect to farm size as measured here. Moving to the second column with ATRAC as the dependent variable, the coefficients on the size and size squared terms were not significant. These results suggest that the tax system, after adjusting the tax liability by subtracting tax credits, was not progressive with

Table 2. Estimated Tax Progressivity Before and After Tax Credits, Pennsylvania Dairy, Beef, and Crop Farm Taxpayers[a]

	Dairy		Beef	
	ATRBC	ATRAC	ATRBC	ATRAC
Intercept	0.064 (6.27)	0.051 (4.87)	0.225 (4.56)	0.220 (4.13)
Farm size	2.7E-7* (4.31)	-6.7E-8 (1.04)	-4.9E-7** (1.88)	-7.9E-7* (2.78)
Farm size squared	-1.9E-13 (1.29)	1.9E-13 (1.26)	1.4E-12* (1.96)	1.9E-12* (2.38)
Part-time dummy	0.014* (3.52)	0.007** (1.84)	-0.041* (2.23)	-0.021 (1.07)
Intermediate time dummy	0.007 (1.51)	0.005 (1.07)	-0.038** (1.65)	-0.011 (0.43)
Working spouse deduction dummy	0.021* (5.75)	0.016* (4.32)	0.022** (1.94)	0.022** (1.78)
Itemize deduction dummy	0.005 (1.21)	0.010* (2.49)	-0.006 (0.50)	0.004 (0.33)
Personal exemptions claimed	-0.015* (3.64)	-0.010* (2.61)	-0.055* (2.31)	-0.073* (2.83)
Personal exemptions squared	0.001** (1.93)	0.001 (1.09)	0.006* (2.09)	0.009* (2.67)
Type of taxpayer	0.001 (0.14)	-0.022* (2.21)	0.003 (0.08)	-0.019 (0.46)
R-square	.20	.10	.27	.33
F-value	18.0	8.2	2.2	3.0
Sample size	663	663	64	-
ATRBC (%)	6.50	-	8.36	-
ATRAC (%)	-	2.57	-	5.37

[a] The dependent variables are the average tax rate before credits (ATRBC) and average tax rate after credits (ATRAC).

t-values are reported in parenthesis. A single and double asterisk indicates significance at the .05 and .10 probability levels, respectively.

respect to farm size. However, the effective average tax rate, and hence marginal tax rate, was not regressive. A general conclusion is that farmers operating larger farms were apparently able to offset a larger portion of their tax liability with ITCs than those operating smaller farms. Note also that the working spouse variable remains significant, and nonfarm earnings continue to contribute to a higher tax, even when measured as ATRAC, but the coefficient for the part-time dummy variable decreased by half.

Looking at the results for beef enterprises, the two farm size variables were significant in both equations, with signs reversed from what were expected. As size of the beef operation increased, both the ATRBC and ATRAC falls. Hence the tax system was found to be regressive with respect to farm size for both the nominal and effective average tax rates. The coefficient for the part- and intermediate-time dummy variables were negative and significant, implying that the farms with smaller amounts of total net income coming from the farm had lower ATRBCs. On an ATRAC basis neither dummy variable was significant. The overall implication is that the larger beef operations were able to shelter more income than their smaller counterparts on a before tax credit basis and were also able to offset a higher proportion of their tax liability after deducting individual tax credits.

There are two plausible explanations for the findings that larger dairy and beef farmers pay proportional or lower tax rates after adjustment for tax credits than do smaller farmers. First, larger farms, as measured, may be less economically viable than smaller farms, resulting in smaller taxable incomes. Second, larger farms may be economically viable but were able to use tax preferences to reduce tax liabilities from farm income and have enough left over to reduce income from other sources sufficiently to end up

with a smaller average tax rate than that faced by smaller farm taxpayers that had taxable incomes.

The sample size of 663 dairy farms is large enough that we can partition the taxpayers into three income groups for additional analysis, based on the percent of total net income earned on farm. The regression equations were estimated for three groups to study the impact of farm size on ATRBC and ATRAC. These coefficient estimates are shown in Table 3. For part-time farmers deriving less than 50 percent of their total net income from dairy operations, farm size had no effect on ATRBC (although the tax rate increased if there was a working spouse). When tax credits were taken, however, the size term was negative and significant and the size squared term was positive and significant, reflecting a regressive tax system with respect to size of farm. For the intermediate-time farmers earning 50 to 80 percent of their income from dairying and full-time farmers earning more than 80 percent of income from farming the ATRBCs increased with in farm size. The coefficients on farm size were negative but not significant after adjusting for credits.

The results for the three groups reported in Table 3 suggest that when dairy farm taxpayers are stratified by the percentage importance of the contribution of net farm income to total net income, those least dependent upon farming as an income source play a major determining role in making the tax system weakly regressive with respect to size of farm. This also supports the speculation that farmers who earn a major proportion of their income from nonfarm sources are effectively using farm-related tax preferences, especially the ITC, to shelter nonfarm income.

Several additional analyses of the dairy farm taxpayers were conducted using data on the three tax provisions to recalculate AGI and the tax liability in determining the average tax rates before and after the

Table 3. Estimated Tax Progressivity Before and After Tax Credits for Pennsylvania Dairy Farm Taxpayers by Percent of Total Net Income from the Farm[1]

Independent Variables	Percent of total net income from farm: Less than 50% ATRBC	Less than 50% ATRAC	50 to 80% ATRBC	50 to 80% ATRAC	More than 80% ATRBC	More than 80% ATRAC
Intercept	0.119	0.090	0.073	0.071	0.055	0.035
	(4.86)	(3.34)	(3.86)	(3.49)	(3.57)	(2.40)
Farm size	-6.2E-8	-3.9E-7*	4.1E-7*	-1.7E-8	3.4E-7*	-5.2E-8
	(-0.41)	(-2.36)	(3.27)	(-0.13)	(3.55)	(-0.58)
Farm size squared	6.3E-13	1.3E-12*	-5.6E-13*	-4.6E-14	-2.4E-13	2.2E-13
	(1.32)	(2.43)	(-2.17)	(-0.17)	(-1.06)	(1.03)
Working spouse deduction dummy	0.025*	0.028*	0.024*	0.010	0.015*	0.010**
	(3.96)	(3.97)	(3.10)	(1.25)	(2.57)	(1.94)
Itemize deduction dummy	-0.003	0.009	0.002	0.010	0.010*	0.010*
	(-0.37)	(1.03)	0.27)	(1.09)	(2.02)	(2.12)
Personal exemption claimed	-0.027*	-0.019	-0.019*	-0.015**	-0.015*	-0.006
	(-2.05)	(-1.35)	(-2.56)	(-1.94)	(-2.30)	(-0.88)
Personal exemptions squared	0.002	0.001	0.001	0.001	0.001	0.0002
	(1.36)	(0.64)	(1.38)	(0.90)	(1.41)	(0.23)
Type of taxpayer	-0.012	-0.020	-0.023	-0.034	0.008	-0.016
	(-0.50)	(-0.73)	(-0.86)	(-1.19)	(0.68)	(-1.40)
R-square	.15	.14	.22	.10	.23	.06
F-value	5.3	4.8	5.0	2.1	13.4	2.8
Sample size	216	216	131	131	316	316
ATRBC (%)	7.13	-	7.33	-	5.73	-
ATRAC (%)	-	3.27	-	3.20	-	1.84

[a] The dependent variables are the average tax rate before credits (ATRBC) and average tax rate after credits (ATRAC).

t-values are reported in parentheses. A single and double asterisk indicates significance at the .05 and .10 probability levels, respectively.

adjustment for tax credits. First, net farm income was transformed from a cash to an accural basis. The results are reported in the first two columns of Table 4. Next the capital gain exclusion of 60 percent was eliminated so that all capital gain was added to income. These estimates are presented in columns 3 and 4 of Table 4. Finally, net farm income was adjusted using ADR depreciation on farm depreciable assets. Because the ITC was disallowed, only the case for ATRDC was estimated. The purpose of these analyses was to determine if these tax provisions, individually, would have an impact on the progressivity of the tax system with respect to size of farm.

For the accural accounting provision, both the ATRBC and ATRAC were increasing for increases in farm size. The coefficient for the latter variable was significant at the .10 probability level using a one-tail t-test. These results differ in two respects from the results under the actual tax system in 1984 (Table 2, columns 1 and 2). First, the increase in ATRBC was greater, but with a greater curvature under the accural case. A greater curvature would imply less tax progressivity at larger farm sizes. Second, the tax system was weakly progressive for ATRAC under accural accounting, but not progressive under cash accounting. The results of the equations with no exclusion on capital gain income shows the tax system to be progressive for the ATRBC case but not progressive for the ATRAC case; a result similar to the equation modelling the actual tax results. Again, ATRAC was rising faster with a greater curvature after eliminating the exclusion on capital gain income. When using ADR depreciation instead of ACRS depreciation the tax system was found to be progressive, but the ATRBC increased at a faster rate and with a greater curvature than under ACRS depreciation.

Table 4. Estimated Tax Progressivity Before and After Credits When Eliminating Selected Tax Preferences, Pennsylvania Dairy Farm Taxpayers[a]

	Accrual Accounting		Capital Gain Income		ADR Depreciation
	ATRBC	ATRAC	ATRBC	ATRAC	ATRBC
Intercept	0.054	0.052	0.065	0.061	0.076
	(4.06)	(3.55)	(6.59)	(4.99)	(7.37)
Farm size	5.9E-7	1.4E-7	4.1E-7*	-6.3E-8	4.0E-7*
	(7.19)	(1.61)	(6.75)	(0.84)	(6.29)
Farm size squared	-5.1E-13*	-5.7E-14	-3.2E-13	2.8E-13	-2.4E-13
	(2.61)	(0.26)	(2.17)	(1.54)	(1.59)
Part time dummy	0.008	0.010	0.013*	0.008**	0.012
	(1.61)	(1.69)	(3.58)	(1.73)	(3.07)
Intermediate time dummy	0.008	0.014*	0.028**	0.007	0.007
	(1.38)	(2.12)	(1.95)	(1.32)	(1.56)
Working spouse deduction dummy	0.025*	0.015*	0.016*	0.018*	0.018*
	(5.31)	(2.86)	(4.39)	(4.15)	(4.75)
Itemize deduction dummy	-0.002	0.015*	0.004	0.015*	0.002
	(0.34)	(2.76)	(1.11)	(3.39)	(0.41)
Personal exemption claimed	-0.010*	-0.014*	-0.012*	-0.013*	-0.015*
	(1.97)	(2.36)	(2.99)	(2.63)	(3.60)
Personal exemptions squared	0.0004	0.0007	0.0006	0.0006	0.0009**
	(0.72)	(1.14)	(1.31)	(1.10)	(1.87)
Type of taxpayer	0.013	-0.024**	0.009	-0.023*	0.006
	(1.06)	(1.76)	(0.98)	(2.00)	(0.57)
R-square	.25	.09	.26	.11	.27
F-value	24.8	7.1	25.5	8.7	26.3
Sample size	663	663	663	663	663
ATRBC	9.34	-	8.52	-	8.84
ATRAC	-	4.30	-	3.46	-

[a] The dependent variables are the average tax rate before credits (ATRBC) and average tax rate after credits (ATRAC).

t-values are in parentheses. A single and double asterisk indicates significance at the .05 and .10 probability levels, respectively.

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