Selected Trends in Iowa Retail Sales and Use Tax Collections, 1939-1952

D.A. Leabo

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Selected Trends in Iowa Retail Sales and Use Tax Collections, 1939–1952

by Dick A. Leabo

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The basic data for this monograph have been taken primarily from the quarterly and annual reports of the Iowa State Tax Commission. In addition, some information was taken from publications of the Bureau of the Census, United States Department of Commerce. Other sources of secondary data employed in this project are indicated by appropriate footnotes.

The writer gratefully acknowledges the contributions of several members of the staff of this Bureau with respect to the preparation of the manuscript. I am particularly indebted to Mrs. Vera Briscoe Toran for her able editing and for her assistance in the assembling of the final copy. My thanks are also due Mrs. Dona J. Meador for typing the manuscript for offset reproduction. For the contributions of these and other Bureau staff members, the writer is indeed grateful.

The writer, however, assumes full responsibility for the accuracy of the computations and for the interpretations contained in this study.

DICK A. LEABO

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Introductory Notes

The measurement of changes in business activity over a period of years is one of the more useful types of statistical analyses. This monograph reports the findings of such a measurement. Specifically, it reports some significant economic trends in the retail business in Iowa for the years 1939 through 1952 as reflected by retail sales and use tax collections. The analysis of these trends in retail activity utilizes a number of statistical techniques. The principle techniques used are as follows. Computations of indexes of retail sales and use tax collections show the growth in retail trade in the State and in the ninety-nine counties. Straight line trend computations indicate variations in trade activity among counties. And various correlation analyses point up the relationship between trade activity and population and between trade activity and income.

USES OF DATA. The data and findings of this study can be put to use in a number of ways. For example, such a study may be helpful in: (1) planning advertising and sales campaigns and determining sales quotas; (2) conducting various types of market research, such as consumer surveys or wholesale and retail distribution analyses; and (3) providing indicators of the stability of at least one segment of the economy of the State and of the individual counties.

LIMITATIONS OF DATA. It is possible to obtain an approximation of changes in retail trade within areas as small as counties by studying fluctuations in retail sales and use tax collections. These collections represent 2 percent of gross sales of most items purchased at the retail level.[1/] However, certain qualifications or limitations in the use of sales and use tax receipts must be noted.

In the first place, these data do not reflect total retail expenditures because of certain exemptions (See footnote 1) from the sales and use tax as specified by the Iowa law.

Another limitation in using such tax collections as an indicator of consumer expenditures, and it appears more serious at first observation, is that the amounts are expressed in current dollars. Consequently, to some extent the data reflect price changes as well as variations in physical volumes. Those fluctuations resulting from price changes can be removed if a suitable price index is available to deflate the data. However, no index of prices is at present computed solely for Iowa or for any particular county in the State.

Fortunately, it may quite reasonably be assumed that price changes between counties changed at approximately the same rates. Therefore, this limitation of using data which reflect current dollar values as well as changes in physical volume is not significant in analyzing relative change. The limitation does not impair the usefulness of these data for measuring differences among the growth patterns of the counties or for relating the trends of individual counties to the State trend.

Finally, other limitations develop if consumer purchases are used as an index of general economic conditions. For example, there is the factor of nonavailability of certain goods and services in the quantities and qualities desired with existing levels of income. The price may be too high, substitutes may be necessary, or because of shortages or rationing the items cannot be purchased. Thus, it may be said that retail sales and use tax collections reflect the major portion of actual retail sales; but it cannot be said that they reflect total retail purchasing power.

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1 SOME OF THE MORE NOTABLE EXEMPTIONS ARE: GASOLINE, BEER, CIGARETTES, CIGARETTE PAPERS, AND OLEOMARGARINE. IN ADDITION, TANGIBLE PERSONAL PROPERTY ACCEPTED BY A RETAILER IN IOWA AS PART CONSIDERATION OF A SALE HAS A TRADE-IN EXEMPTION ON ITS SUBSEQUENT SALE, PROVIDING THE SELLER MEETS OTHER LEGAL REQUIREMENTS.

Trends in Iowa Retail Sales

SECTION ONE

INDEXES OF TOTAL RETAIL SALES AND USE TAX COLLECTIONS

Indexes of total retail sales and use tax collections for all of the ninety-nine counties in Iowa for the years 1939 through 1952 are presented in Table 2. From 1939 to 1952, taxed retail sales for the State increased by almost 258 percent. For the ninety-nine counties the range of the gains during this period was from a low of 176 percent in Boone County to a high of 363 percent in Cass County.

Nevertheless, considering the time period covered, the differences in income, and some factors resulting from war induced patterns of living, the degree of uniformity in the growth of the counties is noteworthy. Almost two-thirds of the counties registered increases in retail sales and use tax collections from 1939 to 1952 within the range of 225 to 275 percent.

Thirty-seven of the counties had increases in taxed retail sales from 1939 to 1952 which exceeded the State average of 257.7 percent. Fifty-five counties made gains during this time which fell within a range of plus or minus 10 percent of the State average. Thirty-six counties were within 10 percent of achieving the State mark.

Figure 1, which shows pictorially the data given in Table 1, makes it possible to contrast the growth of individual counties with the achievements of the remainder of the State. Generally speaking, this figure shows that the largest gains were recorded in those counties normally referred to as our western and our eastern meat areas. Increases below the State average occurred in that section usually called the cash grain area, i.e., the north-northcentral. And average or slightly above average gains were achieved in the dairy area in the northeastern part of Iowa and also in the southern pasture area. There are, of course, notable exceptions in all sections of the State.

TABLE 1. DISTRIBUTION OF COUNTIES BY PERCENTAGE INCREASE IN TAXED RETAIL SALES, 1939 – 1952

PERCENTAGE INCREASE, 1952 OVER 1939	NUMBER OF COUNTIES
175 BUT LESS THAN 200	3
200 BUT LESS THAN 225	15
225 BUT LESS THAN 250	31
250 BUT LESS THAN 275	28
275 BUT LESS THAN 300	16
300 BUT LESS THAN 325	3
325 BUT LESS THAN 350	2
350 BUT LESS THAN 375	1

INDEXES OF PER CAPITA RETAIL SALES AND USE TAX COLLECTIONS IN SELECTED COUNTIES

Indexes of per capita retail sales and use tax collections were computed for only the twenty leading counties in Iowa. The counties analyzed here were chosen in the following manner. The first fifteen counties were selected in terms of their rank by per capita income payments. They are: (1) Scott, (2) Polk, (3) Linn, (4) Black Hawk, (5) Clay, (6) Woodbury, (7) Calhoun, (8) Dubuque, (9) Webster, (10) Jasper, (11) Pocahontas, (12) Ida, (13) Lee, (14) Marshall, and (15) Grundy. In addition, five counties were selected because of their importance in Iowa in terms of value added by manufacture, retail sales, and/or population. They are: (1) Cerro Gordo, (2) Muscatine, (3) Clinton, (4) Pottawattamie, and (5) Des Moines.

Table 2. Indexes of Total Retail Sales and Use Tax Collections, by Counties and Iowa, 1939-1952

NO.	COUNTY	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
1	ADAIR	100.0	104.6	132.1	139.0	150.0	169.9	185.6	246.1	335.9	393.9	400.2	426.7	434.9	398.0
2	ADAMS	100.0	102.4	119.6	123.7	132.0	146.4	158.5	215.7	275.9	318.3	338.4	356.6	364.1	332.3
3	ALLAMAKEE	100.0	102.8	124.4	133.9	138.8	156.8	178.6	233.2	311.8	366.6	363.0	381.4	404.0	369.4
4	APPANOOSE	100.0	105.4	115.4	114.2	124.2	138.0	156.4	203.5	246.3	269.7	278.0	301.4	310.2	280.4
5	AUDUBON	100.0	107.9	133.9	138.7	146.1	165.1	181.3	252.1	338.5	381.0	396.8	394.8	384.2	367.7
6	BENTON	100.0	103.0	116.7	113.5	116.5	132.2	148.1	201.4	273.0	322.5	333.5	354.5	357.2	342.9
7	BLACK HAWK	100.0	109.0	123.5	118.3	127.4	144.8	167.3	231.5	287.4	318.8	323.7	346.0	359.6	357.4
8	BOONE	100.0	103.7	115.0	116.0	127.5	141.4	155.8	202.6	250.2	286.2	286.2	301.1	284.5	275.7
9	BREMER	100.0	104.9	126.2	134.7	133.9	152.3	169.0	232.8	306.7	344.0	345.5	376.0	389.0	372.1
10	BUCHANAN	100.0	106.6	126.8	127.1	128.3	144.7	159.7	223.9	293.0	343.1	346.5	369.5	376.6	351.7
11	BUENA VISTA	100.0	106.1	119.7	117.1	124.7	142.7	163.4	227.3	308.2	364.5	371.2	389.8	388.4	366.7
12	BUTLER	100.0	107.9	129.7	128.2	133.0	153.0	171.9	231.2	305.0	351.9	357.5	390.3	385.7	365.8
13	CALHOUN	100.0	96.9	111.3	110.5	114.7	128.7	141.4	190.6	248.7	293.2	291.9	306.8	310.7	293.7
14	CARROLL	100.0	109.0	125.7	129.4	137.2	154.6	170.3	243.7	316.9	368.6	366.7	396.0	402.7	388.2
15	CASS	100.0	131.2	156.4	159.3	177.4	191.2	215.1	305.6	391.5	448.5	444.8	475.8	476.5	463.1
16	CEDAR	100.0	104.7	123.0	121.5	127.2	144.8	163.0	229.2	308.4	377.6	385.7	409.1	407.5	391.5
17	CERRO GORDO	100.0	102.6	114.7	109.9	117.1	136.4	158.9	227.4	273.2	324.5	332.4	364.3	363.2	358.2
18	CHEROKEE	100.0	103.3	117.5	115.7	114.9	139.9	161.8	223.6	280.7	334.6	330.3	359.5	351.8	326.1
19	CHICKASAW	100.0	106.1	129.3	130.8	141.1	157.5	174.8	230.6	304.5	370.1	358.1	396.0	402.6	368.6
20	CLARKE	100.0	102.8	123.7	133.4	145.2	160.7	182.3	249.2	326.4	356.0	386.1	404.9	401.8	378.6
21	CLAY	100.0	103.9	117.0	118.4	127.7	142.6	162.1	232.2	292.5	340.4	348.3	361.5	355.8	330.4
22	CLAYTON	100.0	106.2	129.4	130.5	137.0	152.9	175.7	246.2	311.6	358.8	359.4	377.5	379.8	355.4
23	CLINTON	100.0	111.9	125.3	135.0	137.6	149.8	174.3	231.1	294.9	331.9	326.9	355.2	350.2	357.2
24	CRAWFORD	100.0	106.3	125.5	134.2	146.8	157.2	174.5	231.0	317.5	373.4	388.9	392.8	395.8	379.6
25	DALLAS	100.0	133.3	150.7	152.2	167.3	185.9	203.5	274.8	356.4	405.8	419.3	453.6	462.6	443.2
26	DAVIS	100.0	100.0	118.0	114.2	132.6	149.0	167.5	235.1	295.1	341.3	371.6	404.3	417.6	400.8
27	DECATUR	100.0	99.8	114.1	119.0	130.4	149.5	192.8	227.5	271.4	302.3	329.5	356.6	358.3	325.2
28	DELAWARE	100.0	104.9	125.8	128.3	133.7	141.7	159.1	214.5	285.8	327.9	340.8	357.8	368.1	340.3
29	DES MOINES	100.0	106.7	162.7	164.3	165.8	169.2	189.1	241.6	285.8	329.1	325.6	339.5	362.7	386.0
30	DICKINSON	100.0	101.3	113.0	109.3	111.0	133.3	155.4	220.3	304.7	339.7	341.6	359.4	337.6	336.4
31	DUBUQUE	100.0	106.9	124.8	125.9	132.5	148.1	173.5	241.3	300.1	341.3	333.1	358.0	373.6	368.6
32	EMMET	100.0	102.5	113.8	109.0	114.6	131.4	148.1	215.3	283.6	335.1	342.5	348.0	361.7	335.0
33	FAYETTE	100.0	106.6	126.2	126.7	132.8	147.6	165.5	220.1	273.6	359.0	313.0	340.1	345.0	331.8
34	FLOYD	100.0	106.1	121.4	112.5	119.4	137.7	159.0	208.4	277.9	325.1	323.1	345.8	362.5	340.3
35	FRANKLIN	100.0	104.1	118.3	112.9	118.6	137.6	150.9	206.4	277.8	320.8	336.4	358.2	351.6	333.0
36	FREMONT	100.0	107.3	120.6	119.3	123.7	145.5	164.9	231.2	311.4	372.9	346.9	343.5	332.9	313.3
37	GREENE	100.0	104.5	120.6	109.5	134.9	155.2	168.3	225.3	305.3	355.8	360.0	374.4	375.8	355.6
38	GRUNDY	100.0	108.2	126.4	122.8	124.8	144.9	163.2	224.5	313.9	367.9	387.8	399.9	400.9	403.2
39	GUTHRIE	100.0	103.5	122.3	122.4	135.8	149.9	167.1	216.8	288.0	326.2	335.4	364.3	360.0	327.3
40	HAMILTON	100.0	105.2	119.9	124.7	129.3	145.1	158.3	224.3	292.1	330.8	341.6	367.6	365.9	353.3
41	HANCOCK	100.0	104.4	122.1	123.7	125.9	144.1	186.1	208.8	275.9	324.6	347.1	364.7	352.7	319.2
42	HARDIN	100.0	99.7	116.1	117.2	124.6	144.9	160.4	212.4	277.9	325.0	330.7	350.3	353.2	330.9
43	HARRISON	100.0	106.4	120.8	129.1	142.3	159.8	172.4	229.5	308.9	351.9	357.0	362.8	356.8	351.7
44	HENRY	100.0	103.2	141.4	150.2	152.5	162.4	181.4	242.8	311.5	362.5	382.4	417.1	412.3	413.8
45	HOWARD	100.0	103.3	125.2	117.1	130.9	144.3	163.9	207.9	282.0	325.0	342.5	381.5	380.7	337.2
46	HUMBOLDT	100.0	99.8	116.7	112.4	114.9	134.0	144.5	198.7	256.6	316.2	349.2	349.9	355.6	334.5
47	IDA	100.0	99.8	119.4	134.0	128.6	147.2	161.8	225.7	305.0	361.0	377.7	386.3	381.9	339.7
48	IOWA	100.0	102.7	119.6	113.2	119.2	132.4	148.0	214.2	290.0	319.2	344.5	365.0	367.1	351.2
49	JACKSON	100.0	105.7	124.3	131.6	129.5	144.0	165.6	218.9	293.2	346.0	351.1	376.7	396.6	399.2
50	JASPER	100.0	106.4	122.1	125.7	143.4	155.0	165.8	231.9	299.5	348.7	360.8	398.3	404.9	399.9

Table 2 Continued. Indexes of Total Retail Sales and Use Tax Collections, by Counties and Iowa, 1939-1952

NO.	COUNTY	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
51	JEFFERSON	100.0	101.0	118.5	121.7	129.0	147.0	169.8	226.0	285.7	331.9	323.9	348.6	358.7	350.6
52	JOHNSON	100.0	102.0	111.8	110.5	118.4	131.3	153.4	210.8	281.2	313.3	323.2	346.5	335.6	321.8
53	JONES	100.0	102.9	123.8	122.8	127.6	147.0	163.5	226.0	299.3	339.5	359.1	386.9	412.1	385.4
54	KEOKUK	100.0	102.7	120.7	121.6	127.3	131.3	155.1	209.4	286.4	328.4	356.9	362.9	352.6	336.9
55	KOSSUTH	100.0	104.6	119.0	119.6	128.9	143.5	162.0	210.3	280.4	337.6	337.4	342.0	342.6	316.2
56	LEE	100.0	107.2	130.7	136.6	139.3	139.9	179.8	227.8	283.2	315.9	326.7	355.0	359.8	381.2
57	LINN	100.0	107.9	113.1	119.9	133.3	148.5	172.6	240.7	286.8	317.5	316.7	360.4	377.7	392.5
58	LOUISA	100.0	111.5	128.2	127.0	126.9	156.7	160.1	229.6	304.0	354.9	359.3	397.2	408.0	378.9
59	LUCAS	100.0	101.6	118.6	120.9	129.5	151.7	162.4	216.3	291.8	347.7	355.6	379.3	368.3	344.6
60	LYON	100.0	112.7	122.0	121.9	134.6	142.6	162.7	221.5	307.8	371.0	379.2	394.2	383.0	349.1
61	MADISON	100.0	99.6	117.5	125.0	129.1	143.2	164.8	226.3	293.0	325.0	346.7	379.5	372.5	344.8
62	MAHASKA	100.0	103.9	127.1	124.5	133.2	151.8	165.5	227.1	274.6	308.4	318.9	342.2	335.0	321.1
63	MARION	100.0	102.1	118.7	120.7	132.3	146.7	154.2	209.9	276.8	317.2	335.6	373.7	370.9	349.3
64	MARSHALL	100.0	108.1	123.8	118.2	126.1	144.4	156.1	213.3	260.9	292.2	296.0	322.4	311.9	309.8
65	MILLS	100.0	99.7	118.0	113.6	123.2	141.5	158.9	224.5	297.3	352.7	341.2	353.0	348.3	331.3
66	MITCHELL	100.0	109.4	130.0	126.1	129.8	137.6	167.9	223.6	293.2	339.9	352.2	382.7	388.8	356.8
67	MONONA	100.0	105.1	126.5	124.9	138.2	146.0	170.3	236.9	311.9	360.0	374.6	402.4	381.4	370.9
68	MONROE	100.0	104.0	114.3	111.0	127.9	146.1	152.3	206.8	264.9	298.0	303.1	318.7	319.9	309.6
69	MONTGOMERY	100.0	101.8	122.9	117.3	126.6	169.4	165.0	221.9	302.3	348.3	355.1	386.4	390.2	364.8
70	MUSCATINE	100.0	109.0	119.9	123.1	133.9	137.1	168.1	225.9	282.6	314.4	311.6	360.4	348.6	357.6
71	O'BRIEN	100.0	106.9	119.1	119.0	126.7	149.3	163.7	223.3	303.2	344.7	336.0	350.0	344.4	315.3
72	OSCEOLA	100.0	107.1	119.6	112.4	116.5	145.3	142.3	210.5	291.8	351.1	350.3	368.1	349.1	316.0
73	PAGE	100.0	104.9	119.3	122.2	135.0	141.6	171.7	231.1	299.2	326.1	328.2	339.7	342.6	318.9
74	PALO ALTO	100.0	103.6	117.8	122.5	127.2	124.2	160.0	212.1	287.2	341.1	336.2	345.8	336.2	322.9
75	PLYMOUTH	100.0	105.3	127.8	131.1	137.1	151.9	181.8	245.5	330.7	385.0	404.8	415.3	419.1	392.0
76	POCAHONTAS	100.0	108.0	123.9	117.4	124.6	143.9	162.2	213.2	285.0	347.1	356.7	366.6	363.9	343.5
77	POLK	100.0	103.9	116.2	120.2	128.0	154.0	159.6	228.1	280.0	308.2	321.0	351.1	354.2	363.7
78	POTTAWATTAMIE	100.0	107.7	125.1	130.4	146.9	145.2	182.1	243.8	306.8	338.5	334.7	352.1	364.4	368.0
79	POWESHIEK	100.0	108.2	119.9	119.9	130.7	137.3	159.6	216.5	283.8	321.9	331.9	361.1	353.5	345.7
80	RINGGOLD	100.0	98.1	111.1	119.6	124.2	159.8	160.5	209.2	282.6	303.8	333.6	370.2	362.7	317.4
81	SAC	100.0	107.1	120.4	121.9	123.4	145.2	160.1	216.2	286.7	341.3	355.4	365.3	370.7	353.1
82	SCOTT	100.0	112.4	131.7	136.0	143.2	143.6	172.1	234.2	300.1	343.4	324.1	344.1	363.3	371.7
83	SHELBY	100.0	109.2	131.7	135.2	145.6	145.3	185.6	256.5	348.2	410.7	396.9	414.9	415.5	389.4
84	SIOUX	100.0	111.7	125.3	129.3	138.5	154.2	177.9	241.7	338.3	393.0	403.8	424.7	421.3	385.7
85	STORY	100.0	102.9	125.5	112.2	118.6	124.9	136.0	205.2	259.3	298.0	308.8	327.0	321.8	334.4
86	TAMA	100.0	130.6	150.9	150.1	159.5	157.3	193.9	267.0	365.3	444.0	449.0	475.3	462.3	444.1
87	TAYLOR	100.0	111.5	129.5	130.6	145.1	124.9	172.7	239.7	297.4	332.6	356.1	374.3	355.1	317.7
88	UNION	100.0	118.1	137.8	141.7	156.0	177.0	194.2	256.0	330.5	367.0	372.4	408.0	398.2	371.7
89	VAN BUREN	100.0	108.0	125.4	128.9	138.9	159.4	163.4	224.6	281.7	311.2	336.9	380.9	401.4	390.1
90	WAPELLO	100.0	107.1	124.8	123.0	138.9	171.0	176.6	223.7	270.0	296.4	309.8	329.5	336.3	346.9
91	WARREN	100.0	102.1	118.3	117.8	126.9	152.6	150.7	211.3	277.9	325.1	350.1	379.5	385.5	370.2
92	WASHINGTON	100.0	104.4	126.5	125.8	124.6	154.1	158.9	218.6	281.2	312.8	322.3	351.1	348.2	332.9
93	WAYNE	100.0	100.9	114.0	115.7	126.7	148.7	164.3	219.4	297.9	319.5	338.7	375.2	401.8	355.5
94	WEBSTER	100.0	104.6	117.5	111.7	117.9	136.7	152.9	217.3	272.2	310.9	315.1	342.5	341.0	339.9
95	WINNEBAGO	100.0	106.6	117.1	120.9	131.0	139.9	158.1	208.0	277.4	333.4	340.4	359.0	363.0	346.0
96	WINNESHIEK	100.0	100.1	123.4	119.9	111.1	136.4	156.5	215.6	275.6	328.6	318.3	336.3	344.8	322.6
97	WOODBURY	100.0	104.5	114.0	117.6	130.6	154.1	179.1	237.4	280.2	307.9	306.9	333.7	331.3	321.6
98	WORTH	100.0	105.8	121.9	122.2	121.1	133.1	152.6	188.7	263.3	312.8	315.2	321.2	318.3	330.4
99	WRIGHT	100.0	105.2	120.3	122.7	128.4	152.5	165.1	224.0	295.9	350.2	362.4	370.2	360.2	343.4
	STATE	100.0	106.2	123.2	130.1	133.8	148.9	168.2	231.0	295.1	339.0	337.5	359.3	364.4	357.7

SOURCE: RAW DATA FURNISHED BY IOWA STATE TAX COMMISSION.

FIGURE 1. PERCENTAGE INCREASE IN RETAIL SALES AND USE TAX COLLECTIONS IN IOWA BY COUNTIES, 1952 OVER 1939.

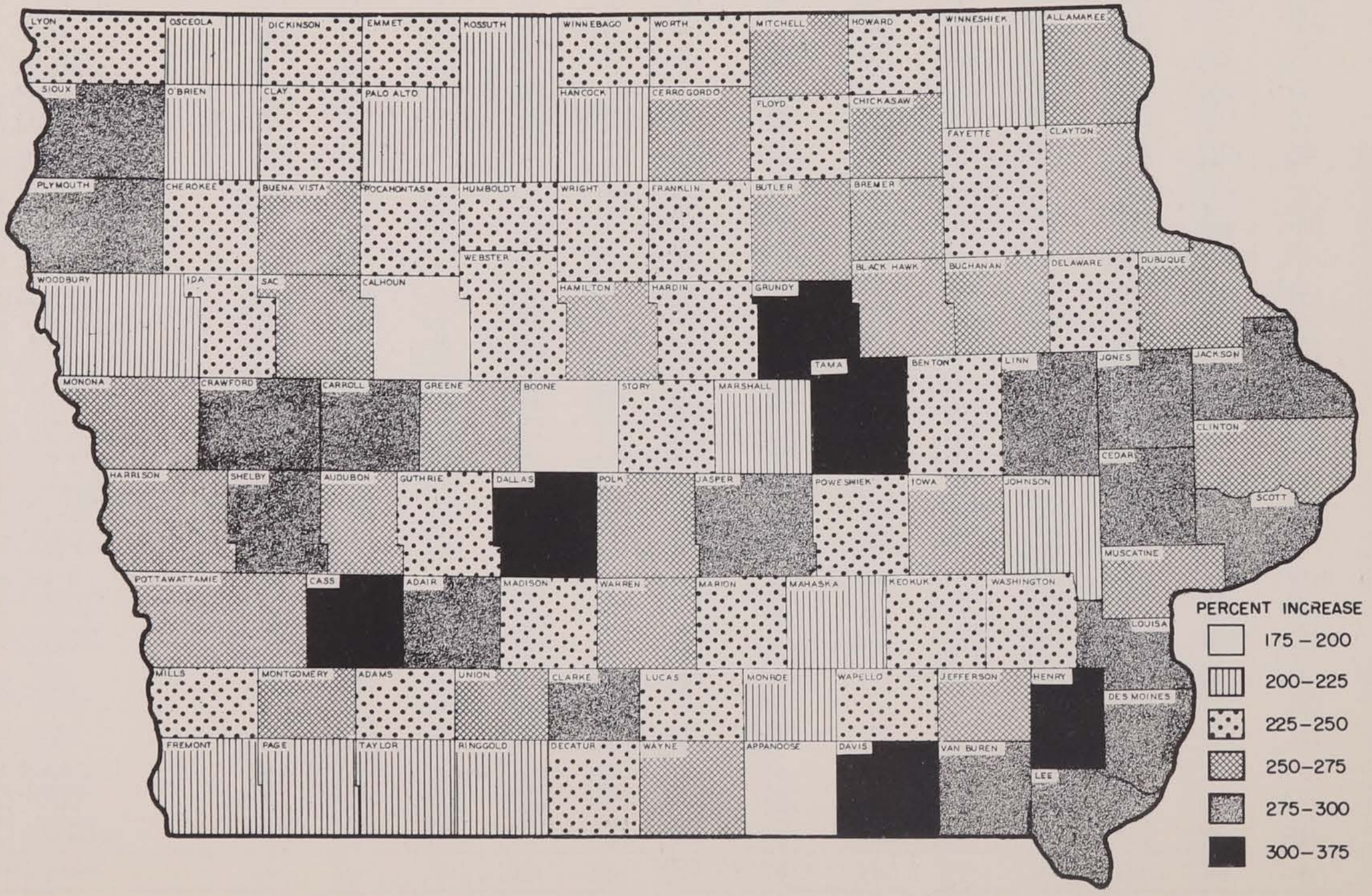


TABLE 3. PER CAPITA RETAIL SALES AND USE TAX COLLECTIONS, SELECTED COUNTIES AND IOWA, 1939 — 1951
(DOLLARS)

NO.	COUNTY	1939	1940	1941	1942	1943	1944	1945
7	BLACK HAWK	8.90	9.39	10.55	10.10	10.92	11.99	13.91
13	CALHOUN	5.78	5.57	6.61	6.67	7.18	8.33	9.08
17	CERRO GORDO	8.70	8.90	10.44	10.04	10.92	12.54	14.31
21	CLAY	7.59	8.11	9.23	9.23	10.59	11.84	13.28
23	CLINTON	6.68	7.24	8.11	8.49	8.80	9.62	11.40
29	DES MOINES	7.41	8.02	10.84	10.18	10.80	11.19	12.79
31	DUBUQUE	6.92	7.23	8.48	8.51	9.35	10.09	11.49
38	GRUNDY	4.81	5.33	6.26	6.19	6.49	7.33	8.58
47	IDA	5.25	5.50	7.00	7.84	7.69	8.75	9.46
50	JASPER	4.59	5.98	6.91	6.68	7.41	8.09	8.89
56	LEE	5.62	5.71	6.98	7.26	7.56	8.69	10.10
57	LINN	9.27	10.22	10.37	10.84	11.75	13.29	15.16
64	MARSHALL	7.54	8.29	9.83	9.48	9.93	11.18	12.52
70	MUSCATINE	6.11	6.92	7.65	7.74	8.21	9.62	10.88
76	POCAHONTAS	5.04	5.65	6.64	6.13	6.94	8.44	8.76
77	POLK	10.55	10.93	12.00	12.21	12.96	14.03	16.04
78	POTTAWATTAMIE	5.18	5.63	6.95	7.10	8.01	8.49	10.03
82	SCOTT	9.05	9.92	11.78	12.17	11.57	12.67	14.35
94	WEBSTER	8.23	8.69	10.09	9.38	10.45	11.96	13.53
97	WOODBURY	8.21	8.58	9.75	9.84	11.47	13.76	16.04
	20 COUNTIES	8.04	8.58	9.80	10.85	10.57	11.75	13.46
	STATE	6.52	7.01	8.23	8.70	9.10	10.22	11.55

NO.	COUNTY	1946	1947	1948	1949	1950	1951
7	BLACK HAWK	18.96	21.72	23.18	22.99	24.26	25.21
13	CALHOUN	11.94	16.04	18.13	17.49	18.22	18.45
17	CERRO GORDO	20.06	23.88	27.78	27.61	29.83	29.74
21	CLAY	18.80	23.60	26.68	26.12	26.69	26.27
23	CLINTON	14.89	18.14	19.38	19.51	21.06	20.76
29	DES MOINES	18.09	20.96	21.80	21.18	21.87	23.37
31	DUBUQUE	16.21	19.76	21.34	20.70	21.99	22.95
38	GRUNDY	11.87	16.23	18.70	18.39	18.71	18.76
47	IDA	13.26	18.05	20.65	20.50	20.79	20.55
50	JASPER	12.66	15.44	17.72	17.42	18.94	19.25
56	LEE	12.61	15.76	17.50	17.26	18.50	18.75
57	LINN	20.82	24.72	25.97	25.25	28.41	29.77
64	MARSHALL	16.98	20.45	22.30	22.21	23.95	23.17
70	MUSCATINE	14.67	17.68	19.15	18.64	21.30	20.60
76	POCAHONTAS	11.56	16.01	18.97	18.99	19.25	19.12
77	POLK	22.58	27.28	28.68	29.34	31.76	32.04
78	POTTAWATTAMIE	13.47	16.48	17.62	16.76	17.38	17.99
82	SCOTT	19.67	24.08	26.12	23.99	25.20	26.61
94	WEBSTER	18.39	21.70	24.60	24.36	26.14	26.03
97	WOODBURY	20.62	23.92	25.83	25.05	26.87	26.68
	20 COUNTIES	18.43	22.09	23.92	23.53	25.24	25.70
	STATE	15.68	19.68	22.04	21.38	22.48	22.80

SOURCE: IOWA STATE TAX COMMISSION; UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS; AND BUREAU OF BUSINESS AND ECONOMIC RESEARCH, STATE UNIVERSITY OF IOWA.

Table 3 indicates the growth of taxed retail sales in the selected counties with differences in population considered. However, it should be recognized that all influences of population differences are not completely removed. For instance, individuals legally residing in County "A" may buy a majority of their items at retail in County "B." Actually these individuals enter into the per capita estimates in County "A," while their purchases are "credited" to those persons living in County "B." This, of course, helps explain the high per capita dollar figures in areas such as Polk, Linn, Cerro Gordo, Scott, and Woodbury counties which contain excellent trading centers and naturally have a strong retail attraction. In contrast, counties such as Pocahontas, Calhoun, and Grundy with no large market centers have relatively low per capita consumption figures. A notable exception is Pottawattamie. Even though this county contains a relatively large city, Council Bluffs, it apparently suffers from the exceptionally strong pull of Omaha just across the State line.[2/]

Some measure, although admittedly only a very rough estimate, of the average propensity to consume[3/] can be obtained from these data. For example, let us consider Dubuque County with per capita retail sales and use tax collections of $22.95 (1951). This figure was only slightly above the State average of $22.80. In order to arrive at an estimate of per capita retail consumption we multiply the $22.95 by fifty (or $22.95 divided by 2 percent -- the rate of the tax) and get approximately $1,148. Per capita income payments in Dubuque County in 1951 were estimated to be $1,737. If we divide $1,148 by $1,737 we obtain the fraction of 66/100 or 66 percent -- a measure of the average propensity to consume in Dubuque County in 1951. This means that almost two-thirds of the income of individuals living in Dubuque County is spent for consumption at the retail level. This compares to a ratio of 75 percent of total income spent for consumption at the retail level in the State as a whole and 73 percent as an average for the twenty selected counties.

VARIATION IN RETAIL TRADE BY COUNTIES

In order to analyze the variation in the growth of retail sales in Iowa, straight line trends were calculated for each of the ninety-nine counties and for the State. The straight line trend was used because it measures the over-all change rather than the variation at any one time. The trend line does not measure volume of growth in retail trade between 1939 and 1952. Instead, it shows the degree to which retail sales change from year to year, whether the volume of sales is at a low level or at a high level. Thus, for example, the trend calculation (the slope of the trend line indicated by the symbol b) for a particular county may be high in comparison to the other counties -- showing a high volatility in trade activity -- but the volume of retail sales for this county may be low in comparison to the other counties.

The meaning of the trend line computations can be further explained by an illustration. For example, the slope of the trend line (b) for Black Hawk County was calculated to be 25.0088. Thus, the retail activity (as measured by retail sales and use tax collections) changed -- in this example, increased -- at the rate of 25.0088 percent per year since 1939 in this county.[4/]

Table 4 presents the end products of the trend line computations for all of the counties in Iowa. In this table the counties are ranked in descending order on the basis of the slope of their trend lines. That is, they are ranked from highest to lowest in terms of their rate of increase in retail activity. In addition, Table 4 contains (by counties): (1) percentage changes in population from 1940 to 1950; (2) percent of income from agriculture; and (3) rural population as a percent of total population, 1950.

Some interesting observations come to light in this table. One striking fact is, that of the fifty counties with highest variation in retail activity, thirty-six of them showed actual decreases in population from 1940 to 1950. Forty-three of these fifty counties had either decreases in population or increases which were below the State average gain during this decade. Second, forty-eight of the first fifty counties contained more rural population than the State average of almost 48 percent. The majority of these fifty counties had a rural population equal to two-thirds or more of their total population. Third, the percentage of income derived from agriculture was lower than the average for the State in only four out of the first fifty counties. The other forty-six counties of this group are definitely the agricultural counties of the state, i.e., they

2 SEE RETAIL TRADE AREA ANALYSIS, ELEVEN SOUTHWEST IOWA TOWNS (BUREAU OF BUSINESS AND ECONOMIC RESEARCH, STATE UNIVERSITY OF IOWA, IOWA CITY, IOWA, 1950).

3 SEE THE GENERAL THEORY OF EMPLOYMENT, INTEREST AND MONEY BY JOHN MAYNARD KEYNES, BOOK III, CHAPTERS 8, 9, AND 10 (HARCOURT, BRACE AND COMPANY, NEW YORK, 1935); AND ECONOMICS OF JOHN MAYNARD KEYNES BY DUDLEY DILLARD (PRENTICE-HALL, INC., NEW YORK, 1948).

4 SEE APPENDIX A FOR ILLUSTRATION OF ACTUAL COMPUTATIONS.

TABLE 4. SELECTED DATA BY COUNTIES

NO.	COUNTY	RURAL POPULATION AS A PERCENT OF TOTAL POPULATION (1950)	PERCENT OF INCOME FROM AGRICULTURE (1947)	SLOPE OF TREND LINE (b)	RANK IN STATE BY (b)	PERCENT CHANGE IN POPULATION 1940 TO 1950
15	CASS	65.0	36.1	35.9659	1	—0.6
86	TAMA	86.5	45.7	35.6742	2	—3.3
25	DALLAS	73.9	40.4	33.4033	3	—4.0
1	ADAIR	100.0	50.4	32.4451	4	—6.9
84	SIOUX	90.0	50.0	32.3352	5	—3.0
83	SHELBY	75.4	51.7	32.0066	6	—4.7
75	PLYMOUTH	74.9	50.7	31.9511	7	—1.1
16	CEDAR	84.4	47.5	30.9500	8	0.2
26	DAVIS	73.0	48.0	30.4060	9	—10.6
38	GRUNDY	100.0	60.3	30.2341	10	1.5
20	CLARKE	63.5	42.8	30.1626	11	—8.4
44	HENRY	68.8	37.3	29.9044	12	4.0
24	CRAWFORD	76.9	48.1	29.6357	13	—3.9
5	AUDUBON	75.7	53.0	29.6154	14	—1.8
14	CARROLL	73.0	42.8	29.5676	15	1.3
11	BUENA VISTA	67.1	44.8	29.3885	16	6.4
58	LOUISA	100.0	45.7	29.1852	17	—2.5
67	MONONA	78.5	48.5	29.1808	18	—10.6
60	LYON	82.0	60.6	29.1588	19	—4.4
53	JONES	65.0	38.9	29.1555	20	—2.8
50	JASPER	63.7	20.6	29.1308	21	2.6
19	CHICKASAW	78.2	47.6	29.1104	22	0.0
3	ALLAMAKEE	80.7	42.0	29.0764	23	—4.8
88	UNION	46.9	25.2	29.0165	24	—3.9
47	IDA	100.0	53.5	28.9527	25	—3.2
69	MONTGOMERY	58.4	33.7	28.5159	26	—0.1
12	BUTLER	100.0	56.8	28.1907	27	—3.3
37	GREENE	72.2	56.1	28.0863	28	—6.4
93	WAYNE	100.0	44.7	28.0527	29	—11.8
49	JACKSON	76.9	40.8	27.9522	30	—2.9
22	CLAYTON	100.0	50.6	27.9269	31	—7.4
66	MITCHELL	75.4	46.9	27.7049	32	—1.2
9	BREMER	72.9	37.6	27.5863	33	5.3
59	LUCAS	55.9	37.3	27.5599	34	—17.2
91	WARREN	71.0	42.9	27.5264	35	0.4

TABLE 4. (CONTINUED) SELECTED DATA BY COUNTIES

NO.	COUNTY	RURAL POPULATION AS A PERCENT OF TOTAL POPULATION (1950)	PERCENT OF INCOME FROM AGRICULTURE (1947)	SLOPE OF TREND LINE (b)	RANK IN STATE BY (b)	PERCENT CHANGE IN POPULATION 1940 TO 1950
61	MADISON	72.8	45.1	27.2648	36	—9.6
99	WRIGHT	62.7	50.4	27.1626	37	—1.9
45	HOWARD	72.2	46.0	27.1093	38	—3.1
89	VAN BUREN	100.0	48.2	27.0143	39	—8.7
81	SAC	81.9	52.2	26.9835	40	—0.7
10	BUCHANAN	77.8	41.3	26.9753	41	4.5
76	POCHANTAS	100.0	57.2	26.8505	42	—4.7
48	IOWA	100.0	43.5	26.6764	43	—6.9
72	OSCEOLA	74.9	50.2	26.6720	44	—4.0
43	HARRISON	81.9	47.8	26.5874	45	—14.1
21	CLAY	58.9	42.5	26.5560	46	1.9
40	HAMILTON	61.3	46.4	26.4687	47	—1.3
32	EMMET	52.4	41.5	26.4434	48	5.2
17	CERRO GORDO	28.4	15.4	26.4038	49	5.0
31	DUBUQUE	30.4	10.2	26.4005	50	11.9
65	MILLS	66.8	37.1	26.3604	51	—6.6
30	DICKINSON	100.0	44.9	26.3533	52	—4.7
63	MARION	53.5	25.3	26.3335	53	—4.0
54	KEOKUK	100.0	43.0	26.2533	54	—8.7
87	TAYLOR	100.0	51.6	26.2440	55	—12.9
80	RINGGOLD	100.0	52.9	26.0742	56	—14.4
57	LINN	25.0	5.9	26.0170	57	17.0
95	WINNEBAGO	79.4	48.0	25.9978	58	—3.7
18	CHEROKEE	59.6	44.0	25.9066	59	—1.1
28	DELAWARE	77.5	55.7	25.8731	60	—4.1
36	FREMONT	100.0	53.5	25.8544	61	—15.9
39	GUTHRIE	100.0	48.1	25.8192	62	—11.7
78	POTTAWATT.	32.3	22.6	25.7665	63	4.4
41	HANCOCK	100.0	59.9	25.7423	64	—2.1
6	BENTON	67.5	49.9	25.6819	65	—1.0
46	HUMBOLDT	75.5	52.7	25.6791	66	—2.5
2	ADAMS	100.0	57.3	25.6687	67	—13.8
35	FRANKLIN	72.8	53.2	25.6231	68	—0.7
71	O'BRIEN	78.9	45.0	25.5692	69	—1.7
51	JEFFERSON	53.5	24.9	25.4659	70	—0.4

TABLE 4. (CONTINUED) SELECTED DATA BY COUNTIES

NO.	COUNTY	RURAL POPULATION AS A PERCENT OF TOTAL POPULATION (1950)	PERCENT OF INCOME FROM AGRICULTURE (1947)	SLOPE OF TREND LINE (b)	RANK IN STATE BY (b)	PERCENT CHANGE IN POPULATION 1940 TO 1950
42	HARDIN	64.0	39.9	25.4291	71	—1.4
79	POWESHIEK	64.7	39.6	25.4115	72	3.1
34	FLOYD	52.1	29.4	25.3066	73	6.6
27	DECATUR	100.0	42.7	25.3038	74	—10.1
74	PALO ALTO	76.3	55.7	25.0852	75	—1.7
7	BLACK HAWK	16.0	6.7	25.0088	76	25.6
55	KOSSUTH	79.4	57.6	24.9651	77	—1.5
82	SCOTT	18.7	5.9	24.9148	78	18.8
77	POLK	11.5	2.3	24.8489	79	15.4
23	CLINTON	33.5	14.8	24.7841	80	11.1
56	LEE	27.9	7.9	24.7000	81	4.9
52	JOHNSON	40.5	19.2	24.6989	82	37.9
73	PAGE	49.7	35.2	24.6967	83	—3.9
70	MUSCATINE	40.8	20.0	24.5907	84	2.7
96	WINNESHIEK	72.0	49.1	24.5258	85	—2.8
92	WASHINGTON	69.8	38.9	24.4209	86	—2.5
33	FAYETTE	72.2	44.1	24.3720	87	—2.9
94	WEBSTER	43.2	22.4	24.2456	88	6.6
62	MAHASKA	54.9	30.1	23.5082	89	—6.8
97	WOODBURY	19.2	8.2	23.4000	90	0.3
29	DES MOINES	27.2	10.3	23.0692	91	14.3
90	WAPELLO	28.0	6.5	22.5544	92	7.0
98	WORTH	62.7	50.4	22.3725	93	—3.3
85	STORY	39.8	24.8	22.2951	94	32.5
68	MONROE	59.0	32.7	22.2187	95	--18.8
13	CALHOUN	100.0	52.5	21.5060	96	—3.7
64	MARSHALL	44.3	21.3	21.3857	97	0.6
4	APPANOOSE	61.3	21.2	20.1527	98	—18.8
8	BOONE	56.8	36.6	19.7582	99	—5.5
	STATE	47.7	26.4	26.0467		3.3

SOURCE: COLUMNS ONE AND FIVE FROM U.S. DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS; COLUMN TWO FROM AN ANALYSIS OF IOWA INCOME PAYMENTS, BY COUNTIES, STUDIES IN BUSINESS AND ECONOMICS, NEW SERIES NO. 1 (BUREAU OF BUSINESS AND ECONOMIC RESEARCH, STATE UNIVERSITY OF IOWA, IOWA CITY, IOWA).

depend upon agriculture as their major provider of income. The majority of the latter group receives from two-fifths to two-thirds of their income from farming.

In contrast, of the twenty-five counties with the least variation in retail activity, thirteen had population gains during the last census decade. Twelve of these thirteen counties were the ones with more diversified sources of income. Agricultural income in all these twenty-five counties was substantially below the 26.4 percent which agriculture contributed to Iowa's total income.

One preliminary conclusion can be drawn from the above analysis. (This conclusion will be more vividly documented by the correlation analyses which follow.) From these data it would appear, that the counties in Iowa which have (1) higher than average rural population ratios and (2) the major share of their income provided by the industry with more volatile prices and output (agriculture) are more sensitive to cyclical fluctuations in retail business activity than are those counties which are more urbanized and have much more diversified sources of income. In addition, it may be noted that the counties experiencing the most variations in business activity are those losing their population from decade to decade.

Nevertheless, Table 5 below, indicates that there is a high degree of uniformity in the rate of growth which has taken place in the retail trade industry in Iowa from 1939 to 1952.

It may be readily seen that the growth rate of seventy-seven of the ninety-nine counties ranged between 23.8 and 29.9 percent, or slightly over a 6 percent spread. Figure 2 pictorially attests to the same general story as told by Figure 1 and as outlined above.

TABLE 5. DISTRIBUTION OF COUNTIES BY SLOPE OF TREND LINES COMPUTED FROM RETAIL SALES AND USE TAX DATA FROM 1939 TO 1951

CLASS LIMITS (PERCENT)	NUMBER OF COUNTIES
19.75 — 21.78	4
21.79 — 23.81	7
23.82 — 25.84	27
25.85 — 27.87	30
27.88 — 29.90	20
29.91 — 31.93	4
31.94 — 33.96	5
33.97 — 36.00	2

FIGURE 2. SLOPE OF RETAIL SALES AND USE TAX COLLECTIONS TREND LINE, IN IOWA BY COUNTIES, 1939-51.

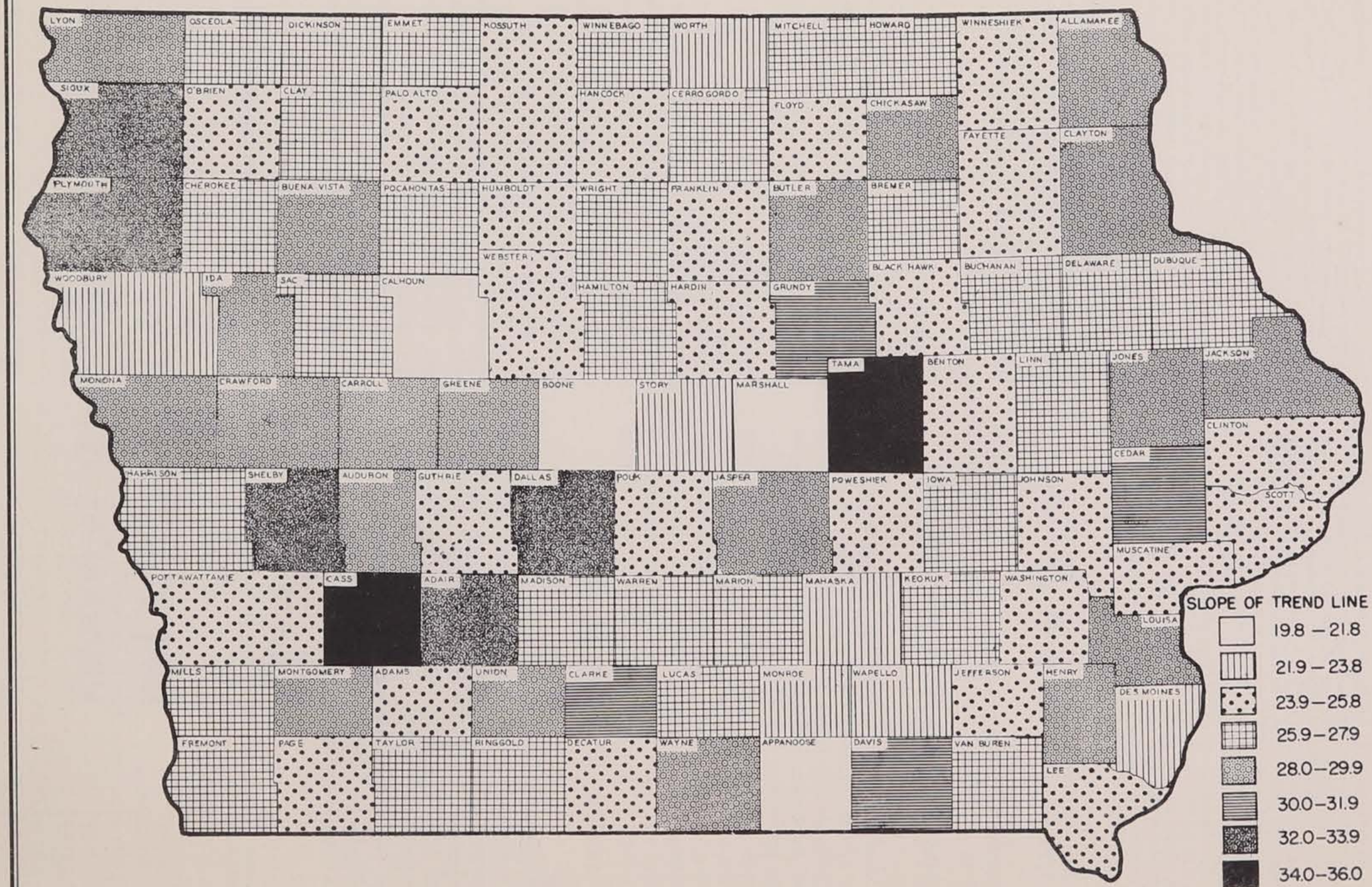
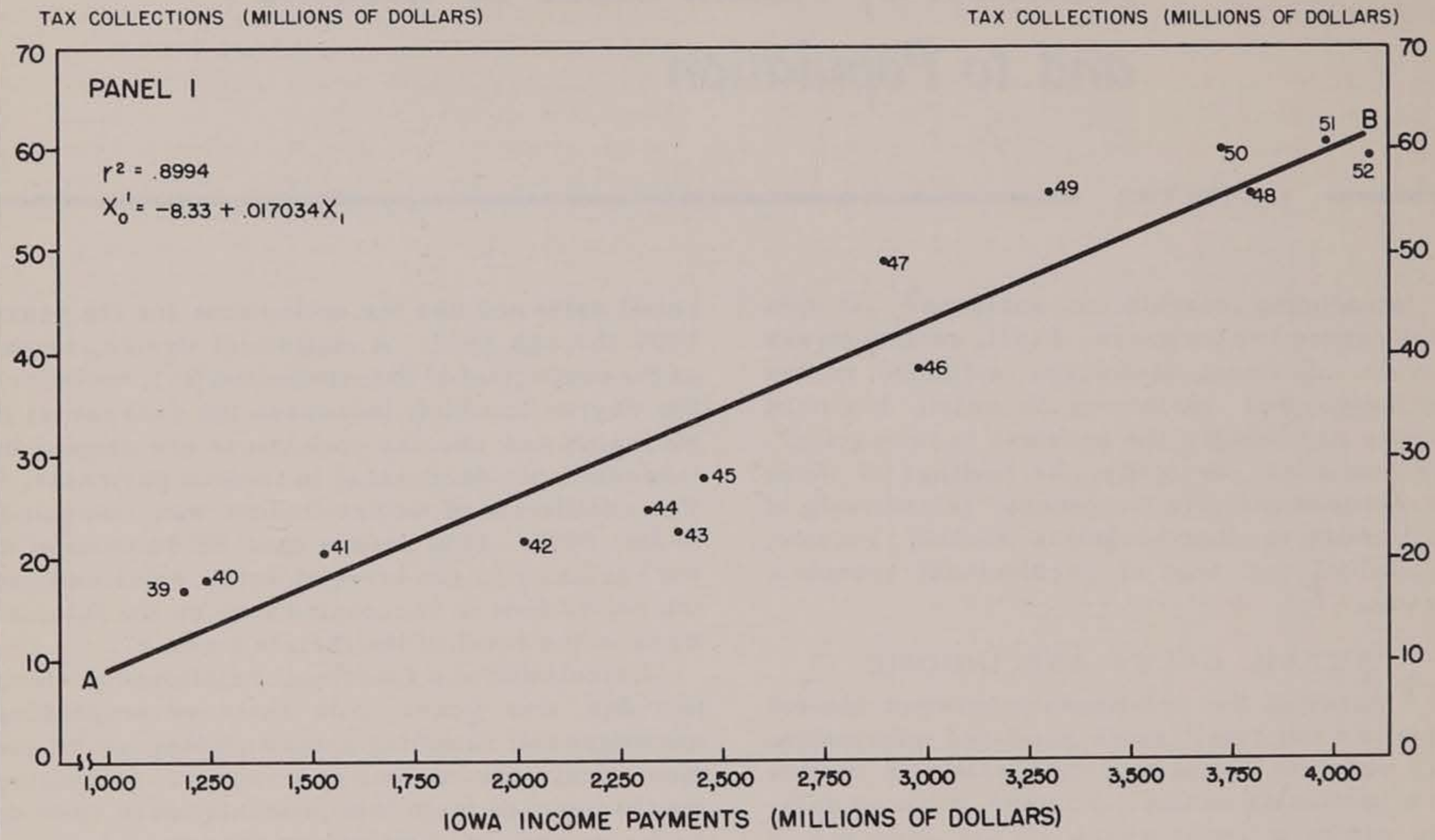
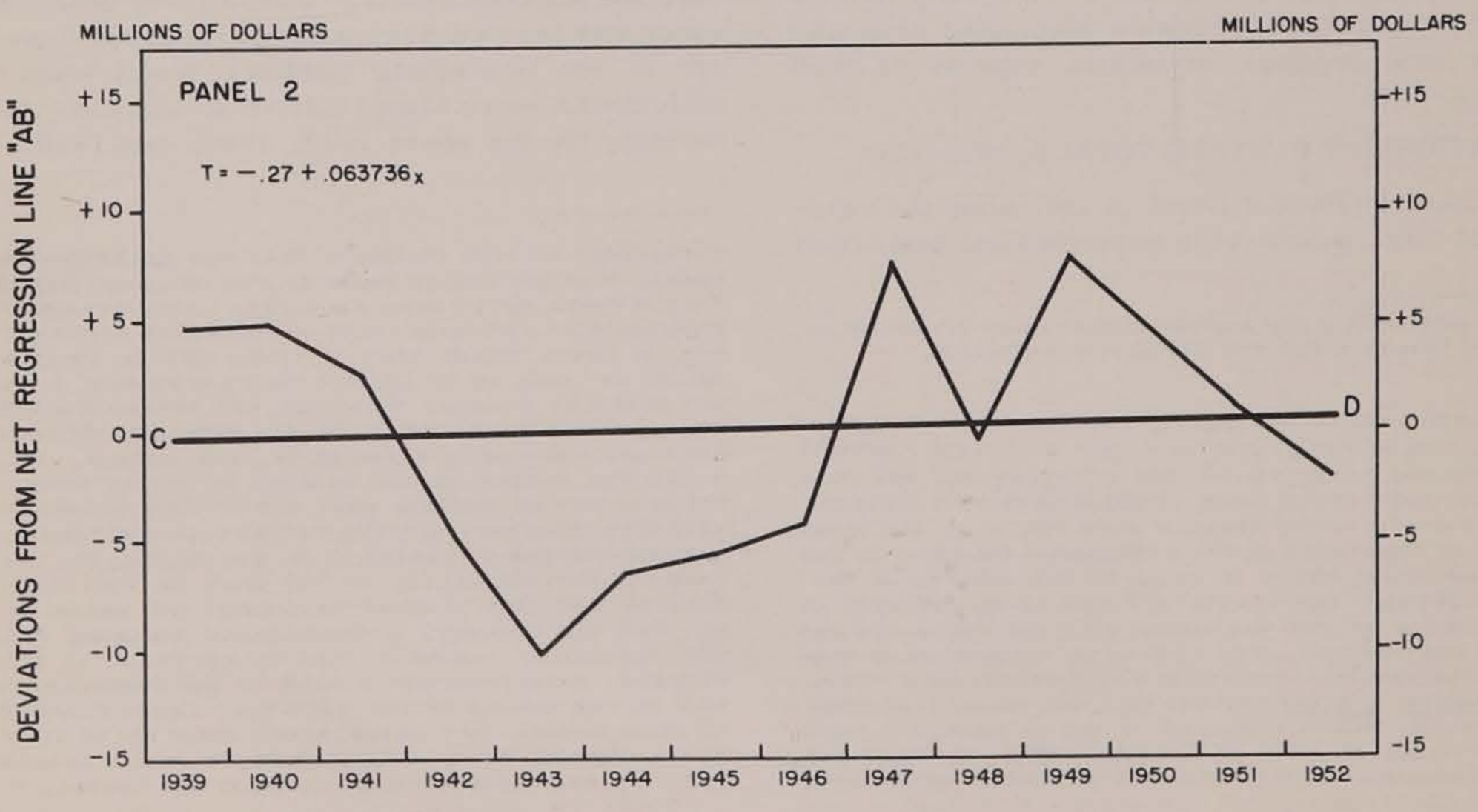


CHART I. RELATION OF TOTAL IOWA RETAIL SALES AND USE TAX COLLECTIONS & TOTAL IOWA INCOME PAYMENTS, 1939 - 52.



NET TREND



The coefficient of regression (b) was calculated to be $17 thousand. This means that for every $1 million change in the level of Iowa income payments, retail sales and use tax collections tend to change at the rate of $17 thousand.

Relative to the State's income payments, Iowa's retail sales and use tax collections have indicated a slightly rising trend.[7] The net trend of retail sales and use tax collections -- line "CD" in Panel 2 -- is determined after allowing for the influence of the change in the level of Iowa income payments. The points in this panel are located very simply by plotting the deviations of actual tax collections from estimated tax collections (line "AB" Panel 1) for each year. For example, in 1939 the actual retail sales and use tax collections were $16.6 million. The tax collections that could have been "expected" for 1939 on the basis of the regression line "AB" would have been $11.9 million. Thus, the deviation was a positive $4.7 million which is the amount plotted in Panel 2. Points for the other years were determined in a similar manner. The trend line "CD" was then calculated and the constant b was found to be .063736. This means that, on the average, total retail sales and use tax collections in Iowa tended to increase by more than $64 thousand per year if all other factors had remained constant. Stated another way, this increase in retail sales and use tax collections could be expected to occur on the average from one year to the next if no change were to occur in the level of Iowa income (and of course tax rates).

One word of caution is necessary in using the extension of the trend line "CD." For example, the many factors that determine the level of income payments, and of course the net trend, may not continue to operate in the same manner for later years. Furthermore, because so few years entered into the calculation, the extension of the trend line should be made with caution.

RELATIONSHIP IN SELECTED COUNTIES, 1939 AND 1951

Chart 2 shows the relation of total income to total retail sales and use tax collections for the twenty leading counties for the year 1939. Each dot in this chart represents a county and is given that particular county's regular state number. Income in 1939 is plotted on the horizontal axis or X scale, and tax collections on the Y axis. The point indicating the relationship for Polk County has been omitted merely to give meaning to the scale. In order to plot the data for Polk County on arithmetic paper, the divisions would necessarily be too large to be interpreted meaningfully. Polk County is omitted also in Chart 3 for the same reason. Data in 1939 for Polk County (referring to Chart 2) are: income -- $129,356,000 and retail sales and use tax collections -- $2,066,000.

The coefficient of determination is .9942 for the twenty counties and is highly significant.[8] The relation indicates that for each $100 increase in income, retail sales and use tax collections tended to increase by $1.61. As expected, the counties with the highest income also have the highest tax collections, and therefore, the highest retail sales.

The reason that the points do not fall directly on the trend line "AB" may be readily explained in most cases. First of all, by definition, this regression line is an average. Second, the income estimates are perhaps either too high or too low. This is not considered too serious; if excessive errors did exist, the estimates would not agree as closely with the original values as indicated by Chart 2. Third, residents in County "A" may make larger (or smaller) retail purchases in "foreign" counties than is true for the average. Finally, consumption patterns vary in relation to income because of population characteristics and many other factors.

It is to be noted that Linn County (number 57 on Chart 2) is slightly above the regression line, while Black Hawk (7), Scott (82), Woodbury (97), and Pottawattamie (78) are below this line. The other fifteen counties cluster closely around the trend line. As noted above this may be because of errors in estimating income and/or taxes collected. On the other hand, it may be that Linn County attracts more retail trade from surrounding counties than it loses. The reverse situation may be true in the cases of the other counties. Scott, Woodbury, and Pottawattamie in particular, probably lose large shares of their retail potential to neighboring cities in other states.

Chart 3 presents data for 1951 similar to that in Chart 2 and indicates the dispersion around the trend line in 1951 was similar to the pattern of 1939. However, some accuracy in the income estimates may have been lost over this twelve year interval as indicated by the lower r^2 of .9860. Nevertheless, the relation is still highly significant. It is noteworthy that the slope of the

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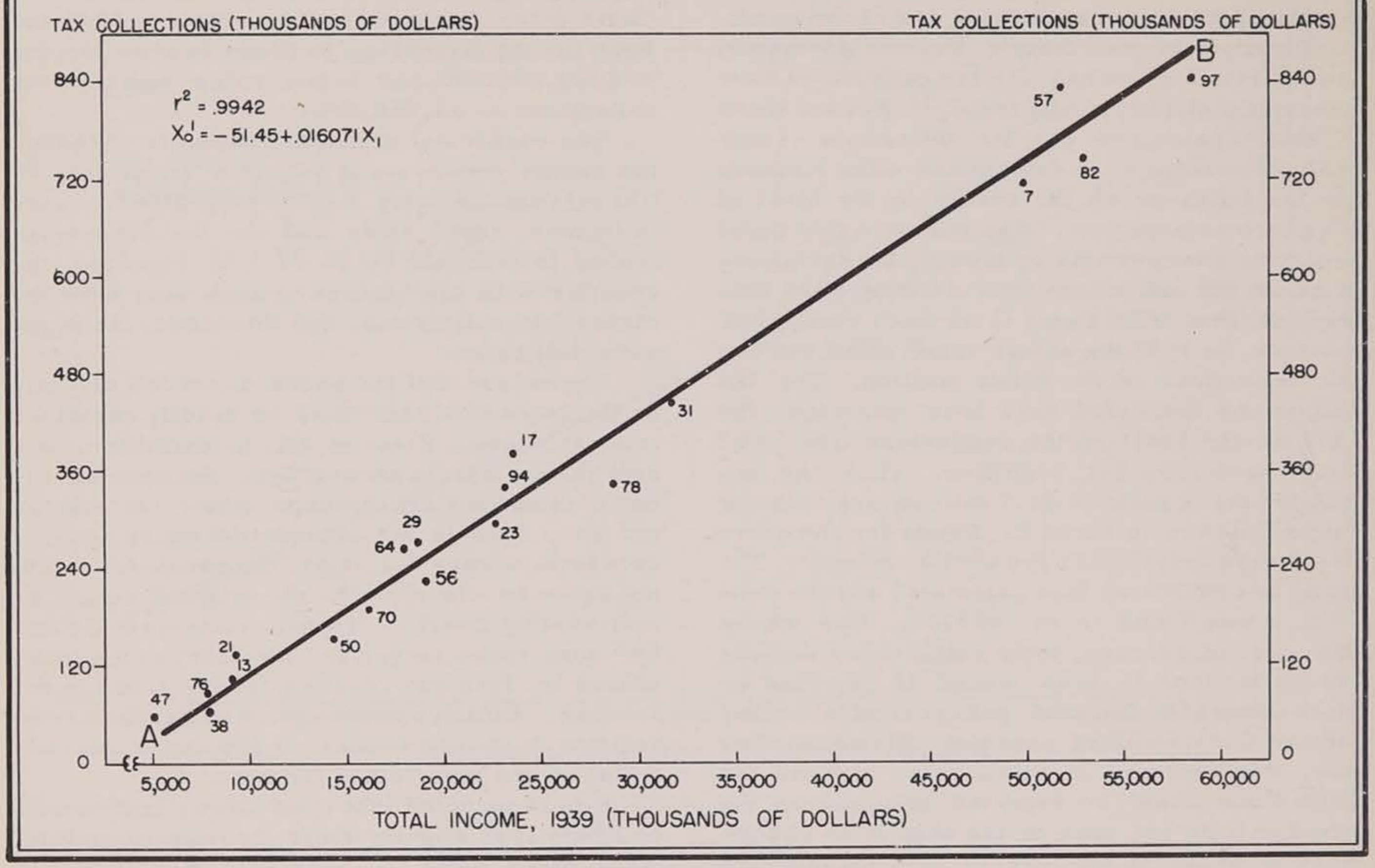
7 THE REGRESSION FORMULA DESCRIBING THIS RELATIONSHIP IS $T = -.27 + .063736X_1$.

8 A SIMILAR MEASURE CALCULATED FOR ALL OF THE NINETY-NINE COUNTIES FOR 1939 WAS FOUND TO BE .9895. THE r^2 IN 1947 FOR THE TWENTY COUNTIES WAS .9894 COMPARED TO .9893 FOR ALL OF THE NINETY-NINE COUNTIES.

CHART 2. RELATION OF TOTAL INCOME, 1939, AND TOTAL RETAIL SALES AND USE TAX COLLECTIONS, 1939, BY SELECTED COUNTIES.



trend line is slightly higher in 1951 than in 1939. In 1951, for every $100 change in income there was an accompanying change of $1.65 in tax collections, whereas in 1939 the change in tax collections per $100 change in income was $1.61. Measured in terms of retail purchases only, this would seem to indicate an increase in the average propensity to consume in these counties. Of course, the higher value of the regression coefficient for 1951 may be merely a consequence of price advances, necessitating the spending of more income to maintain the same scale of living. Note, however, that no simple relationship between the price level and the consumption function should be inferred from this statement.

Scott County (82) has fallen farther below the regression line "AB" in 1951 than it was in 1939. Again that may be a result of overstating income produced in Scott County because Woodbury and Linn counties maintained approximately their same relative positions. What has been said about Scott County probably holds true for Black Hawk (7) and Dubuque (31). Cerro Gordo (17), on the other hand, veered off farther above the line "AB." It should be remembered that the lines "AB" in each chart are different and are calculated separately and are not of the same slope because of the different relationship existing in each year.

PER CAPITA RELATIONSHIP IN SELECTED COUNTIES, 1939 AND 1951

The next step is a similar analysis for these same twenty counties (although less in detail) taking account of differences in population, i.e., using per capita data rather than totals. When this is done, much more variation is left "unexplained," i.e., the coefficient of determination is lower, and in some cases significantly lower, than in the cases where totals are used. This difference in the two correlations may be explained algebraically. First, one cannot expect the same relation to exist when one divides each set of paired observations by different numbers. If one divided each set by the same figure, of course, the relation would not change. However, there are wide variations in county population, so that both income and tax collections must be

divided by widely varying population figures. Second, some spurious correlation is introduced in an analysis of totals when each variable is multiplied by the same figure.[9/]

Chart 4 is an example of the relation of per capita income and per capita retail sales and use tax collections in 1939. The most striking feature of this particular chart is the location of the point (38) identifying Grundy County. Quite possibly the income estimate for this county may be too high; but, on the other hand, it may be that the retail trade gravitates toward Cedar Rapids in Linn County (57) or to Marshalltown in Marshall County (64). Grundy County does not contain a large trading center, and its residents necessarily must go elsewhere to obtain the types of goods and services usually identified with larger trading centers. One additional point should be noted regarding Chart 4. Because Woodbury (97), Black Hawk (7), Scott (82), Linn (57), and Polk (77) counties contain the largest cities, they may, at first thought, be expected to be located much higher above the regression line "AB" than is actually the case. Further consideration, however, would seem to indicate that because of this concentration of population, relatively large amounts of expenditures must be made by out-of-county residents to raise significantly their per capita figures.

9/ THIS IS ESSENTIALLY WHAT HAPPENS WHEN ONE DEALS WITH TOTALS. ACTUALLY THE RESULT IS PER CAPITA DATA MULTIPLIED BY THE SAME POPULATION FIGURES AND NATURALLY SOME RELATIONSHIP IS "BUILT IN."

COMPARISON OF VARIOUS STATISTICAL MEASURES, SELECTED COUNTIES

Table 6 following contrasts (selected years) the various statistical measures of the relationship between income and sales in the twenty selected counties. The r^2 was highly significant in every year, whether the totals or per capita data were used, with the exception of per capita in 1951. For that year the r^2 was designated as significant through the use of a table of F.

The possible explanation for the regression coefficient, based on per capita data, falling off noticeably in 1951 may be a consequence of an

CHART 3. RELATION OF TOTAL INCOME, 1951, AND TOTAL RETAIL SALES AND USE TAX COLLECTIONS, 1951, BY SELECTED COUNTIES.

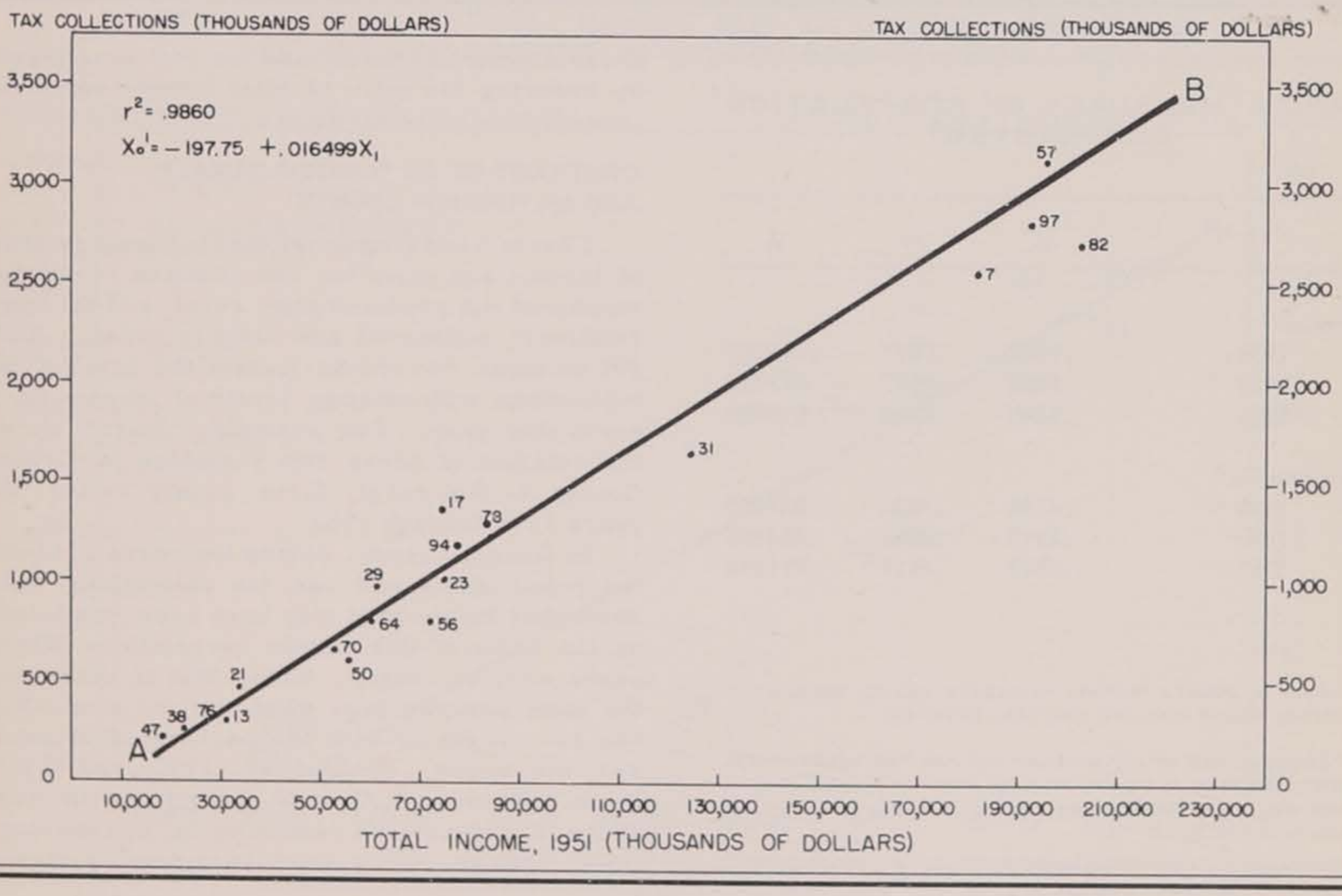


CHART 4. RELATION OF PER CAPITA INCOME PAYMENTS AND PER CAPITA RETAIL SALES AND USE TAX COLLECTIONS, SELECTED COUNTIES, 1939.

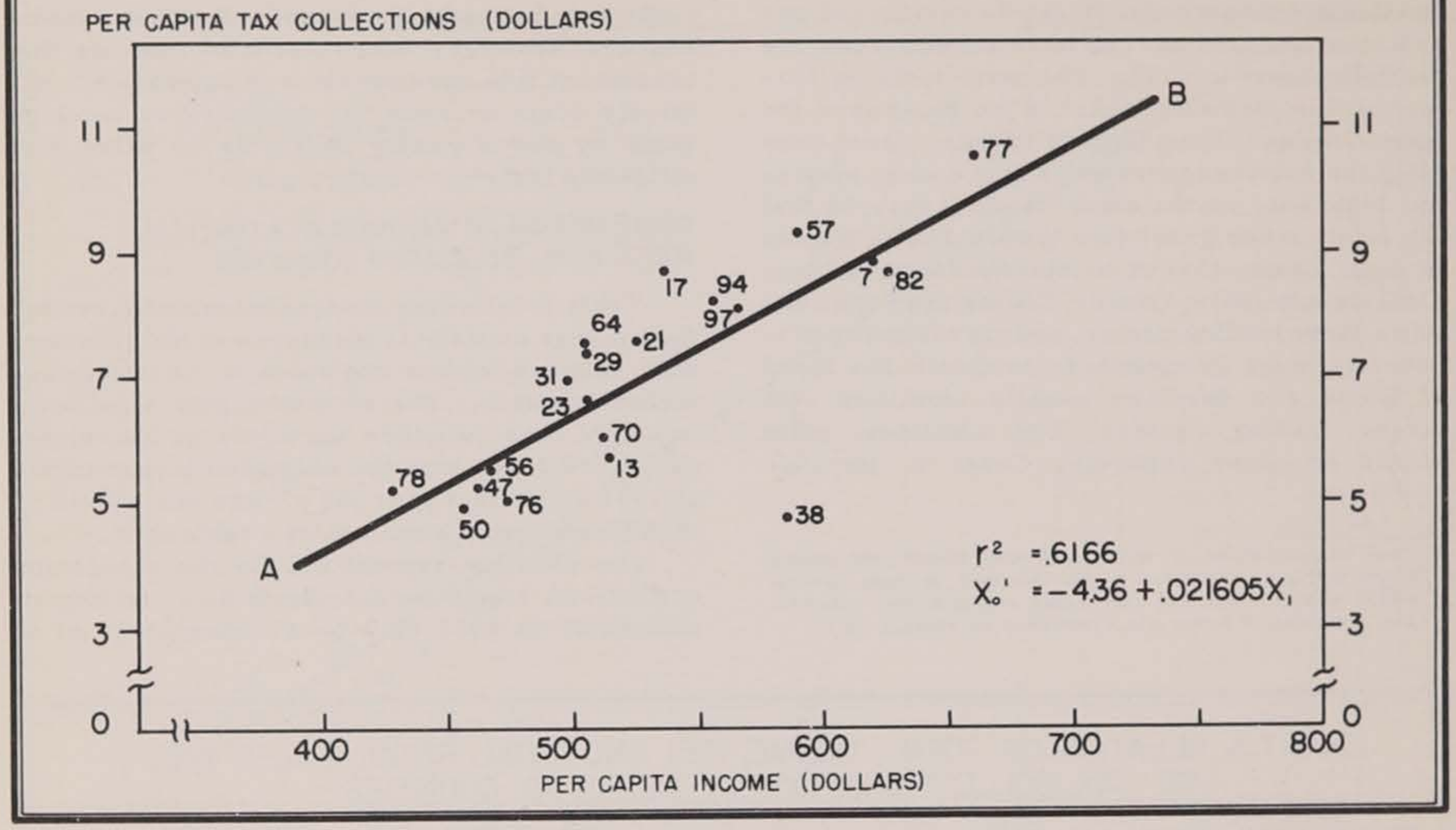


TABLE 6. MEASURES OF CORRELATION CONTRASTED[1]

YEAR	r^2	r	b
TOTALS:			
1939	.9942	.9971	.016071
1947	.9894	.9947	.017724
1951	.9860	.9930	.016499
PER CAPITA:[2]			
1939	.6166	.7853	.021605
1947	.4315	.6569	.024295
1951	.2317	.4814	.011632

[1] WHERE X_1 EQUALS INCOME PAYMENTS AND X_O EQUALS RETAIL SALES AND USE TAX COLLECTIONS.

[2] A COEFFICIENT OF DETERMINATION FOR THE NINETY-NINE COUNTIES WAS ALSO CALCULATED FOR THE YEARS 1939 AND 1947; THEY WERE FOUND TO BE .6084 AND .8406 RESPECTIVELY.

overstatement of the income for that year thereby lowering the ratio of total income spent for consumption at retail stores.

CONTRAST OF AN "AGRICULTURAL" AND AN "URBAN" COUNTY

Charts 5 and 6 contrast the functional relation of income and sales for two counties -- one agricultural and predominately rural, and the other relatively industrial and largely urban. Each dot on these two charts locates the level of tax collections with existing levels of income for a particular year. For example, Chart 5 shows the relation of these two variables in Grundy County -- the rural, farm county -- for the years 1939 through 1952.

In Grundy County, during the years 1942-46, the retail sales and use tax collections were somewhat below what may have been "expected" on the basis of this simple correlation. These years are, of course, World War II years and the first postwar year when civilian production had not caught up with the backlogged demand. For the years, 1947, 1949, 1950, and 1951, there appears, in Grundy County, as in most areas, to have been a "catching up" on consumption. That is, sales were considerably higher

than may have been "expected." It may be that a new trend has started on a higher level. The reason that 1948 is below the line "AB" may be the result of the high income during that year (occurring largely in the agricultural sector) with the consequence of less money spent -- percentagewise -- on retail consumption.

Chart 6 depicts the retail consumption pattern by sales made in Black Hawk County -- an urban, industrial county -- for the same years. The "closeness of the fit" of the regression line in Black Hawk County is slightly better than for Grundy County. The same general conclusions, however, can be drawn for the war and postwar years as were stated in the discussion of Chart 5. One additional fact seems to be worth noting. The slope of the line for Grundy County is steeper than the one for Black Hawk County even though the differences in scales may obstruct this observation. This would seem to give support to the economic principle that as income increases, less is spent percentagewise on the consumption of necessities.

SUMMARY

In summary, it seems that the relatively stable relation between total income and total retail sales and use taxes collected offers a means of estimating or predicting either the level of income or retail sales provided one or the other is known. The use of totals is not too serious a limitation because actually a particular area's retail trade is to some degree dependent upon income levels in contiguous areas.

RETAIL SALES, POPULATION, AND SOURCE OF INCOME

The relationships to be discussed in this section are based on four correlations as follows:

(1) Where the independent variable (X_1) is defined as the rural population of a county expressed as a percent of its total population, and where the dependent variable (X_o) is the trend line value (b) for each of the ninety-nine counties, as shown in Table 4, page 9.

(2) Where the independent variable is equal to the percent of total income a county received from agriculture, and where the dependent variable is again equal to the computed b values.

(3) Where the independent variable is equal to the total 1950 population as a percent

CHART 5. RELATION OF TOTAL INCOME AND TOTAL RETAIL SALES AND USE TAX COLLECTIONS IN GRUNDY COUNTY, 1939 – 51.

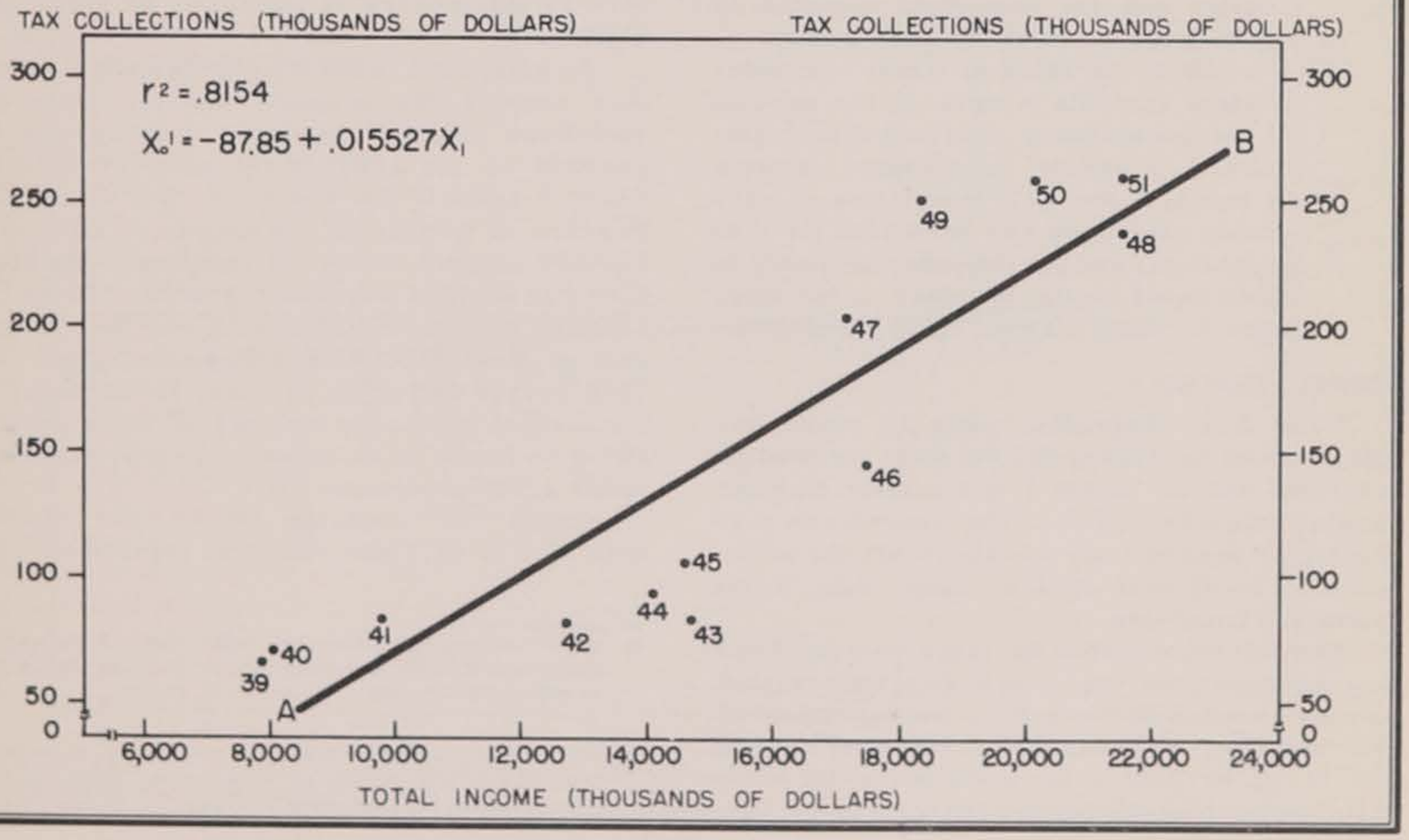
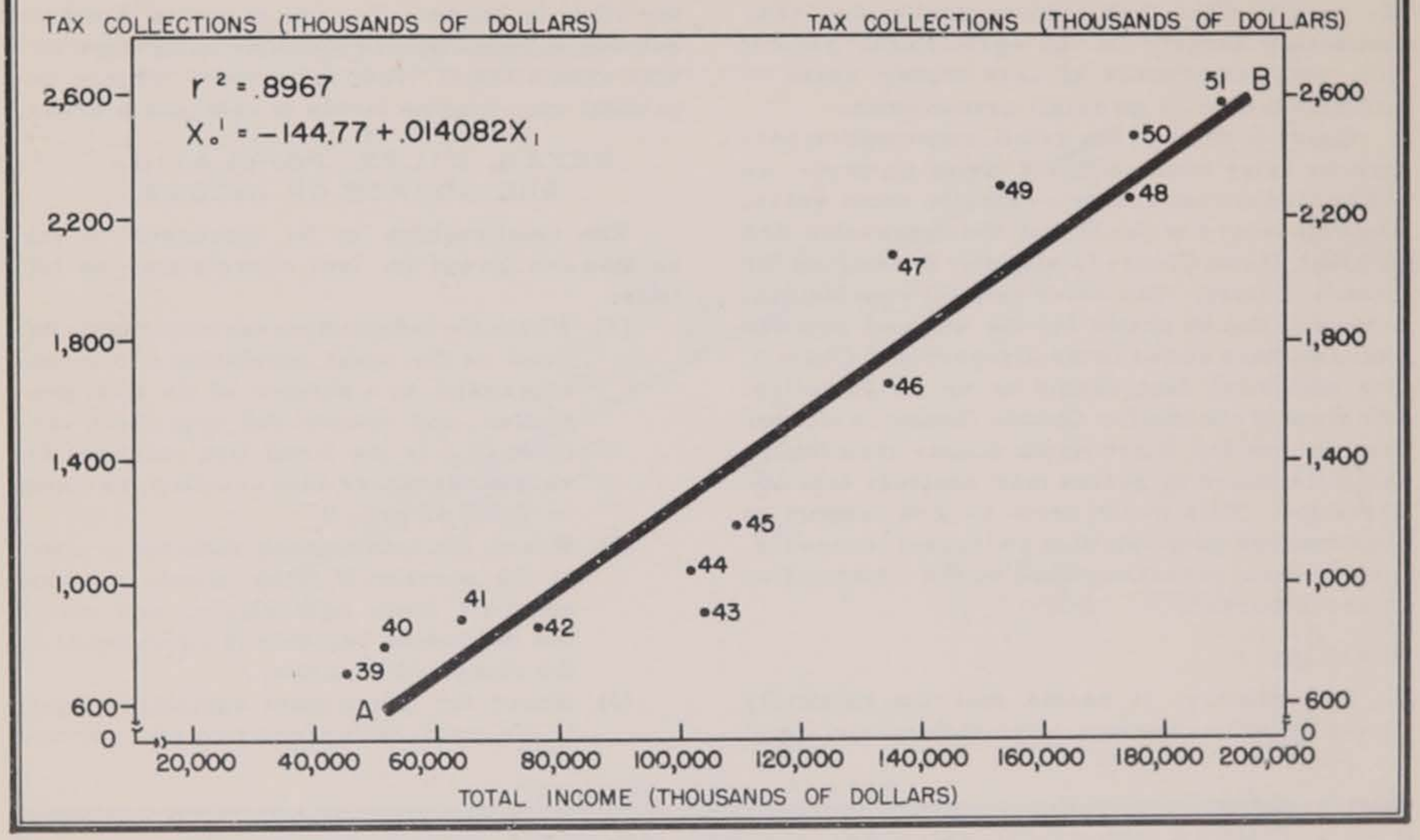


CHART 6. RELATION OF TOTAL INCOME PAYMENTS AND TOTAL RETAIL SALES AND USE TAX COLLECTIONS IN BLACK HAWK COUNTY, 1939 - 1951



of the total 1940 population for each county, and the deperdent variable is equal to the b values for each county.

(4) A multiple correlation where one independent variable is equal to the percent of income a county received from agriculture, a second independent variable is equal to the 1950 population of each county expressed as a percent of its 1940 population, and the dependent variable is again equal to the b values -- the slope of each county's retail trade trend line.

CORRELATION NO. 1

Table B.1, Appendix, page 31, shows the computations necessary for the first correlation described above. Chart 7 is a scatter diagram showing this relationship. The lines drawn perpendicular to each scale merely locate the arithmetic mean of each series. Line "AB" is the calculated trend line.

The interdependence of these two variables may not appear too important at first observation. As may be noted in Table B.1, the coefficient of determination (r^2) is equal to .1128, which means that 11.28 percent of the variation in the slope of the trend lines of retail sales and use tax collections by counties is explained or "accounted for" by differences in the ratios of rural population. 10/

An additional refinement is desirable to further support the original finding, i.e., that variations in retail business activity are the greatest in the agricultural counties in Iowa. Chart 7 again is the basis for this discussion. In order to emphasize the degree of fluctuation in retail activity among the counties of the State, they are divided into three groups. Group "A" contains nineteen counties with less than 50 percent of their population defined as rural. The 1950 census definition of rural is employed -- i.e., rural population includes all those persons living on farms or in cities, villages, and towns under 2,500 population. 11/

Group "B" contains twenty-four counties with 50.0 to 69.2 percent rural population. And

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10 THE STATISTIC F INDICATES THAT THE r^2 IS HIGHLY SIGNIFICANT. THE CALCULATED F IS 12.33 WHILE THE .05 LEVEL IS 3.90 AND THE .01 LEVEL IS 6.85.

11 UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS, 1950 CENSUS OF POPULATION, IOWA, GENERAL CHARACTERISTICS, PP. IV-V.

finally, Group "C" includes fifty-six counties that contain 69.3 to 100.0 percent rural population. In other words, the further one moves to the right on the X axis, the more rural are the counties. Conversely, the further one moves to the left on this same scale, the more urbanized are the counties -- that is, those containing the largest cities.[12]

In order to compare the variation of the items within each group of counties, several measures are computed for each. The arithmetic mean, the standard deviation, and the coefficient of variation (or the coefficient of the standard deviation) are all calculated for each county group. The standard deviation (indicated by the symbol σ) is a measure of the dispersion of the items about their mean. The larger the value of the standard deviation, the larger is the spread of the items. In a normal distribution, about two-thirds of all of the items in the distribution will fall within one standard deviation, and virtually all of the items will be contained within a range of plus or minus three standard deviations of the mean.[13] The coefficient of variation (V) is a relative measure of dispersion and is preferable to the standard deviation when (1) the series to be compared are stated in different and noncomparable units or (2) although stated in the same terms, the series differ so in their average magnitudes that more absolute variation should be expected in the one series than in the other.

Referring to Table 7, it should be noted that the last column, V, is the most significant. It reveals that the variation of trade activity in the middle group -- Group "B" -- is four times that of Group "A" which contains our largest cities. Column four also indicates that as the rural population as a percent of total population ex-

12 FOR A LISTING OF THE COUNTIES INCLUDED IN EACH GROUP SEE TABLE B.1, APPENDIX, PAGE 31.

13 TECHNICALLY 68.3 PERCENT OF THE ITEMS WILL FALL WITHIN A RANGE OF PLUS OR MINUS ONE STANDARD DEVIATION OF THE MEAN AND 99.7 PERCENT WILL BE INCLUDED WITHIN THE RANGE OF PLUS OR MINUS THREE STANDARD DEVIATIONS OF THE MEAN.

CHART 7. RELATION OF RURAL POPULATION AS A PERCENT OF TOTAL POPULATION, 1950, AND THE SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939-51, BY COUNTIES.

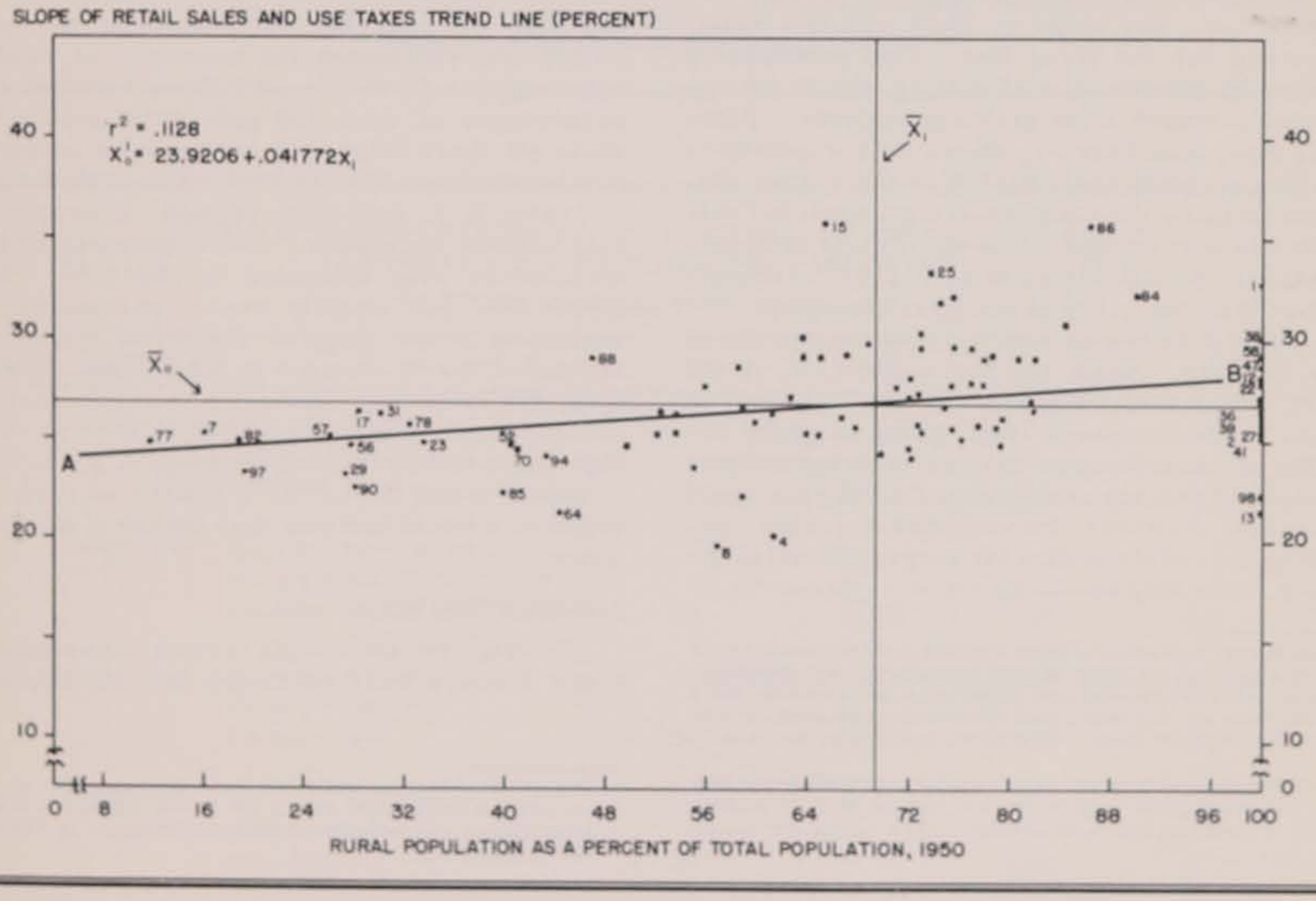


TABLE 7. COMPARISON OF VARIATIONS IN RETAIL TRADE ACTIVITY BY GROUPS OF COUNTIES

(BY PERCENT OF RURAL POPULATION)

GROUP		N	$\bar{X}_o$	σ_{x_o}	V
GROUP "A":	UNDER 50.0 PERCENT RURAL POPULATION	19	24.67	1.74	7.1
GROUP "B":	50.0 TO 69.2 PERCENT RURAL POPULATION	24	26.58	7.62	28.7
GROUP "C":	69.3 TO 100.0 PERCENT RURAL POPULATION	56	27.63	2.66	9.6

ceeds 69.2 percent, the variation falls significantly, yet is still higher than in Group "A." Probably the most important factor to explain this phenomenon is the volatile nature of the income in the predominantly rural counties.

CORRELATION NO. 2

The second simple correlation to be discussed in this part is the relationship where the independent variable is equal to a county's percent of total income from agriculture in 1947[14] and the dependent variable is again equal to the b values, i.e., the slope of each county's retail sales and use tax trend line. This relationship is merely another way of stating the same results as obtained in the previous analysis. Table B.2, Appendix, page 36, shows the computations for this problem and Chart 8 is the scatter diagram. Again, the counties are grouped, but this time into four groups. The coefficient of determination was calculated to be .1259[15] (slightly higher than the .1128 in the first example).

Table 8 following summarizes the results of this analysis. Again the last column, V, is the most significant. Apparently the variation in retail trade increases from group to group until the percent of income derived from agriculture exceeds 48 percent and then the fluctuations begin to lessen. However, the variation in groups containing the rural counties far surpasses that of the group containing the large cities -- Group "A."

CORRELATION NO. 3

In order to dispel the possible impression that the variation in the growth of the counties' retail sales, as measured by the slope of their trend lines, is solely a result of population change, one additional relationship is presented here. For this problem, the independent variable equals the total 1950 population as a percent of the total 1940 population for each county, and the dependent variable is again equal to the b values. The independent variable measures the increase or decrease in population for each county and eliminates the necessity of dealing with negative numbers. All those counties with percentages of over 100 gained in population, while all those below 100 lost population during the decade from 1940 to 1950. (See Chart 9.)

Table B.3, Appendix, page 40, indicates the calculations necessary. The coefficient of determination thus computed is .0218.[16] This means that only slightly over 2 percent of the variations in the slope of the trend lines were accounted for by changes in population. Therefore, the following conclusion is valid: that increases in population from 1940 to 1950 were not significant in determining the slope of the various counties' trend lines. As a matter of fact, the negative b would indicate the reverse of this condition.

CORRELATION NO. 4

Finally, the two simple correlations numbers 2 and 3 above were combined into one multiple

14 DATA FOR THIS INDEPENDENT VARIABLE WERE TAKEN FROM AN ANALYSIS OF IOWA INCOME PAYMENTS, BY COUNTIES, STUDIES IN BUSINESS AND ECONOMICS, NEW SERIES, NO. 1 (BUREAU OF BUSINESS AND ECONOMIC RESEARCH, STATE UNIVERSITY OF IOWA, IOWA CITY, IOWA, 1950) PP. 54–55.

15 THIS MEASURE IS ALSO HIGHLY SIGNIFICANT BECAUSE THE F AS COMPUTED IS 12.86, WHILE THE .05 AND .01 VALUES OF F ARE 3.90 AND 6.85 RESPECTIVELY WHEN $N = 99$ AND $m = 2$.

16 THE STATISTIC F AS COMPUTED IS 2.16 WHILE THE .05 AND .01 LEVELS FROM THE TABLE OF F ARE 3.90 AND 6.85 RESPECTIVELY. THEREFORE, THE RELATIONSHIP IS TERMED NOT SIGNIFICANT.

CHART 8. RELATION OF PERCENT OF INCOME FROM AGRICULTURE, 1947, AND THE SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939-51, BY COUNTIES.

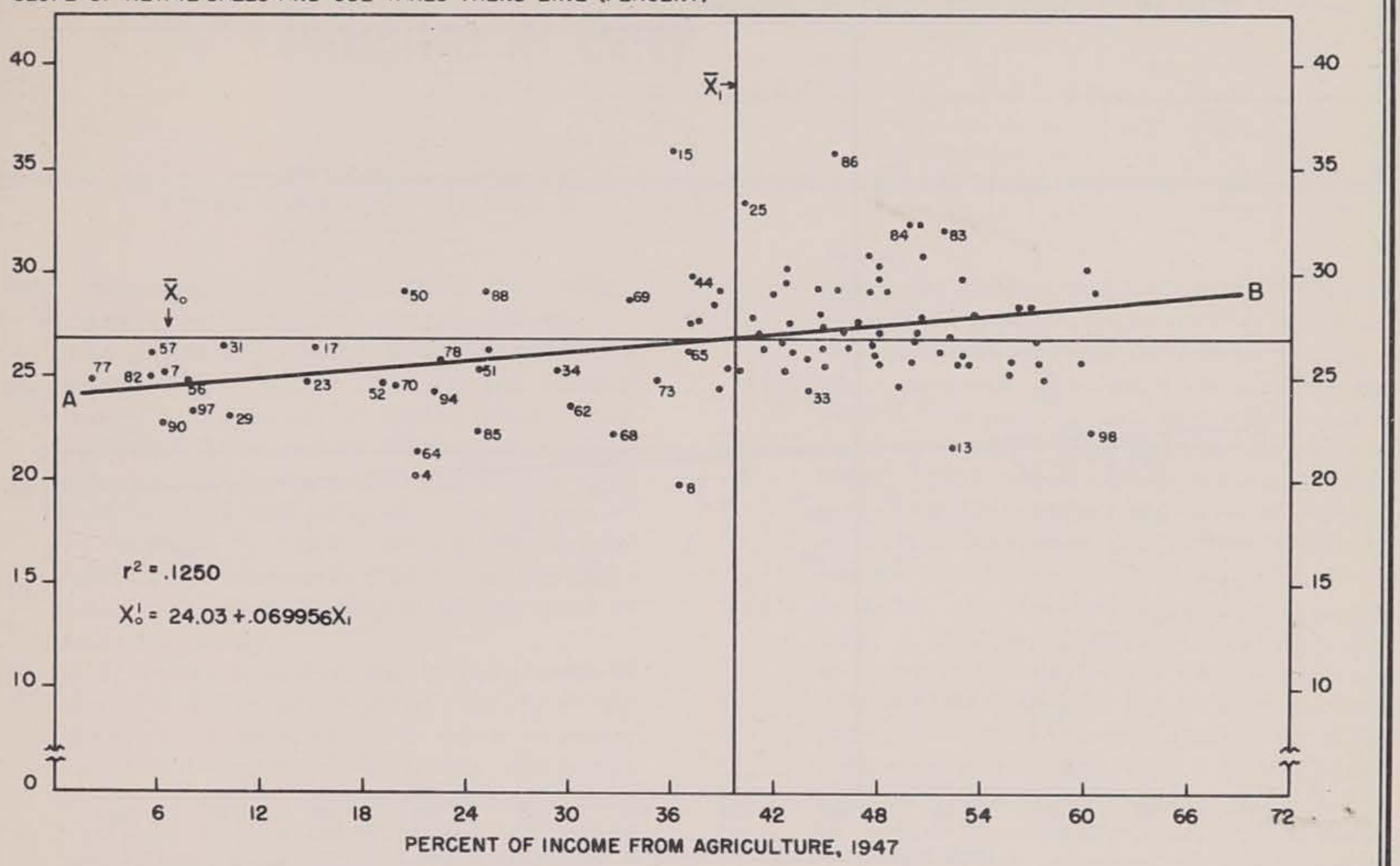
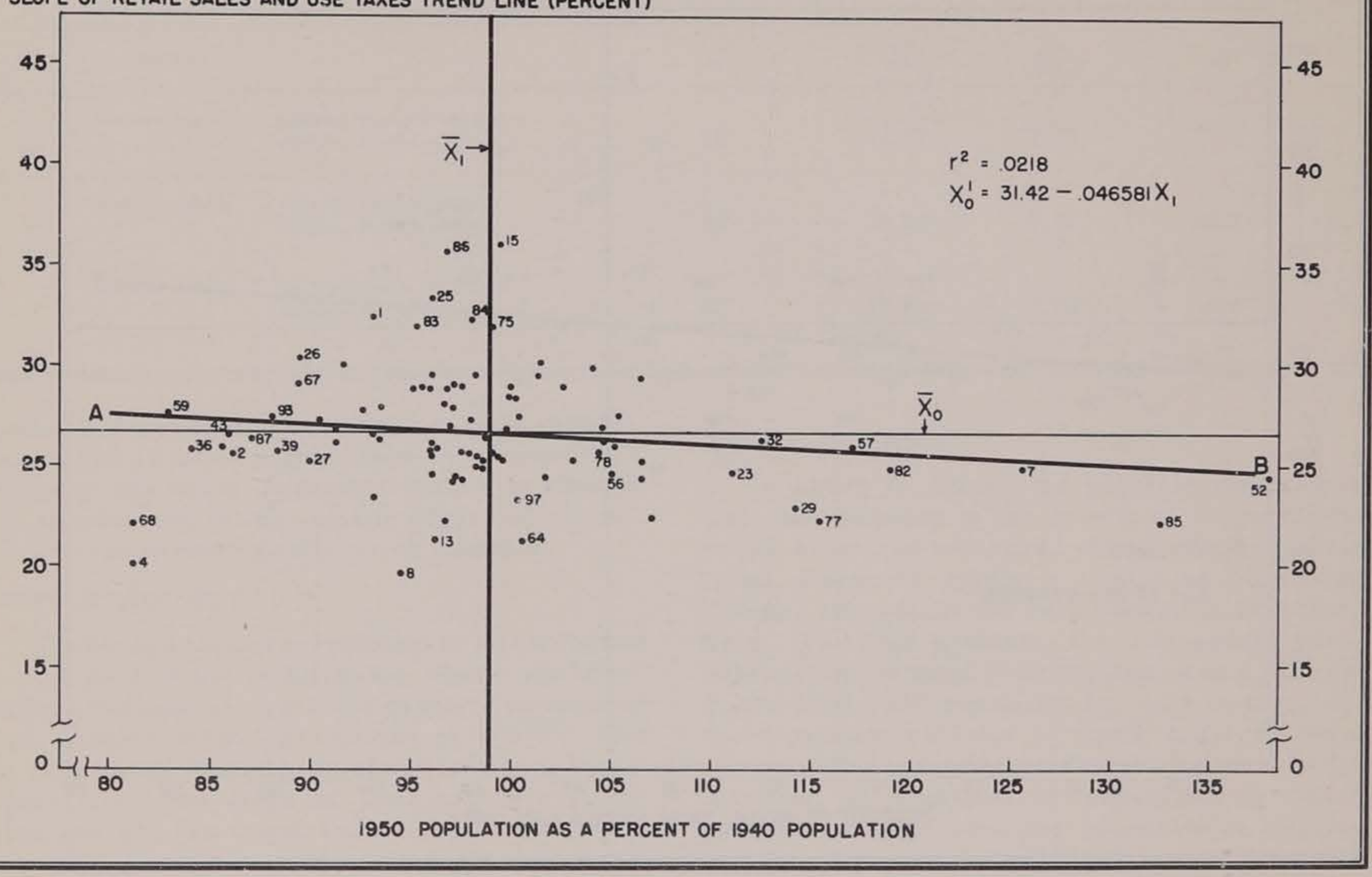


TABLE 8. COMPARISON OF VARIATION IN RETAIL TRADE ACTIVITY BY GROUPS OF COUNTIES

(BY PERCENT OF INCOME FROM AGRICULTURE)

GROUP		N	$\bar{X}_o$	σ_{x_o}	V
GROUP "A":	0.0 – 16.0 PERCENT OF INCOME FROM AGRICULTURE, 1947	11	24.74	1.14	4.6
GROUP "B":	16.1 – 32.1 PERCENT OF INCOME FROM AGRICULTURE, 1947	13	24.76	2.54	10.3
GROUP "C":	32.2 – 48.2 PERCENT OF INCOME FROM AGRICULTURE, 1947	45	27.59	2.89	10.5
GROUP "D":	48.3 – 64.3 PERCENT OF INCOME FROM AGRICULTURE, 1947	30	27.29	2.68	9.8

CHART 9. RELATION OF 1950 POPULATION AS A PERCENT OF 1940 POPULATION AND THE SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939-51, BY COUNTIES.



correlation. The coefficient of multiple determination ($R^2_{0.12}$) was calculated to be .1299 and the F value to be 7.17. The F values for the .05 and the .01 levels taken from the table of F are 3.10 and 4.85 respectively; therefore, an F of 7.17 is considered highly significant.

PRICE CHANGES

What has been the effect of the changes in price levels upon the growth of retail sales? Has this growth in each county largely been the result of price inflation rather than physical volume of sales? To help answer these questions, trend lines for two retail price indexes were computed. The indexes used were the Consumers' Price Index and the "all commodities" group of the Retail Price Index.[17]

The percent increase per year as thus indicated by the Consumers' Price Index was 7.6220. The figure for the "all commodities" was 9.4489 percent per year. When these trend lines are compared with the slope of the trend lines of retail sales for the individual counties, it becomes obvious that increases in retail sales are largely in physical volume and are not primarily the result of price fluctuations.

17 THE CONSUMERS' PRICE INDEX IS PREPARED BY THE BUREAU OF LABOR STATISTICS OF THE U.S. DEPARTMENT OF LABOR AND PUBLISHED IN THE MONTHLY LABOR REVIEW. THE "ALL COMMODITIES" RETAIL PRICE INDEX IS PREPARED BY THE OFFICE OF BUSINESS ECONOMICS, U.S. DEPARTMENT OF COMMERCE AND IS PUBLISHED MONTHLY IN THE SURVEY OF CURRENT BUSINESS.

Findings in Brief

SECTION THREE

The following facts concerning the retail trade in Iowa seem worthy of recapitulation.

(1) The percentage increase in taxed retail sales from 1939 to 1952 ranged from a low of 176 percent in Boone County to a high of 363 percent in Cass County. The gain for the State as a whole during this interval was 258 percent. The spread of percentage increases among the twenty leading counties extended from 194 percent in Calhoun County to 303 percent in Grundy County.

(2) The degree of uniformity in the growth of the counties is noteworthy. Ninety of the ninety-nine counties made gains in retail sales and use tax collections within the range of 200 to 300 percent; over one-half (59) of the counties had increases within the range of 225 to 275 percent.

(3) Largest gains in retail sales (as measured by the sales and use taxes collected) were recorded in counties normally referred to as our western and our eastern meat areas. Below State average increases in retail sales occurred in the north-northcentral or cash grain area. Average or slightly above average gains in retail sales occurred in the northeastern dairy area of Iowa and in the southern pasture area.

(4) Increases in retail sales since 1939 were primarily in physical volume and were not merely the result of price fluctuations.

(5) The counties in Iowa which in the period studied had (a) higher than average rural population ratios, and (b) the major share of their income provided by the volatile industry -- agriculture -- were more sensitive to cyclical fluctuations in retail trade activity than were those counties which were more urbanized, and had more diversified sources of income. In addition, those counties which experienced the most variations in retail business activity were those that were losing their population from decade to decade.

(6) The analysis disclosed a relatively stable relationship between total income and total retail sales and use tax collections. This relationship makes it possible to predict either the level of income or sales, provided one or the other is known.

(7) In 1939, for the twenty selected counties, a change of $1.61 in retail sales and use taxes collected was associated with a $100 change in the level of income payments. In 1951 the change in taxes collected associated with a $100 change in income was $1.65. Measured in terms of retail purchases, this would seem to indicate an increase in the average propensity to consume in these areas.

(8) And, finally, as indicated by Chart 1, the State's retail sales and use taxes collected (relative to the State's income payments) showed a slightly rising trend. On the average, total retail sales and use tax collections in Iowa tended to increase by more than $64 thousand per year if all other factors remained constant. Stated another way, this increase in retail sales and use tax collections could be expected to occur on the average from one year to the next if no change were to occur in the level of Iowa income (and, of course, tax rates).

An analysis of retail sales and use tax collections seems to leave little apprehension as to the usefulness of such indicators in measuring changes in one sector of the State's economy. However, the availability of more complete and more detailed information on the taxes collected would undoubtedly enhance such a study. For example, nothing was included here concerning the variation in retail business activity by type of

business operation. The sole reason for such an omission was that such data are not available on a county or city basis. Only limited data are published on a statewide basis by various business classifications.

The fact that a more complete analysis could have been undertaken if more detailed information were available does not distract from the usefulness of the study. It does, however, point out a need for improved tabulating and reporting techniques of such basic information.

Appendix

SECTION A — STATISTICAL TECHNIQUES

STRAIGHT LINE TREND CALCULATIONS

To determine the straight line trends the index numbers of total retail sales and use tax collections for the years 1939 through 1951 were treated by the following formula:[18]

$$T = a + bx$$

where $a = \Sigma Y/N$ and $b = \Sigma xY/\Sigma x^2$. The symbol x is equal to the deviations from the middle year, 1945. The method used for computing the parameter b for each of the trend lines can best be explained by an example. The following computations for Black Hawk County are used for illustrative purposes.

YEAR	Y	x	x^2	T
1939	100.0	−6	36	62.0
1940	109.0	−5	25	
1941	123.5	−4	16	
1942	118.3	−3	9	
1943	127.4	−2	4	
1944	144.8	−1	1	
1945	167.3	0	0	212.1
1946	231.5	1	1	
1947	287.4	2	4	
1948	318.8	3	9	
1949	323.7	4	16	
1950	346.0	5	25	
1951	359.6	6	36	308.6
Σ	2,757.3	0	182	

Therefore,

$a = \Sigma Y/N$ $\quad b = \Sigma xY/\Sigma x^2$

$= 2,757.3/13$ $\quad = 45,516/182$

$= 212.1$ $\quad = 25.0088$

$T = a + bx$

$= 212.1 + 25.0088x$

Therefore, for 1939:

$T = 212.1 + (25.0088)(-6)$

$= 62.0$

for 1945:

$T = 212.1 + (25.0088)(0)$

$= 212.1$

for 1951:

$T = 212.1 + (25.0088)(6)$

$= 362.2$

SIMPLE CORRELATION ANALYSIS

Simple rectilinear correlation involves the means by which values of one variable may be estimated from the values of another, according to the functional relationship indicated in a set of paired observations. This statistical technique also is a means for measuring how closely such estimates (frequently designated by the symbol X'_0) conform to, and account for, the original variance in the variable which is being estimated, for the given set of observations. In statistical terminology, the term regression line designates the straight line used to estimate one variable from another by means of the equation $X'_0 = a + bX_1$. This formula is referred to as the rectilinear regression equation. The parameter b is termed the coefficient of regression and measures how many units, or fractional parts, the dependent variable X_0 changes for each unit change in the independent variable X_1. The coefficient of correlation, r, may be defined as the ratio of the standard deviation of the es-

[18] CF. DAVIES AND YODER, P. 236 FF.

timated values of X_o, to the standard deviation of the actual values. If, however, one wishes to express the covariation in two series in terms of percentages, the square of the coefficient of correlation is the measure to employ. This latter measure, indicated by the symbol r^2 and termed the coefficient of determination, represents the percentage of total squared variation in the dependent variable that is accounted for by the squared variation in the trend. Finally, the constant a in the regression formula indicates the height of the regression line at the point where X_1 is equal to zero.[19]

PROBLEMS IN CORRELATING NON-RANDOM SAMPLES OF TIME SERIES

All the error formulas given in this monograph, as well as the measurement of the reliability of F, are based upon the theory of random sampling. Briefly, that theory assumes that each observation in a sample is selected purely at random from all of the items in the universe, i.e., each possible item has an opportunity of being chosen. It further assumes that successive samples are chosen in such a manner that values found in one sample have no relation or connection with the values found in the next sample.

However, it is apparent that the level of income in any one given year, for example, is not completely independent of the income in the previous year. Rather it is probably approximately the level established in the preceding year modified by new or changing factors. Does this mean that the measures of correlation and range of error in these particular problems are invalidated? Not necessarily, because of the very nature of the data being studied. Forces of nature, such as temperature, rainfall, etc. which affect crop production, the threat of wars and/or peace, and perhaps many other variables remove some of this "built in" relationship. That is, the level of the time series being analyzed is in some ways not necessarily geared to the previous years and therefore may be regarded as reasonably "random" sampling from the observations that might otherwise have been secured for the given year. And if the observations have no particular relation with what other observations might have been "selected" each year if the forces of nature had nodded another way instead, we may then be reasonably confident that the method is a useful technique in spite of its theoretical weaknesses.

One additional limitation concerns the reliability one should place upon measures of correlation when the variables involved are to some degree interdependent in a different sense than discussed above. That is, does the level of income determine the level of consumption? Or does the level of consumption determine the level of income? Much debate and theoretical discussion in addition to some research on this point has been undertaken by various commissions and groups interested in this issue. In brief summary it may be said that where the measures of correlation are small, this interdependence of the variables is more important and therefore may overstate the degree of reliability of such measures.

With reference to correlation of interdependent data, some writers have maintained that a third regression line exists.[20] For example, Davies and Ringstrom say:

> "It may be argued that whereas the two conventional regression lines are prescribed for data in which y is dependent on x, and x is dependent on y, respectively, the line of regression expressed by the line of maximum frequencies may be applied generally to interdependent data."[21]

These same writers continue:

> "But as Einstein has contended, the ultimate proof of mathematical logic -- based as it is on assumed axioms -- lies in its utility. And the third regression line of a correlation surface has not been given a thorough test."[22]

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19 MORDECAI EZEKIEL, METHODS OF CORRELATION ANALYSIS, 2ND. ED., (JOHN WILEY AND SONS, INC., NEW YORK, 1941) P. 60; AND CF. G. R. DAVIES AND DALE YODER, PP. 232 AND 341.

20 G. R. DAVIES AND NORMAN H. RINGSTROM, UNPUBLISHED PAPER ON "THE THIRD REGRESSION LINE OF A CORRELATION SURFACE," AND HENRY SCHULTZ, STATISTICAL LAWS OF DEMAND AND SUPPLY, CHICAGO, UNIVERSITY OF CHICAGO PRESS (1928).

21 DAVIES AND RINGSTROM, IBID.

22 IBID.

B.1. RELATION OF RURAL POPULATION AS A PERCENT OF TOTAL POPULATION, 1950, AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY	X_1 RURAL POPULATION AS PERCENT OF TOTAL POPULATION, 1950	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
GROUP "A" (UNDER 50 PERCENT RURAL POPULATION)				
7	BLACK HAWK	16.0	25.01	41.01
17	CERRO GORDO	28.4	26.40	54.80
23	CLINTON	33.5	24.78	58.28
29	DES MOINES	27.2	23.07	50.27
31	DUBUQUE	30.4	26.40	56.80
52	JOHNSON	40.5	24.70	65.20
56	LEE	27.9	24.70	52.60
57	LINN	25.0	26.02	51.02
64	MARSHALL	44.3	21.39	65.69
70	MUSCATINE	40.8	24.59	65.39
73	PAGE	49.7	24.70	74.40
77	POLK	11.5	24.85	36.35
78	POTTAWATTAMIE	32.3	25.77	58.07
82	SCOTT	18.7	24.91	43.61
85	STORY	39.8	22.30	62.10
88	UNION	46.9	29.02	75.92
90	WAPELLO	28.0	22.55	50.55
94	WEBSTER	43.2	24.25	67.45
97	WOODBURY	19.2	23.40	42.60
GROUP "B" (50 – 69.2 PERCENT RURAL POPULATION)				
4	APPANOOSE	61.3	20.15	81.45
6	BENTON	67.5	25.68	93.18
8	BOONE	56.8	19.76	76.56
11	BUENA VISTA	67.1	29.39	96.49
15	CASS	65.0	35.97	100.97

B.1. (CONTINUED) RELATION OF RURAL POPULATION AS A PERCENT OF TOTAL POPULATION, 1950, AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY	X_1 RURAL POPULATION AS PERCENT OF TOTAL POPULATION, 1950	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
18	CHEROKEE	59.6	25.91	85.51
20	CLARKE	63.5	30.16	93.66
21	CLAY	58.9	26.56	85.46
32	EMMET	52.4	26.44	78.84
34	FLOYD	52.1	25.31	77.41
40	HAMILTON	61.3	26.47	87.77
42	HARDIN	64.0	25.43	89.43
44	HENRY	68.8	29.90	98.70
50	JASPER	63.7	29.13	92.83
51	JEFFERSON	53.5	25.47	78.97
53	JONES	65.0	29.16	94.16
59	LUCAS	55.9	27.56	83.46
62	MAHASKA	54.9	23.51	78.41
63	MARION	53.5	26.33	79.83
65	MILLS	66.8	26.36	93.16
68	MONROE	59.0	22.22	81.22
69	MONTGOMERY	58.4	28.52	86.92
79	POWESHIEK	64.7	25.41	90.11
99	WRIGHT	62.7	27.16	89.86
GROUP "C" (69.3 – 100.0 PERCENT RURAL POPULATION)				
1	ADAIR	100.0	32.45	132.45
2	ADAMS	100.0	25.67	125.67
3	ALLAMAKEE	80.7	29.08	109.78
5	AUDUBON	75.7	29.62	105.32
9	BREMER	72.9	27.59	100.49
10	BUCHANAN	77.8	26.98	104.78
12	BUTLER	100.0	28.19	128.19
13	CALHOUN	100.0	21.51	121.51
14	CARROLL	73.0	29.57	102.57
16	CEDAR	84.4	30.95	115.35

B.1. (CONTINUED) RELATION OF RURAL POPULATION AS A PERCENT OF TOTAL POPULATION, 1950, AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY	X_1 RURAL POPULATION AS PERCENT OF TOTAL POPULATION, 1950	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
19	CHICKASAW	78.2	29.11	107.31
22	CLAYTON	100.0	27.93	127.93
24	CRAWFORD	76.9	29.64	106.54
25	DALLAS	73.9	33.40	107.30
26	DAVIS	73.0	30.41	103.41
27	DECATUR	100.0	25.30	125.30
28	DELAWARE	77.5	25.87	103.37
30	DICKINSON	100.0	26.35	126.35
33	FAYETTE	72.2	24.37	96.57
34	FRANKLIN	72.8	25.62	98.42
36	FREMONT	100.0	25.85	125.85
37	GREENE	72.2	28.09	100.29
38	GRUNDY	100.0	30.23	130.23
39	GUTHRIE	100.0	25.82	125.82
41	HANCOCK	100.0	25.74	125.74
43	HARRISON	81.9	26.59	108.49
45	HOWARD	72.2	27.11	99.31
46	HUMBOLDT	75.5	25.68	101.18
47	IDA	100.0	28.95	128.95
48	IOWA	100.0	26.68	126.68
49	JACKSON	76.9	27.95	104.85
54	KEOKUK	100.0	26.25	126.26
55	KOSSUTH	79.4	24.97	104.37
58	LOUISA	100.0	29.19	129.19
60	LYON	82.0	29.16	111.16
61	MADISON	72.8	27.26	100.06
66	MITCHELL	75.4	27.70	103.10
67	MONONA	78.5	29.18	107.68
71	O'BRIEN	78.9	25.57	104.47
72	OSCEOLA	74.9	26.67	101.57

B.1. (CONTINUED) RELATION OF RURAL POPULATION AS A PERCENT OF TOTAL POPULATION, 1950, AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY		X_1 RURAL POPULATION AS PERCENT OF TOTAL POPULATION, 1950	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
74	PALO ALTO		76.3	25.09	101.39
75	PLYMOUTH		74.9	31.95	106.85
76	POCAHONTAS		100.0	26.85	126.85
80	RINGGOLD		100.0	26.07	126.07
81	SAC		81.9	26.98	108.88
83	SHELBY		75.4	32.01	107.41
84	SIOUX		90.0	32.34	122.34
86	TAMA		86.5	35.67	122.17
87	TAYLOR		100.0	26.24	126.24
89	VAN BUREN		100.0	27.01	127.01
91	WARREN		71.0	27.53	98.53
92	WASHINGTON		69.8	24.42	94.22
93	WAYNE		100.0	28.05	128.05
95	WINNEBAGO		79.4	26.00	105.40
96	WINNESHIEK		72.0	24.53	96.53
98	WORTH		100.0	22.37	122.37
		Σ	6,846.5	2,654.13	9,500.63
		P	527,269.83	185,797.418 71,988.0397	713,067.248 257,785.4577
		N_p	5,325,150.92	222,443.337 82,409.8734	5,547,594.257 304,853.2104

B.1. (CONTINUED) RELATION OF RURAL POPULATION AS A PERCENT OF TOTAL POPULATION, 1950, AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 — 1951

WHERE N = 99; $b = \frac{n\Sigma x_1 x_0}{n\Sigma x_1^2}$ $a = \frac{\Sigma X_0 - b\Sigma X_1}{N}$; AND $r^2 = \frac{b \cdot n\Sigma x_1 x_0}{n\Sigma x_0^2}$

THEN:

$b = 222,443.337 \div 5,325,150.92$

$= .041772$

$a = 2,654.13 - (.041772)\ (6846.5) \div 99$

$= 23.9206$

$r^2 = (.041772)\ (222,443.337) \div 82,409.8734$

$= .1128$

$r = .3358$

$$F = \frac{r^2}{1 - r^2} \cdot \frac{N - n}{n - 1}$$

$$= \frac{.1128}{1 - .1128} \cdot \frac{99 - 2}{2 - 1}$$

$= 12.33$

TABLE OF F:

WHEN N = 99 AND $n = 2$ THEN

F = 3.90 = .05 LEVEL

F = 6.85 = .01 LEVEL

SOURCE: POPULATION DATA ARE FROM UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS.

B.2. RELATION OF PERCENT OF INCOME FROM AGRICULTURE, 1947, AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY	X_1 PERCENT OF INCOME FROM AGRICULTURE, 1947	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
GROUP "A" (0 – 16 PERCENT)				
7	BLACK HAWK	6.7	25.01	31.71
17	CERRO GORDO	15.4	26.40	41.80
23	CLINTON	14.8	24.78	39.58
29	DES MOINES	10.3	23.07	33.37
31	DUBUQUE	10.2	26.40	36.60
56	LEE	7.9	24.70	32.60
57	LINN	5.9	26.02	31.92
77	POLK	2.3	24.85	27.15
82	SCOTT	5.9	24.91	30.81
90	WAPELLO	6.5	22.55	29.05
97	WOODBURY	8.2	23.40	31.60
GROUP "B" (16.1 – 32.1 PERCENT)				
4	APPANOOSE	21.2	20.15	41.35
34	FLOYD	29.4	25.31	54.71
50	JASPER	20.6	29.13	49.73
51	JEFFERSON	24.9	25.47	50.37
52	JOHNSON	19.2	24.70	43.90
63	MARION	25.3	26.33	51.63
64	MARSHALL	21.3	21.39	42.69
70	MUSCATINE	20.0	24.59	44.59
78	POTTAWATTAMIE	22.6	25.77	48.37
85	STORY	24.8	22.30	47.10
88	UNION	25.2	29.02	44.22
94	WEBSTER	22.4	24.25	46.65
62	MAHASKA	30.1	23.51	53.61
GROUP "C" (32.2 – 48.2 PERCENT)				
3	ALLAMAKEE	42.0	29.08	71.08
8	BOONE	36.6	19.76	56.36
9	BREMER	37.6	27.59	65.19
10	BUCHANAN	41.3	26.98	68.28
11	BUENA VISTA	44.8	29.39	74.19

B.2. (CONTINUED) RELATION OF PERCENT OF INCOME FROM AGRICULTURE, 1947, AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY	X_1 PERCENT OF INCOME FROM AGRICULTURE 1947	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
14	CARROLL	42.8	29.57	72.37
15	CASS	16.1	35.97	52.07
16	CEDAR	47.5	30.95	78.45
18	CHEROKEE	44.0	25.91	69.91
19	CHICKASAW	47.6	29.11	76.71
20	CLARKE	42.8	30.16	72.96
21	CLAY	42.5	26.56	69.06
24	CRAWFORD	48.1	29.64	77.74
25	DALLAS	40.4	33.40	73.80
26	DAVIS	48.0	30.41	78.41
27	DECATUR	42.7	25.30	68.00
30	DICKINSON	44.9	26.35	71.25
32	EMMET	41.5	26.44	67.94
33	FAYETTE	44.1	24.37	68.47
39	GUTHRIE	48.1	25.82	73.92
40	HAMILTON	46.4	26.47	72.87
42	HARDIN	39.9	25.43	65.33
43	HARRISON	47.8	26.59	74.39
44	HENRY	37.3	29.90	67.20
45	HOWARD	46.0	27.11	73.11
48	IOWA	43.5	26.68	70.18
49	JACKSON	40.8	27.95	68.75
53	JONES	38.9	29.16	68.06
54	KEOKUK	43.0	26.25	69.25
58	LOUISA	45.7	29.19	74.89
59	LUCAS	37.3	27.56	64.86
61	MADISON	45.1	27.26	72.36
65	MILLS	37.1	26.36	63.46
66	MITCHELL	46.9	27.70	74.60
68	MONROE	32.7	22.22	54.92
69	MONTGOMERY	33.7	28.52	62.22
71	O'BRIEN	45.0	25.57	72.57
73	PAGE	35.2	24.70	59.90

B.2. (CONTINUED) RELATION OF PERCENT OF INCOME FROM AGRICULTURE, 1947, AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY	X_1 PERCENT OF INCOME FROM AGRICULTURE 1947	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
79	POWESHIEK	39.6	25.41	65.01
86	TAMA	45.7	35.67	81.37
89	VAN BUREN	48.2	27.01	75.21
91	WARREN	42.9	27.53	70.43
92	WASHINGTON	38.9	24.42	63.32
93	WAYNE	44.7	28.05	72.75
95	WINNEBAGO	48.0	26.00	74.00
GROUP "D" (48.3 – 64.3 PERCENT)				
1	ADAIR	50.4	32.45	82.85
2	ADAMS	57.3	25.67	82.97
5	AUDUBON	53.0	29.62	82.62
6	BENTON	49.9	25.68	75.58
12	BUTLER	56.8	28.19	84.99
13	CALHOUN	52.5	21.51	74.01
22	CLAYTON	50.6	27.93	78.53
28	DELAWARE	55.7	25.87	81.57
35	FRANKLIN	53.2	25.62	78.82
36	FREMONT	53.5	25.85	79.35
37	GREENE	56.1	28.09	84.19
38	GRUNDY	60.3	30.23	90.53
41	HANCOCK	59.9	25.74	85.64
46	HUMBOLDT	52.7	25.68	78.38
47	IDA	53.5	28.95	82.45
55	KOSSUTH	57.6	24.97	82.57
60	LYON	60.6	29.16	89.76
67	MONONA	48.5	29.18	77.68
72	OSCEOLA	50.2	26.67	76.87
74	PALO ALTO	55.7	25.09	80.87
75	PLYMOUTH	50.7	31.95	82.65
76	POCAHONTAS	57.2	26.85	84.05
80	RINGGOLD	52.9	26.07	78.97
81	SAC	52.2	26.98	79.18
83	SHELBY	51.7	32.01	83.71

B.2. (CONTINUED) RELATION OF PERCENT OF INCOME FROM AGRICULTURE, 1947, AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 — 1951

NO.	COUNTY	X_1 PERCENT OF INCOME FROM AGRICULTURE 1947	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
84	SIOUX	50.0	32.34	82.34
87	TAYLOR	51.6	26.24	77.84
96	WINNESHIEK	49.1	24.53	73.63
98	WORTH	60.6	22.37	82.97
99	WRIGHT	50.4	27.16	77.56
	Σ	3,929.2	2,654.13	6,583.33
	P	177,201.20	106,826.444	284,027.644
			71,988.0397	178,814.4841
	N_p	2,104,306.16	147,210.360	2,251,516.520
			82,409.8734	229,620.2334

WHERE N = 99 ; $b = \frac{n\Sigma x_1 x_o}{n\Sigma x_1^2}$ $a = \frac{\Sigma X_o - b\Sigma X_1}{N}$; AND $r^2 = \frac{b \cdot n\Sigma x_1 x_o}{n\Sigma x_o^2}$

THEN:

$b = 147,210.360 \div 2,104,306.16$

$= .069956$

$a = 2,654.13 - (.069956)\ (3,929.2) \div 99$

$= 24.03$

$r^2 = (.069956)\ (147,210.360) \div 82,409.8734$

$= .1250$

$r = .3535$

$$F = \frac{r^2}{1 - r^2} \cdot \frac{N - m}{m - 1}$$

$$= \frac{.1250}{1 - .1250} \cdot \frac{99 - 1}{2 - 1}$$

$= 13.86$

TABLE OF F:

WHEN N = 99 AND $m = 2$ THEN

F = 3.90 = .05 LEVEL

F = 6.85 = .01 LEVEL

SOURCE: INCOME DATA ARE FROM AN ANALYSIS OF IOWA INCOME PAYMENTS, BY COUNTIES, STUDIES IN BUSINESS AND ECONOMICS, NEW SERIES NO. 1 (BUREAU OF BUSINESS AND ECONOMIC RESEARCH, STATE UNIVERSITY OF IOWA, IOWA CITY, IOWA).

B.3. RELATION OF 1950 POPULATION AS A PERCENT OF 1940 POPULATION AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY	X_1 1950 POPULATION AS A PERCENT OF 1940 POPULATION	X_o SLOPE OF RETAIL SALES ANS USE TAXES TREND LINE (b)	Z CHECK
1	ADAIR	93.1	32.45	125.55
2	ADAMS	86.2	25.67	111.87
3	ALLAMAKEE	95.2	29.08	124.28
4	APPANOOSE	81.2	20.15	101.35
5	AUDUBON	98.2	29.62	127.82
6	BENTON	99.0	25.68	124.68
7	BLACK HAWK	125.6	25.01	150.61
8	BOONE	94.5	19.76	114.26
9	BREMER	105.3	27.59	132.89
10	BUCHANAN	104.5	26.98	131.48
11	BUENA VISTA	106.4	29.39	135.79
12	BUTLER	96.7	28.19	124.89
13	CALHOUN	96.3	21.51	117.81
14	CARROLL	101.3	29.57	130.87
15	CASS	99.4	35.97	135.37
16	CEDAR	100.2	30.95	131.15
17	CERRO GORDO	105.0	26.40	131.40
18	CHEROKEE	98.9	25.91	124.81
19	CHICKASAW	100.0	29.11	129.11
20	CLARKE	91.6	30.16	121.76
21	CLAY	101.9	26.56	128.46
22	CLAYTON	92.6	27.93	120.53
23	CLINTON	111.1	24.78	135.88
24	CRAWFORD	96.1	29.64	125.74
25	DALLAS	96.0	33.40	129.40
26	DAVIS	89.4	30.41	119.81
27	DECATUR	89.9	25.30	115.20
28	DELAWARE	95.9	25.87	121.77
29	DES MOINES	114.3	23.07	137.37
30	DICKINSON	104.7	26.35	131.05
31	DUBUQUE	119.9	26.40	138.30
32	EMMET	105.2	26.44	131.64
33	FAYETTE	97.1	24.37	121.47

B.3. (CONTINUED) RELATION OF 1950 POPULATION AS A PERCENT OF 1940 POPULATION AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY	X_1 1950 POPULATION AS A PERCENT OF 1940 POPULATION	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
34	FLOYD	106.6	25.31	131.91
35	FRANKLIN	99.3	25.62	124.92
36	FREMONT	84.1	25.85	109.95
37	GREENE	93.6	28.09	121.69
38	GRUNDY	101.5	30.23	131.73
39	GUTHRIE	88.3	25.82	114.12
40	HAMILTON	98.7	26.47	125.17
41	HANCOCK	97.9	25.74	123.64
42	HARDIN	98.6	25.43	124.03
43	HARRISON	85.9	26.59	112.49
44	HENRY	104.0	29.90	133.90
45	HOWARD	96.9	27.11	124.01
46	HUMBOLDT	97.5	25.68	123.18
47	IDA	96.8	28.95	125.75
48	IOWA	93.1	26.68	119.78
49	JACKSON	97.1	27.95	125.05
50	JASPER	102.6	29.13	131.73
51	JEFFERSON	99.6	25.47	125.07
52	JOHNSON	137.9	24.70	162.60
53	JONES	97.2	29.16	126.36
54	KEOKUK	91.3	26.25	117.55
55	KOSSUTH	98.5	24.97	123.47
56	LEE	104.9	24.70	129.60
57	LINN	117.0	26.02	143.02
58	LOUISA	97.5	29.19	126.69
59	LUCAS	82.8	27.56	110.36
60	LYON	95.6	29.16	124.76
61	MADISON	90.4	27.26	117.66
62	MAHASKA	93.2	23.51	116.71
63	MARION	96.0	26.33	122.33
64	MARSHALL	100.6	21.39	121.99
65	MILLS	93.4	26.36	119.76

B.3. (CONTINUED) RELATION OF 1950 POPULATION AS A PERCENT OF 1940 POPULATION AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY	X_1 1950 POPULATION AS A PERCENT OF 1940 POPULATION	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
66	MITCHELL	98.8	27.70	126.50
67	MONONA	89.4	29.18	118.58
68	MONROE	81.2	22.22	103.42
69	MONTGOMERY	99.9	28.52	128.42
70	MUSCATINE	102.7	24.59	127.29
71	O'BRIEN	98.3	25.57	123.87
72	OSCEOLA	96.0	26.67	122.67
73	PAGE	96.1	24.70	120.80
74	PALO ALTO	98.3	25.09	123.39
75	PLYMOUTH	98.9	31.95	130.85
76	POCAHONTAS	95.3	26.85	122.15
77	POLK	115.4	24.85	140.25
78	POTTAWATTAMIE	104.4	25.77	130.17
79	POWESHIEK	103.1	25.41	128.51
80	RINGGOLD	85.6	26.07	111.67
81	SAC	99.3	26.98	126.28
82	SCOTT	118.8	24.91	143.71
83	SHELBY	95.3	32.01	127.31
84	SIOUX	97.0	32.34	129.34
85	STORY	132.5	22.30	154.80
86	TAMA	96.7	35.67	132.37
87	TAYLOR	87.1	26.24	113.34
88	UNION	96.1	29.02	125.12
89	VAN BUREN	91.3	27.01	118.31
90	WAPELLO	107.0	22.55	129.55
91	WARREN	100.4	27.53	127.93
92	WASHINGTON	97.5	24.42	121.92
93	WAYNE	88.2	28.05	116.25
94	WEBSTER	106.6	24.25	130.85
95	WINNEBAGO	96.3	26.00	122.30
96	WINNESHIEK	97.2	24.53	121.73
97	WOODBURY	100.3	23.40	123.70
98	WORTH	96.7	22.37	119.07
99	WRIGHT	98.1	27.16	125.26

B.3. (CONTINUED) RELATION OF 1950 POPULATION AS A PERCENT OF 1940 POPULATION AND SLOPE OF RETAIL SALES AND USE TAXES TREND LINE, 1939 – 1951

NO.	COUNTY		X_1 1950 POPULATION AS A PERCENT OF 1940 POPULATION	X_o SLOPE OF RETAIL SALES AND USE TAXES TREND LINE (b)	Z CHECK
		Σ	9,788.9	2,654.13	12,443.03
		P	976,280.69	262,044.305 71,988.0397	1,238,324.995 334,032.3447
		N_p	829,225.10	−38,626.962 82,409.8734	790,598.138 43,782.9114

WHERE N = 99 ; $b = \frac{n\Sigma x_1 x_o}{n\Sigma x_1^2}$ $a = \frac{\Sigma X_o - b\Sigma X_1}{N}$; AND $r^2 = \frac{b \cdot n\Sigma x_1 x_o}{n\Sigma x_o^2}$

THEN:

$b = -38{,}626.962 \div 829{,}225.10$

$= -.046581$

$a = 2{,}654.13 - (-.046581)(9{,}788.9) \div 99$

$= 31.42$

$r^2 = (-.046581)(-38{,}626.962) \div 82{,}409.8734$

$= .0218$

$r = .1475$

$$F = \frac{r^2}{1 - r^2} \cdot \frac{N - m}{m - 1}$$

$$= \frac{.0218}{1 - .0218} \cdot \frac{99 - 2}{2 - 1}$$

$= 2.16$

TABLE OF F:

WHEN N = 99 AND m = 2 THEN

F = 3.90 = .05 LEVEL

F = 6.85 = .01 LEVEL

SOURCE: POPULATION DATA ARE FROM UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS.

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