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Attitude of Tennessee Farmers toward Credit

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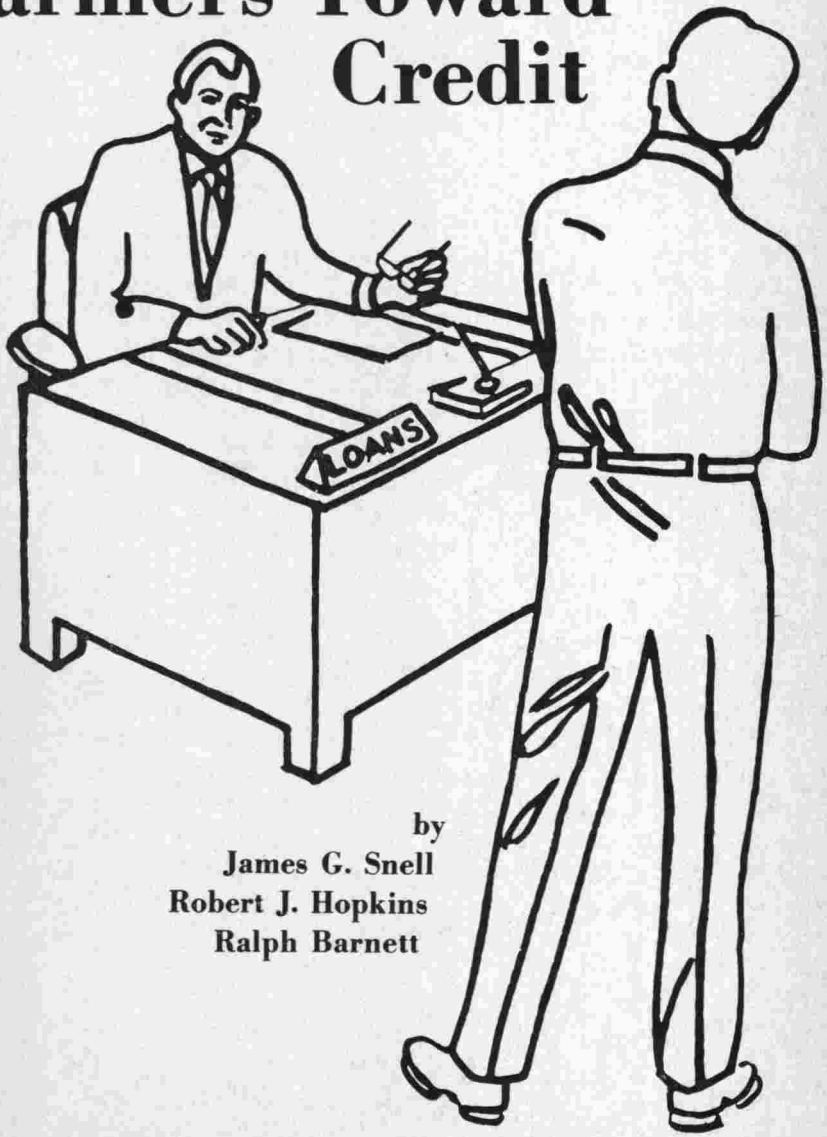

by
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SUMMARY

The specific objectives were: 1) to determine the attitude of East, Middle, and West Tennessee farmers toward credit, and 2) to determine the relationship between selected variables and the attitude of East, Middle, and West Tennessee farmers toward credit.

The study was based on a 1968-69 survey of 535 Tennessee farm operators whose total gross farm income for the preceding year was $1,500 or more. The sample was stratified into East, Middle, and West Tennessee with 200 farmers each in East and Middle and 135 in West Tennessee. In general, Tennessee farmers had a positive attitude toward credit though the attitude cannot be considered to be highly favorable. East Tennessee farmers were less favorable than were Middle and West Tennessee farmers. While variation in attitude existed, the range of attitude scores within a region was not large—indicating Tennessee farmers within a region do not differ widely in their attitude toward credit.

The relationship between selected variables and attitude toward credit in the three regions differ sufficiently so that each area should be and was analyzed separately.

The general conclusion reached was that Tennessee farmers may tend to be conservative in the use of credit and hence Tennessee agriculture may grow at a slower rate than national agriculture. Certainly farmers' attitudes toward credit is not the only limiting factor for agricultural growth in East Tennessee, but this study tends to indicate that East Tennessee farmers will probably use credit to a somewhat lesser extent than Middle and West Tennessee farmers. Hence East Tennessee agriculture may tend to lag behind the growth of agriculture in the other two regions of Tennessee.

The implications of the regional difference between attitude toward credit and the selected variables were that educational programs to promote the use of credit may need to be tailored on a regional basis rather than on a state basis. Credit agencies may need to institute different regional approaches for attracting and servicing clients.

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James G. Snell, Robert J. Hopkins, and Ralph Barnett*

INTRODUCTION

A major problem that confronts a farm operator is obtaining control of land and productive assets. There are several ways of obtaining these assets, but the most prevalent way in recent years has been through the employment of borrowed capital.

Borrowed capital has played a major role in farm expansion over the years, and in recent years its use has increased. Farm debt, as a percentage of farm assets, in the United States has increased from 9.4% in 1950 to 19.2% in 1971.[1] There was an increase in total farm debt from $12.4 billion in 1950 to $61.2 billion in 1971. Figure 1 shows the changes in farm debt during the period 1950-1972. Continued expansion of farm size and increased requirements for purchased inputs have played a major role in the continued increase in farm debt. In Tennessee, average farm size, in acres, increased 55% from 1950 to 1969. The number of farms having less than 200 acres decreased 54% while farms with more than 200 acres increased 156%.[2] Farm real estate prices have continually increased during this same time period. Expansion and consolidation of farms and the adoption of new technologies have required increased amounts of borrowed capital.

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[1] U. S. Department of Agriculture, *Handbook of Agricultural Charts*, Agricultural Handbook No. 423, Washington, Government Printing Office, 1971, p. 14.

[2] U. S. Bureau of Census, *United States Census of Agriculture: 1959, Tennessee Counties*, Washington: Government Printing Offices, 1961; and U. S. Bureau of Census, *United States Census of Agriculture: 1969, Tennessee Counties*, Washington: Government Printing Office, 1972.

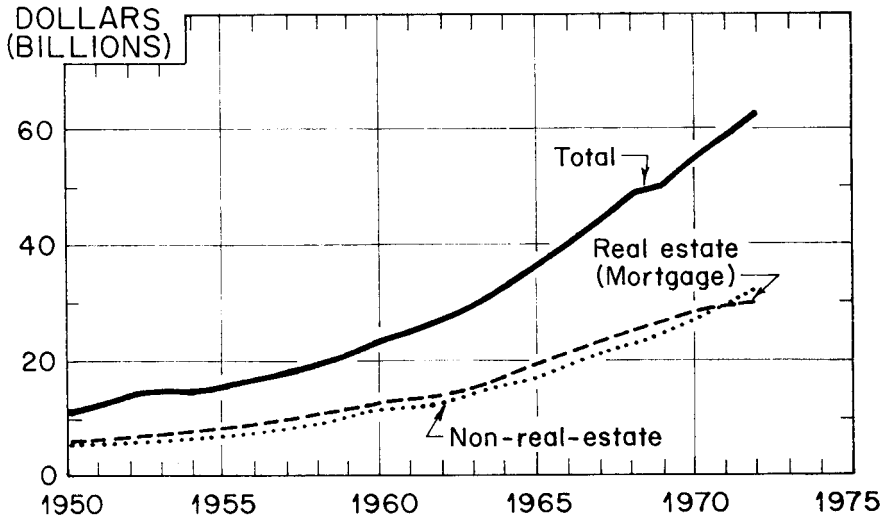

Figure 1. Changes in farm debt in the United States, 1950-1972. Source: United States Department of Agriculture, *Agricultural Finance Outlook*, AFO-11 (Washington: Government Printing Office, February, 1972).

Larger farms need larger amounts of credit in the form of long-term loans. Intermediate and short-term credit demands have also risen due to the need for more equipment, livestock, and operating funds for each farm unit and all farm units together.

A farm operator with a positive attitude toward credit will more readily accept the idea that credit is vital to his operation. Hence, the attitude that a farmer has toward credit may well determine his ability to compete in modern farming. The willingness of Tennessee farmers to use credit will have a strong influence upon the relative position and vitality of Tennessee agriculture in the U. S. economy.

OBJECTIVES

The objectives were: 1) to determine the general attitude of East, Middle, and West Tennessee farmers toward credit; and 2) to determine the relationship between selected variables and attitude of East, Middle, and West Tennessee farmers toward credit.

PROCEDURE

Source of Data

This study was based on a 1968-69 survey of 535 Tennessee farm operators whose total gross farm income for the preceding year

was $1,500 or more.[3] The sample was stratified into East, Middle, and West Tennessee. A random sample of 200 farmers was selected for both East and Middle Tennessee and 135 farmers were selected in West Tennessee.[4]

A structured questionnaire with a personal interview was used to obtain the data.[5] The general characteristics of the farm and farm operator were collected in order that a comparison could be made of the holders of different attitudes. Also, the farmer was asked whether he strongly agreed, merely agreed, was uncertain, disagreed, or strongly disagreed with a series of statements about credit and its relevance to the farm. A scale of 1 to 5 was used to record the farmers' responses which enabled the quantification of each farmer's attitude toward credit. The general characteristics of the farmers sampled and the farm types are presented in Appendix A Tables 2, 3, and 4.

Statistical Analyses

In the first phase of the statistical analysis, attitude scores were computed for East, Middle, and West Tennessee. Standard statistical tests between means were applied to determine if the attitude scores showed a favorable or unfavorable attitude toward credit on the part of the farmers sampled, and if the East, Middle, or West Tennessee farmers sampled had different attitudes toward credit.

In the second phase separate regression equations were fitted for East, Middle, West Tennessee, and the aggregated data.

The dependent variables for the separate equations were:

Y_e = attitude score on East Tennessee farmers
Y_m = attitude score on Middle Tennessee farmers
Y_w = attitude score on West Tennessee farmers
Y_S = attitude score for aggregated data

The explanatory variables were:

X_1 = total tillable acres in acres
X_2 = farmer's age in years

[3] This dollar value was arbitrarily selected in an attempt to limit the sample to the more viable farms.

[4] For the detailed sampling procedure see Robert J. Hopkins, "Knowledge and Attitude Toward the Use of Credit by Farmers in Middle and East Tennessee," unpublished M.S. thesis, University of Tennessee, 1970; and Ralph Barnett, "Knowledge and Attitude Toward the Use of Credit by Farmers in West Tennessee," unpublished M.S. thesis, University of Tennessee, 1971.

[5] A copy of the schedule is available upon request from the Department of Agricultural Economics and Rural Sociology, University of Tennessee, Knoxville, Tennessee 37901.

X_3 = actual number of years engaged in farming
X_4 = husband work off the farm (0, 1 dummy variable)[6]
X_5 = wife works off the farm (0, 1 dummy variable)
X_6 = son over 14 (0, 1 dummy variable)
X_7 = educational level. X_7 is defined as 0 for no school, 1 for 1-4 years, 2 for 5-7 years, 3 for 8 years, 4 for 9-11 years, 5 for 12 years, 6 for 13-15 years, 7 for 16 years and 8 for graduate study
X_8 = has a long-term loan (0, 1 dummy variable)
X_9 = has a short-term loan (0, 1 dummy variable)
X_{10} = is or has been a PCA borrower (0, 1 dummy variable)
X_{11} = crop farmer (0, 1 dummy variable)
X_{12} = livestock farmer (0, 1 dummy variable)
X_{13} = livestock products farmer (0, 1 dummy variable)

A statistical test was made utilizing the results from the four equations (East, Middle, West, and State) to test the hypothesis that there was no significant difference between regions in the relationship between attitude score and the explanatory variables.

RESULTS[7]

On the average, the farmers sampled had a favorable attitude toward credit, although the attitude scores were not high enough to say the farmers were strongly favorable toward credit (Table 1). East Tennessee farmers, however, were less favorable in their attitude than were Middle and West Tennessee farmers (Appendix B).

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[6] Zero-one dummy variables were used to quantify the qualitative variables such as husband works off the farm, PCA borrower, etc. The mathematics requires one variable in a class to be omitted from the regression equation. That omitted variable becomes the base to which the other variables in that class are compared. For example, there is an omitted variable, call it X_{6a}, which is defined as 1 if the farmer has no son 14 years or older, 0 otherwise. If the regression coefficient for X_6 is positive, it means that farmers with sons 14 years or older have a more favorable attitude to credit than farmers who do not have sons 14 years or older.

For more detail on the use of zero-one dummy variables, see Johnston, *Econometrics Methods*, McGraw Hill Book Co., Inc., New York, 1963, pp. 221-28; also Charles Sappington, "A Numerical Example of the Practical Use of Dummy Variables," *Southern Journal of Agricultural Economics*, Vol. 2, No. 1, December, 1970, pp. 197-201.

[7] See Appendix B for the statistical tests on which the statements in this section are based.

Table 1. Attitude scores and standard errors of attitude scores for 535 East, Middle and West Tennessee farmers, 1968-69

Region	Attitude score[a]	Standard deviation
East Tennessee	3.35	.335
Middle Tennessee	3.46	.306
West Tennessee	3.43	.314

[a] An attitude score of "3" indicates an indifferent or uncertain attitude toward credit.

The attitude scores of the farmers sampled were regressed on the 13 selected variables by region and for the three regions combined.[8] The results reinforce the implied assumptions of previous studies that the three regions in Tennessee differ sufficiently so that data from each region should be analyzed separately (Appendix B.2).

The regression equations for the three regions showed that the 13 variables chosen explained little of the variation in attitude scores though the overall relationship for each region was significant at the .01 probability level. The standard error of estimate for each regression equation indicated that while there was variation in attitude toward credit, the range in variation was not large. This indicates that farmers in a given region did not differ widely in their attitude toward credit.

Few of the variables in the three equations were significantly related to attitude scores and only two variables were significantly related to attitude score in all three regions; these significant variables were: "have a long-term loan" (X_9) and "PCA borrower" (X_{10}). "Total tillable acres" (X_1), "wife works off the farm" (X_5), and "farmer's education level" (X_7) were related to attitude toward credit for Middle and West Tennessee but not for East Tennessee.

The attitude scores of East Tennessee farmers increased as the number of tillable acres farmed increased. Farmers whose wives worked off the farm also had higher attitude scores than those farmers whose wives did not work off the farm. These two variables had no relationship with the attitude scores of Middle and West Tennessee.

Farmers with higher educational levels had a more positive attitude toward credit in Middle and West Tennessee, but educational level was not related to the attitude score of East Tennessee farmers.

The two variables, "have a long-term loan" and "PCA borrower," had practically the same positive relationship in all three regions.

[8] See Appendix A for the estimated regression equations for East, Middle, and West Tennessee.

Several of the other variables appeared to have opposite effects in different regions. For example, the coefficient for the variable, "years in farming," had a negative sign in East and West Tennessee but a positive sign for Middle Tennessee. Statistical tests were made and none of these differences among the coefficients was large enough to be significant (Appendix Table B.1).

APPENDIX A

Appendix A. Table 1. Estimated regression coefficients, standard errors of regression coefficients, R^2, standard error of estimate, and residual sums of squares for the regression equation for East Tennessee, Middle Tennessee, and West Tennessee

	East Tennessee	Middle Tennessee	West Tennessee
Intercept	3.14	2.992	3.193
Total tillable acres (x_1)	.00038	.00001	.00005
	(.00002)	(.00015)	(.00006)
	(.0029)	(.0026)	(.0043)
	(.0030)	(.0029)	(.0041)
Farmer age (X_2)	—.0006	.0012	—.0009
	(.0029)	(.0026	(.0043)
Husband works off farm (X_3)	—.0271	—.0769	.0173
	(.0582)	(.0603)	(.0864)
Wife works off farm (X_5)	.1053	.0534	.0298
	(.0564)	(.0475)	(.0667)
Son over 14 (X_6)	.0692	.0540	.0129
	(.0495)	(.0470)	(.0660)
Farmers education (X_7)	.0013	.0426	.0439
	(.0165)	(.0169)	(.0179)
Have short term loan (X_8)	.0762	—.0168	—.0418
	(.0521)	(.0500)	(.0617)
Have long term loan (X_9)	.1438	.1179	.1454
	(.0506)	(.0473)	(.0688)
PCA borrower (X_{10})	.1223	.0935	.1296
	(.0500)	(.0480)	.0565)
	(.0500)	(.0480)	(.0565)
	(.1347)	(.0926)	(.0812)
Livestock (X_{12})	.0064	.0530	—.0104
	(.0694)	(.0589)	(.1022)
Livestock Product (X_{13})	.0012	.0593	.0542
	(.0570)	(.0525)	(.1457)
R^2	.26	.14	.21
Standard error of estimate	.30	.29	.29
Residual sum of square	16.385	16.027	10.438

Appendix A. Table 2. Average farm size of the farms sampled by regions and state, 1968-69

Item	Region			
	East Tennessee	Middle Tennessee	West Tennessee	State
	Acres			
Total acres	223	292	368	285
Total tillable acres	168	208	331	224
Owned	136	147	159	146
Rented	32	61	172	78

Appendix A. Table 3, Mean values for selected variables by regions and state, 1968-69

Item	Region			
	East Tennessee	Middle Tennessee	West Tennessee	State
	Acres			
Number of years in farming	24	25	30	26
Years of age	51	50	52	51
Percent with sons 14 years or over at home	27	34	20	28
Percent of husbands working off farm	25	18	12	19
Years of schooling	11	10.5	10	10.5
Percent using PCA	50	57	37	50

Appendix A. Table 4. Percent of farm types in the sample by regions and state, 1968-69

Farm type	Region			
	East Tennessee	Middle Tennessee	West Tennessee	State
	Percent			
Crop	3	7	70	21
Variable	18	24	13	19
Livestock products	56	35	4	35
Crops and livestock	23	34	13	25
Total	100	100	100	100

APPENDIX B

Statistical Tests

1. Test for Positive Attitude

The hypothesis was that farmers in the East, Middle, and West Regions of Tennessee had a negative or an indifferent attitude toward credit. The statistical hypothesis was: H_o: $\overline{X}_i \leq 3$

H_A: $\overline{X}_i > 3$

Where $\overline{X}_i$ is the attitude score of the farmers sampled in the ith region of Tennessee. An attitude score of "3" indicates an indifferent attitude and corresponds to the answer "uncertain" in the attitude questions. The regions were $\overline{X}_e$ = East, $\overline{X}_m$ = Middle, and $\overline{X}_w$ = West.

The statistical test was the large sample test.[9]

$$Z = \frac{(\overline{X}_i - 3)\sqrt{n}}{S}$$

where: X_i is the sample mean
S is the sample standard deviation and
n is the sample size

East Tennessee

$$14.80 = \frac{(3.46 - 3)\sqrt{200}}{.3345}$$

Middle Tennessee

$$21.28 = \frac{(3.45 - 3)\sqrt{200}}{.3057}$$

West Tennessee

$$15.90 = \frac{(3.43 - 3)\sqrt{135}}{.3145}$$

Tests were also made to test the hypothesis that

H_o: $\overline{X}_i < 4$

H_A: $\overline{X}_i > 4$

where X_i is the average attitude score of farmers sampled in the ith region in Tennessee and 4 is an attitude score corresponding to a favorable attitude.[10] The test scores were:

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[9] John E. Freund, Mathematical Statistics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1962, p. 263.

[10] Strictly speaking, the hypotheses as set up are not legitimate. The usual form of the test is $t = \frac{\overline{X} - \mu_o}{S_{\bar{x}}}$ and hence the point is '4' is included in the null hypothesis which is incorrect. Practically, this was handled by using $t = \frac{X^1 - 3.9999}{S_{\bar{x}}}$ which in fact tests $H_o \leq 3.9999$ against $H_A: > 3.9999$. This later hypothesis seemed to unduly complicate the concept to be tested; i.e., the attitude score was less than 4.

East Tennessee	29.42
Middle Tennessee	24.98
West Tennessee	21.00

The results of the tests show that while Tennessee farmers have a favorable attitude toward credit, it is only "weakly" favorable at the .001 probability level.[11]

2. **Regional Differences—Attitude**

The following pairwise hypotheses were tested to determine if there was a significant difference between the attitude scores of East, Middle, and West Tennessee farmers sampled.

(1) H_o: $\overline{X}_{East} = \overline{X}_{Middle}$
H_A: $\overline{X}_{East} \neq \overline{X}_{Middle}$

(2) H_o: $\overline{X}_{East} = \overline{X}_{West}$
H_A: $\overline{X}_{East} \neq \overline{X}_{West}$

(3) H_o: $\overline{X}_{Middle} = \overline{X}_{West}$
H_A: $\overline{X}_{Middle} \neq \overline{X}_{West}$

The specific statistical test was the large sample test for difference between means.[12]

$$Z = \frac{X_i - X_j - \delta}{\left[\frac{S_i^2}{n_i} + \frac{S_j^2}{n_j}\right]^{1/2}}$$

where: X_i is the sample mean of ith region
X_j is the sample mean of the jth region
δ is an arbitrarily small number (0 in actual use)
S_i^2 is the sample variance of the ith region being tested
S_j^2 is the sample variance of the ith region being tested
n_i and n_j are the sample sizes

East—Middle

$$-3.433 = \frac{3.35 - 3.46}{\left[\frac{.11189}{200} + \frac{.09345}{200}\right]^{1/2}}$$

East—West

$$2.226 = \frac{3.35 - 3.43}{\left[\frac{.11189}{200} + \frac{.09878}{200}\right]^{1/2}}$$

Middle—West

$$.866 = \frac{3.46 - 3.43}{\left[\frac{.09345}{200} + \frac{.09878}{135}\right]^{1/2}}$$

[11] Tennessee farmers can be said to be "weakly" favorable in credit in that their average score fell between the uncertain (3) and the merely favorable (4) answers on the attitude qustions.

[12] *Ibid.*, p. 267.

The results show that the average attitude score of East Tennessee farmers sampled had statistically significant (.05 probability level) less favorable attitudes toward credit than did Middle and West Tennessee farmers; however, there was no significant difference between the attitude scores of the Middle and West Tennessee farmers sampled.

3. **Regional Sample Population Differences**

In many analysis, Tennessee is divided into three regions—East, Middle and West. The analysis proceeds on the generally untested assumption that the underlying population in the three areas differ. The following test was used to determine if the samples taken in each region can be considered to have been generated from the sample population. The formal hypothesis was:

$$H_o: \bar{B}_e = \bar{B}_m = \bar{B}_w = \bar{B}_s$$
$$H_A: \bar{B}_e \neq \bar{B}_m \neq \bar{B}_w \neq \bar{B}_s$$

where B_i is the vector of regression coefficients with the subscripts denoting the area.

The specific test was:[13]

$$F_{k,\ n_e + n_m + n_w - 3k} = \frac{\dfrac{Q_s - (Q_e + Q_m + Q_w)}{k}}{\dfrac{Q_e + Q_m + Q_w}{n_e + n_m + n_w - 3k}}$$

where: Q_i denotes error sums of squares and

k = the number of parameters estimated
Q_s = pooled data
Q_e = East
Q_m = Middle
Q_w = West

Obtain Q_s (error sum of squares from pooled data) Q_e, Q_m and Q_w (error sum of squares from East, Middle, and West samples, respectively) from the four regression equations.

$Q_s = 45.62241$ $\quad N = 535$
$Q_e = 16.38501$ $\quad n_e = 200$
$Q_m = 16.02713$ $\quad n_m = 200$
$Q_w = 10.43765$ $\quad n_w = 135$

$$\frac{\dfrac{2.77362}{13}}{\dfrac{42.48979}{496}} = 2.469 > F_{.01(15,503)}$$

The null hypothesis was rejected; therefore, the data sets from

[13] Johnston, *Econometric Methods*, McGraw Hill Book Co., Inc., New York, 1963, pp. 136-8.

the three regions can be considered to have been drawn from different populations.

4. **Differences between Individual Regression Coefficients**

Pairwise tests were made to determine which individual regression coefficients differed. The null hypotheses were:

$$H_o: B_{ij} = B_{il}$$
$$H_A: B_{ij} \neq B_{il}$$

where B_{ij} and B_{il} is the ith regression coefficient for jth and lth region, $j \neq l$.

$$t = \frac{b_{ij} - b_{il}}{\left| S_p^2 C^1_{ii} + C^l_{ii}) \right|^{1/2}}$$

where: $S_p^2 = \frac{ESS_j + ESS_l}{n_j + n_l - 2_k}$

and C_{ii} is the appropriate diagonal element of the $[(X'X)^{-1}]$ matrix for the different regions.[14, 15]

The results for all possible pairwise tests are given in Appendix Table B.1.

[14] Steel and Torrie, *Principles and Procedures of Statistics*, McGraw Hill Book Company, Inc., New York, 1960, p. 173.

[15] Since $(X'X)^{-1}$ matrix is rarely printed out on a standard computer program, the C_{ii} were calculated from the fact that Var $b_i = S_E^2 C_{ii}$ (where S_E^2 is the variance of the estimate),

$$\frac{\text{Var } b_i}{S_E^2 C_{ii}} = C_{ii}$$

Appendix B. Table 1. t-test scores between estimated regression coefficients from the 3 regions[a]

Variable	East Tennessee Middle Tennessee	East Tennessee West Tennessee	Middle Tennessee West Tennessee
X_1	1.46	1.59	—.29
X_2	—.62	.06	.58
X_3	—.80	.00	.64
X_4	.59	—.42	—.89
X_5	.70	.86	.29
X_6	.22	.68	.51
X_7	—1.72	1.75	—.05
X_8	1.27	1.46	.31
X_9	.37	—.02	—.33
X_{10}	.41	—.10	—.49
X_{11}	.40	.18	—.30
X_{12}	—.51	.14	.54
X_{13}	—.74	—.34	.03

[a] T-value for statistical significance at the .05 probability level is 1.96 (two tailed test) and 1.65 for the .10 probability level (two tailed test).

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