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SUMMARY

This bulletin presents estimates of the annual net income from flue-cured tobacco production and the value of tobacco allotments in the "New Belt" of Eastern North Carolina from the beginning of supply control to 1962. When the prices received and net revenues per pound are converted to constant dollars, it is noted both tobacco price and net revenue have been relatively constant over time.

The important observations about net revenues and capitalized values of allotments are summarized in the following table in which the average quantities for the "New Belt" of Eastern North Carolina are expressed in constant 1957-59 dollars, but as cents per pound.

Years averaged together	Price	Net revenue	Capitalized values
		(cents per pound)	
1934-42	49.2	19.2	34.5
1943-52	64.0	25.6	63.5
1953-62	58.2	23.7	151.2

(See Tables 3 and 7 for the values for individual years.)

Capitalized values of flue-cured tobacco allotments have increased dramatically in the past 20 years while net revenues per pound have been relatively constant. Comparing averages for the decades 1943-52 and 1953-62, net revenues decreased 7 percent, while the amount people paid for the right to grow a pound of tobacco increased 138 percent. This increase in capitalized values in the face of constant net revenues implies an increase in the degree of certainty that farmer-investors have with respect to the future of the tobacco production controls.

In a society like ours, oriented by freedom to purchase into various lines of production, one expects higher rates of return to be given to those who buy risky assets. The "market rate of return" or earnings/asset price ratio gives us an index of the uncertainty in the minds of the actual investors. From 1947 to 1962 the earnings/price ratio for owners of flue-cured tobacco allotments in Eastern North Carolina fell more or less gradually from .30 to .15. In this setting, the converse

of the proposition that high rates of return imply high uncertainty is that high uncertainty implies high rates of return; and hence we conclude that it is impossible for our government to establish more confidence in a program of agricultural supply control and at the same time preserve high rates of return for investors in purchasable production rights.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The authors wish to thank Professors Dale M. Hoover and Paul R. Johnson for their helpful suggestions on an earlier draft of this manuscript. Differences of opinion remain over the description of uncertainty (which could also be considered as lags in obtaining perfect information, or differential planning horizons), but we in no way want to implicate these friends with the uncertainty discount or blame them for any other deficiencies that remain.

LIST OF TABLES

APPENDIX TABLES

FLUE-CURED TOBACCO ALLOTMENT VALUES AND UNCERTAINTY, 1934-1962

I. INTRODUCTION

Objectives

Supply controls are similar to other inputs which limit production and which represent property. Flue-cured tobacco allotments represent one type of supply control which cannot be purchased except in conjunction with the farms to which they have been assigned. Nevertheless, multiple regression provides a method of separating the value of allotments from other elements of property value which are normally bought and sold as a bundle. The main purpose of this publication is to present an objective comparison of prices paid for tobacco allotments with annual net incomes from tobacco for the years 1934 through 1962. The ratio of annual earnings to purchase price is used as an indication of uncertainty in the minds of investors. One incidental objective is to illustrate the possibility of using aggregate data, in this case the total value of farmland in counties, to estimate allotment values per pound.

Theoretical Model

The basic framework assumed here is that there are many buyers and sellers of farms and hence of tobacco allotments. In other words, the market for allotments among farmers is approximately competitive even though the total quantity of tobacco produced is limited. Purchasers of assets always face uncertainty, and the ratio of earnings

to asset prices, or percentage profit, reflects this uncertainty. High profits are associated with incurring high risks. The principle has been elaborated in a sophisticated way by Markowitz (1959) and Sharpe (1964), and empirically by Farrar (1962).

We can describe the distribution of receipts among inputs as follows: Buyers compete for the "fixed resources" like land, water and allotments. Each buyer looks to the future with imperfect expectations but offers to pay what he thinks these property rights are worth. Differences in expectations about the future account for many of the land transfers. An owner almost always has the alternative of selling his fixed resources and hiring himself out at some wage. If he uses the current market value for these assets as well as the variable inputs, he will find little special profit in this investment above that which all other investors see in it, or above what they all see in other investments of equal risk.

Like any description, this theory of asset prices is a simplification of the real world. The theory is developed from the capitalization formula for an infinite stream of riskless receipts. Annual rents, R, are connected with purchase prices of assets, P, by the interest rate, i, in a world of certainty:

$$R = iP, \quad \text{or} \quad P = \frac{R}{i}$$

When there is uncertainty, we can augment the interest rate for loans that have no risk, i, by a discounting factor for uncertainty, u, and think of expected receipts, E (R) instead of riskless annual receipts.

$$E(R) = (i + u)\ P, \quad \text{or} \quad P = \frac{E(R)}{(i + u)}$$

The rational investor would continue to buy this asset and others until the price of the asset is equal to his expected annual rent for future years, R, divided by the interest rate plus an uncertainty discount for this asset.

However, annual expected capital gains, or increments in the value of an asset, $E(\Delta P)$ represent returns also, and thus:

$$E(R) + E(\Delta P) = (i + u)\ P, \quad \text{or} \quad P = \frac{E(R) + E(\Delta P)}{(i + u)}$$

In other words expected rents, E(R), expected increments in asset value, E(ΔP), and the uncertainty factor for that asset, u, are the main factors that explain the current asset price, P. Here, P, E(ΔP), E(R), and i are used to estimate the uncertainty discount, u, from the beginning of the tobacco program to 1962.

$$u = \frac{E(R)}{P} + \frac{E(\Delta P)}{P} - i$$

Each of the elements on the right of this equation is impossible to measure without error. Hence, the estimates of the uncertainty discount are bound to include all the errors in the other estimates.

The values of tobacco allotments for each year, P, are estimated from the reported value of farmland in a multiple regression equation which is explained in footnote 1 of Section III. An extremely simple model is used for expected capital gains, E(ΔP), in which average annual gains for the period 1945-62 are assumed to be equal to expected annual gains for each year in the indefinite future. Expected annual revenues, E(R), are assumed to be equal to actual revenues in each year, R.

Hypothesis

The authors began with an hypothesis that commodity support programs such as tobacco supply control have the effect of reducing short-run uncertainty while increasing the long-run uncertainty of owning these production rights. As of 1962, the behavior of investors indicated confidence rather than uncertainty in the long-run future of their tobacco program. However, earnings/price ratios over time are not powerful enough to test this kind of hypothesis. Regulated production, or monopolies guaranteed by the state, imply less uncertainty, lower earnings, and higher asset prices at a certain level of income. To say that the state can take away what it has granted may be true, but not very revealing of the political base or the economic rationale of a particular program.

Data

The following two sections are devoted to discussions of the most readily available estimates of annual returns, R, and purchase prices, P, respectively. Annual returns are based on Crop Reporting Board estimates of yield, prices, and wages; and linear trends of labor,

variable costs, and land rents. Allotment values are based on Crop Reporting Board land values adjusted to the overall level of the U. S. Census land values for 20 counties in Eastern North Carolina. They are regression estimates based on pounds of tobacco produced in each county over the 29 years, 1934-1962. The interest rate series which is used in Section IV to estimate the net uncertainty discount factor is the Federal Land Bank rate of new agricultural loans.

II. ANNUAL VALUES OF FLUE-CURED TOBACCO ALLOTMENTS

Since 1962, farmers have been able to rent tobacco allotments to one another separate from farmland. These rental rates provide us with our most reliable index of the net value, or market price, of the right to grow tobacco. Linear programming studies also can be used to estimate net values of limiting resources, and in recent years this has been our best method of estimating annual resource values on well-managed farms. A long series of annual net revenues from the inception of the tobacco program to the present was necessary for this study and budgeting techniques were used. Average yields, prices, and wage rates were assumed to be the key factors determining annual net income per acre of tobacco. These different types of estimates will be illustrated in this section. No attempt is made to present a complete review of such estimates.

Rents Paid

For many years farmers have grown tobacco for other farmers. Share rental arrangements have been most common, but with the decline of the share-cropping system and increased emphasis on good management, cash rentals are now quite common. It is awkward for a person to rent widely separated plots, and in the early 1960's legislation was passed making it possible to rent up to 5 acres of allotment from other persons within the same county and transfer it to one's own farm. Acreage rented had to be adjusted downward if the farmer on whose land the tobacco would be grown had base yields more than 10 percent greater than those of the owner. Bordeaux (1964) studied these rental arrangements and found that the average rent paid in Pitt and Wilson counties was 17 and 18 cents per pound, respectively, in 1963. These counties are in the heart of the "New Belt" of Eastern North Carolina. Bordeaux also studied

Guilford County in the Piedmont, where wages were higher and yields lower, and found an average rental of 10 cents per pound. It was necessary to make a farm survey to obtain these estimates.[1]

Diversion Payments

At several times since the early 1930's farmers have been paid to take land out of tobacco production and either hold it idle or transfer it to some very low income use. This can not be viewed as a two-sided market for typical land, as only those people with poor land or good alternatives for their labor are likely to divert their acres. Nevertheless, it is instructive in this context to remember that these governmental rental arrangements did exist and to recall the percentage participation as well as the rent paid (see Table 1).

Table 1. Acreage reserve payments made to North Carolina flue-cured tobacco farmers to divert acres, 1956-1958

Year	Average diversion payments		Percent of allotment diverted
	Value per acre	Value per pound	
	(dollars)	(cents)	
1956	210	11.9	1.28
1957	234	15.2	5.44
1958	189	10.3	10.48

Source: North Carolina Agricultural Stabilization and Conservation Service, Annual Report, 1956, 1957 and 1958.

[1] Leases are registered in county ASCS offices but rental rates are not necessarily given. Bordeaux was careful to exclude within-family transfers. The following is a summary of his basic data.

County	Usable schedules	Value per acre (dollars)	Value per pound (cents)
Guilford	54	157	10.2
Pitt	30	297	16.7
Wilson	22	327	18.3

Linear Programming Studies

In recent years a number of linear programming studies in the various tobacco producing areas have revealed the separate marginal value products of labor, cropland, tobacco allotment and other fixed resources. For example Pasour and Toussaint (1960) found values of $454 to $579 (about 20 cents per pound) as the added income possible per added acre of tobacco allotment in the Central Coastal Plain in 1958. A Virginia programming study directed explicitly at estimating annual tobacco allotment values found values of $99 to $402 on small farms and $160 to $256 on medium-sized farms (see Gibson et al., 1962). Many of these studies have had as their objective encouraging efficient farm practices and farm planning and the results may only apply to such management systems.

Budgets

Bradford and Toussaint (1962) used budgeting techniques to estimate rental values of 12 cents a pound in the Old Belt and Middle Belts, and 16.5 cents a pound in the Eastern and Border Belts. These are remarkably close to the values encountered by Bordeaux. In the present study budgeting techniques are used to estimate annual net returns from tobacco for the period 1930-1962. These estimates are listed in Table 2. The main factors affecting allotment values were thought to be yield, price and wage rates of hired labor for the tobacco harvest. Linear trends were used to estimate the variable costs, hours of labor, and the rental value of cropland. They are described in the footnote to the table.

For the years 1931 and 1932, the net income from tobacco before subtracting rent was found to average $9 per acre. This amount was also considered the rental value of bare cropland. In 1933 the price was supported, though there was no acreage control, and the combination of higher price and yield led to much higher net returns. In 1934 acreage was restricted and the price rose appreciably from 16.4 to 29.7 cents per pound. The growers "voted out" the acreage controls in 1939. Somewhat lower prices in 1955 and 1956 were associated with high production of "slick tobacco" at a time when the industry needed more of the

Table 2. Estimation of net revenue from flue-cured tobacco in the "New Belt" of Eastern North Carolina, 1930-1962

Year	Yield[a]	Price[a]	Total revenue	Wage rate[b]	Total cost[c]	Net revenue	Net revenue
	(lbs./ac.)	(¢/lb.)	($/ac.)	(¢/hr.)	($/ac.)	($/ac.)	($/lb.)
1930	760	13.4	101.84	15.75	86.83	15.01	.020
1931	700	9.0	63.00	12.05	81.23	-18.23	-.026
1932	630	12.5	78.75	8.34	75.22	3.53	.006
1933	830	16.4	136.12	7.41	79.71	56.41	.068
1934	905	29.7	268.79	10.19	99.35	169.44	.187
1935	960	20.9	200.64	10.19	108.12	92.52	.096
1936	790	23.1	175.56	11.12	120.67	54.89	.072
1937	925	25.1	232.18	12.05	133.43	98.75	.107
1938	860	23.0	197.80	12.05	142.17	55.63	.065
1939	1,010	15.4	155.54	12.05	151.03	4.51	.004
1940	1,120	17.0	190.40	12.05	159.89	30.51	.027
1941	995	29.4	292.53	13.90	176.73	115.80	.116
1942	1,110	37.9	420.69	17.61	201.86	218.83	.197
1943	990	40.3	398.97	23.17	235.52	163.45	.165
1944	1,110	43.0	477.30	28.72	269.69	207.61	.187
1945	1,120	44.0	492.80	33.36	300.31	192.49	.172
1946	1,150	52.5	603.75	37.99	331.35	272.40	.237
1947	1,205	43.1	519.36	42.62	362.86	156.50	.130
1948	1,285	49.5	636.08	45.40	385.75	250.33	.195
1949	1,245	48.8	607.56	44.48	391.96	215.60	.173
1950	1,380	56.4	778.32	45.40	406.81	371.51	.269
1951	1,435	55.1	790.69	50.04	439.61	351.08	.244
1952	1,270	50.9	646.43	53.74	468.32	178.11	.140
1953	1,360	57.9	787.44	54.67	483.82	303.62	.223
1954	1,430	55.3	790.79	54.67	494.82	295.97	.206
1955	1,625	53.0	861.25	55.60	510.46	350.79	.220
1956	1,760	51.8	911.68	61.16	549.58	362.10	.206
1957	1,535	54.8	841.18	63.01	570.33	270.85	.176
1958	1,825	57.7	1,053.03	60.23	567.42	485.61	.266
1959	1,550	58.7	909.85	64.86	602.77	307.08	.198
1960	1,980	61.2	1,211.76	64.86	614.28	597.48	.302
1961	1,875	65.5	1,228.13	66.72	635.64	592.49	.316
1962	1,825	59.8	1,091.35	69.50	662.11	429.24	.235

Table 2 (continued)

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[a]North Carolina Department of Agriculture, Agricultural Statistics, various issues. Average yields and prices for New Belt, Type 12 tobacco.

[b]U. S. Department of Agriculture (1952-1962). Crop reporting board wage rates times .926, an adjustment factor, based on private communication with J. S. Chappell and D. D. Osburn, 1963.

[c]Variable costs and the quantity of labor per acre are based on linear trends connecting the data from these farm management studies: Greene (1936), cost data for 1932-1934; Chumney and Vermeer (1962), cost data for 1959 and labor data for 1956 and 1959; Coutu and Mangum (1960), cost data for 1959; and Hole and Vermeer (1960), labor data for 1941-1942 and 1957-1958.

Variable costs in dollars per acre are approximated by:

$$VC = 18.61 + 7.71t \quad (t = 0 \text{ in } 1930)$$

Labor in hours per acre are approximated by:

$$\text{Hours} = 376 + 4.947t \quad (t = 0 \text{ in } 1930)$$

Labor increases because yields have been increasing; see Hartman and Tolley (1961). Rent per acre of cropland without allotment is estimated from the net tobacco income of $9 per acre for the years 1930-1932. After 1933 it was assumed to increase following a linear trend to $25 per acre in 1962, which was approximately the net income from corn. The trend is:

$$\text{Rent} = 9.00 + .55t \quad (t = 1 \text{ in } 1934)$$

darker varieties. In 1957 supports were cut in half on the high-yielding, "slick" varieties and at the same time acreage allotments were cut 20 percent. Price, yield, and total revenue rose dramatically in 1958.

Net revenue per acre has increased a great deal since the 1930's but so have yields and the price level. The main analyses of section IV will be based on net revenue per pound figures listed in the final column of Table 2. However, to understand the level of price support achieved by production controls, it is well to express the net revenues per pound in constant dollars. The Index of Consumer Prices of the Department of Labor is divided into both the flue-cured tobacco prices and net revenues per pound to obtain these series in constant dollars based on the years 1957-59 (See Table 3).

At the foundation of our agricultural program is the concept of parity of farm prices with the index of prices of things farmers buy. It is evident from column 2 of Table 3 that tobacco prices in constant 1957-59 dollars generally have stayed in a range of 50-70 cents per pound centering in recent years on 55-65 cents per pound. The same is true of net incomes per pound. They have generally stayed in the range of 20-30 cents per pound in 1957-59 dollars, with the exception of the years at the end of the 1930's when the program was abandoned.

In other words, the parity concept as applied to support tobacco farmers' prices has led to almost constant net revenues per pound since 1941. Worldwide consumption of tobacco has increased a great deal and U. S. production has increased somewhat, too. Even though the farmers are selling more pounds of tobacco, yields have increased dramatically, and the number of acres devoted to tobacco has decreased. It was a foregone conclusion that high price supports would gradually take the U. S. out of the export market for tobacco. Whether this has been a net benefit or loss to the country is a question on which economists and the people at large will most likely never agree (see Johnson, 1965). The debate continues each year in arguments for and against higher prices, or more restricted production. For an historical analysis of the concept of parity prices for flue-cured tobacco see Williamson and Toussaint (1961).

Table 3. Tobacco prices and net revenues per pound in constant dollars, 1934-1962[a]

Year	Consumer Price Index (1957-59 = 100)	Flue-cured tobacco prices, 1957-59 dollars (cents/lb.)	Net revenue per pound of tobacco, 1957-59 dollars (cents/lb.)
1934	.47	63.2	39.8
1935	.48	43.5	20.0
1936	.48	48.1	15.0
1937	.50	50.2	21.4
1938	.49	46.9	13.3
1939	.48	32.1	0.8
1940	.49	34.7	5.5
1941	.51	57.6	22.7
1942	.57	66.5	34.6
1943	.60	67.2	27.5
1944	.61	70.5	30.6
1945	.63	69.8	27.3
1946	.68	77.2	34.8
1947	.78	55.2	16.2
1948	.84	58.9	23.2
1949	.83	58.8	20.8
1950	.84	67.2	32.0
1951	.91	60.5	26.8
1952	.93	54.7	15.0
1953	.93	62.2	24.0
1954	.94	58.8	21.9
1955	.93	57.0	23.6
1956	.95	54.5	21.7
1957	.98	55.9	18.8
1958	1.01	57.1	26.3
1959	1.02	57.5	19.4
1960	1.03	59.4	29.2
1961	1.04	63.0	30.4
1962	1.05	56.9	22.4

[a]Agricultural Statistics, USDA, 1946, 1958 and 1963, based on U. S. Department of Labor Index of Consumer Prices.

III. CAPITALIZED VALUES OF ALLOTMENTS

Tobacco allotments have not been salable except in conjunction with the farms to which they have been assigned. The most satisfactory method we have found for studying allotment values is to make a breakdown of land values as recorded by registered sales or census data. A study by Maier et al. (1960) of tobacco allotment values illustrated the possibilities of using multiple regression for this purpose and highlighted the difficulties to be overcome in this type of analysis. They recorded data from actual farm sales for four years, 1954-57, for three Eastern North Carolina counties: Greene, Wilson, and Pitt. This was tedious work and involved special efforts to eliminate within family transfers. They then used multiple regression techniques to obtain the values per acre listed in the first column of Table 4. Their procedure also involved judgment estimates of the values of other land, and did not explicitly include information about yields.

Table 4. A comparison of estimates of tobacco allotment values obtained from sale values of farms and county land values from the census, Greene, Pitt, and Wilson counties, North Carolina, 1954-1957

	Data source	
Year	Maier et al. recorded farm sales data	Manning, Census, and Crop Reporting Board Data
	(dollars/acre)	
1954	1290	1368
1955	1800	1807
1956	2040	2058
1957	2500	2748

Hoover (1964) showed that under the lease and transfer operations Eastern North Carolina rental values were positively correlated with yield. It might be assumed, then, that tobacco production provides a better basis for estimating allotment values than do the acres of allotment.

Using data for 20 counties, Manning (1965) estimated allotment values per pound for 1951-1963. His data included the value of farmland, pounds of tobacco production for previous years, acres of cropland, acres of other land, and acres of peanut and cotton allotments.[1] Several of these series were highly intercorrelated with one another and this led to negative coefficients. To overcome this difficulty, variables for cotton allotments and other land were deleted from the model. The resulting regression reported in Table 5 was estimated with a constant term equal to zero. Justification for the use of the zero constant term is provided in Appendix II.

Multiplying the values per pound for years 1954-1957 from Table 5 by the lagged average yields for the three counties, Greene, Wilson, and Pitt, provides a basis for comparing these results with those of Maier et al. (1960) in Table 4. The estimates are sufficiently similar so that Manning (1965) was inclined to accept this procedure, and the county land value data, as a basis for further analysis of factors affecting allotment values.

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[1]This regression model for explaining W_{ij}, the value of all farmland in county i and year j, is

$$W_{ij} = \sum_{j=51}^{62} B_{1j} X_{1ij} g_j + \sum_{k=2}^{5} (B_k X_{kij} + C_k X_{kij} t_j) + e_{ij}$$

where: X_{1ij} is the county allotment times the average yield in the previous year, or pounds of tobacco,

X_{2ij} is the county cotton allotment in acres,

X_{3ij} is the county peanut allotment in acres,

X_{4ij} is acres of cropland for the county,

X_{5ij} is acres of other land for the county,

e_{ij} is a random error,

t_j is the year, and

g_j = 1 for year j and zero otherwise.

Capital letters B and C represent population parameters and the corresponding small letters in Tables 5 and 6 represent regression estimates.

Table 5. Regression coefficients for tobacco production county land values, 1951-1963

Variables	Coefficients	t-ratios
Tobacco allotment values, $b_{1,51}$	$ .76/1b.	8.44
Tobacco allotment values, $b_{1,52}$	.86/1b.	12.29
Tobacco allotment values, $b_{1,53}$	1.27/1b.	15.88
Tobacco allotment values, $b_{1,54}$	1.05/1b.	15.00
Tobacco allotment values, $b_{1,55}$	1.22/1b.	20.33
Tobacco allotment values, $b_{1,56}$	1.19/1b.	19.83
Tobacco allotment values, $b_{1,57}$	1.51/1b.	21.57
Tobacco allotment values, $b_{1,58}$	1.90/1b.	21.11
Tobacco allotment values, $b_{1,59}$	1.64/1b.	20.50
Tobacco allotment values, $b_{1,60}$	1.95/1b.	19.50
Tobacco allotment values, $b_{1,61}$	1.52/1b.	16.80
Tobacco allotment values, $b_{1,62}$	1.75/1b.	17.50
Tobacco allotment values, $b_{1,63}$	1.86/1b.	16.91
Peanut allotment value, $b_{3,1900}$	-$2368.90/acre	3.09
Increment in peanut allot. value, c_3	53.53/acre/year	3.96
Value of cropland, $b_{4,1900}$	-$383.91/acre	2.03
Increment in value of cropland, c_4	8.19/acre/year	2.44

The same procedure was used to obtain the allotment values per pound for 1934-1950 listed in Table 6. In this period, cotton and peanut allotments did not have significant effects on total farm value. When both cropland and other land were included in the same regression, the annual incrementation coefficient for other land was negative. The regression equation listed in Table 6 was chosen over several others (see Appendix II) even though the implied changes in the cropland values between 1934 and 1950 are only from $53 to $60 per acre. Regression equations for individual years based on the aggregate value of farmland in the 20 counties are also presented in Appendix II. The individual year approach was rejected because of the instability in cropland and allotment values, instability which originates in the high correlation among the independent variables.

The form in which allotment values are presented in Tables 5 and 6 as dollars per pound in current dollars is difficult to comprehend. Again, the value of the dollar has changed dramatically since 1934. But more important, the item traded in the market in those years was acres of tobacco allotment not poundage rights. In Table 7 allotment values are multiplied by yields to obtain dollars per acre, and each series is converted to 1957-59 dollars.

In constant value dollars, the allotment value per pound more than doubled in the decade 1953-62 over the average level in the prior decade. Recall that net revenue per pound of tobacco fell slightly between the same decades. The comparison for the three decades is as follows:

Years averaged together	Net revenue per pound of tobacco, 1957-59 dollars		Capitalized value per pound of tobacco, 1957-59 dollars	
	Average	Range	Average	Range
1934-42	$.192/lb.	(.008-.398)	$.345/lb.	(.106-.600)
1943-52	$.256/lb.	(.150-.348)	$.635/lb.	(.250-.950)
1953-62	$.237/lb.	(.188-.310)	$1.512/lb.	(1.116-1.892)

Table 6. Regression coefficients for tobacco production and cropland as factors explaining county land values, 1934-1950

Variables	Coefficients	t-ratios
Tobacco allotment values, $b_{1,34}$	$.050/lb.	1.24
Tobacco allotment values, $b_{1,35}$	.100/lb.	2.99
Tobacco allotment values, $b_{1,36}$	.101/lb.	3.35
Tobacco allotment values, $b_{1,37}$	.217/lb.	5.88
Tobacco allotment values, $b_{1,38}$	.294/lb.	7.52
Tobacco allotment values, $b_{1,39}$	.196/lb.	4.91
Tobacco allotment values, $b_{1,40}$	.238/lb.	6.12
Tobacco allotment values, $b_{1,41}$	.155/lb.	4.47
Tobacco allotment values, $b_{1,42}$	.201/lb	5.69
Tobacco allotment values, $b_{1,43}$	.150/lb.	4.90
Tobacco allotment values, $b_{1,44}$	.215/lb.	7.32
Tobacco allotment values, $b_{1,45}$	.250/lb.	9.44
Tobacco allotment values, $b_{1,46}$	.334/lb.	13.48
Tobacco allotment values, $b_{1,47}$	.430/lb.	17.24
Tobacco allotment values, $b_{1,48}$	.654/lb.	18.08
Tobacco allotment values, $b_{1,49}$	.681/lb.	19.54
Tobacco allotment values, $b_{1,50}$	.798/lb.	21.88
Value of cropland, $b_{4,\ 1900}$	42.16/acre	1.62
Increment in value of cropland, c_4	.354/acre/year	.57

Table 7. Capitalized values of tobacco allotments per pound and per acre in current and constant dollars, 1934-1962

Year	Capitalized value per pound		Capitalized value per acre	
	Current dollars	1957-59 dollars[a]	Current dollars[b]	1957-59 dollars[a]
1934	.050	.106	42	89
1935	.100	.208	90	187
1936	.101	.210	97	202
1937	.217	.434	165	330
1938	.294	.600	272	555
1939	.196	.408	168	350
1940	.238	.486	240	489
1941	.155	.304	174	341
1942	.201	.352	200	351
1943	.150	.250	166	277
1944	.215	.352	213	349
1945	.250	.397	278	441
1946	.334	.491	374	550
1947	.430	.551	494	633
1948	.654	.778	788	938
1949	.681	.821	875	1054
1950	.798	.950	993	1182
1951	.76	.834	1049	1152
1952	.86	.924	1234	1326
1953	1.27	1.365	1613	1734
1954	1.05	1.116	1428	1518
1955	1.22	1.312	1745	1876
1956	1.19	1.252	1934	2034
1957	1.51	1.540	2658	2711
1958	1.90	1.881	2916	2887
1959	1.64	1.607	2993	2933
1960	1.95	1.892	3022	2934
1961	1.52	1.490	3009	2949
1962	1.75	1.666	3281	3123

[a]The Consumers Price Index from Table 3 was divided into the current values to obtain values in 1957-59 dollars.

[b]Values per acre are the values per pound in column 1 multiplied by average yields from the previous year from Table 2.

From the first decade of the program to the most recent decade net revenues have increased 27 percent while the capitalized values of allotments have increased 340 percent. It is clear that confidence in the future of the tobacco program has gradually increased.

IV. RELATIONSHIP OF ANNUAL VALUES OF CAPITALIZED VALUES OF ALLOTMENTS

The conclusions from Section II that tobacco net revenues per pound have been very stable during the past 30 years suggest that farmers might gradually have gained confidence in the support program. The increase in capitalized values observed in Section III, coupled with the observation of stable net revenues, also suggests increased confidence in the program. This section will quantify this increased confidence in terms of the earnings/price ratios and discounts for uncertainty.

The ratio of annual earnings to capitalized values is expressed in column 3 of Table 8. From 1934 to 1947 the ratio was quite unstable, varying from 0.02 to 3.74. The average ratio of .61 for the 13 years including 1935 and 1947 might be used to represent this period if one remembers the large variance. From 1947 to 1962 the earnings/price ratio fell more or less gradually from a level of .30 to .15. This implies considerable reduction in uncertainty.

However, asset prices depend on expected future earnings, expected capital gains, the interest rate, and lastly on the uncertainty associated with earnings and capital gains. As was pointed out in the discussion of the theoretical model in Section I, an uncertainty discount rate can be calculated as:

$$u = \frac{E(R)}{P} + \frac{E(\Delta P)}{P} - i$$

where u is understood to include all the errors in measurement of other factors.

For example, an asset might have an expected annual "growth" in price equal to 5 percent, and the interest rate on riskless assets might also be 5 percent. If such an asset has zero expected earnings, we would say that it has a zero discount rate for uncertainty. Another asset with earnings equal to 25 percent of the asset price might have

zero growth. Allowing 5 percent for riskless interest, we would say that the risk discount of this asset is 20 percent. Still another asset may have an earnings/price ratio of 5 percent and a growth/price ratio of 10 percent. Subtracting from these gross earnings of 15 percent the same 5 percent for interest, we are left with an uncertainty discount rate of 10 percent. As was stressed above, this is a very simple theoretical model, but it is also quite useful.

In the application of this model to derive an uncertainty discount for our time series data, we assumed that annual net revenues, R, were equal to expected net revenues for the indefinite future, and hence the earnings/price ratio serves as the first term, $\frac{E(R)}{P}$, of our equation for the uncertainty discount. We tried two different assumptions about expected capital gains on growth. First, we observed that the capitalized values listed in column 1 of Table 8 were quite stable before 1945 and that they increased more or less steadily from 25 cents per pound in 1945 to $1.75 in 1962. This is equal to an average increment of 8.8 cents per year. We assumed that this actual annual increment was equal to the expected annual change in asset price from 1945 on. The ratios of these expected annual capital gains to asset prices are presented in column 4 of Table 8. The other method used to calculate expected capital gains was to take the difference between the current price and the average of the two previous years.

$$E(\Delta P_t) = P_t - \frac{(P_{t-1} + P_{t-2})}{2}$$

Use of this method did not affect the basic conclusions and only made the estimates of u more erratic. Thus the first, and simpler, of the two expectations models was chosen for illustrative purposes in Table 8.

It was also necessary to assume a "riskless" interest rate. For this purpose the rate of new agricultural loans of the Federal Land Bank was used. These interest rates are listed in column 5 of Table 8.

The net discount for uncertainty is, then, the sum of the "expected" earnings/price ratio (column 3), and the growth/price ratio (column 4), minus the interest rate (column 5). These uncertainty discounts are presented in the final column of Table 8. From a value of .40 in 1947-49 this uncertainty discount fell to a level of .16 in 1960-62. Hence, we have the same conclusion which was arrived at from simply looking

Table 8. Capitalized values, net revenues, earnings/price ratios and uncertainty discounts for rights to produce a pound of tobacco, 1934-1962

Year	Capitalized values P	Net revenues R	Earnings/ price ratio $\frac{R}{P}$	Growth/ price ratio $\frac{E(\Delta P)}{P}$	Interest rate on new agr. loans i	Uncertainty discount $u=\frac{E(R)}{P}+\frac{E(\Delta P)}{P}-i$
1934	.050	.187	3.74	.00	.05	3.69
1935	.100	.096	.96	.00	.04	.92
1936	.101	.072	.71	.00	.04	.67
1937	.217	.107	.49	.00	.04	.45
1938	.294	.065	.22	.00	.04	.18
1939	.196	.004	.02	.00	.04	.02
1940	.238	.027	.11	.00	.04	.07
1941	.155	.116	.75	.00	.04	.71
1942	.201	.197	.98	.00	.04	.94
1943	.150	.165	1.10	.00	.04	1.06
1944	.215	.187	.87	.00	.04	.83
1945	.250	.172	.69	.35	.04	1.00
1946	.334	.237	.71	.26	.04	.93
1947	.430	.130	.30	.20	.04	.47
1948	.654	.195	.30	.20	.04	.39
1949	.680	.173	.25	.13	.04	.34
1950	.798	.269	.34	.11	.04	.42
1951	.76	.244	.32	.11	.04	.40
1952	.86	.140	.16	.10	.04	.22
1953	1.27	.223	.18	.07	.04	.20
1954	1.05	.206	.20	.08	.04	.24
1955	1.22	.220	.18	.07	.04	.21
1956	1.19	.206	.17	.07	.04	.21
1957	1.51	.176	.12	.06	.05	.12
1958	1.90	.266	.14	.05	.05	.14
1959	1.64	.198	.12	.05	.06	.11
1960	1.95	.302	.16	.05	.06	.14
1961	1.52	.316	.21	.06	.06	.21
1962	1.75	.235	.13	.05	.06	.12

at the earnings and price series and the earnings/price ratio. The uncertainty about the program in the minds of farmer-investors declined a great deal between World War II and 1962.

This has not been a very critical or useful application of the idea of a net uncertainty discount. This concept would contribute more where expected revenue is different than the actual revenue, and where the expected capital gains are relatively greater and more subject to measurement. More thought needs to be given to the aggregation of individual uncertainty coefficients for assets that make up a package or portfolio such as a farm. It may also be useful to consider separate uncertainty discounts and portions of prices that pertain to income and to capital gains.

V. CONCLUSIONS

The prices that farmer-investors have been paying for tobacco allotments since World War II indicate gradually increasing confidence in the continued future of this support program. One consequence of greater certainty is a lower return on investments in tobacco allotments. The price of allotments has been rising steadily while net revenue per pound was almost constant.

It is not possible to conclude from this analysis that there is long-run political certainty connected with the future of the tobacco program. Sophisticated political analysis is needed to make predictions about whether and when agricultural programs, such as that for tobacco, are in danger.

There is now a tendency within our democracy to compensate property owners for losses they incur due to program changes. With growing awareness of the property values involved in production controls, we can expect more and more sympathy for members of younger generations who have borrowed money to buy allotments at high prices. Hence, there may be progressively more certainty and protection against losses due to program changes.

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APPENDIX I
DATA AND SOURCES

The value of farmland and buildings by counties was obtained from the U. S. Censuses of Agriculture. Interpolations for intervening years were made using unpublished U. S. Crop Reporting Service estimated values of land with improvements for the relevant districts of North Carolina. These data were made available by W. H. Scofield of the Economic Research Service, U. S. Department of Agriculture, Washington.

The interpolated values were the district values relevant for the county, adjusted up or down according to the relationship between the district and county values in the adjacent census years. The differences between census year values for county and district were weighted so as to reflect the proximity of the year of interest to the census year before and after it. Adopting the following symobolism:

V_{ij} = Census land value for county i in year j;

B_{ij} = District land value relevant to county i in year j;

$r \leq s$; $s \leq t$; r, t are adjacent census years;

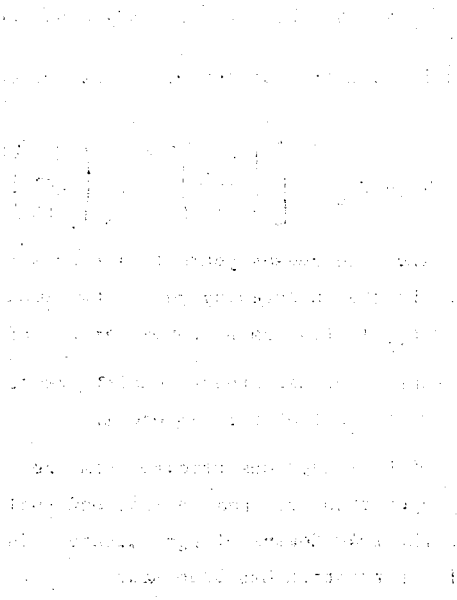
the interpolated value of land and buildings for county i in year s is found as W_{is}.

$$W_{is} = B_{is} \left[\left(\frac{V_{ir}}{B_{ir}} \right)^{t-s} \cdot \left(\frac{V_{it}}{B_{it}} \right)^{s-r} \right]^{\frac{1}{t-r}}$$

As can be seen, in census years (s = t or s = r) the census values result. In the intervening years, the impact of the difference between V_{ir} and B_{ir} is less as s approaches t, while the impact of the difference in year t becomes proportionally greater. The census values, V_{ij}, are given in Table 1 of this appendix.

The value of buildings was removed from the total values in accordance with the proportion of land to land and building values given for each county in the 1940 Census of Agriculture. This is the latest year for which such a separation has been made.

Tobacco and peanut allotments and tobacco yields were obtained from North Carolina Annual Reports of the Production and Marketing Admimistration and the Agricultural Stabilization and Conservation Service. County cropland areas and total farmland were obtained from the annual North Carolina agricultural censuses reported in North Carolina Farm Report and North Carolina Agricultural Statistics.



Appendix Table 1. Census year values per acre for land and buildings, in dollars

County	C.R.S. District	Years						
		1930	1935	1940	1945	1950	1954	1959
Beaufort	6	52	36	42	47	90	122	183
Bertie	3	41	29	31	51	89	121	205
Carteret	6	47	27	29	49	77	91	194
Craven	6	45	30	36	48	88	147	196
Duplin	9	40	27	35	50	80	120	218
Edgecombe	3	55	36	52	75	128	179	254
Greene	6	74	53	79	92	198	327	432
Hertford	3	46	38	39	58	96	107	192
Johnston	6	62	40	55	72	137	193	258
Jones	6	33	22	38	41	75	113	199
Lenoir	6	69	46	60	83	160	242	368
Martin	3	46	34	46	68	116	190	256
Nash	3	65	42	55	74	144	193	269
Onslow	9	30	20	27	38	72	114	183
Pamlico	6	38	35	31	35	71	82	127
Pender	9	29	18	30	38	69	83	168
Pitt	6	78	52	71	84	198	288	448
Sampson	9	41	30	37	55	87	171	205
Wayne	6	72	51	59	73	129	217	303
Wilson	6	86	60	80	101	238	307	406

APPENDIX II
SELECTED LAND VALUE REGRESSION EQUATIONS FOR 1934-1950

Table 6 in Section III presents the regression results for the equation that was finally selected to describe allotment values for 1934-50. Equations finally selected are always compromises -- with more trials they can usually be improved, but the research worker has limited time. Our objectives in presenting this section are to reveal our process of selecting the equation in Table 6 of the text, and to mention some improvements upon it that future research workers might logically keep in mind.

In Appendix Table 2 the coefficients for six regression equations are listed in the order in which they were computed. The dependent variable was county land values for the years 1931-1950 and for the 20 Eastern North Carolina counties. Independent variables were: tobacco production of the previous year, yielding a coefficient that estimates the value of allotments per pound; and cultivated and other land acres, yielding value estimates for 1900 and linear trends of the annual increments of cultivated and other land values. The coefficients for allotment values are quite similar for the six regression models tried and listed in Appendix Table 2. The pattern of t-ratios indicated in Table 6 of the text is typical of the other equations as well. Many of the coefficients for cultivated and other land were not significant, and many were negative when positive coefficients would be expected for this period.

The first and final regression equations listed in Appendix Table 2 are based on data from 1934-1950, while the others are for 1931-1950. The shorter period is more appropriate if a linear trend is used for the value of cultivated land. This is because land values fell sharply between 1930 and 1940 and then rose slowly until the postwar period. A quadratic or other curvilinear trend would be more appropriate when the longer series of years is used. A longer series of years should be preferred in order to establish land values independent of tobacco allotment values.

The first three regressions all have negative trend values for the non-cultivated land. These terms are deleted in equations 4 and 5 but still negative trends for cultivated land appear. This occurs because

the series starts in 1931 when land values were still quite high. The sixth equation is based on the shorter period and only includes cultivated acres. A slightly positive coefficient, $.35 per acre, results for the annual increment of the value of cultivated land.

It is difficult to justify including constant terms in these regression equations for land value. The twenty counties used in these regressions varied considerably in size and land values. Yet, the constant term represents a kind of intrinsic value of the farmland regardless of county size and tobacco production. Thus, it was considered desirable to leave the constant term out as was done in regression equation 6, the equation upon which earlier parts of this study were based.

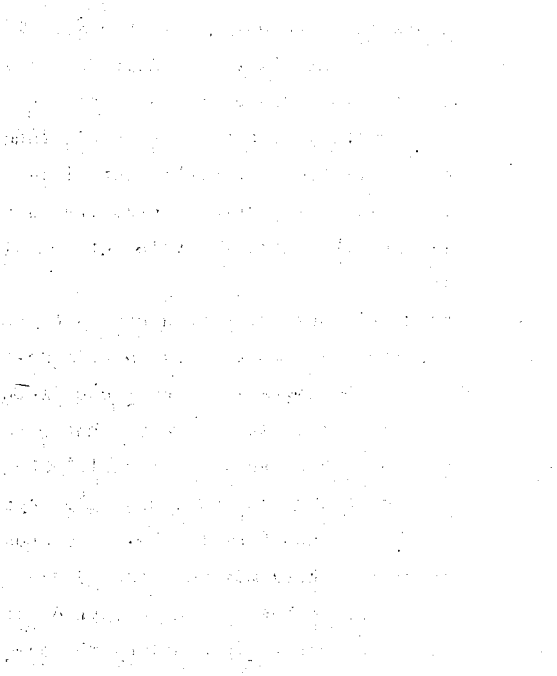
Some people may object that there is no more basis for using a trend for land values and letting tobacco allotment values take on annual values than there is for the opposite. This is true in a sense, but we wanted to allow small differences due to allotment and yield changes to affect our estimates of tobacco allotment values. An alternative, given the 20-county observations for each year, is to fit individual regression equations for each year. This was done for two models and the results are listed in Appendix Table 3.

The first model includes a constant term and coefficients for tobacco poundage, cultivated acres, and other land. Because these three independent variables are highly correlated with one another, their coefficients and the constant terms are quite unstable from one year to the next and the indicated value of noncultivated land is usually negative.

The second model does not have a constant term and only includes the cultivated acres. Values of tobacco allotments indicated here are similar to those in the regression equations listed in Appendix Table 2, but they are more erratic. In the years that allotment values are relatively high, the indicated value of cultivated land is relatively low and vice versa. For these reasons the single regression equation approach represented by Tables 5 and 6 of the text was chosen.

Future research workers may note that individual regressions for years provide clues as to the desirable form of an overall single regression. If we had carefully examined the above separate regression

equations before fitting the multiple regression equations listed in Appendix Table 2, we perhaps would have ignored the constant terms and the "other land" variables and at the same time introduced both a linear and a quadratic term for cultivated land. Whenever cross-sectional and yearly data are combined in one equation, it may be well to consider individual yearly or sectional regressions as a means of better understanding or "previewing" one's data.



Appendix Table 2. Alternative multiple regression equations used in the process of selecting a model to explain county land values, 1931-1950, 20 Eastern North Carolina counties

Meaning of coefficients	1934-50 data	1931-1950 data				1934-50 data
	1	2	3	4	5	6
Allotment values, $/lb., 1934	.091	.038	.040	.034	.029	.050
Allotment values, $/lb., 1935	.125	.086	.088	.087	.084	.100
Allotment values, $/lb., 1936	.125	.092	.094	.093	.089	.101
Allotment values, $/lb., 1937	.239	.205	.208	.207	.204	.217
Allotment values, $/lb., 1938	.323	.291	.297	.292	.283	.294
Allotment values, $/lb., 1939	.222	.197	.213	.197	.189	.196
Allotment values, $/lb., 1940	.256	.240	.254	.243	.234	.238
Allotment values, $/lb., 1941	.165	.159	.175	.165	.155	.155
Allotment values, $/lb., 1942	.203	.207	.228	.216	.205	.201
Allotment values, $/lb., 1943	.145	.157	.176	.168	.157	.150
Allotment values, $/lb., 1944	.203	.221	.240	.234	.224	.215
Allotment values, $/lb., 1945	.235	.257	.275	.270	.261	.250
Allotment values, $/lb., 1946	.316	.340	.358	.354	.346	.334
Allotment values, $/lb., 1947	.407	.437	.454	.452	.444	.430
Allotment values, $/lb., 1948	.614	.663	.689	.687	.675	.654
Allotment values, $/lb., 1949	.637	.690	.715	.715	.703	.681
Allotment values, $/lb., 1950	.754	.809	.833	.832	.822	.798
Constant terms, $/county	1,361,500	1,111,100	-	1,236,700	-	-
Value of cultivated land, $/acre, 1900	-92.139	- 6.265[a]	21.931[a]	53.375	64.158	42.164
Increment, $/acre/year after 1900	3.391	1.325	.608[a]	-.198[a]	-.183[a]	.354[a]
Value of other land, $/acre, 1900	54.289	33.512	25.817	-	-	-
Increment, $/acre/year after 1900	-1.371	-.833	-.510	-	-	-
Coefficient of determination, R^2	.948	.944	.942	.943	.937	.940

[a]Indicates a t-ratio for the individual coefficient less than $|1|$.

Appendix Table 3. Individual regression equations for the years 1934-1950 for the total value of farmland in 20 Eastern North Carolina counties

Year	Variables	Results of three-variable regressions with constant terms		Results of two-variable regressions without constant terms	
		Coefficients	t-ratios	Coefficients	t-ratios
1934:					
	R^2	.89	-	.74	-
	Constant term	-183,620.00	-	0.00	-
	Allotment pounds	.12	3.47	.06	1.28
	Cultivated acres	22.21	2.57	52.44	6.72
	Other land acres	12.57	3.47	-	-
1935:	R^2	.89	-	.78	-
	Constant term	843,380.00	-	.00	-
	Allotment pounds	.12	3.28	.09	2.01
	Cultivated acres	32.37	3.55	56.80	6.68
	Other land acres	6.34	2.04	-	-
1936:	R^2	.92	-	.76	-
	Constant term	688,560.00	-	.00	-
	Allotment pounds	.10	3.23	.06	1.40
	Cultivated acres	34.23	4.37	63.04	7.10
	Other land acres	8.64	3.06	-	-
1937:	R^2	.88	-	.76	-
	Constant term	1,358,500.00	-	.00	-
	Allotment pounds	.18	3.24	.14	1.95
	Cultivated acres	38.83	3.55	68.42	6.10
	Other land acres	6.40	1.71	-	-
1938:	R^2	.86	-	.78	-
	Constant term	2,428,700.00	-	.00	-
	Allotment pounds	.30	3.40	.28	2.92
	Cultivated acres	33.67	2.21	58.32	4.46
	Other land acres	1.22	.20	-	-
1939:	R^2	.97	-	.96	-
	Constant term	986,620.00	-	.00	-
	Allotment pounds	.19	4.20	.24	5.40
	Cultivated acres	64.69	6.75	50.38	8.79
	Other land acres	-11.70	-2.30	-	-
1940:	R^2	.96	-	.96	-
	Constant term	1,062,000.00	-	.00	-
	Allotment pounds	.31	5.59	.33	6.75
	Cultivated acres	44.22	3.75	44.13	6.95
	Other land acres	-4.53	-.83	-	-

Appendix Table 3 (continued)

Year	Variables	Results of three-variable regressions with constant terms		Results of two-variable regressions without constant terms	
		Coefficients	t-ratios	Coefficients	t-ratios
1941:	R^2	.95	-	.94	-
	Constant term	1,008,000.00	-	.00	-
	Allotment pounds	.22	3.73	.26	5.43
	Cultivated acres	51.07	3.60	41.34	6.09
	Other land acres	-8.70	-1.29	-	-
1942:	R^2	.95	-	.94	-
	Constant term	1,448,600.00	-	.00	-
	Allotment pounds	.21	3.55	.28	5.44
	Cultivated acres	61.54	4.31	46.13	6.56
	Other land acres	-13.65	-1.79	-	-
1943:	R^2	.93	-	.93	-
	Constant term	711,380.00	-	.00	-
	Allotment pounds	.22	3.72	.22	4.56
	Cultivated acres	41.26	2.69	45.08	5.72
	Other land acres	-1.23	-.16	-	-
1944:	R^2	.96	-	.95	-
	Constant term	541,660.00	-	.00	-
	Allotment pounds	.18	3.59	.18	4.48
	Cultivated acres	63.10	4.46	63.62	9.08
	Other land acres	-2.09	-.26	-	-
1945:	R^2	.96	-	.96	-
	Constant term	596,770.00	-	.00	-
	Allotment pounds	.23	4.21	.22	5.07
	Cultivated acres	56.84	3.06	63.75	7.23
	Other land acres	.54	.06	-	-
1946:	R^2	.93	-	.92	-
	Constant term	2,272,600.00	-	.00	-
	Allotment pounds	.26	3.47	.30	4.52
	Cultivated acres	84.12	3.00	65.66	4.36
	Other land acres	-19.96	-1.38	-	-
1947:	R^2	.91	-	.89	-
	Constant term	2,616,100.00	-	.00	-
	Allotment pounds	.35	3.47	.35	4.28
	Cultivated acres	78.84	1.79	77.49	3.97
	Other land acres	-14.91	-.67	-	-

Appendix Table 3 (continued)

Year	Variables	Results of three-variable regressions with constant terms		Results of two-variable regressions without constant terms	
		Coefficients	t-ratios	Coefficients	t-ratios
1948:	R^2	.93	-	.92	-
	Constant term	2,567,700.00	-	.00	-
	Allotment pounds	.60	3.98	.66	5.42
	Cultivated acres	78.85	1.78	56.94	2.69
	Other land acres	-22.80	-1.04	-	-
1949:	R^2	.91	-	.90	-
	Constant term	2,267,300.00	-	.00	-
	Allotment pounds	.57	3.34	.62	4.68
	Cultivated acres	83.70	1.54	71.98	2.90
	Other land acres	-15.29	-.54	-	-
1950:	R^2	.94	-	.94	-
	Constant term	2,151,000.00	-	.00	-
	Allotment pounds	.86	5.67	.87	7.64
	Cultivated acres	39.68	.76	44.76	2.04
	Other land acres	6.47	-.23	-	-

Agricultural Experiment Station

North Carolina State University
at Raleigh

R. L. Lovvorn, Director of Research

Bulletins of this station will be sent free to all citizens of the state who request them.