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DYNAMICS OF THE U.S. TOBACCO ECONOMY
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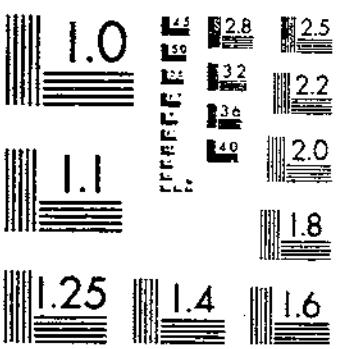
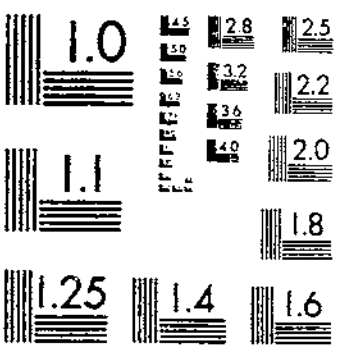
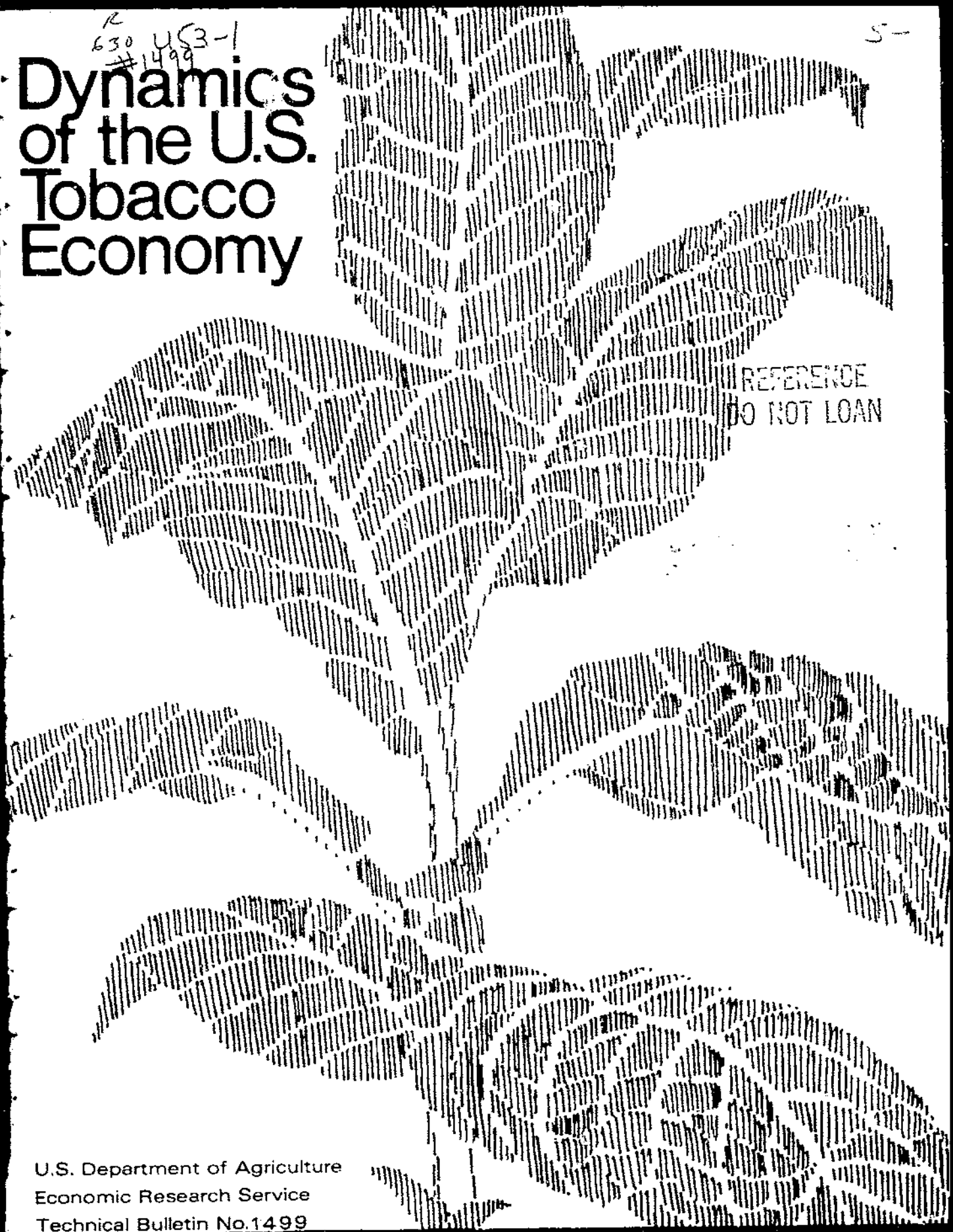


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Dynamics of the U.S. Tobacco Economy



U.S. Department of Agriculture
Economic Research Service
Technical Bulletin No.1499

ABSTRACT

A 14-equation recursive model is developed for (1) flue-cured acreage, (2) burley acreage, (3) flue-cured leaf price, (4) burley leaf price, (5) cigarette price linkage, and (6) consumer demand for cigarettes. These behavioral equations are tied together into a system by a set of identities encompassing certain technical and marketing characteristics of the tobacco economy. The coefficients of the behavioral equations are estimated using time-series data for 1954-72. The methods of principal components regression and mixed estimation are used to overcome multicollinearity. The reduced form of the system is derived and the impact multipliers are calculated. The multipliers are used to illustrate the effects of (1) a 6.5-cent-per-pound increase in the support rate for flue-cured tobacco, (2) a 30-million-pound increase in the quota for burley, and (3) a 1-cent-per-pack increase in Federal and State cigarette taxes.

Key Words: Flue-cured, burley, recursive model, multipliers.

FOREWORD

In the late 1960's, we became concerned over the nature of impending human resource adjustments in the flue-cured tobacco region. This concern led to a study in 1969 by the Economic Research Service which outlined the complex nature of the problem and recommended additional research to determine the magnitude and specific characteristics of the problem. In 1972 we began a research program addressing human resource adjustment problems expected to accompany changes in the flue-cured tobacco industry. This included analyses of anticipated changes in the production, marketing, and processing segments of the industry, and an analysis of alternative rural development strategies that might be used to abate any adverse effects of the expected adjustments on rural people and their communities.

This study is one of a series of interdependent analyses that are part of this research program. The studies are being conducted by the Economic Research Service, North Carolina State University, and the U.S. Department of Labor. As an integrated cooperative effort it provides for a comprehensive analysis of the many facets of the problem and permits a much more efficient use of research resources. It is anticipated that upon completion of the analyses, sufficient knowledge will be available to evaluate alternative development strategies for the flue-cured tobacco region. The research is unique in that its main objective is to provide a knowledge base for guiding policy and program decisions on emerging adjustments rather than addressing postadjustment problems.

Quentin M. West
Administrator
Economic Research Service

CONTENTS

Washington, D. C. 20250 August 1974

SUMMARY

To analyze the impact of potential policy and technological changes, an econometric model of the U.S. tobacco economy has been constructed. This model takes into account current trends in production, processing, and consumption of tobacco and cigarettes. It also reflects the strong impact of allotments in influencing acreage, and of price support level in maintaining a floor under auction market prices. Effects of three potential policy changes are analyzed:

(1) A possible 6.5-cent-per-pound rise in the support rate for flue-cured tobacco is estimated to lead to an increase of 8.3 cents per pound in the auction market price of flue-cured tobacco. The higher price of tobacco is expected to be reflected in a rise of 0.38 percentage point in the real consumer price index of tobacco products, a decline of 13 cigarettes in per capita cigarette use, a decrease of 1.82 million pounds in use of flue-cured tobacco in cigarette manufacturing, and a drop of 1.74 billion cigarettes in cigarette production.

(2) A possible increase in burley quota of 30 million pounds is estimated to lead to an increase in burley acreage of 12,760 acres, an increase in leaf production of 31.12 million pounds, and a rise in yearend inventory of 31.04 million pounds.

(3) A possible 1-cent-per-pack increase in Federal and State cigarette taxes is expected to lead to an increase of 2.19 points in the real consumer price index of tobacco products, a decline in per capita cigarette consumption of 72 cigarettes, and a decrease in cigarette production of 9.95 billion cigarettes.

DYNAMICS OF THE U.S. TOBACCO ECONOMY

by

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INTRODUCTION

Public concern about the effects of smoking on health, and changes in cigarette advertising policy are critical factors which may modify the demand for tobacco products. Although total demand for cigarettes is rising, the rate of increase has slowed down. Tobacco production, distribution, and manufacturing processes are faced with several potential technological innovations. (See (29) for an excellent discussion of these factors in the flue-cured industry.)1/ The cultivation of flue-cured tobacco is being mechanized. Tobacco substitutes are being considered for use in cigarette manufacturing. These factors, combined with government policy programs aimed at controlling the supply and supporting the price of certain types of tobacco, are the major features of the dynamics of U.S. tobacco markets.

Flue-cured and burley tobacco account for 90 percent of total tobacco production in the United States. These two types of tobacco, along with small quantities of Maryland and imported oriental types, are used in the manufacture of cigarettes. Flue-cured tobacco is grown mainly in Virginia, North Carolina, South Carolina, Georgia, and Florida. Burley is produced principally in Kentucky, Tennessee, Ohio, Indiana, West Virginia, Virginia, North Carolina, and Missouri. After harvesting, the tobacco is cured, a process which involves drying by the application of regulated heat for flue-cured and by circulation of air for burley. The cured tobacco is moved to the auction market for sale. There it is purchased by representatives of manufacturers or dealers, or if it is eligible for price support and the bid is not high enough, it is taken by a cooperative association. In either case it is put into storage after redrying and/or stemming. Tobacco is aged before it is used to manufacture cigarettes and other products.2/ How tobacco moves from farm to retail outlets is shown in the industry flow chart in figure 1.

Marketing quotas and price supports are the two main features of government policy regulating tobacco supply. A national marketing quota for each

1/ Underlined numbers in parentheses refer to the Literature Cited, p.33 .
2/ For a discussion of the various phases of the tobacco economy--cultivation, harvesting, curing, marketing, storage, and manufacturing--see (28).

type of tobacco is proclaimed for 3 years, and the quota for each year is announced annually. Acreage allotments are used to implement the marketing quota for flue-cured tobacco. The burley program is now entirely on a poundage quota. These quotas have to be approved by the producers in a referendum every 3 years. A national quota is proclaimed if the total supply exceeds the reserve supply. The reserve supply is the normal supply plus 5 percent to meet domestic and foreign demand in years of drought, flood, and other adverse conditions. Normal supply is the normal year's domestic consumption and exports (average domestic consumption and exports for the last 10 marketing years adjusted for trends) plus 175 percent of a normal year's domestic consumption and 65 percent of a normal year's export as an allowance for a normal carryover.

For those years in which the marketing quota has not been disapproved by the producers, the support level is determined by adjusting the 1959 support price upward or downward in proportion to a change in a 3-year moving average of the parity index. If the marketing quota is disapproved by the producers, no price support is available for that year. Both quotas and price support were effective for flue-cured and burley tobacco during the period 1954-72 studied here.

An econometric model of the U.S. tobacco economy has been constructed in order to study the effects of potential policy and technological changes. The model includes six behavioral equations: (1) flue-cured acreage, (2) burley acreage, (3) flue-cured leaf price, (4) burley leaf price, (5) cigarette price linkage, and (6) consumer demand for cigarettes. These behavioral equations are tied into the system by a set of identities describing certain technical and marketing characteristics of the tobacco economy. This is a recursive model based on annual data and will be useful in studying structural changes in the tobacco economy.3/

THE MARKET AND THE MODEL

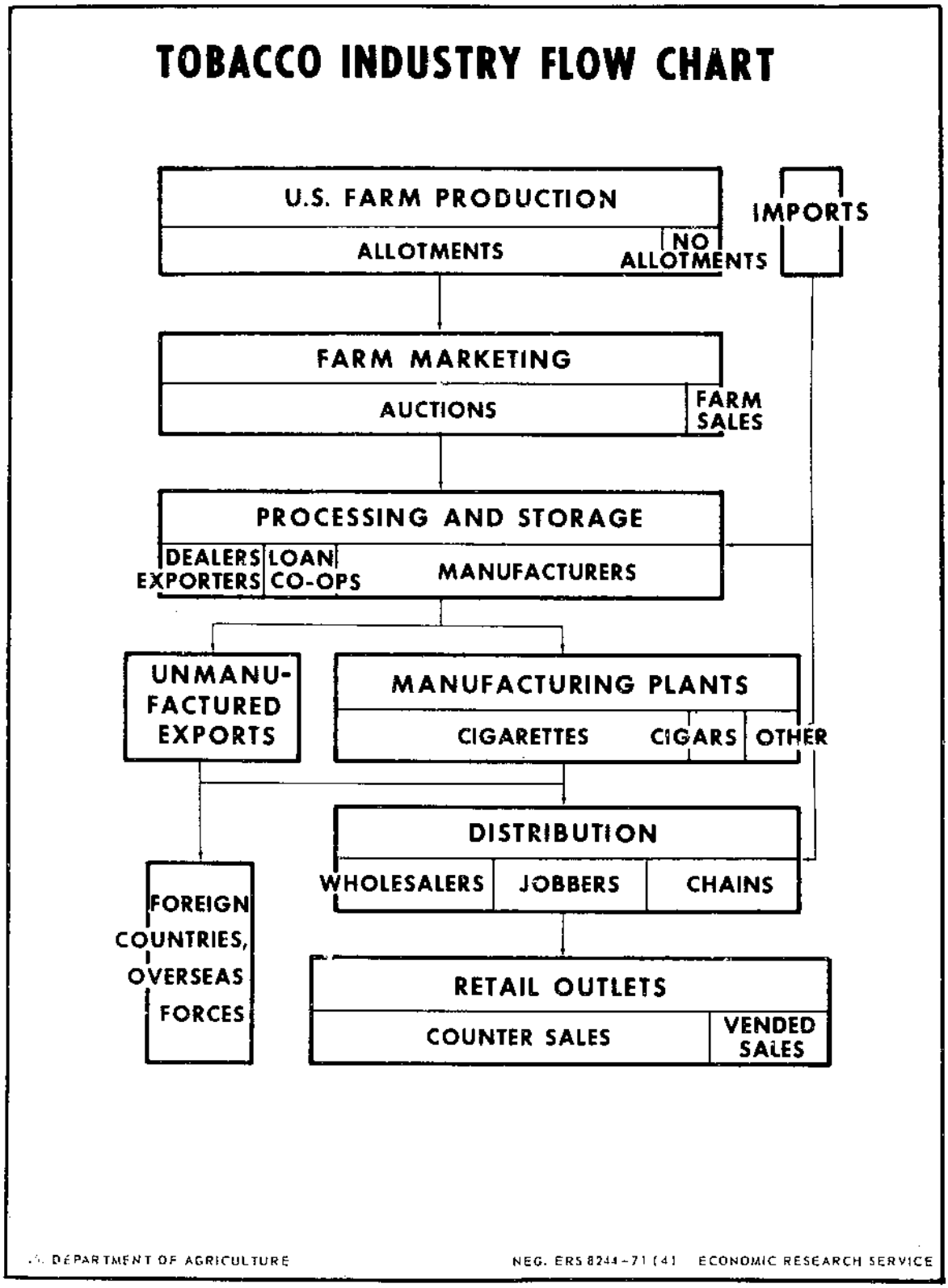
The important features of the tobacco market are: (1) the joint input of flue-cured and burley tobacco for the manufacture of cigarettes, (2) the multiple sources of demand (domestic and foreign) for tobacco and cigarettes, and (3) the derived nature of demand for tobacco originating from tobacco products, particularly cigarettes.

Flue-cured and burley tobacco are used, along with Maryland tobacco and some imported oriental tobacco, in the manufacture of cigarettes. The various types of tobacco are blended to give the cigarettes the desired amount of flavor and smoking properties. The ratio of flue-cured to burley per 1,000 cigarettes declined from 1.65 in 1954-56 to 1.35 in 1969-71.

The newly produced tobacco, after being sold in the auction warehouses, goes into storage for aging. The current demand is met from old stocks. The multiple outlets for tobacco demand are cigarette manufacturing, other tobacco products, and exports. Similarly, the demand for cigarettes is for domestic consumption or for export.

A simplified model of the flue-cured and cigarette markets is shown in figure 2. (The figure can be applied equally well to the burley market).

3/ For a discussion of the problem of seasonality, see Braden (2).


TOBACCO INDUSTRY FLOW CHART
U.S. FARM PRODUCTION
ALLOTMENTS
NO ALLOTMENTS
IMPORTS
FARM MARKETING
AUCTIONS
FARM SALES
PROCESSING AND STORAGE
DEALERS EXPORTERS
LOAN CO-OPS
MANUFACTURERS
UNMANU-FACTURED EXPORTS
MANUFACTURING PLANTS
CIGARETTES
CIGARS
OTHER
DISTRIBUTION
WHOLESALERS
JOBBERS
CHAINS
FOREIGN COUNTRIES, OVERSEAS FORCES
RETAIL OUTLETS
COUNTER SALES
VENDED SALES
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NEG. ERS 8244-71 (4) ECONOMIC RESEARCH SERVICE

Figure 1

A SIMPLIFIED MODEL OF FLUE-CURED TOBACCO AND CIGARETTE MARKETS

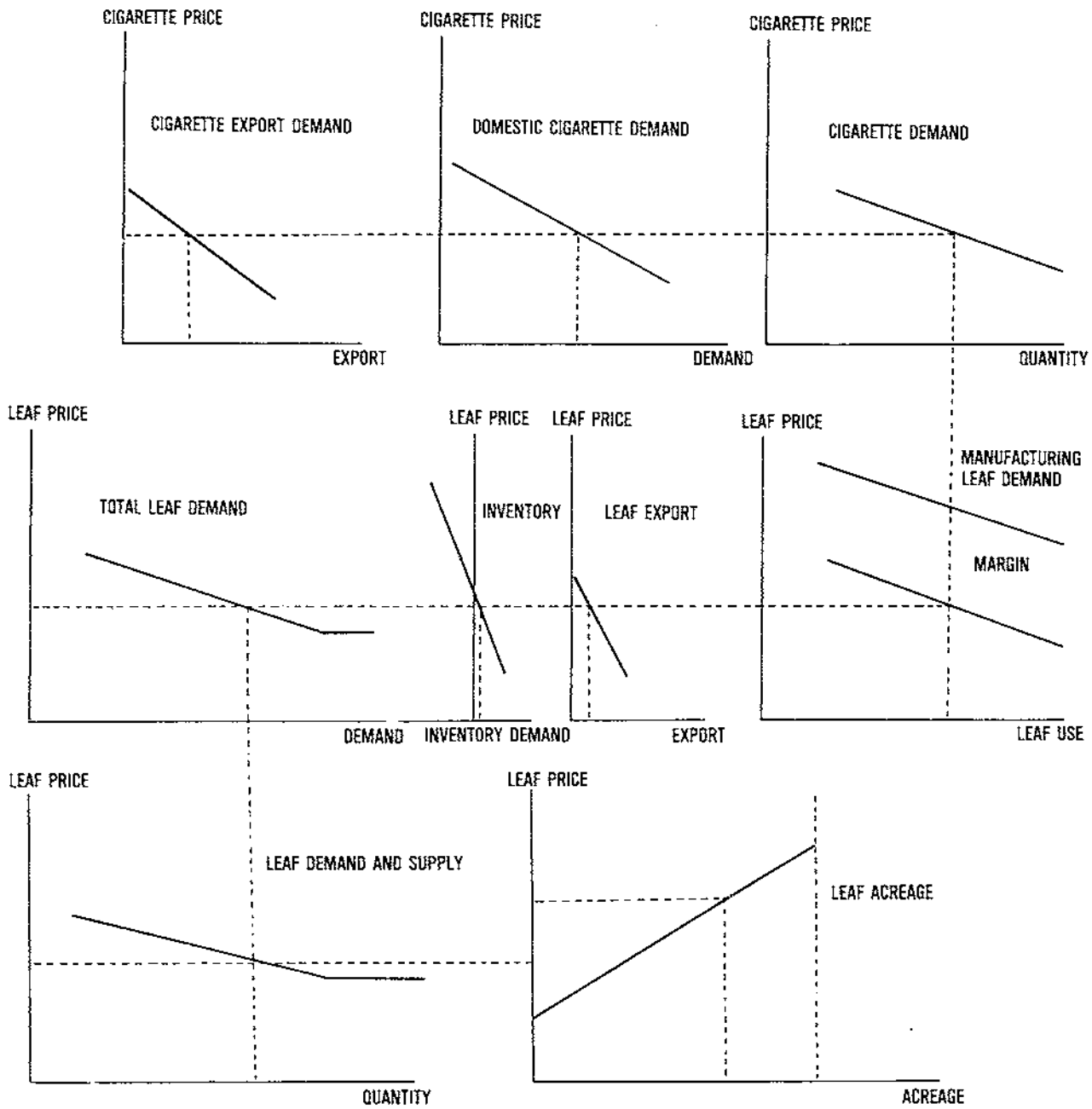

Figure 2

This graphic model sets up a broad economic framework for a statistical model. In the top section, there are two components of cigarette demand, domestic and export. Their horizontal summation gives the total cigarette demand. This is transferred to the middle section by a suitable change in the X-axis scale. By subtracting the marketing, manufacturing, and tax margin, the derived demand for leaf is obtained. To this, export and inventory leaf demands are added to obtain total leaf demand. Since the market price for leaf cannot fall below the support price, the demand curve has a horizontal range. The demand for inventory is shown here as net demand in terms of change in stocks. This is in contrast to the usual practice of adding the carryover to production to obtain supply, which is used in the following empirical analysis. (The demand for leaf for other tobacco products has been ignored in this discussion.) The supply function gives the response of acreage to price subject to the limit of allotments. The acreage is easily converted to production and intersects with demand. The resulting price allocates the available quantities to net inventory demand, exports, and manufacturing demand. The leaf price with added margins, in the form of cigarette retail price, allocates the cigarette demand. The current leaf price, along with allotments for the next year, starts another round of supply response, and the process goes on in a dynamic fashion.

The chain of causation which underlies the model may be visualized as follows:

Acreage--Leaf production--Auction leaf price--Cigarette price--
Cigarette demand--Cigarette production--Tobacco cigarette use--
Tobacco yearend inventory

This causal sequence underpins the recursive model discussed in this study.

VARIABLES AND THE MODEL

The following 14 variables are treated as endogenous in the system. They are recursively determined in a system of 14 equations by the predetermined variables included in the system. The dividing line between endogenous and predetermined variables is arbitrary and changes as the scope of research expands. For example, behavioral equations can be developed for tobacco and cigarette exports, and these variables will move from predetermined to the exogenous group.4/

AF_t = Acreage of flue-cured tobacco (1,000 acres)

AB_t = Acreage of burley tobacco (1,000 acres)

PF_t = Average price per pound to growers, flue-cured (cents per pound)

PB_t = Average price per pound to growers, burley (cents per pound)

QPF_t = Production of flue-cured tobacco (million pounds)

QPB_t = Production of burley (million pounds)

4/ The actual values of the endogenous variables and sources of data are given in tables 4, 5, and 6.

SF_t = Yearend inventory, flue-cured (million pounds)

SB_t = Yearend inventory, burley (million pounds)

DF_t = Flue-cured tobacco used in cigarette manufacturing (million pounds)

DB_t = Burley tobacco used in cigarette manufacturing (million pounds)

QC_t = Per capita cigarette consumption (in terms of population 18 years old and over)

QCC_t = Total domestic cigarette consumption (billions)

PC_t = Consumer price index for tobacco products, deflated by the consumer price index (1967=100)

QCP_t = Production of cigarettes (billions)

The following variables are included as predetermined in the present analysis. These variables include policy, technology, and other outside factors affecting the tobacco economy.5/

ALF_t = Acreage allotted, flue-cured (1,000 acres)

ALB_t = Acres allotted, burley (1,000 acres)

PQB_t = Poundage quota, burley (million pounds) (Since 1971 the burley program has been based entirely on poundage. Therefore, starting with 1971, this variable is included and ALB is set equal to zero.)

SPF_t = Support price, flue-cured (cents per pound)

SPB_t = Support price, burley (cents per pound)

QF_t = Percent of total flue-cured crop which is choice, fine, and good quality

QB_t = Percent of burley crop which is choice, fine, and good quality

XF_t = Export of flue-cured tobacco (million pounds)

XB_t = Export of burley tobacco (million pounds)

ODF_t = Flue-cured used for other products (million pounds)

ODB_t = Burley tobacco used for other products (million pounds)

5/ The observed values of predetermined variables and sources of data are given in appendix table 12.

FL_t = Percent of cigarettes filter-tipped (this embodies the impact of health scare)

I_t = Per capita disposable income at 1958 dollars

QCX_t = Quantity of cigarettes exported (billions)

TX_t = Federal and State cigarette taxes (cents per pack)

The following multiplicative factors are used to make the units in various markets comparable. Values for these factors for each year can be inserted in the system and will satisfy the necessary market-clearing conditions. To calculate the predicted values of the endogenous variables, the actual value of these multiplicative factors for each of the years 1954-72 was used. However, to calculate the reduced form and the multipliers, the average values for the most recent 3-year period, 1970-72, were used.

YF = Yield per acre, flue-cured (1,000 pounds)

YB = Yield per acre, burley (1,000 pounds)

F = Pounds of flue-cured tobacco used per 1,000 cigarettes

B = Pounds of burley tobacco used per 1,000 cigarettes

P = Population 18 years and over (billion)

The importance of the above rates in the tobacco economy should be noted. Given the per capita cigarettes consumed, the adult population is the major source of increase in demand for cigarettes. Although the variable included in this analysis is the total population 18 years and older, some research has been done on the actual smoking population (21 and 25). The trends in yield per acre and leaf use by domestic manufacturers per 1,000 cigarettes (see table 1) are two very important factors in the technology of tobacco cultivation and use. To the extent that increase in average yield was in response to restrictions through quotas and allotments, there may be a case for treating yield as endogenous. This point has not been pursued in the present study. (See, however, Johnson (12), which includes a behavioral equation for average yield for burley.) It has been argued that the tobacco programs encouraged the adoption of yield-increasing practices. These practices, particularly for flue-cured tobacco, were responsible for deterioration of the quality of tobacco raised. (See Darkis (4), for this line of reasoning.)

The decline in the use of leaf per 1,000 cigarettes is the result of emergence of filter-tipped cigarettes, homogenization, freeze-drying, and other technological innovations in cigarette manufacturing. Moreover, recently the average weight of cigarettes has been declining and various tobacco-substitutes are being considered for use in cigarette manufacturing. Cigarettes containing 10-25 percent synthetic material are considered a distinct possibility.6/

6/ See (27), TS-145, Sept. 1973, pp. 34-35.

Table 1--Flue-cured and burley tobacco: Yields per acre and cigarette use per 1,000 cigarettes, 1954-72

Year 1/	Yield per acre		Leaf use per 1,000 cigarettes	
	Flue-cured	Burley	Flue-cured	Burley
	Pounds			
1954	1,261	1,586	1.73	1.01
1955	1,497	1,513	1.66	1.01
1956	1,625	1,635	1.54	.97
1957	1,471	1,592	1.55	.94
1958	1,691	1,567	1.46	.88
1959	1,559	1,669	1.44	.87
1960	1,808	1,639	1.46	.87
1961	1,801	1,820	1.40	.88
1962	1,930	1,993	1.36	.87
1963	1,975	2,231	1.36	.85
1964	2,211	2,022	1.30	.88
1965	1,883	2,116	1.27	.87
1966	1,825	2,437	1.13	.84
1967	2,048	2,274	1.13	.85
1968	1,868	2,372	1.10	.80
1969	1,825	2,488	1.07	.79
1970	2,042	2,590	1.02	.75
1971	2,050	2,213	1.04	.77
1972	1,970	2,547	1.03	.77

1/ Crop year beginning July 1 for flue-cured, and October 1 for burley.

Source: (26).

Data for 1954-72 are used in the following analysis. All data on tobacco are on a farm-sales-weight basis. Data for flue-cured tobacco are for the crop year beginning July 1; for burley, the crop year starting October 1; and for cigarettes, the calendar year.

Following is a summary of the model in symbolic form:

1. Flue-cured acreage: $(AF_t; AF_{t-1}, PF_{t-1}, ALF_t)$

2. Flue-cured production: $QPF_t = YF \times AF_t$

3. Flue-cured auction price: $(PF_t, QPF_t; SF_{t-1}, SPF_t, QF_t)$

4. Burley acreage: $(AB_t; AB_{t-1}, PB_{t-1}, ALB_t, PQB_t)$

5. Burley production: $PQB_t = YB \times AB_t$

6. Burley auction price: $(PB_t, QPB_t; SB_{t-1}, SPB_t, QB_t)$

7. Cigarette price linkage: $(PC_t, PF_t, PB_t; TX_t)$

8. Per capita cigarette demand: $(QC_t, PC_t; QC_{t-1}, I_t, FL_t)$

9. Total cigarette demand: $QCC_t = P \times QC_t$

10. Cigarette market clearing: $QCP_t = QCC_t + QCX_t$

11. Flue-cured cigarette use: $DF_t = F \times QCP_t$

12. Burley cigarette use: $DB_t = B \times QCP_t$

13. Flue-cured market clearing identity:

$$SF_t = QPF_t + SF_{t-1} - DF_t - XF_t - ODF_t$$

14. Burley market clearing identity:

$$SB_t = QPB_t + SB_{t-1} - DB_t - XB_t - ODB_t$$

ESTIMATES

The model consists of six behavioral equations and eight technological and market clearing identities. The system brings together the forces of Government policy, technological factors, market mechanism, and consumer decisionmaking. The system is recursive; that is, the matrix of the coefficients of endogenous variables is triangular. If, in addition, it is assumed that the disturbances have a variance-covariance matrix which is diagonal, the system is identified (Johnston 13, section 12.4) and can be estimated by ordinary least squares (Wold 33).

Some estimated equations include lagged value of the endogenous variable as a regressor. The use of the traditional Durbin-Watson statistics in this case is not recommended. (See Durbin and Watson 6 and Nerlove and Wallis 19). Recently, Durbin has developed a test for least-squares regressions including lagged dependent variables (5). The test statistic recommended is

$$h = a \sqrt{\frac{n}{1 - n \hat{V}(b_1)}}$$

where $a = 1 - 1/2\ d$, and d is the Durbin-Watson statistic. $\hat{V}(b_1)$ is the estimate of variance of the coefficient of lagged dependent variable given by the least-squares analysis and n is the sample size. This is tested as a standard normal deviate. In the following analysis, this test statistic is given where appropriate.

The estimated model is discussed below. The estimates are made from data for 1954-72 by ordinary least squares. The values in parentheses under the coefficients are the t-values of the coefficients. The squared multiple correlation has been corrected for degrees of freedom.

Flue-cured tobacco was subject to allotments. The acreage allotments are used as an instrument for implementing marketing quota. In recent years the basic acreage quota has been adjusted for undermarketing and overmarketing the previous year. This is called the "effective" quota. Burley tobacco was under acreage allotments up to 1970. Starting with 1971 the burley program was changed completely to poundage. Price supports were available for both flue-cured and burley tobacco during the period studied. The model takes these policy instruments into account. The acreage equations are cobweb type. The acreage is a function of a lagged acreage, lagged price, and acreage allotted (and poundage quota for burley tobacco).

$$(1)\quad AF_t = -96.49457 + 0.04779\ AF_{t-1} + 0.12126\ PF_{t-1}$$

$$(0.63249) \qquad (0.12980)$$

$$+1.03122\ ALF_t$$

$$(13.44588)$$

$$R^2 = 0.985$$

$$h = 1.966$$

$$(2)\quad AB_t = -149.23199 + 0.24779\ AB_{t-1}$$

$$(2.64881)$$

$$+1.11946PB_{t-1} + 0.98670ALB_t + 0.42539PQB_t$$

$$(1.78813) \qquad (14.37724) \qquad (12.69128)$$

$$R^2 = 0.982$$

$$h = 0.477$$

In each case the variables included explain over 98 percent of the variation in acreage. The signs of the coefficients are also correct. The lagged value of acreage accounts for the longrun trend. The price for the previous year represents average revenue in the recent past.7/ The effectiveness of the acreage allotted is indicated by the high t values.

The cobweb nature of the acreage equations can be demonstrated better by rewriting as

$$\Delta\ AF_t = -96.49457 - 0.95221AF_{t-1}$$

$$+0.12126PF_{t-1} + 1.3122ALF_t$$

$$\Delta\ AB_t = -149.23199 - 0.75221AB_{t-1} + 1.11946PB_{t-1}$$

$$+0.98760ALB_t + 0.42539PQB_{t-1}$$

7/ For a different concept of average revenue (per acre), see Vernon, et al.(32).

The inverse relationship between level of acreage and change in acreage may be noted. Attention is called to the special use of Δ operator. In the literature on difference equations, Δ is changed from t to t+1. Here it denotes change from t-1 to t.

A note of caution about the flue-cured equation is also in order. A high degree of multicollinearity among the independent variables was observed. Therefore, the coefficients given above are not very reliable as far as their relative magnitude is concerned. However, this equation can be used for forecasting as long as the intercorrelations do not change during the forecast period. For policy analysis, a different regression based on principal components is given on page 16.8/

For some purposes the excess of allotments over acreage is of interest. The allotments set a limit to the acres harvested. Therefore, the deviation of acreage from this limit may be deemed as a variable of interest. The values obtained by subtracting the observed and the estimated values of acreage from allotments9/are given in table 2.

For each year, the production is obtained by multiplying the acreage by average yield.

(3) $QPF_t = YF \times AF_t$

(4) $QPB_t = YB \times AB_t$

The price equations represent the process of price formation in the auction markets. The supply consisting of production from the current year's crop is inelastic and must be sold because the farmer has very limited storage facilities. However, at the same time, the auction price has to be more than the support rate. On the side of the buyers, the size of the existing stocks, to which the current purchases are to be added, is a potential factor in determining the price bid.

8/ Johnson (12) and Vernon, et al. (32) previously made attempts to study acreage response indirectly by analyzing underplanting (allotment less acreage). Glenn Johnson set up a system of simultaneous equations for underplantings, acreage, and auction market price for burley for 1933-50. He explained underplantings in terms of lagged price, lagged value of underplanting, and penalty for overplanting. Vernon, et al., studying underplanting for flue-cured tobacco as part of a simulation model, used estimated relationships for 1910-30 to generate the "free market" acreage for 1949-66. The underplantings are explained in terms of the excess of "free market" acres over allotments. Without making any differentiation between acres and yield, Tennant (23) estimated production of flue-cured as a function of lagged price and time.

9/ The observed values for burley for 1954, 1955, and 1956 are negative. During those years, the farmers were overplanting in an effort to build a base in spite of the penalities provided in the burley program.

Table 2--Flue-cured and burley tobacco: Difference between allotments and acreage, 1954-72

Year 1/	Flue-cured		Burley	
	Actual	Computed	Actual	Computed
	1,000 acres			
1954	11	9	-22	-9
1955	16	9	-2	-7
1956	13	16	-1	11
1957	48	27	2	6
1958	73	37	12	10
1959	20	38	8	6
1960	21	34	13	11
1961	25	34	10	9
1962	15	32	10	1
1963	14	32	11	5
1964	10	37	9	4
1965	45	41	10	10
1966	37	42	9	9
1967	35	40	12	18
1968	45	42	12	13
1969	64	43	12	11
1970	55	41	15	16
1971	46	42	2/	2/
1972	48	45	2/	2/

1/ Crop year beginning July 1 for flue-cured, and October 1 for burley.
2/ The program is now based on poundage quota.
SOURCE: (26).

$$(5)\quad PF_t = 8.02821 - 0.00160\ (QPF_t + SF_{t-1})$$

$$(0.45018)$$

$$+1.28099SPF_t + 0.20951QF_t$$

$$(10.49729) \qquad (1.81819)$$

$$R^2 = 0.948$$

$$DW = 1.690$$

$$(6)\quad PB_t = 59.93257 - 0.02052\ (QPB_t + SB_{t-1})$$

$$(2.93752)$$

$$+0.50941SPB_t + 0.42966QB_t$$

(4.03610) (4.09386)

$$R^2 = 0.863$$

$$DW = 1.555$$

During those years when producers approve the quota, the price support is available. The support rate sets the lower limit to the price in the auction markets. This explains the high t values for this variable in the above equations. The percentage of a crop which is choice, fine, and good represents the premium for these qualities of leaf.10/

The above equations can be rewritten to express the difference between auction market price and support price as follows:

$$PF_t - SPF_t = -8.02821 - 0.00160\ (QPF_t + SF_{t-1}) + 0.28099SPF_t + 0.20951QF_t$$

$$PB_t - SPB_t = 59.93257 - 0.02052\ (QPB_t + SB_{t-1}) - 0.49059SPB_t + 0.42966QB_t$$

The actual values of these differences and the values predicted from the above equations are given in table 3.

The tobacco markets satisfy the following market-clearing identities:

(7) $SF_t - SF_{t-1} = QPFt - DF_t - XF_t - ODF_t$

(8) $SB_t - SB_{t-1} = QPB_t - DB_t - XB_t - ODB_t$

This means that the excess of production over domestic disappearance and export is inventory demand and is added to stocks of tobacco. In actual practice, production for the current year is added to the carryover, and tobacco for domestic disappearance and export comes out of aged stocks. This can be shown by rewriting the above identities appropriately.

The retail price of cigarettes is linked to the leaf price as an element of cost. Other items in the margin are taxes and manufacturing and marketing

10/ Johnson (12) explained burley auction price in terms of pledges of burley tobacco to associations for price support, burley production, carryover, and disappearance. Vernon, et al. (32) fit a double log regression equation of leaf price on the ratio of net leaf supply to domestic disappearance (SQNET) and per capita income. A "free market" leaf price is derived from the above by replacing SQNET by the ratio of leaf supply less exports to disappearance in the estimated equation. Miller (18) estimates equations which resemble the ones given above. However, he includes time as an independent variable, and he has production and stocks as separate variables in his equations leading to implausible signs.

Table 3--Flue-cured and burley tobacco: Difference between auction market price and support price, 1954-72

Year 1/	Flue-cured		Burley	
	Actual	Predicted	Actual	Predicted
	Cents per pound			
1954	4.8	4.9	3.4	8.6
1955	4.4	4.4	12.4	13.0
1956	2.6	3.0	15.5	10.3
1957	4.6	4.4	8.6	8.4
1958	3.6	5.0	10.7	6.8
1959	2.8	4.8	2.9	3.8
1960	4.9	4.8	7.1	7.0
1961	8.8	6.0	9.3	10.6
1962	4.0	4.3	0.8	4.5
1963	1.4	4.1	0.9	2.8
1964	1.3	3.4	1.4	0.8
1965	6.9	4.1	7.5	4.3
1966	8.1	4.1	6.3	5.3
1967	5.0	4.3	10.0	10.2
1968	5.3	5.3	10.2	10.6
1969	8.6	6.4	3.8	4.5
1970	5.4	7.2	3.6	3.3
1971	7.8	8.6	9.4	6.4
1972	12.6	12.5	4.3	7.2

1/ Crop year beginning July 1 for flue-cured, and October 1 for burley.

costs. In the present analysis three cost items are considered: (1) flue-cured leaf, (2) burley leaf, and (3) Federal and State taxes. Although tobacco cost is a small fraction of the price of cigarettes, leaf cost is included in order to establish a linkage between cigarette price and leaf price. A more comprehensive study of costs and margins would include several other items.11/ The cost of the above three items for 1,000 cigarettes is calculated as

$$COST = F \times PF_t + B \times PB_t + 50 \times TX_t$$

The cigarette price linkage equation is obtained from this cost by the following regression:

$$(9) \quad PC_t = 57.86563 + 0.04295\ COST_t$$

$$(16.96616)$$

11/ See, for example, Farnsworth (7), and Braden (1).

$$= 57.86563 + 0.04295\ (F \times PF_t + B \times PB_t + 50 \times TX_t)$$

$$R^2 = 0.941$$

$$DW = 1.515$$

Consumer demand for cigarettes is studied in terms of per capita consumption of cigarettes for the population 18 years old and over. The use of per capita consumption (instead of total consumption) is based on the basic consumer theory of the individual.12/ Cigarette demand is influenced by the habit-forming nature of the product and reaction to the issue of smoking and health. These factors are embodied in the lagged value of consumption and the percentage of cigarettes filter-tipped.

$$QC_t = 3795.37830 + 0.66603QC_{t-1}$$

$$(6.15698)$$

$$-32.99555PC_t + 11.16354FL_t$$

$$(4.29536) \qquad (4.08496)$$

$$+0.03771I_t$$

$$R^2 = 0.908$$

$$h = 0.450$$

The regression for per capita cigarette consumption was fitted by using extraneous information about the income elasticity of demand for cigarettes.13/ This was necessary because of the high correlation (0.959) between per capita income and the consumer price index of tobacco products. The demand functions were fitted using several given values of income elasticity. The best of these equations (considering signs of coefficients, price elasticity, and R^2) is included in the system.14/ This equation includes an extraneous value of income elasticity of demand at mean for cigarettes equal to 0.02, and gives a price elasticity of demand at mean equal to -0.776. This compares with earlier estimates of -0.68 by Schoenberg (22), -0.51 by Lyon and Simon (15), -0.38 to -1.48 by Maier (16), -0.3 to 0.4 by Sackrin (20), and -0.43 by Vernon, et al. (32).

Total cigarette consumption is the product of per capita consumption and population 18 years old and over.

$$(11) \quad QCC_t = P \times QC_t$$

12/ For further discussion of this point see Houthakker and Taylor (11), chapter 1, section VI.

13/ See Kuh and Meyer (14) for various approaches to use of extraneous information in regression analysis.

14/ For another example of the use of extraneous information in estimating the demand function for cigarettes, see Hamilton (9).

The quantity of cigarettes produced has to satisfy the technical relationships in terms of flue-cured and burley tobacco disappearance.

$$(12)\quad DF_t = F \times QCP_t$$

$$(13)\quad DB_t = B \times QCP_t$$

Finally, to complete the system we have a market-clearing identity for cigarettes:

$$(14)\quad QCP_t = QCC_t + QCX_t$$

BACK SOLUTIONS, REDUCED FORM, AND MULTIPLIERS

Before using the system for policy analysis, the performance of the model over the sample period should be evaluated. In order to study the "track record" of the model, the back solutions of the system were obtained. In other words, observed values of predetermined variables and the multiplicative factors for each year of the sample period 1954-72 were used to derive the values of endogenous variables for each year. These values are obtained by solving the triangular system of equations using a modified Gauss-Seidel method.15/ This method is particularly suitable in this case because the system is triangular, and a new set of multiplicative factors (YF, YB, F, B, and P) has to be used for each year.

The computed values of the endogenous variables, along with the observed values for 1954-72, are given in tables 4, 5, and 6 and figures 3-16.

The structural system of 14 equations and identities embodies the a priori specifications and restrictions of the model. The strategic technological and policy variables included in the structural system can be appropriately modified to trace the impact on the market. The system can be explicitly solved for the 14 endogenous variables to obtain the reduced form of the system. However, before deriving the reduced form, a modified behavioral equation for flue-cured acreage is substituted. This equation was fitted by using regression on principal components.16/ This new regression equation is:

$$AF_t = -798.15818 + 0.42380\ AF_{t-1} + 2.26244PF_{t-1} + 0.64657ALF_t$$

This regression presumably overcomes the problem of multicollinearity and gives better estimates of relative size of the coefficients.

The reduced form, given in appendix table 1, expresses each endogenous variable as a linear function of the several predetermined variables, including lagged endogenous variables. This reduced form is obtained by using the average values for the most recent 3 years, 1970-72, for the multiplicative

15/ See Heien, Matthews, and Womack (10) for further discussion.
16/ See Johnston (13), section 11-1 for a discussion of the theoretical background for principal components regression.

Table 4--Flue-cured tobacco, types 11-14: Endogenous variables, actual and computed from the reduced form 1954-72

Year beginning July 1	Acreage harvested		Average price per pound		Production		Yearend stocks		Domestic use in cigarettes	
	Actual	Computed	Actual	Computed	Actual	Computed	Actual	Computed	Actual	Computed
	--1,000 acres--		----Cents----		----------Million pounds----------					
1954	1,042	1,044	52.7	52.8	1,314	1,317	2,057	2,049	704	714
1955	991	998	52.7	52.7	1,483	1,494	2,258	2,279	690	680
1956	875	872	51.5	51.9	1,423	1,417	2,511	2,502	669	674
1957	663	684	55.4	55.1	975	1,006	2,308	2,341	698	696
1958	639	675	58.2	59.5	1,081	1,142	2,210	2,289	698	680
1959	693	675	58.3	60.3	1,081	1,053	2,106	2,091	728	716
1960	692	679	60.4	60.3	1,251	1,227	2,090	2,078	753	742
1961	689	680	64.3	61.5	1,258	1,225	2,081	2,060	743	731
1962	730	713	60.1	60.5	1,408	1,375	2,282	2,244	738	742
1963	694	676	58.0	60.8	1,371	1,335	2,386	2,361	725	714
1964	628	601	58.5	60.7	1,388	1,330	2,555	2,471	733	759
1965	562	566	64.6	61.8	1,059	1,065	2,439	2,462	712	695
1966	607	602	66.9	63.0	1,108	1,098	2,273	2,266	647	644
1967	610	605	64.9	64.3	1,250	1,240	2,302	2,285	646	652
1968	533	536	66.6	66.9	996	1,001	2,100	2,086	629	649
1969	577	598	72.4	70.1	1,053	1,091	1,972	1,985	602	627
1970	584	598	72.0	73.7	1,178	1,222	1,976	2,031	596	585
1971	526	530	77.2	78.0	1,076	1,086	1,910	1,919	618	618
1972	514	517	85.3	85.2	1,022	1,019	1,807	1,744	619	635

Source: (26). Data are on a farm-sales-weight basis.

Table 5--Burley tobacco, type 31: Endogenous variables, actual and computed from the reduced form, 1954-72

Year beginning October 1	Acreage harvested		Average price per pound		Production		Yearend stocks		Domestic use in cigarettes	
	Actual	Computed	Actual	Computed	Actual	Computed	Actual	Computed	Actual	Computed
	--1,000 acres--		----Cents----		----------Million pounds----------					
1954	421	408	49.8	55.4	668	647	1,347	1,319	415	421
1955	311	316	58.6	59.0	470	478	1,299	1,313	421	415
1956	310	298	63.6	58.8	506	487	1,295	1,273	424	427
1957	307	303	60.3	60.2	488	483	1,276	1,272	419	418
1958	297	299	66.1	62.1	466	469	1,224	1,233	424	419
1959	301	303	60.1	60.9	502	506	1,191	1,203	441	434
1960	296	298	64.3	64.1	485	489	1,127	1,138	450	443
1961	319	320	66.5	67.7	580	583	1,137	1,148	467	459
1962	339	348	58.6	62.3	675	694	1,228	1,244	474	477
1963	338	345	59.2	60.8	755	769	1,412	1,432	452	446
1964	307	312	60.3	59.4	620	632	1,416	1,409	496	514
1965	277	277	67.0	63.8	586	586	1,395	1,406	489	477
1966	241	241	66.9	65.8	587	587	1,382	1,385	484	482
1967	238	232	71.8	72.3	541	527	1,324	1,306	484	488
1968	238	237	73.7	74.2	563	561	1,316	1,300	456	470
1969	238	239	69.6	70.3	591	594	1,343	1,327	445	463
1970	216	215	72.2	72.0	561	558	1,346	1,352	441	433
1971	214	221	80.9	77.6	473	490	1,249	1,266	455	455
1972	236	220	79.2	82.7	590	561	1,260	1,230	461	467

Source: (26). Data are on a farm-sales-weight basis.

Table 6--Cigarettes: Endogenous variables, actual and computed from reduced form, 1954-72

Year	Per capita cigarette consumption		Total cigarette consumption		Consumer price index, tobacco products 1967=100		Total cigarette production	
	Actual	Computed	Actual	Computed	Actual	Computed	Actual	Computed
	--Number--		--Billions--				--Billions--	
1954	3,546	3,578	386	391	87.1	87.9	401.8	407.7
1955	3,597	3,535	396	389	87.8	87.9	412.3	406.2
1956	3,650	3,680	406	409	88.3	87.5	424.2	427.1
1957	3,755	3,756	422	422	87.7	89.8	442.3	441.2
1958	3,953	3,908	449	444	88.0	89.8	470.1	464.2
1959	4,073	4,008	467	460	90.6	92.0	489.9	481.6
1960	4,171	4,109	484	477	92.2	92.1	506.9	499.5
1961	4,266	4,194	503	494	92.1	92.1	528.3	519.5
1962	4,265	4,294	508	511	91.7	91.7	535.5	538.6
1963	4,345	4,274	524	515	93.5	93.5	550.6	542.2
1964	4,194	4,354	511	530	94.4	93.8	539.9	559.3
1965	4,258	4,158	529	517	97.1	98.0	556.8	543.5
1966	4,287	4,256	541	537	99.1	97.7	567.3	564.6
1967	4,280	4,318	549	554	100.0	97.9	576.2	581.5
1968	4,186	4,347	546	567	102.0	97.9	579.5	597.9
1969	3,993	4,167	529	552	101.9	102.2	557.6	580.7
1970	3,985	4,008	536	539	105.1	104.2	583.2	572.3
1971	4,037	3,939	550	541	104.2	107.0	576.4	575.0
1972	4,040	3,966	565	555	106.5	107.5	599.1	591.3

Source: (27).

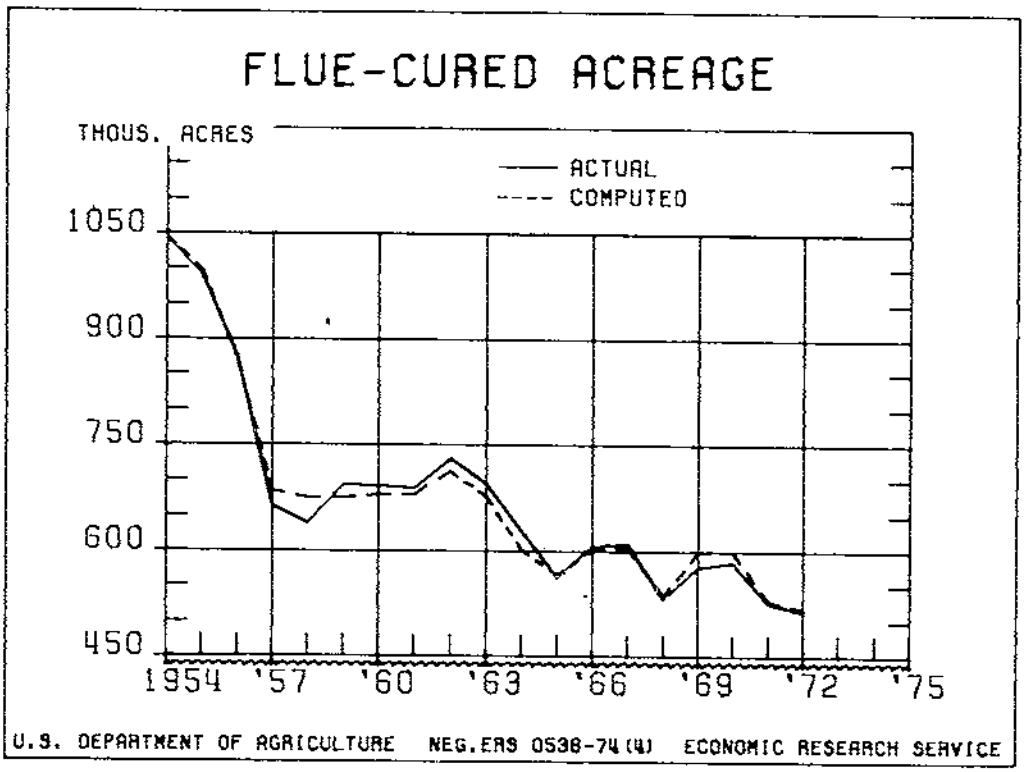

Figure 3

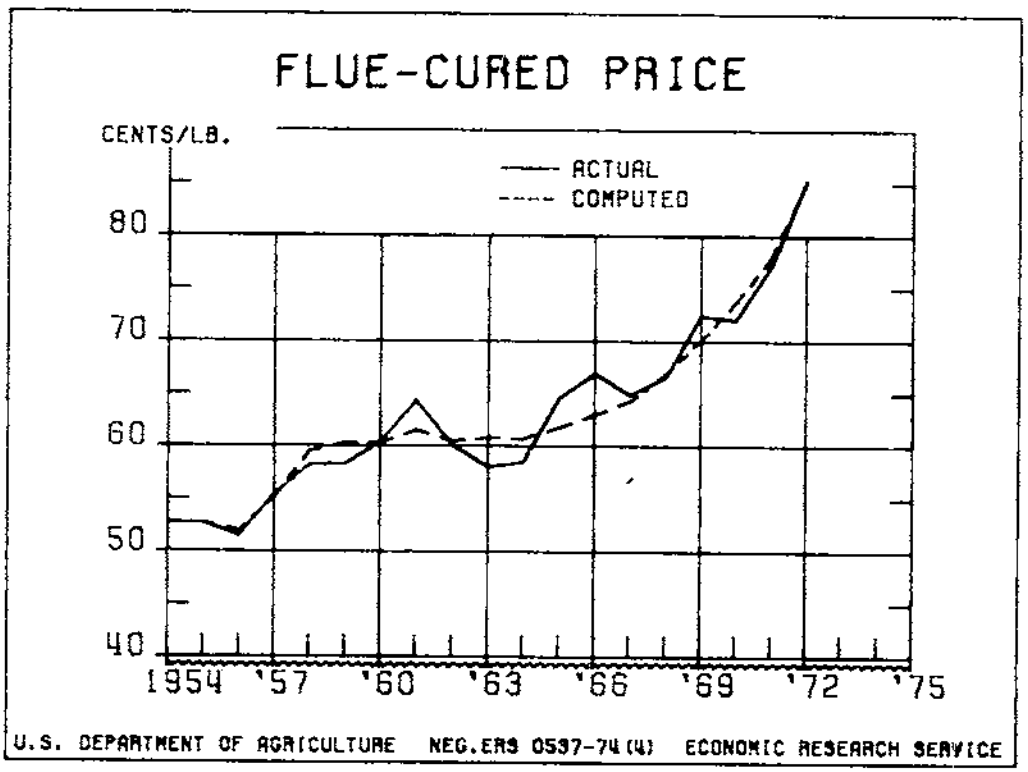

Figure 4

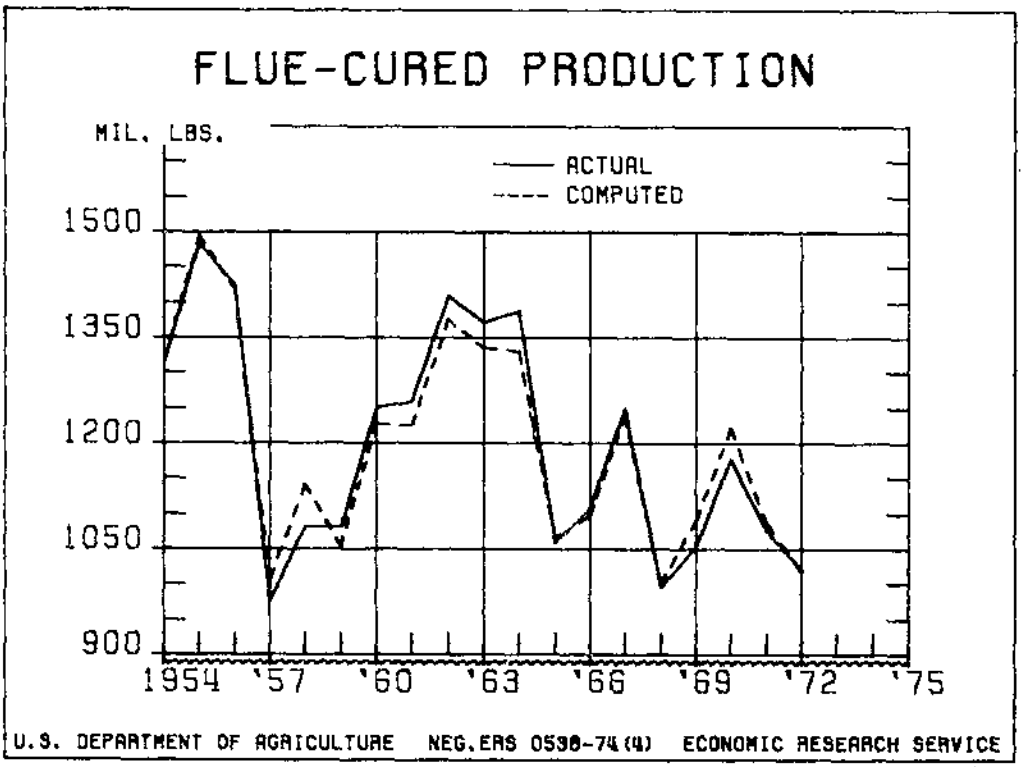

Figure 5

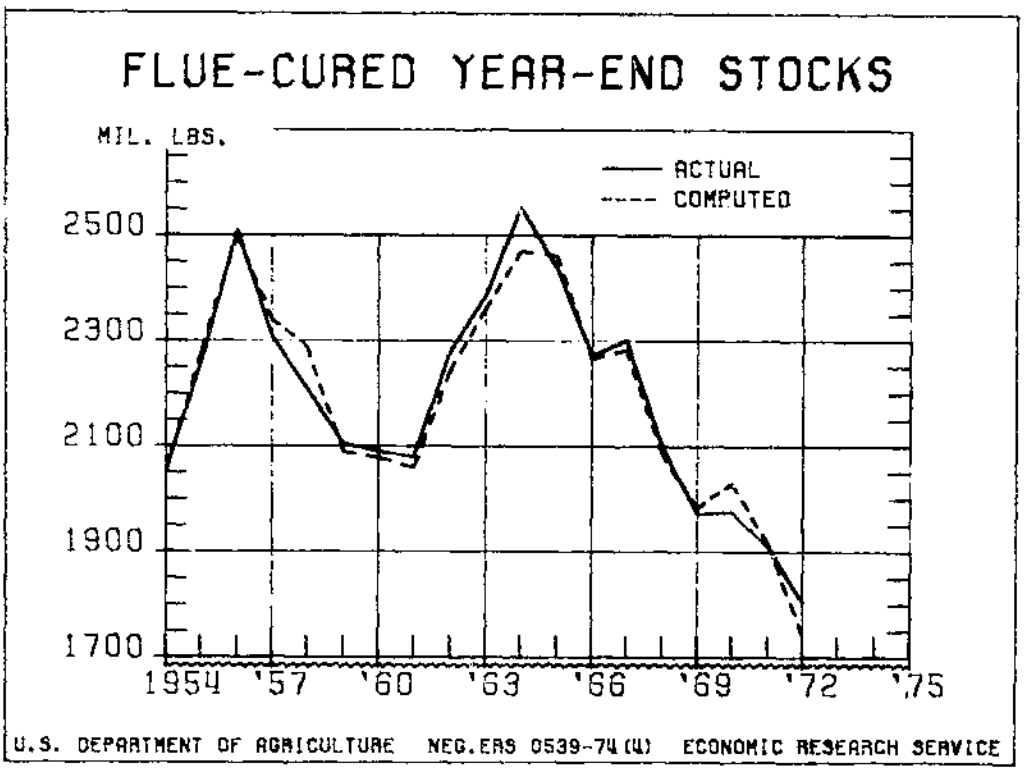

Figure 6

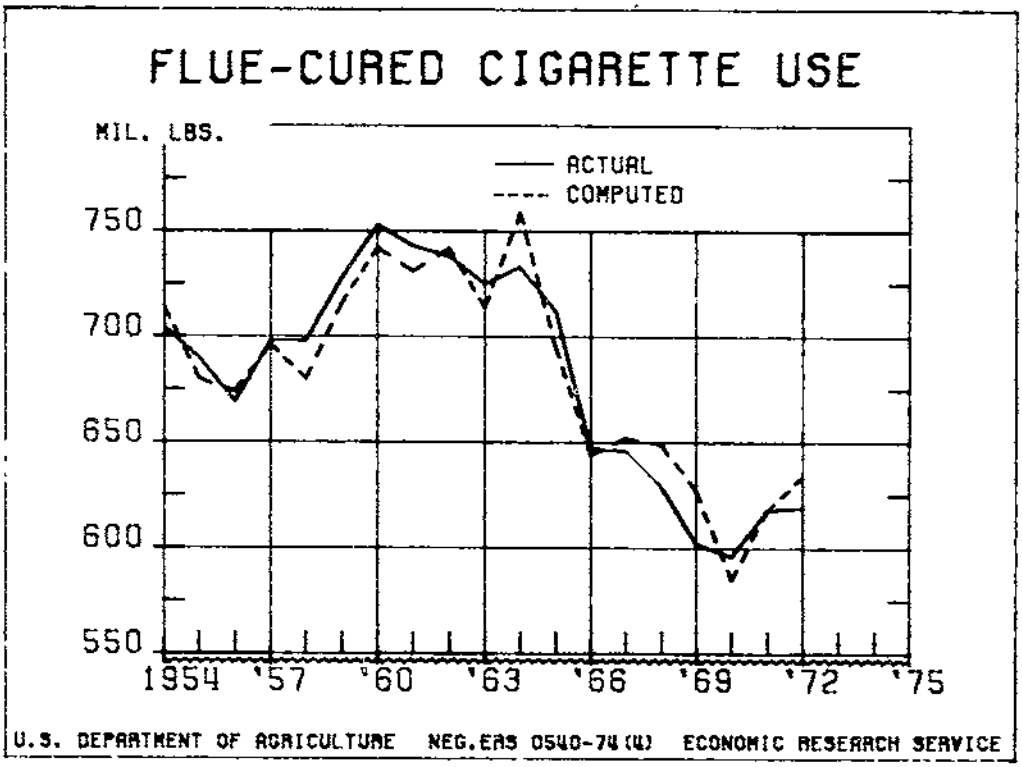

Figure 7

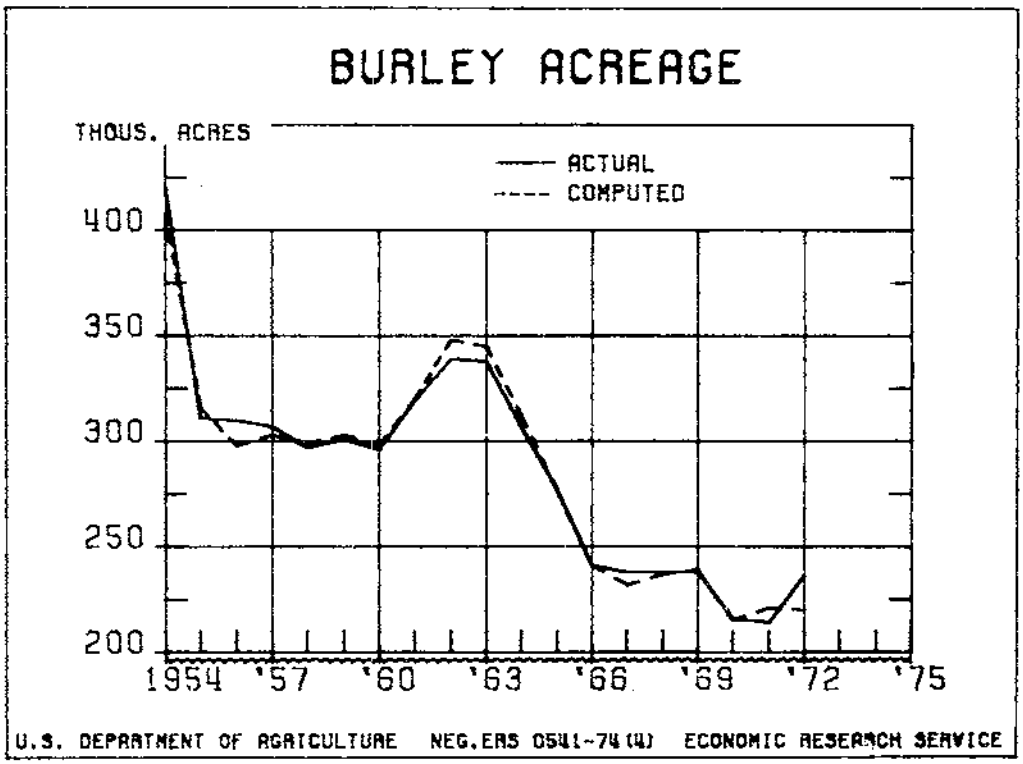

Figure 8

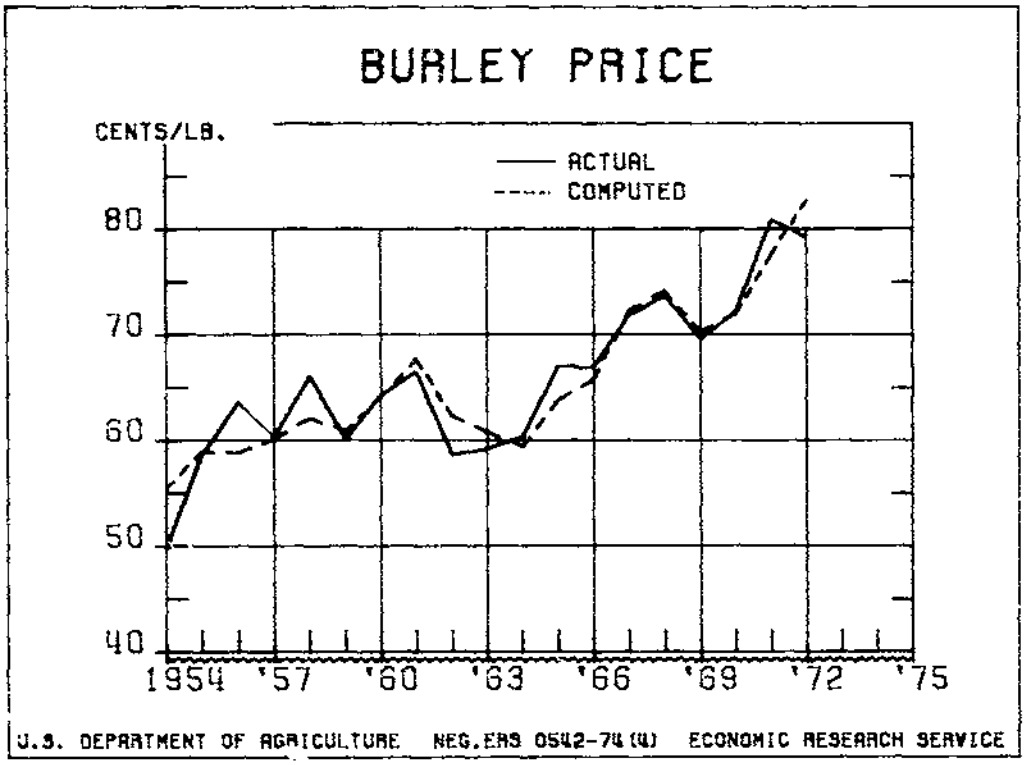

Figure 9

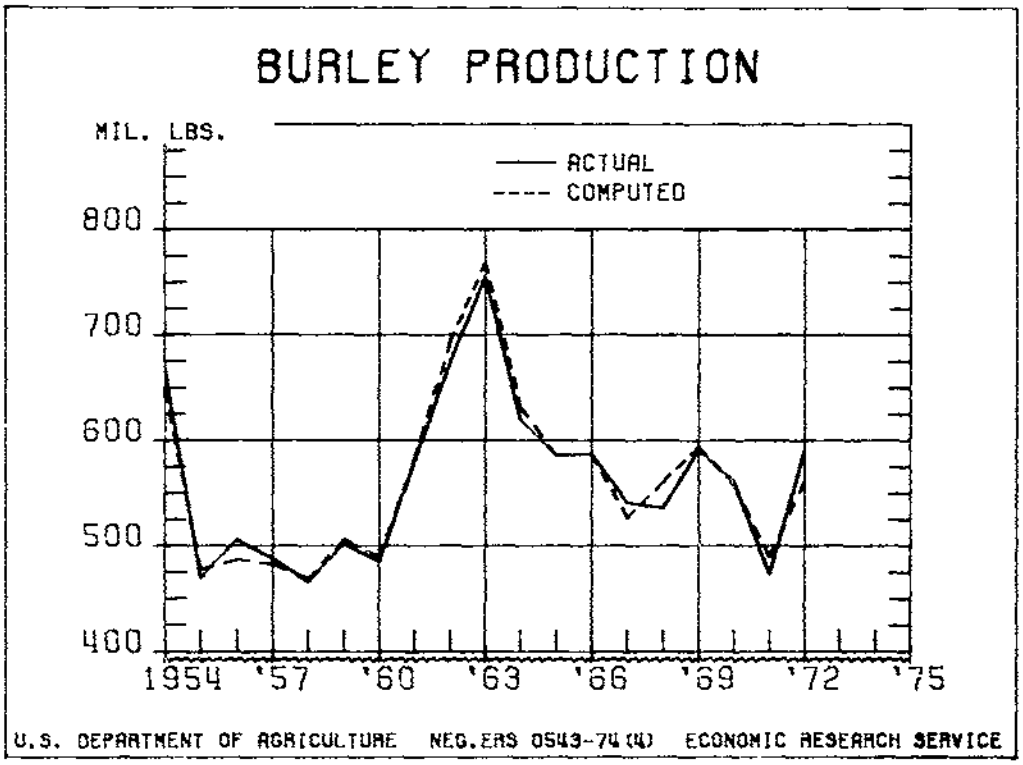

Figure 10

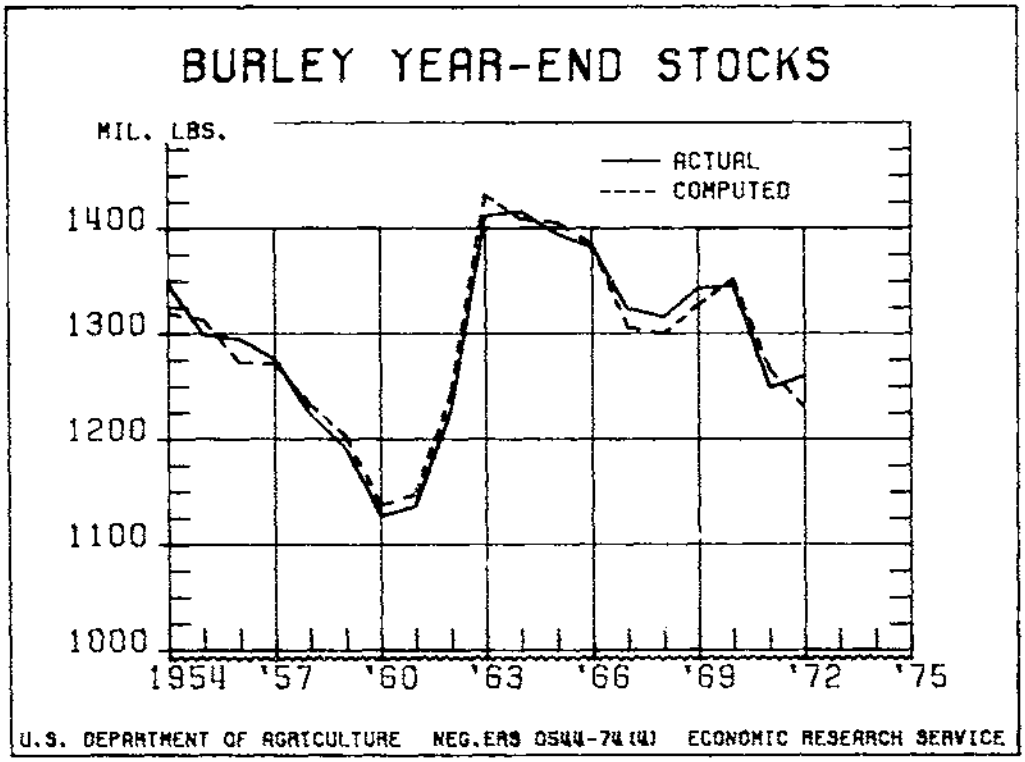

Figure 11

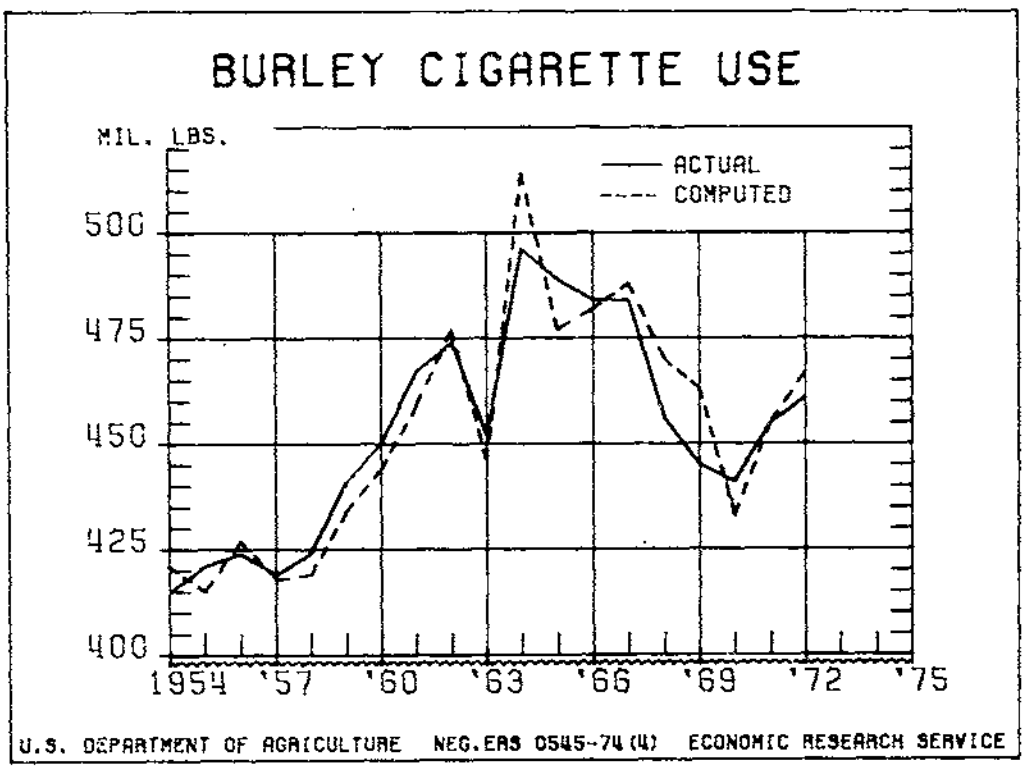

Figure 12

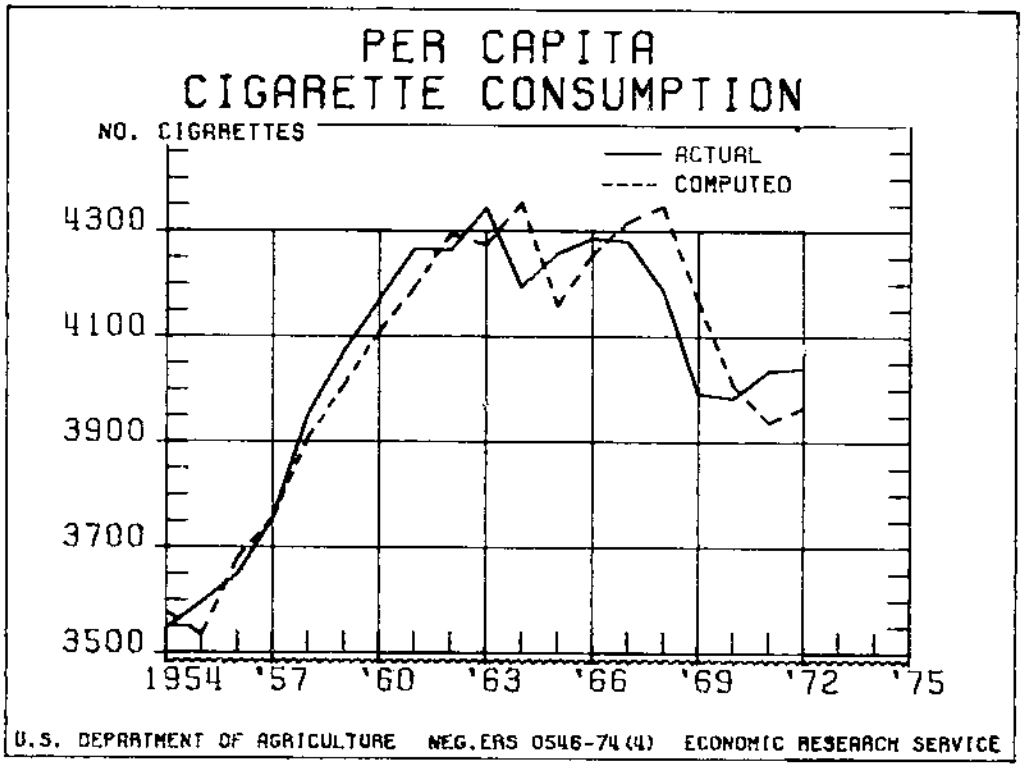

Figure 13

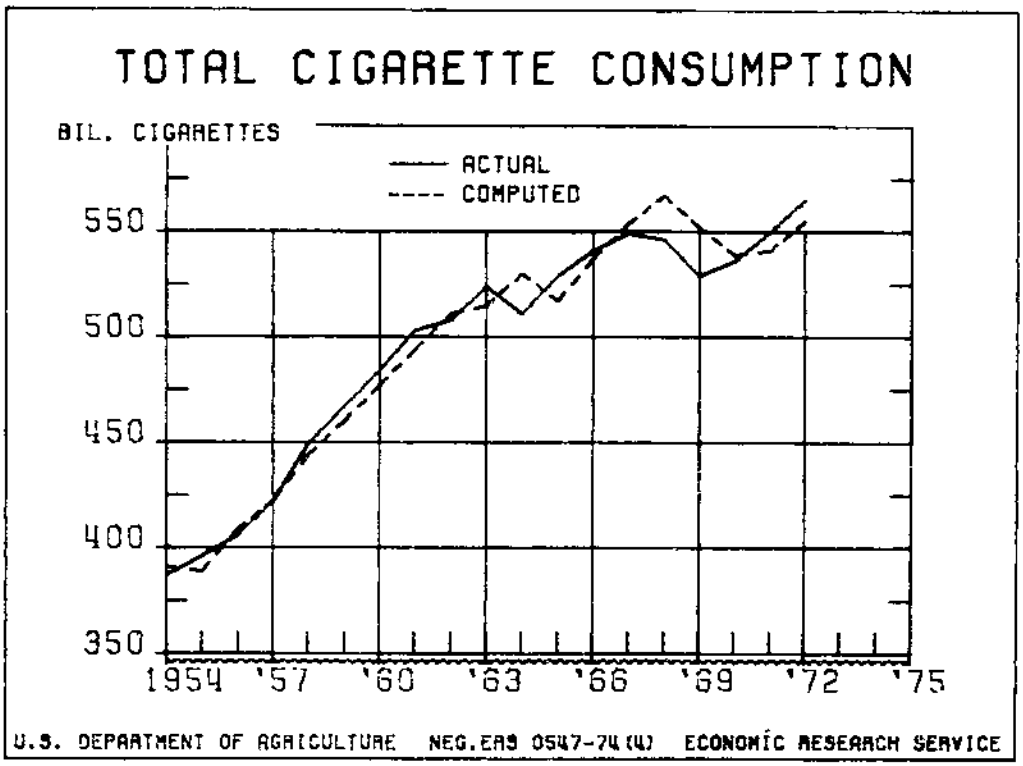

Figure 14

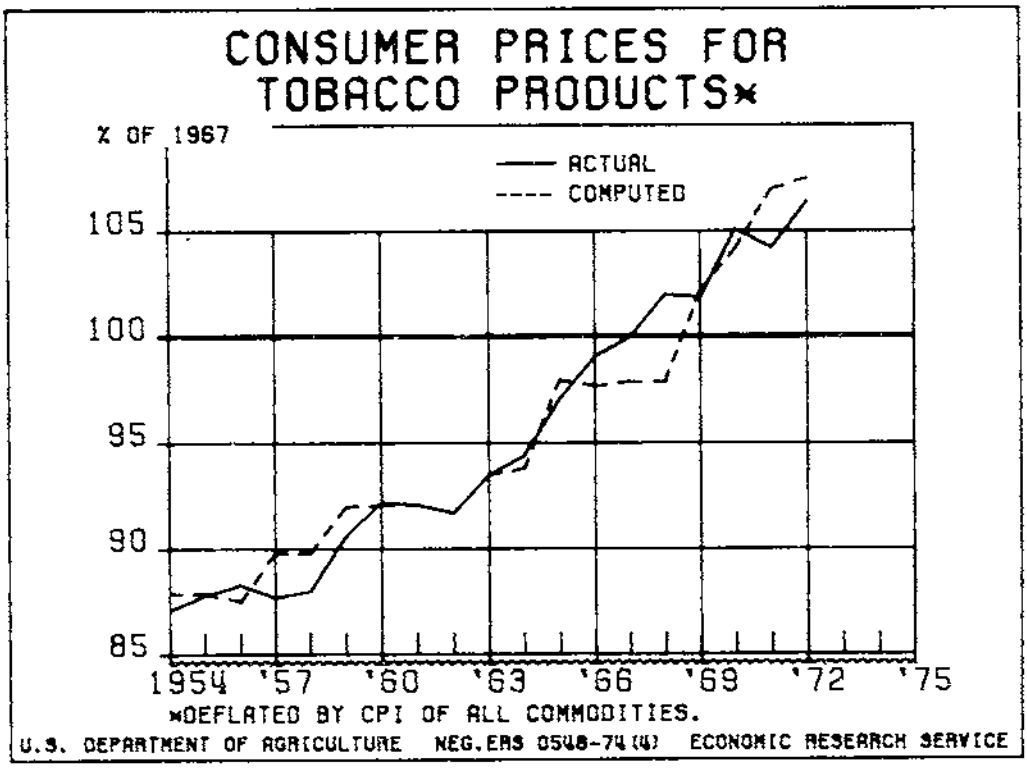

Figure 15

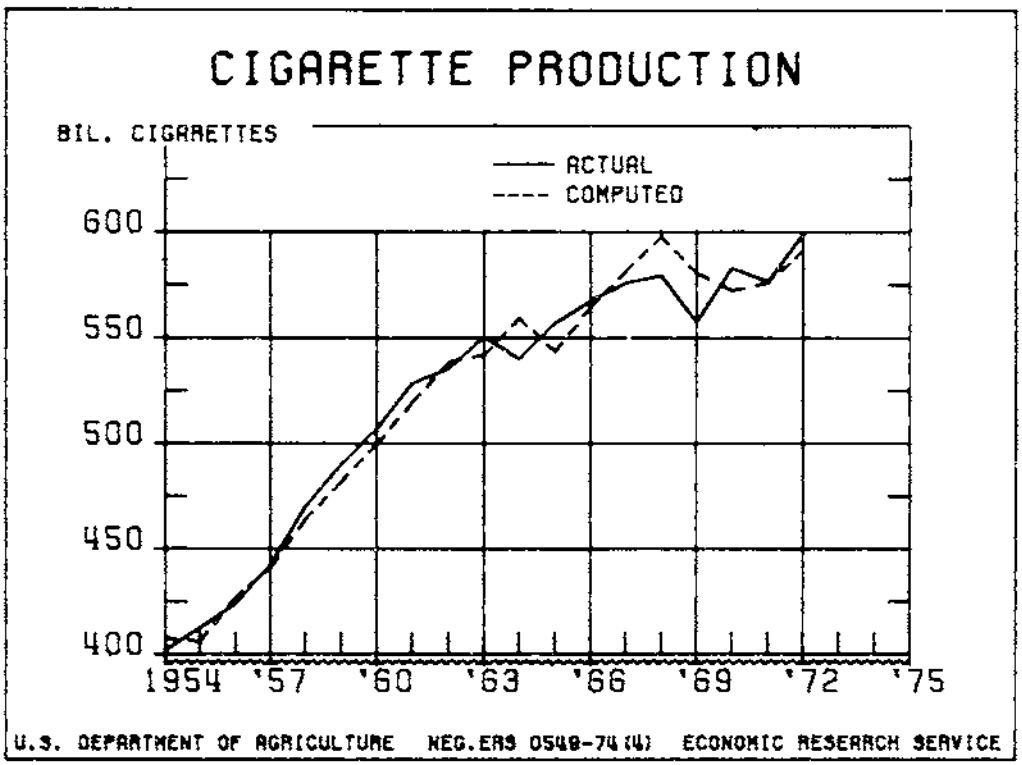

Figure 16

factors (average yields, tobacco used per 1,000 cigarettes, and population 18 years and older). In the reduced form of the system the interactions of the various forces have been allowed for. The reduced form matrix is used below to study the impact of a given change in an exogenous variable on endogenous variables. These impacts are useful guides in analyzing the effects of possible policy changes.

The reduced form can be written symbolically as 17/

$$y_t = ay_{t-1} + Bz_t$$

where y_t is a 14x1 vector of the endogenous variables,

y_{t-1} is a 14x1 vector of the endogenous variables lagged by one year.

z_t is the vector of the exogenous variables (excluding lagged endogenous variables);

A is the 14x14 matrix of the reduced-form coefficients of y_{t-1} (note that only the columns corresponding to AF_{t-1}, AB_{t-1}, PF_{t-1}, PB_{t-1}, SF_{t-1}, SB_{t-1}, and QC_{t-1} are nonzero);

B is the matrix of reduced form coefficients of z_t.

Starting with

$$y_t = Ay_{t-1} + Bz_t$$

by successive substitutions, we obtain

$$y_t = A\,(Ay_{t-2} + Bz_{t-1}) + Bz_t$$

$$= A^2\, y_{t-2} + ABz_{t-1} + Bz_t$$

$$= --$$

$$= A^{s+1}\, y_{t-s-1} + \sum_{r=0}^{s} A^r\, Bz_{t-r}$$

Assuming that $\lim_{r \to \infty} A^r = 0$, that is, the system is stable 18/

$$y_t = \sum_{r=o}^{\infty} A^r Bz_{t-r}.$$

The elements of $A^oB = B$, the matrix of reduced form coefficients of exogenous variables, are called impact multipliers. They give the effect of a unit change in an exogenous variable on an endogenous variable during the same time period. The elements of A^rB for r> o are called delay multipliers and give the response to a change in an exogenous variable after a delay of r time periods. These two concepts, impact and delay multipliers, give the

17/ The following analytical framework is based on Goldberger (8), pp. 373-375.
18/ The reduced form matrix in the estimated model was found to be stable.

response to a one-time change in an exogenous variable, i.e., the variable is increased by one unit in a time period and then reduced to its original level. (An example of this kind of change is the one-time purchase of flue-cured tobacco by Communist China). The values for delay multipliers for periods 2, 3, 4, and 5 are given in appendix tables 8-11.19/

The effect of a sustained change is measured by cumulated multipliers:

$$D_r = \sum_{v=o}^{r} A^v B = (I + A + -- + A^r)B$$

If the system is stable, i.e., if

$$\lim_{v \to \infty} A^v = 0$$

the equilibrium (or longrun) multipliers are defined as

$$D = \sum_{r=o}^{\infty} A^r B = (I-A)^{-1}B$$

In the above discussion, the error term has been suppressed. Therefore, in each case we get the expected effect of a given change. The cumulative multipliers for 5 years and longrun multipliers are given in appendix tables 2-7.

POLICY ANALYSIS

Before illustrating the use of the multipliers in policy analysis, it should be emphasized that the values for the multipliers given in appendix tables 2-11 are derived by using the 3-year (1970-72) average for average yields, pounds of tobacco used per 1,000 cigarettes, and population 18 years old and over. Therefore, the following analysis holds for these values.

The multiplier effects discussed here are the partial effects of a given change. However, these effects will in practice be mitigated by the influence of other factors which may change in the meantime. But the model enables us to isolate for analytical purposes the impact of a single possible policy change. To demonstrate the use of multipliers three possible policy changes are considered below: (1) A 6.5-cent-per-pound increase in support rate for flue-cured tobacco, (2) a 30-million-pound increase in burley poundage quota, and (3) a 1-cent-per-pack increase in Federal and State cigarette taxes.

Consider a possible 6.5-cent-per-pound increase in the support rate for flue-cured tobacco. Using the coefficients from the column headed SPF in appendix tables 2-6, the effects on the following variables are calculated: flue-cured acreage, flue-cured price, flue-cured yearend stocks, flue-cured production, flue-cured cigarette use, per capita cigarette consumption, total domestic cigarette consumption, retail tobacco price, and cigarette production.

19/ The delay multipliers for period 1 are identical to those given in appendix table 2.

The effects for the years 1-5 are given in table 7. It may be noted that a rise of 6.5 cents per pound in the support rate is estimated to lead to a rise of 8.33 cents per pound in the price of flue-cured tobacco. The higher tobacco price is estimated to lead to a rise in the retail tobacco price index of 0.38 percentage points, a decline in per capita consumption of about 13 cigarettes, a decrease of 1.82 million pounds in use of flue-cured tobacco in cigarette manufacturing, and a decline in cigarette production of 1.74 billion. The following year, as a result of the higher support rate and the higher flue-cured price, flue-cured acreage may be expected to increase by 18,840 acres and leaf production, by 38.02 million pounds.

Another example of the use of the multipliers is given in table 8. This shows the expected impact of an increase of 30 million pounds in burley poundage quota. The first-year effect is increased burley acreage of 12,760 acres, increased leaf production of 31.12 million pounds, and an increase of 31.04 million pounds in the yearend carryover. The effects on leaf use and cigarette production and consumption are small, perhaps because of the dominant role of flue-cured tobacco in cigarette manufacturing.

The last case of policy analysis considered is a possible 1-cent-per-pack increase in Federal and State cigarette taxes. The results of this analysis are shown in table 9. Since tax is the major component in the retail cost of cigarettes, the index of retail tobacco prices goes up by 2.19 points. Per capita cigarette consumption declines by about 72 cigarettes, causing a decrease of 9.95 billion in cigarette production. This results in an increase of 10.4 million pounds in yearend flue-cured stocks and 7.8 million pounds in yearend burley stocks.

Another question which may be analyzed is the impact of increased exports (or lower exports, assuming an alternative source of supply, Rhodesia, opens up). To study the impact of technological change, a new reduced form can be calculated by changing the multiplicative factors. The average yield per acre embodies the technological change in production 20/ and the pounds of tobacco used per 1,000 cigarettes in the manufacturing sector. The impact on the tobacco market of changes in any one or all of these coefficients can be traced. Similarly, we can study the effect of change in the percentage of cigarettes that are filter-tipped,which embodies the changing trend in tastes and habits.

20/ This is only one dimension of the problem since output is measured in terms of land. Another equally important aspect of technological change is output in terms of labor.

Table 7--The expected cumulative impact of a possible 6.5-cent-increase in support rate for flue-cured tobacco

Variable	Year				
	1	2	3	4	5
Flue-cured acreage, 1000 acres	---	18.84	26.68	29.79	30.88
Flue-cured price, cents/pound	8.33	8.26	8.17	8.07	7.96
Flue-cured yearend stocks, million pounds	1.82	42.86	100.48	164.87	231.75
Per capita cigarette consumption, number	-12.64	-20.92	-26.25	-29.57	-31.56
Flue-cured production, million pounds	---	38.02	53.84	60.13	62.33
Flue-cured cigarette use, million pounds	-1.82	-3.02	-3.78	-4.26	-4.55
Cigarette consumption, billion	-1.74	-2.88	-3.61	-4.07	-4.34
Retail tobacco price, index	.38	.38	.37	.37	.36
Cigarette production, billion	-1.74	-2.88	-3.61	-4.07	-4.34

Table 8.--Expected cumulative impact of a possible increase of 30 million pounds in poundage quota for burley tobacco

Variable	Year				
	1	2	3	4	5
Burley acreage, 1,000 acres	12.76	15.21	14.96	14.07	13.07
Burley price, cents/pound	-.64	-1.40	-2.14	-2.84	-3.48
Burley yearend stocks, million pounds	31.04	67.89	103.95	137.61	168.60
Burley production, million pounds	31.12	37.09	36.50	34.32	31.88
Burley cigarette use, million pounds	.08	.23	.44	.66	.88
Per capita cigarette consumption, number	.77	2.19	4.02	6.08	8.21
Cigarette consumption, billion	.11	.30	.55	.84	1.13
Retail tobacco price, index	-.02	-.05	-.08	-.10	-.13
Cigarette production, billion	.11	.30	.55	.84	1.13

Table 9--Expected cumulative impact of a possible 1-cent-per-pack increase in Federal and State cigarette taxes

Variable	Year				
	1	2	3	4	5
Flue-cured acreage, 1,000 acres			---	-0.01	-0.01
Burley acreage, 1,000 acres			-0.18	-.51	-.94
Flue-cured price, cents/pound		-0.02	-.04	-.08	-.12
Burley price, cents/pound		-.16	-.42	-.73	-1.07
Flue-cured production, million pounds			---	-.01	-.02
Burley production, million pounds			-.44	-1.25	-2.30
Flue-cured yearend stocks, million pounds	10.43	27.77	49.67	74.53	101.30
Burley yearend stocks, million pounds	7.83	20.84	36.83	54.24	72.03
Flue-cured cigarette use, million pounds	-10.43	-17.34	-21.90	-24.87	-26.79
Burley cigarette use, million pounds	-7.83	-13.01	-16.43	-18.66	-20.10
Per capita cigarette consumption, number	-72.36	-120.33	-151.94	-172.56	-185.83
Cigarette consumption, billion	-9.95	-16.54	-20.89	-23.72	-25.55
Retail tobacco price, index	2.19	2.19	2.18	2.16	2.15
Cigarette production, billion	-9.95	-16.54	-20.89	-23.72	-25.55

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APPENDIX TABLE 1.--REDUCED FORM OF THE SYSTEM

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES							
	AF(T-1)	PF(T-1)	ALF	AB(T-1)	PB(T-1)	ALB	PQB	SF(T-1)
AF	0.42380	2.26244	0.64657	0.0	0.0	0.0	0.0	0.0
AB	0.0	0.0	0.0	0.24779	1.11946	0.98670	0.42539	0.0
PF	-0.00137	-0.00731	-0.00209	0.0	0.0	0.0	0.0	-0.00160
PB	0.0	0.0	0.0	-0.01240	-0.05602	-0.04938	-0.02129	0.0
QPF	0.85530	4.56599	1.30489	0.0	0.0	0.0	0.0	0.0
QPF	0.0	0.0	0.0	0.60427	2.72996	2.40621	1.03737	0.0
SF	0.85500	4.56439	1.30443	-0.00214	-0.00968	-0.00853	-0.00368	0.99965
SB	-0.00022	-0.00120	-0.00034	0.60266	2.72270	2.39981	1.03461	-0.00026
DF	0.00030	0.00160	0.00046	0.00214	0.00968	0.00853	0.00368	0.00035
DB	0.00022	0.00120	0.00034	0.00161	0.00726	0.00640	0.00276	0.00026
QC	0.00208	0.01109	0.00317	0.01486	0.06715	0.05919	0.02552	0.00243
QCC	0.00029	0.00152	0.00044	0.00204	0.00923	0.00814	0.00351	0.00033
PC	-0.00006	-0.00034	-0.00010	-0.00045	-0.00204	-0.00179	-0.00077	-0.00007
QC°	0.00029	0.00152	0.00044	0.00204	0.00923	0.00814	0.00351	0.00033

CONTINUED

APPENDIX TABLE 1.--REDUCED FORM OF THE SYSTEM - CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES							
	ΔPF	DF	SB(T-1)	SPB	UB	XF	XB	DDF
AF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PF	1.28099	0.20951	0.0	0.0	0.0	0.0	0.0	0.0
PB	0.0	0.0	-0.02052	0.50941	0.42966	0.0	0.0	0.0
QPF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
QPB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF	0.28019	0.04583	-0.00355	0.08802	0.07424	-1.00000	0.0	-1.00000
SB	0.21021	0.03438	0.99734	0.06604	0.05570	0.00000	-1.00000	0.00000
DF	-0.28019	-0.04583	0.00355	-0.08802	-0.07424	-0.00000	0.0	-0.00000
DB	-0.21021	-0.03438	0.00266	-0.06604	-0.05570	-0.00000	0.0	-0.00000
QC	-1.94386	-0.31792	0.02460	-0.61064	-0.51505	0.0	0.0	0.0
QCC	-0.26722	-0.04371	0.00338	-0.08395	-0.07080	0.0	0.0	0.0
PC	0.05891	0.00964	-0.00075	0.01851	0.01561	0.0	0.0	0.0
QCP	-0.26722	-0.04371	0.00338	-0.08395	-0.07080	0.0	0.0	0.0

CONTINUED

APPENDIX TABLE 1.--REDUCED FORM OF THE SYSTEM - CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	UDB	I	QC(T-1)	FL	QCX	TX	CONSTANT
AF	0.0	0.0	0.0	0.0	0.0	0.0	-798.15818
AB	0.0	0.0	0.0	0.0	0.0	0.0	-149.23199
PF	0.0	0.0	0.0	0.0	0.0	0.0	-5.45090
PB	0.0	0.0	0.0	0.0	0.0	0.0	67.40127
QPF	0.0	0.0	0.0	0.0	0.0	0.0	-1610.81889
QPB	0.0	0.0	0.0	0.0	0.0	0.0	-363.92310
SF	0.0	-0.00544	-0.09600	-1.60910	-1.04851	10.42976	-1875.96725
SB	-1.00000	-0.00408	-0.07203	-1.20725	-0.78666	7.82508	-562.85454
DF	0.0	0.00544	0.09600	1.60910	1.04851	-10.42976	265.14835
DB	0.0	0.00408	0.07203	1.20725	0.78666	-7.82508	198.93144
QC	0.0	0.03771	0.66603	11.16354	0.0	-72.35924	1839.53655
QCC	0.0	0.00518	0.09156	1.53465	0.0	-9.94722	252.88109
PC	0.0	0.0	0.0	0.0	0.0	2.19300	59.27593
QCP	0.0	0.00518	0.09156	1.53465	1.00000	-9.94722	252.88109

APPENDIX TABLE 2.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES FOR YEAR 1

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQB	SPF	QF	SPB	QB	XF
AF	0.64657	0.0	0.0	0.0	0.0	0.0	0.0
AB	0.0	0.42539	0.0	0.0	0.0	0.0	0.0
PF	-0.00209	0.0	1.28099	0.20951	0.0	0.0	0.0
PB	0.0	-0.02129	0.0	0.0	0.50941	0.42966	0.0
QPF	1.30489	0.0	0.0	0.0	0.0	0.0	0.0
QPB	0.0	1.03737	0.0	0.0	0.0	0.0	0.0
SF	1.30443	-0.00368	0.28019	0.04583	0.08802	0.07424	-1.00000
SB	-0.00034	1.03461	0.21021	0.03438	0.06604	0.05570	0.00000
DF	0.00046	0.00368	-0.28019	-0.04583	-0.08802	-0.07424	-0.00000
DB	0.00034	0.00276	-0.21021	-0.03438	-0.06604	-0.05570	-0.00000
QC	0.00317	0.02552	-1.94386	-0.31792	-0.61064	-0.51505	0.0
QCC	0.00044	0.00351	-0.26722	-0.04371	-0.08395	-0.07080	0.0
PC	-0.00010	-0.00077	0.05891	0.00964	0.01851	0.01561	0.0
QCP	0.00044	0.00351	-0.26722	-0.04371	-0.08395	-0.07080	0.0

CONTINUED

APPENDIX TABLE 2.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES FOR YEAR 1 CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	XR	OOF	OOR	I	FL	OCX	TX
AF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
QPF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
QPR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF	0.0	-1.00000	0.0	-0.00544	-1.60910	-1.04851	10.42976
SR	-1.00000	0.00000	-1.00000	-0.00408	-1.20725	-0.78666	7.82508
DF	0.0	-0.00000	0.0	0.00544	1.60910	1.04851	-10.42976
DR	0.0	-0.00000	0.0	0.00408	1.20725	0.78666	-7.82508
QC	0.0	0.0	0.0	0.03771	11.16354	0.0	-72.35924
QCC	0.0	0.0	0.0	0.00518	1.53465	0.0	-9.94722
PC	0.0	0.0	0.0	0.0	0.0	0.0	2.19300
QCP	0.0	0.0	0.0	0.00518	1.53465	1.00000	-9.94722

APPENDIX TABLE 3.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARTABLES FOR YEAR 2

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQB	SPF	QF	SPB	QB	XF
AF	0.91586	0.0	2.89816	0.47400	0.0	0.0	0.0
AB	0.0	0.50697	0.0	0.0	0.57026	0.48099	0.0
PF	-0.00504	0.00001	1.27118	0.20791	-0.00014	-0.00012	0.00160
PB	0.00001	-0.04660	-0.00431	-0.00071	0.47952	0.40445	-0.00000
QPF	1.84837	0.0	5.84899	0.95662	0.0	0.0	0.0
QPB	0.0	1.23631	0.0	0.0	1.39067	1.17295	0.0
SF	3.15139	-0.01418	6.59308	1.07832	0.22946	0.19354	-1.99965
SB	-0.00140	2.26305	0.55827	0.09131	1.56283	1.31816	0.00026
DF	0.00141	0.01050	-0.46391	-0.07587	-0.14144	-0.11930	-0.00035
DB	0.00106	0.00788	-0.34805	-0.05693	-0.10612	-0.08951	-0.00026
QC	0.00976	0.07265	-3.21847	-0.52639	-0.98131	-0.82768	-0.00243
QCC	0.00134	0.01001	-0.44244	-0.07236	-0.13490	-0.11378	-0.00033
PC	-0.00023	-0.00169	0.05831	0.00954	0.01741	0.01469	0.00007
QCP	0.00134	0.01001	-0.44244	-0.07236	-0.13490	-0.11378	-0.00033

CONTINUED

APPENDIX TABLE 3.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES FOR YEAR 2 - CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	AP	ODF	ODB	I	FL	QCX	TX
AF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AB	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PF	0.0	0.00160	0.0	0.00001	0.00257	0.00168	-0.01669
PB	0.02052	-0.00000	0.02052	0.00008	0.02477	0.01614	-0.16057
QPF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
QPB	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF	0.00355	-1.99965	0.00355	-0.01447	-4.28506	-2.09386	27.77467
SB	-1.99734	0.00026	-1.99734	-0.01086	-3.21493	-1.57095	20.83835
OF	-0.00355	-0.00035	-0.00355	0.00904	2.67596	1.04535	-17.34491
OB	-0.00266	-0.00026	-0.00266	0.00678	2.00768	0.78429	-13.01327
QC	-0.02460	-0.00243	-0.02460	0.06271	18.56519	-0.02190	-120.33446
QCC	-0.00338	-0.00033	-0.00338	0.00862	2.55216	-0.00301	-16.54243
PC	0.00075	0.00007	0.00075	0.00000	0.00102	0.00066	2.18640
QCP	-0.00338	-0.00033	-0.00338	0.00862	2.55216	0.99699	-16.54243

APPENDIX TABLE 4.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES FOR YEAR 3

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQR	SPF	QF	SPR	QB	XF
AF	1.02330	0.00001	4.10422	0.67126	-0.00032	-0.00027	0.00362
AB	0.00001	0.49685	-0.00483	-0.00079	0.67811	0.57195	-0.00000
PF	-0.00835	0.00002	1.25719	0.20562	-0.00037	-0.00031	0.00319
PR	0.00003	-0.07140	-0.01121	-0.00183	0.44341	0.37399	-0.00001
QPF	2.04519	0.00003	8.28301	1.35471	-0.00064	-0.00054	0.00731
QPR	0.00002	1.21650	-0.01178	-0.00193	1.65366	1.39477	-0.00000
SF	5.21383	-0.03348	15.45810	2.52822	0.39956	0.33701	-2.99142
SB	-0.00345	3.46505	0.98316	0.16080	3.34459	2.82098	0.00096
DF	0.00276	0.01933	-0.58202	-0.09519	-0.17074	-0.14401	-0.00093
DB	0.00207	0.01450	-0.43667	-0.07142	-0.12810	-0.10805	-0.00070
QC	0.01913	0.13407	-4.03790	-0.66041	-1.18455	-0.99910	-0.00645
QCC	0.00263	0.01843	-0.55509	-0.09079	-0.16284	-0.13735	-0.00089
PC	-0.00038	-0.00259	0.05741	0.00939	0.01609	0.01357	0.00015
QCP	0.00263	0.01843	-0.55509	-0.09079	-0.16284	-0.13735	-0.00089

CONTINUED

APPENDIX TABLE 4.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES FOR YEAR 3

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	XR	ODF	ODB	I	FL	QCX	TX
AF	0.0	0.00362	0.0	0.00002	0.00582	0.00380	-0.03775
AB	0.02297	-0.00000	0.02297	0.00009	0.02773	0.01807	-0.17975
PF	-0.00001	0.00319	-0.00001	0.00002	0.00684	0.00334	-0.04432
PB	0.03984	-0.00001	0.03984	0.00022	0.06458	0.03133	-0.41861
QPF	0.0	0.00731	0.0	0.00004	0.01176	0.00766	-0.07620
QPB	0.05602	-0.00000	0.05602	0.00023	0.06763	0.04407	-0.43835
SF	0.01279	-2.99142	0.01279	-0.02585	-7.65202	-3.12647	49.59845
SB	-2.93439	0.00096	-2.93439	-0.01919	-5.68223	-2.30736	36.83078
DF	-0.00924	-0.00093	-0.00924	0.01141	3.37871	1.04026	-21.89997
DB	-0.00693	-0.00070	-0.00693	0.00856	2.53493	0.78047	-16.43077
QC	-0.06413	-0.00645	-0.06413	0.07918	23.44072	-0.05721	-151.93682
QCC	-0.00882	-0.00089	-0.00882	0.01089	3.22240	-0.00786	-20.88675
PC	0.00145	0.00015	0.00145	0.00001	0.00266	0.00129	2.17575
QCP	-0.00882	-0.00089	-0.00882	0.01089	3.22240	0.99214	-20.88675

APPENDIX TABLE 5.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES FOR YEAR 4

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQB	SPF	QF	SPB	QB	XF
AF	1.06136	0.00006	4.58368	0.74968	-0.00096	-0.00081	0.00875
AB	0.00003	0.46907	-0.01375	-0.00225	0.66441	0.56039	-0.00001
PF	-0.01177	0.00005	1.24146	0.20304	-0.00064	-0.00054	0.00476
PB	0.00007	-0.09458	-0.01949	-0.00319	0.40753	0.34373	-0.00002
QPF	2.14201	0.00011	9.25065	1.51297	-0.00194	-0.00164	0.01765
QPB	0.00008	1.14389	-0.03353	-0.00548	1.62025	1.36659	-0.00001
SF	7.35144	-0.06256	25.36456	4.14845	0.58161	0.49055	-3.97211
SB	-0.00667	4.58703	1.44166	0.23579	5.10287	4.30400	0.00219
DF	0.00440	0.02920	-0.65581	-0.10726	-0.18399	-0.15519	-0.00166
DB	0.00330	0.02191	-0.49203	-0.08047	-0.13804	-0.11643	-0.00124
QC	0.03052	0.20259	-4.54987	-0.74415	-1.27650	-1.07666	-0.01149
QCC	0.00420	0.02785	-0.62547	-0.10230	-0.17548	-0.14801	-0.00158
PC	-0.00054	-0.00343	0.05639	0.00922	0.01478	0.01246	0.00022
QCP	0.00420	0.02785	-0.62547	-0.10230	-0.17548	-0.14801	-0.00158

CONTINUED

APPENDIX TABLE 5.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES FOR YEAR 4 - CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	XB	OOF	OOB	I	FL	QCX	TX
AF	-0.00001	0.00875	-0.00001	0.00006	0.01794	0.00916	-0.11627
AB	0.05029	-0.00001	0.05029	0.00027	0.07917	0.03955	-0.51316
PF	-0.00002	0.00476	-0.00002	0.00004	0.01219	0.00497	-0.07898
PB	0.05770	-0.00002	0.05770	0.00038	0.11264	0.04537	-0.73009
QPF	-0.00003	0.01765	-0.00003	0.00012	0.03620	0.01849	-0.23465
QPP	0.12263	-0.00001	0.12263	0.00065	0.19307	0.09645	-1.25140
SF	0.02888	-3.97211	0.02888	-0.03869	-11.45311	-4.14207	74.23418
SB	-3.79966	0.00219	-3.79966	-0.02827	-8.36815	-2.98675	54.24024
DF	-0.01612	-0.00166	-0.01612	0.01296	3.83730	1.03409	-24.87238
DB	-0.01209	-0.00124	-0.01209	0.00973	2.87899	0.77594	-18.66987
QC	-0.11184	-0.01149	-0.11184	0.08993	26.62225	-0.10003	-172.55869
QCC	-0.01538	-0.00158	-0.01538	0.01236	3.65976	-0.01375	-23.72164
PC	0.00210	0.00022	0.00210	0.00002	0.00465	0.00188	2.16284
QCP	-0.01538	-0.00158	-0.01538	0.01236	3.65976	0.98625	-23.72164

APPENDIX TABLE 6.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES FOR YEAR 5

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQH	SPF	QF	SPH	QH	XF
AF	1.04975	0.00014	4.75126	0.77709	-0.00185	-0.00156	0.01447
AB	0.00009	0.43575	-0.02522	-0.00413	0.62085	0.52365	-0.00002
PF	-0.01522	0.00010	1.22506	0.20036	-0.00092	-0.00078	0.00531
PB	0.00013	-0.11593	-0.02832	-0.00463	0.37363	0.31514	-0.00004
QPF	2.15693	0.00029	9.58890	1.56829	-0.00373	-0.00314	0.02921
QPB	0.00021	1.06263	-0.06151	-0.01006	1.51403	1.27700	-0.00006
SF	9.50413	-0.10173	35.65331	5.83121	0.76478	0.64505	-4.94043
SH	-0.01113	5.62006	1.90522	0.31161	6.75712	5.69927	0.00399
DF	0.00624	0.03946	-0.69985	-0.11446	-0.18690	-0.15764	-0.00248
DB	0.00468	0.02960	-0.52507	-0.08588	-0.14022	-0.11827	-0.00186
QC	0.04326	0.27375	-4.85539	-0.79411	-1.29667	-1.09367	-0.01717
QCC	0.00595	0.03763	-0.66747	-0.10917	-0.17825	-0.15035	-0.00236
PC	-0.00069	-0.00421	0.05531	0.00905	0.01353	0.01141	0.00029
QCP	0.00595	0.03763	-0.66747	-0.10917	-0.17825	-0.15035	-0.00236

CONTINUED

APPENDIX TABLE 6.--EXPECTED CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES FOR YEAR 5 - CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	XH	DDF	DDB	I	FL	GCX	TX
AF	-0.00005	0.01447	-0.00005	0.00012	0.03517	0.01513	-0.22797
AB	0.07705	-0.00002	0.07705	0.00049	0.14571	0.06059	-0.94446
PF	-0.00005	0.00631	-0.00005	0.00006	0.01821	0.00658	-0.11804
PB	0.07411	-0.00004	0.07411	0.00056	0.16442	0.05826	-1.06575
QPF	-0.00010	0.02921	-0.00010	0.00024	0.07098	0.03054	-0.46007
QPB	0.18790	-0.00004	0.18790	0.00120	0.35534	0.14775	-2.30320
SF	0.05231	-4.94043	0.05231	-0.05241	-15.51459	-5.13893	100.56166
SB	-4.59411	0.00399	-4.59411	-0.03754	-11.11325	-3.60982	72.03330
DF	-0.02353	-0.00248	-0.02353	0.01396	4.13246	1.02740	-26.78555
DB	-0.01766	-0.00186	-0.01766	0.01047	3.10044	0.77082	-20.09625
QC	-0.16326	-0.01717	-0.16326	0.09685	28.67002	-0.14644	-185.83184
QCC	-0.02244	-0.00236	-0.02244	0.01331	3.94127	-0.02013	-25.54630
PC	0.00269	0.00029	0.00269	0.00002	0.00681	0.00242	2.14885
QCP	-0.02244	-0.00236	-0.02244	0.01331	3.94127	0.97987	-25.54630

APPENDIX TABLE 7.--EXPECTED LONGRUN CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQB	SPF	QF	SPH	QB	XF
AF	0.07796	0.08189	-0.00000	-0.00000	0.0	-0.00000	0.66107
AB	0.04841	0.05084	0.00000	0.00000	-0.00000	-0.00000	-0.02137
PF	-0.26593	0.02085	-0.00000	-0.00000	0.00000	0.00000	0.11743
PB	0.03253	-0.34583	0.00000	0.00000	-0.00000	-0.00000	-0.01436
QPF	0.15734	0.16526	-0.00000	-0.00000	0.00000	0.00000	0.93052
QPB	0.11804	0.12399	0.00000	0.00000	-0.00000	-0.00000	-0.05212
SF	166.04858	-13.19963	800.61875	130.94375	-0.00000	-0.00000	-74.32214
SB	-1.70312	16.72941	-0.00000	-0.00000	24.82505	20.93860	0.75205
DF	0.15734	0.16526	0.00000	0.00000	-0.00000	-0.00000	-0.06948
DB	0.11804	0.12399	0.00000	0.00000	0.0	-0.00000	-0.05212
QC	1.09156	1.14654	-0.00000	-0.00000	-0.00000	0.0	-0.48200
QCC	0.15006	0.15762	-0.00000	-0.00000	-0.00000	0.0	-0.06626
PC	-0.01105	-0.01160	0.00000	0.00000	0.00000	0.00000	0.00488
QCP	0.15006	0.15762	-0.00000	-0.00000	-0.00000	0.0	-0.06626

CONTINUED

APPENDIX TABLE 7.--EXPECTED LONGRUN CUMULATIVE MULTIPLIER EFFECTS OF A UNIT CHANGE IN EXOGENOUS VARIABLES ON ENDOGENOUS - CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	XR	ODF	ODB	I	FL	QCX	TX
AF	-0.05938	0.46107	-0.05938	0.00678	2.00686	0.43673	-13.00793
AB	0.37320	-0.02137	0.37320	0.00421	1.24607	0.27117	-8.07668
PF	-0.01512	0.11743	-0.01512	0.00173	0.51111	0.11123	-3.31287
PB	0.25077	-0.01436	0.25077	0.00283	0.83728	0.16221	-5.42704
QPF	-0.11983	0.93052	-0.11983	0.01368	4.05018	0.88140	-26.25222
QPB	0.91009	-0.05212	0.91009	0.01026	3.03870	0.66128	-19.69611
SF	9.57119	-74.32214	9.57119	-1.09274	-323.49248	-70.39824	2096.79639
SB	-13.13067	0.75205	-13.13067	-0.14810	-43.84188	-9.54084	284.17196
DF	-0.11983	-0.06948	-0.11983	0.01368	4.05018	0.88140	-26.25222
DB	-0.08991	-0.05212	-0.08991	0.01026	3.03870	0.66128	-19.69611
QC	-0.83137	-0.48200	-0.83137	0.09492	28.09917	-1.15939	-182.13170
QCC	-0.11429	-0.06626	-0.11429	0.01305	3.86279	-0.15938	-25.03764
PC	0.00841	0.00488	0.00841	0.00018	0.05392	0.01173	1.84348
QCP	-0.11429	-0.06626	-0.11429	0.01305	3.86279	0.84062	-25.03764

APPENDIX TABLE 8.--EXPECTED VALUES OF INTERIM MULTIPLIERS FOR DELAY PERIOD = 2

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQB	SPF	QF	SPB	QB	XF
AF	0.26929	0.0	2.89816	0.47400	0.0	0.0	0.0
AB	0.0	0.08158	0.0	0.0	0.57026	0.48099	0.0
PF	-0.00296	0.00001	-0.00981	-0.00160	-0.00014	-0.00012	0.00160
PB	0.00001	-0.02531	-0.00431	-0.00071	-0.02989	-0.02521	-0.00000
QPF	0.54348	0.0	5.84899	0.95662	0.0	0.0	0.0
QPB	0.0	0.19894	0.0	0.0	1.39067	1.17295	0.0
SF	1.84696	-0.01050	6.31289	1.03249	0.14144	0.11930	-0.99965
SB	-0.00106	1.22843	0.34805	0.05693	1.49679	1.26246	0.00026
DF	0.00095	0.00682	-0.18372	-0.03005	-0.05343	-0.04506	-0.00035
DB	0.00071	0.00512	-0.13784	-0.02254	-0.04008	-0.03381	-0.00026
QC	0.00659	0.04733	-1.27462	-0.20847	-0.37066	-0.31263	-0.00243
QCC	0.00091	0.00651	-0.17522	-0.02866	-0.05095	-0.04298	-0.00033
PC	-0.00014	-0.00092	-0.00061	-0.00010	-0.00109	-0.00092	0.00007
QCP	0.00091	0.00651	-0.17522	-0.02866	-0.05095	-0.04298	-0.00033

CONTINUED

APPENDIX TABLE 8.--EXPECTED VALUES OF INTERIM MULTIPLIERS FOR DELAY PERIOD = 2
CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	XR	ODF	ODB	I	FL	QCX	TX
AF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AB	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PF	0.0	0.00160	0.0	0.00001	0.00257	0.00168	-0.01669
PB	0.02052	-0.00000	0.02052	0.00008	0.02477	0.01614	-0.16057
QPF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
QPB	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF	0.00355	-0.99965	0.00355	-0.00904	-2.67596	-1.04535	17.34491
SB	-0.99734	0.00026	-0.99734	-0.00678	-2.00768	-0.78429	13.01327
DF	-0.00355	-0.00035	-0.00355	0.00360	1.06686	-0.00316	-6.91514
DB	-0.00266	-0.00026	-0.00266	0.00270	0.80043	-0.00237	-5.18819
QC	-0.02460	-0.00243	-0.02460	0.02500	7.40165	-0.02190	-47.97562
QCC	-0.00338	-0.00033	-0.00338	0.00344	1.01750	-0.00301	-6.59521
PC	0.00075	0.00007	0.00075	0.00000	0.00102	0.00066	-0.00660
QCP	-0.00338	-0.00033	-0.00338	0.00344	1.01750	-0.00301	-6.59521

APPENDIX TABLE 9.--EXPECTED VALUES OF INTERIM MULTIPLIERS FOR DELAY PERIOD = 3

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQB	SPF	QF	SPB	QB	XF
AF	0.10744	0.00001	1.20605	0.19725	-0.00032	-0.00027	0.00362
AB	0.00001	-0.00812	-0.00483	-0.00079	0.10784	0.09096	-0.00000
PF	-0.00330	0.00002	-0.01400	-0.00229	-0.00023	-0.00019	0.00159
PB	0.00002	-0.02480	-0.00690	-0.00113	-0.03611	-0.03046	-0.00001
QPF	0.21683	0.00003	2.43402	0.39809	-0.00064	-0.00054	0.00731
QPB	0.00002	-0.01981	-0.01178	-0.00193	0.26299	0.22182	-0.00000
SF	2.06244	-0.01930	8.86503	1.44990	0.17010	0.14347	-0.99177
SB	-0.00205	1.20201	0.42489	0.06949	1.78176	1.50282	0.00070
DF	0.00135	0.00883	-0.11811	-0.01932	-0.02930	-0.02471	-0.00058
DB	0.00101	0.00662	-0.08861	-0.01449	-0.02198	-0.01854	-0.00043
QC	0.00937	0.06123	-0.81942	-0.13402	-0.20324	-0.17142	-0.00402
QCC	0.00129	0.00842	-0.11265	-0.01842	-0.02794	-0.02357	-0.00055
PC	-0.00015	-0.00090	-0.00089	-0.00015	-0.00132	-0.00112	0.00007
QCP	0.00129	0.00842	-0.11265	-0.01842	-0.02794	-0.02357	-0.00055

CONTINUED

APPENDIX TABLE 9.--EXPECTED VALUES OF INTERIM MULTIPLIERS FOR DELAY PERIOD = 3
CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	XB	ODF	ODB	I	FL	QCX	TX
AF	0.0	0.00362	0.0	0.00002	0.00582	0.00380	-0.03775
AB	0.02297	-0.00000	0.02297	0.00009	0.02773	0.01807	-0.17975
PF	-0.00001	0.00159	-0.00001	0.00001	0.00426	0.00166	-0.02763
PB	0.01932	-0.00001	0.01932	0.00013	0.03981	0.01519	-0.25804
QPF	0.0	0.00731	0.0	0.00004	0.01176	0.00766	-0.07620
QPB	0.05602	-0.00000	0.05602	0.00023	0.06763	0.04407	-0.43835
SF	0.00924	-0.99177	0.00924	-0.01137	-3.36696	-1.03260	21.82378
SB	-0.93705	0.00070	-0.93705	-0.00833	-2.46730	-0.73641	15.99242
DF	-0.00570	-0.00058	-0.00570	0.00237	0.70275	-0.00509	-4.55506
DB	-0.00427	-0.00043	-0.00427	0.00178	0.52725	-0.00382	-3.41750
QC	-0.03953	-0.00402	-0.03953	0.01647	4.87553	-0.03531	-31.60196
QCC	-0.00543	-0.00055	-0.00543	0.00226	0.67024	-0.00485	-4.34432
PC	0.00070	0.00007	0.00070	0.00001	0.00164	0.00063	-0.01065
QCP	-0.00543	-0.00055	-0.00543	0.00226	0.67024	-0.00485	-4.34432

APPENDIX TABLE 10.--EXPECTED VALUES OF INTERIM MULTIPLIERS FOR DELAY PERIOD = 4

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQB	SPF	QF	SPB	QB	XF
AF	0.03806	0.00004	0.47946	0.07842	-0.00064	-0.00054	0.00513
AB	0.00003	-0.02978	-0.00892	-0.00146	-0.01370	-0.01156	-0.00001
PF	-0.00342	0.00003	-0.01573	-0.00257	-0.00027	-0.00023	0.00157
PB	0.00004	-0.02318	-0.00827	-0.00135	-0.03588	-0.03026	-0.00001
QPF	0.07681	0.00009	0.96764	0.15826	-0.00130	-0.00110	0.01035
QPB	0.00006	-0.07261	-0.02176	-0.00356	-0.03341	-0.02818	-0.00001
SF	2.13761	-0.02909	9.90646	1.62023	0.18205	0.15355	-0.98069
SB	-0.00322	1.12198	0.45850	0.07499	1.75829	1.48302	0.00123
DF	0.00164	0.00988	-0.07379	-0.01207	-0.01325	-0.01118	-0.00073
DB	0.00123	0.00741	-0.05537	-0.00906	-0.00994	-0.00839	-0.00055
QC	0.01139	0.06851	-0.51197	-0.08373	-0.09195	-0.07756	-0.00504
QCC	0.00157	0.00942	-0.07038	-0.01151	-0.01264	-0.01066	-0.00069
PC	-0.00016	-0.00084	-0.00102	-0.00017	-0.00132	-0.00111	0.00007
QCP	0.00157	0.00942	-0.07038	-0.01151	-0.01264	-0.01066	-0.00069

CONTINUED

APPENDIX TABLE 10.--EXPECTED VALUES OF INTERIM MULTIPLIERS FOR DELAY PERIOD = 4
CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	XB	ODF	ODB	I	FL	QCX	TX
AF	-0.00001	0.00513	-0.00001	0.00004	0.01211	0.00536	-0.07851
AB	0.02732	-0.00001	0.02732	0.00017	0.05144	0.02148	-0.33340
PF	-0.00001	0.00157	-0.00001	0.00002	0.00535	0.00163	-0.03466
PB	0.01786	-0.00001	0.01786	0.00016	0.04806	0.01404	-0.31148
QPF	-0.00003	0.01035	-0.00003	0.00008	0.02445	0.01083	-0.15845
QPB	0.06661	-0.00001	0.06661	0.00042	0.12544	0.05239	-0.81305
SF	0.01609	-0.98069	0.01609	-0.01284	-3.80109	-1.01560	24.63774
SB	-0.86527	0.00123	-0.86527	-0.00907	-2.68592	-0.67939	17.40947
DF	-0.00688	-0.00073	-0.00688	0.00155	0.45858	-0.00617	-2.97241
DB	-0.00516	-0.00055	-0.00516	0.00116	0.34406	-0.00463	-2.23009
QC	-0.04772	-0.00504	-0.04772	0.01075	3.18153	-0.04282	-20.62187
QCC	-0.00656	-0.00069	-0.00656	0.00148	0.43736	-0.00589	-2.83489
PC	0.00065	0.00007	0.00065	0.00001	0.00199	0.00059	-0.01291
QCP	-0.00656	-0.00069	-0.00656	0.00148	0.43736	-0.00589	-2.83489

APPENDIX TABLE 11.—EXPECTED VALUES OF INTERIM MULTIPLIERS FOR DELAY PERIOD = 5

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	ALF	PQB	SPF	QF	SPB	QB	XF
AF	0.00839	0.00009	0.16760	0.02741	-0.00088	-0.00075	0.00573
AB	0.00005	-0.03332	-0.01147	-0.00188	-0.04356	-0.03674	-0.00002
PF	-0.00345	0.00005	-0.01639	-0.00268	-0.00029	-0.00024	0.00155
PB	0.00006	-0.02136	-0.00883	-0.00144	-0.03390	-0.02859	-0.00002
QPF	0.01693	0.00018	0.33825	0.05532	-0.00178	-0.00151	0.01155
QPB	0.00013	-0.08126	-0.02797	-0.00458	-0.10622	-0.08959	-0.00004
SF	2.15270	-0.03917	10.28875	1.68276	0.18317	0.15449	-0.96832
SB	-0.00447	1.03303	0.46357	0.07582	1.65425	1.39527	0.00180
DF	0.00184	0.01026	-0.04404	-0.00720	-0.00291	-0.00245	-0.00092
DB	0.00138	0.00770	-0.03304	-0.00540	-0.00218	-0.00184	-0.00061
QC	0.01274	0.07116	-0.30552	-0.04997	-0.02017	-0.01701	-0.00568
QCC	0.00175	0.00978	-0.04200	-0.00687	-0.00277	-0.00234	-0.00078
PC	-0.00016	-0.00077	-0.00107	-0.00018	-0.00124	-0.00105	0.00007
QCP	0.00175	0.00978	-0.04200	-0.00687	-0.00277	-0.00234	-0.00078

CONTINUED

APPENDIX TABLE 11.---EXPECTED VALUES OF INTERIM MULTIPLIERS FOR DELAY PERIOD = 5
CONTINUED

ENDOGENOUS VARIABLES	EXOGENOUS VARIABLES						
	XR	ODF	ODB	I	FL	QCX	TX
AF	-0.00004	0.00573	-0.00004	0.00006	0.01723	0.00597	-0.11170
AB	0.02676	-0.00002	0.02676	0.00022	0.06654	0.02104	-0.43130
PF	-0.00003	0.00155	-0.00003	0.00002	0.00603	0.00161	-0.03906
PB	0.01642	-0.00002	0.01642	0.00017	0.05179	0.01289	-0.33566
QPF	-0.00008	0.01155	-0.00008	0.00012	0.03478	0.01205	-0.22543
QPB	0.06527	-0.00004	0.06527	0.00055	0.16227	0.05130	-1.05180
SF	0.02343	-0.96832	0.02343	-0.01372	-4.06148	-0.99686	26.32548
SB	-0.79445	0.00180	-0.79445	-0.00927	-2.74510	-0.62307	17.79306
DF	-0.00741	-0.00082	-0.00741	0.00100	0.29516	-0.00669	-1.91317
DB	-0.00556	-0.00061	-0.00556	0.00075	0.22145	-0.00502	-1.43539
QC	-0.05142	-0.00568	-0.05142	0.00692	2.04777	-0.04641	-13.27315
QCC	-0.00707	-0.00078	-0.00707	0.00095	0.28151	-0.00638	-1.82466
PC	0.00060	0.00007	0.00060	0.00001	0.00216	0.00054	-0.01399
QCP	-0.00707	-0.00078	-0.00707	0.00095	0.28151	-0.00638	-1.82466

Appendix table 12--Exogenous variables, 1954-72

Year	Flue-cured tobacco, types 11-14					Burley tobacco, type 31					Per capita disposable income, 1958 prices	Cigarettes		Federal and State cigarette taxes per package
	Acreage allotted	Price support level	Leaf share in choice, fine, and good	Exports	Other use	Acreage allotted	Price support level per pound	Leaf share in choice, fine, and good	Exports	Other use		Share filter-tipped	Exports 1/	
	1,000 acres	Cents	Percent	Million pounds		1,000 acres	Cents	Percent	Million pounds		Dollars	Percent	Billions	Cents
1954	1,053	49.7	22.0	429	40	399	46.4	22.5	33	71	1,714	9.2	17.2	11
1955	1,007	48.3	21.5	553	38	309	46.2	30.2	34	63	1,795	18.7	17.1	11
1956	888	48.9	15.3	465	35	309	48.1	25.7	28	58	1,839	27.6	17.7	11
1957	711	50.8	17.7	441	39	309	51.7	24.2	28	59	1,844	38.0	19.1	12
1958	712	54.6	14.9	443	38	309	55.4	22.7	35	59	1,831	45.3	20.3	12
1959	713	55.5	11.7	419	38	309	57.2	17.2	36	58	1,881	48.7	22.1	13
1960	713	55.5	12.2	475	39	309	57.2	22.1	41	58	1,883	50.9	22.7	13
1961	714	55.5	17.9	485	39	329	57.2	32.0	45	58	1,909	52.5	25.0	13
1962	745	56.1	10.3	431	39	349	57.8	24.4	53	57	1,969	54.6	24.2	13
1963	708	56.6	10.0	498	43	349	58.3	28.3	57	61	2,015	58.0	26.8	14
1964	638	57.2	6.8	444	42	316	58.9	26.6	56	65	2,126	60.9	28.8	14
1965	607	57.7	8.0	423	40	287	59.5	34.0	57	61	2,239	64.4	27.0	15
1966	2/644	58.8	6.3	587	40	250	60.1	36.6	56	60	2,335	68.2	27.4	16
1967	2/645	59.9	5.6	533	42	250	61.8	46.7	53	61	2,403	72.4	27.6	16
1968	2/578	61.6	6.4	525	43	250	63.5	47.9	55	60	2,486	74.9	31.2	16
1969	2/641	63.8	7.3	535	44	250	63.8	37.3	58	62	2,534	77.0	28.7	18
1970	2/639	66.6	7.5	534	44	231	68.6	37.3	54	62	2,603	80.1	32.9	19
1971	2/572	69.4	9.5	480	45	3/555	71.5	43.9	55	60	2,679	82.4	34.5	20
1972	2/562	72.4	22.8	519	32	3/531	74.9	50.6	68	45	2,771	82.9	36.7	20

1/ Includes shipments to Puerto Rico and U.S. possessions.

2/ Effective quota (basic quota adjusted for overmarketing and unmarketing). See (27, March 1974).

3/ Poundage quota, million pounds.

Source: (26) for the following variables; flue-cured acres allotted, flue-cured support price, flue-cured export, flue-cured other use, burley acres allotted, burley poundage quota, burley support price, burley export, and burley other use; (18) and (30) for percent of flue-cured choice, fine, and good; (3) for per capita income; and (27) for percent cigarettes filter-tipped; (27) for cigarette exports; and (24) for Federal and State cigarette taxes.

END