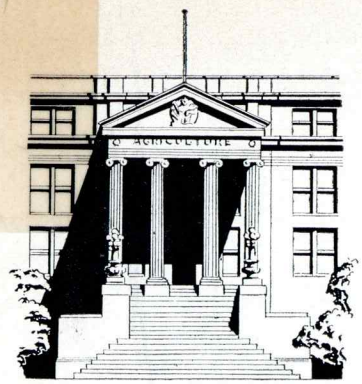

A Statistical Analysis Of Certain Institutional Variables In the Butter and Margarine Market

by George W. Ladd

(with a Historical Summary of Selected State and Federal Oleomargarine Laws, 1919-56, by George W. Ladd and J. D. Jenkins)

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GLOSSARY OF SYMBOLS

For convenient reference, the variables used are summarized below. More information on the variables in models I and II is presented in Appendix A. More information on the variables in Model III is presented in the text.

Models I and II

DEFLATORS

I = consumer price index.

N_{ij} = population of the j-th state in group i; i = 0 if the state prohibits the retail sale of yellow margarine; i = 1 if the state permits its sale.

$N_0 = \Sigma N_{0j}$ = total population of states prohibiting the sale of yellow margarine.

$N_1 = \Sigma N_{1j}$ = total population of states permitting its sale.

$N = N_0 + N_1$ = total domestic population.

$n_0 = \frac{N_0}{N}$ = proportion of population residing in states in group zero.

$n_1 = \frac{N_1}{N}$ = proportion of population residing in states in group one.

N' = population, including armed forces overseas.

N_e = population eating out of civilian food supplies.

QUANTITIES

$C_m = Q_m/N_e$. Q_m = total civilian margarine consumption.

$Q_m = \Sigma Q_{0i} + \Sigma Q_{u1i} + \Sigma Q_{c1i}$.

Q_{0i} = quantity of uncolored margarine purchased by the i-th resident of group zero of states.

Q_{u1i} = quantity of uncolored margarine purchased by the i-th resident of group one.

Q_{c1i} = quantity of colored margarine purchased by i-th resident of group one.

$C_b = Q_b/N_e$. Q_b = total civilian butter consumption.

$C_{mb} = Q_m/N_e + Q_b/N_e$.

$C_{pf} = Q_{pf}/N_e$. Q_{pf} = total civilian consumption of potatoes and flour.

$S_0 = Q_0/N'$. Q_0 = total supply of coconut oil and food fats and oils excluding butter and lard.

$S_L = Q_L/N'$. Q_L = total supply of lard.

INCOME AND ASSETS

$Y = Y^*/N'I$. Y^* = total disposable personal income in the United States.

$Y_0 = Y^*_0/NI$.

$Y^*_0 = \Sigma Y^*_{0i}$ = total disposable personal income of residents of states prohibiting the sale of colored margarine.

Y^*_{0i} = disposable personal income of i-th resident of group zero of states.

$Y_1 = Y^*_1/NI$.

$Y^*_1 = \Sigma Y^*_{1i}$ = total disposable personal income of residents of states permitting the sale of colored margarine.

Y^*_{1i} = disposable personal income of i-th resident of group one of states.

$A = \left(\frac{a}{N'I}\right)_{t-1} \cdot a_{t-1}$ = total value of liquid assets in the hands of consumers at the end of the preceding year.

$A_y = 100\ A/Y$.

PRICES

$P_m = p_m/I$. p_m = average retail price of margarine.

P_{u0i} = price of uncolored margarine for the i-th resident of group zero of states.

P_{u0} = average retail uncolored margarine price in states in group zero.

P_{u1i} = price of uncolored margarine for the i-th resident of group one.

P_{u1} = average retail price of uncolored margarine in states in group one.

P_{c1i} = price of colored margarine for the i-th resident of group one.

P_{c1} = average retail price of colored margarine in states in group one.

$P_b = p_b/I$. p_b = average retail price of butter.

P_{b0i} = price of butter for the i-th resident of group zero of states.

P_{b1i} = price of butter for the i-th resident of group one.

P_{b0} = average retail price of butter in states prohibiting the sale of yellow margarine.

P_{b1} = average retail price of butter in states permitting its sale.

$P_{r1} = P_b/P_m$

$P_{r2} = P_m/P_b$

$P_{mb} = p_{mb}/I$. p_{mb} = index of retail prices of butter and margarine.

$P_{sL} = p_{sL}/I$. p_{sL} = index of retail prices of shortening and lard.

$P_{mw} = p_{mw}/I$. p_{mw} = average wholesale price of margarine.

$P_w = p_w/I$. p_w = index of wholesale prices of all products other than farm products and foods.

$P_{mi} = p_{mi}/I$. p_{mi} = index of prices of principal margarine ingredients.

$W_1 = w_1/I$. w_1 = average wage rate of employees of chemical manufacturing industries.

LEGAL VARIABLES

$e_w = E_w/I.$

E_w = weighted average of excise tax on uncolored margarine.

$$= \left[\frac{\sum_{i=0}^{1} \sum_{j=0}^{n'_i} N_{ij} E_{wij} f_{ij}}{\sum_i \sum_j N_{ij}} + K_w \right] \times 100.$$

E_{wij} = excise tax on uncolored margarine in the j-th state in group i.

f_{ij} = fraction of year the tax was levied by the j-th state in group i.

K_w = 0.25 cents through 1949
= 0.125 cents in 1950
= 0 since 1950.

K_w is the amount of the tax levied by the federal government.

n'_i = number of states in group i; i = 0 or 1.

$n'_0 + n'_1 = 49$ (48 states plus the District of Columbia).

E_c = weighted average tax on colored margarine.

L_{rw} = weighted average of license fees levied on retailers of uncolored margarine.

L_{hw} = weighted average of license fees levied on wholesale dealers for uncolored margarine.
The same type of formula was used in the computation of E_c, L_{rw} and L_{hw} as was used in the computation of E_w.

MISCELLANEOUS

$F = F_1/F_2.$

F_1 = pounds of margarine produced.

F_2 = pounds of ingredients used in margarine production.

t = time, 1920 = 0.

COEFFICIENTS

a, b, c: parameters to be estimated. Numerical subscripts and prime superscripts are sometimes used to distinguish among parameters, as in a_1, a_2, a'_2.

a_{si} = value of parameter a_s for i-th individual, s = 1, 2, ...

MODEL III

$L = L'/N$. L' = number of retail stores in a state holding federal licenses to sell margarine on June 30. N = midyear population of the state in thousands.

X_1 = state excise tax on uncolored domestic ingredient margarine.

X_2 = state excise tax on colored domestic ingredient margarine.

X_3 = state excise tax on foreign ingredient margarine in states where $X_1 = X_2 = 0$.

X_4 = margarine wholesaler's license fee.

X_5 = margarine retailer's license fee.

X_6 = fraction of the year that state law permitted the retail sale of colored margarine.

X_7 = number of retail food stores per capita.

X_8 = state per-capita personal income.

$X_9 = X^2_8$.

X_{10} = average butter price.

X_{11} = lard price plus shortening price plus salad dressing price.

M = average margarine price.

SUMMARY

The objective of this study was to explain recent trends in per-capita butter and margarine consumption —primarily, to determine the relation between these trends and the repeal of legal restrictions on the distribution and consumption of margarine. As a first step in the study, a historical summary was made of pertinent state and federal laws. The effects of these laws then were determined by statistical analysis. In most cases the sample period was 1920-41, 1947-49.

In the time-series analysis, no relation was found between the retail supply of margarine and margarine excise taxes. This is understandable, since less than one-fifth of the population has ever lived in states which levied excises on margarine. The cross-section analyses of data by states and cities, however, show that excise taxes reduce the retail supply of margarine. They reduce the number of stores selling margarine and raise the prices charged by those stores that do sell it. On the other hand, margarine distributors' license fees seem to have no effect on the retail supply of margarine.

The results of this study emphasize the validity of the observation that the analysis of aggregate time series data often is useful and necessary, but the degree of aggregation involved may hide significant relationships. The results also show that a process of disaggregation sometimes may be used to bring these relations to light. No relation was found between margarine consumption and national average per-capita income. When income was disaggregated into two series—income in states permitting the sale of colored margarine and income in states prohibiting its sales—significant differences were found in the relation between margarine consumption and income in the two groups of states. Significant differences also were found in the relation between butter consumption and the two income series.

State laws prohibiting the retail sale of colored margarine are effective in restricting margarine consumption. The substantial increases which have taken place in margarine consumption relative to butter consumption can be largely explained by the fact that a number of states have repealed colored margarine prohibitions in the last 20 years. If the number of states prohibiting the sale of colored margarine had remained constant after 1935, it is estimated that the 1947-49 averages of annual per-capita butter and margarine consumption would have been 18.5 and 2.2 pounds, respectively. These figures contrast with the actual averages of 10.4 and 5.6 pounds, respectively.

Changes in consumers' preferences may have been one reason for the increase in margarine consumption relative to butter consumption. The analysis indicates, however, that these changes played a minor role in consumption compared with the role played by the removal of legal restrictions on margarine distribution.

Between 1926-35 and 1947-49, per-capita potato and flour consumption declined from 350 to 270 pounds. This decline depressed margarine price and butter consumption slightly and depressed margarine consumption and butter price by one-tenth to one-fifth. Since 1947-49, potato and flour consumption has declined still further, presumably exerting a still more depressing effect on these prices and consumption.

Equations fitted to 1920-41, 1947-49 data were used to predict 1950-55 values. The predictions were generally poor, but this was expected because of certain changes which have occurred since 1949. These changes are: (1) the 1950 action of the federal government in repealing excise taxes on margarine and license fees on its manufacture and distribution, (2) the Bureau of Labor Statistics' shift from pricing uncolored to pricing colored margarine and (3) the dairy price support and dairy products disposal programs of the United States Department of Agriculture. Another factor in explaining the poor predictions is the linearity of the estimated demand equations in contrast with the probable nonlinearity of the actual relationship between margarine consumption and income.

A Statistical Analysis of Certain Institutional Variables in the Butter and Margarine Market[1]

BY GEORGE W. LADD

Over the past 25 years, per-capita margarine consumption has risen by about 300 percent in this country, while per-capita butter consumption has fallen by about 50 percent. The declining trend in butter consumption has created serious problems for dairy farmers, dairy processors and formulators and administrators of national dairy policy. The growth of margarine consumption has furnished vegetable fat and oil producers and processors an expanding market. It will be useful to all of these groups to have some quantitative information on causes of these trends and on probable future developments.

Various hypotheses have been advanced to explain these trends: (1) changes in consumer preferences brought about by the expanded use of margarine during the butter rationing period of World War II or by improvements in margarine quality, (2) the changing price ratio between butter and margarine and (3) the gradual repeal of various legal restrictions on the production, distribution and consumption of margarine. Between 1935 and 1955, 24 states repealed laws prohibiting the retail sale of yellow margarine, 1 other repealed a tax on its sale, 5 states repealed taxes on uncolored margarine, and 8 removed license fees on margarine distributors. In addition, in 1950 the federal government repealed excise taxes and license fees on its sale and distribution.

The primary objective of this study was to learn whether the observed trends in butter and margarine consumption were consequences, at least in part, of the removal of legal restrictions on the consumption and distribution of margarine. A secondary objective was to evaluate the relation between these trends and the other hypothesized causes mentioned above. The study used a method of analysis which may be of use to other investigators who are interested in analyzing the economic effects of various laws or regulations.

Three models were constructed for statistical analysis. Special attention was devoted to the definition and selection of variables which could be used to measure the effects of legal restrictions on margarine distribution. Model I, presented in the next section, contains 63 equations and 63 endogenous variables; only the seven equations of immediate interest are presented here. This model is more complex than necessary for this study because it also was used to analyze the markets for other dairy products and to study the relationships between dairy products and other food products. Statistical analyses using time series data were based on Model I. Model II consists of five equations from Model I, plus two identities. It was used for prediction. Model III was tested with cross-section data referring to a given year.

MODEL I

Demand for Table Fat

The first equation in this model is a demand function for total table fat (butter and margarine). The next two equations determine the consumption of each of these two table fats separately.

Since table fats are used primarily as a spread for bread and other baked goods and as a flavoring on potatoes, one would expect the consumption of bread and potatoes to have a significant effect on the total demand for table fat. Since data on bread consumption are not available, figures on flour consumption were used in the variable C_{pf}, which is the sum of per-capita consumption of total wheat flour, rye flour, corn flour and cornmeal, potatoes and sweet potatoes.

In addition to their uses as table spreads, butter and margarine are used to some extent in cooking and baking. Here they compete with lard and shortening. To reflect this fact, the variable P_{sL}, a deflated index of the retail prices of shortening and lard, is included. Per-capita disposable personal income, Y, may affect the demand for table fat. Klein and Goldberger (13) found a significant relationship between liquid assets in the hands of consumers and total consumption expenditures. Fox (7) found that forecasts of postwar consumption of agricultural products using regressions computed from prewar data were improved if allowance was made for the stock of liquid assets. The stock of liquid assets can be formally incorporated into the theory of consumer behavior, as is done by Klein (12, pp. 46-50). To test the hypothesis that liquid assets affect the demand for table fat, deflated per-capita liquid assets in the hands of consumers at the end of the preceding year, A, are included.

[1]Project 1355 of the Iowa Agricultural and Home Economics Experiment Station. The author is grateful to John Nordin, John Heer, John Timmons, Emil Jebe and Emerson Bird for their helpful comments on earlier drafts of this manuscript.

The demand equation for table fats is

$$(1)\quad P_{mb} = F_1(C_{mb},\ P_{sL};\ C_{pf},\ Y,\ A,\ u_1)$$

where P_{mb} is a deflated index of retail prices of butter and margarine, C_{mb} is per-capita consumption of margarine and butter, and u_1 is a random disturbance. Throughout this section, the symbol u_i denotes the random disturbance in the i-th equation.

The absence of the subscript t on a variable denotes current period values. Terms preceding the semicolon are treated as jointly determined; terms following, as predetermined. Linear forms of the equations are used in estimation.

Demand for Margarine

In this study, states are classified into two groups—states in group zero prohibiting the retail sale of yellow margarine, and those in group one permitting its sale.

For present purposes, it is useful to derive the macro-demand function for margarine by aggregating individual demand functions. Conceptually there are three sets of micro-demand equations: (1) the demand for uncolored margarine by residents of states in group zero,

$$Q_{0i} = a_{0i} + a_{1i}P_{u0i} + a_{2i}P_{b0i} + a_{3i}Y^*_{0i};$$

(2) the demand for uncolored margarine by residents of states in group one,

$$Q_{u1i} = b_{0i} + b_{1i}P_{u1i} + b_{2i}P_{b1i} + b_{3i}Y^*_{1i} + b_{4i}P_{c1i};$$

(3) the demand for colored margarine by residents of states in group one,

$$Q_{c1i} = c_{0i} + c_{1i}P_{u1i} + c_{2i}P_{b1i} + c_{3i}Y^*_{1i} + c_{4i}P_{c1i}.$$

The published figures on per-capita margarine consumption are equal to

$$\frac{N_0\dfrac{\Sigma Q_{0i}}{N_0} + N_1\dfrac{\Sigma(Q_{u1i} + Q_{c1i})}{N_1}}{N}.$$

The procedure followed here is to substitute the appropriate demand equations for the respective quantity variables following the summation signs and then to consider similar terms from each equation.

The constant in the macro-demand equation is derived from the constants in the micro-demand equations as

$$\frac{N_0\dfrac{\Sigma a_{0i}}{N_0} + N_1\dfrac{\Sigma b_{0i} + \Sigma c_{0i}}{N_1}}{N}.$$

$\Sigma a_{0i}/N_0$ is an average coefficient, say $\bar{a}_0$. Treating the other constants in the same way, the constant in the macro-demand function becomes

$$\bar{a}_0 n_0 + \bar{b}_0 n_1 + \bar{c}_0 n_1.$$

Consider next the price terms. $\Sigma a_{1i}P_{u0i} \div \Sigma P_{u0i} = \bar{a}_1$ gives $\bar{a}_1$ as a weighted average coefficient. If we suppose that the average price, P_{u0}, is such that $N_0P_{u0} = \Sigma P_{u0i}$ (18, p. 11), then $\Sigma a_{1i}P_{u0i} \div N_0P_{u0} = \bar{a}_1$, or $\Sigma a_{1i}P_{u0i} = \bar{a}_1N_0P_{u0}$. Then,

$$\frac{\Sigma a_{1i}P_{u0i}}{N} = \frac{\bar{a}_1N_0P_{u0}}{N} = \bar{a}_1n_0P_{u0}.$$

Treating the other price terms similarly leads to these price terms in the macro-demand function:

$$\bar{a}_1n_0P_{u0} + (\bar{b}_1 + \bar{c}_1)n_1P_{u1} + \bar{a}_2n_0P_{b0} + (\bar{b}_2 + \bar{c}_2)n_1P_{b1} + (\bar{b}_4 + \bar{c}_4)n_1P_{c1}.$$

The income variables are worked out as follows (using $a_{3i}Y_{0i}$ as an example):

$$\frac{\Sigma a_{3i}Y^*_{0i}}{\Sigma Y^*_{0i}} = \bar{a}_3 \quad \text{or} \quad \frac{\Sigma a_{3i}Y^*_{0i}}{N} = \frac{\bar{a}_3\Sigma Y^*_{0i}}{N}.$$

Note that $\Sigma Y^*_{0i}/N + \Sigma Y^*_{1i}/N = \Sigma Y^*_i/N$ equals per-capita disposable personal income for the United States.

The per-capita macro-demand equation for margarine turns out to be

$$\frac{Q_m}{N} = \bar{a}_0n_0 + \bar{B}_0n_1 + \bar{a}_1n_0P_{u0} + \bar{B}_1n_1P_{u1} + \bar{a}_2n_0P_{b0} + \bar{B}_2n_1P_{b1} + \bar{a}_3\frac{\Sigma Y^*_{0i}}{N} + \bar{B}_3\frac{\Sigma Y^*_{1i}}{N} + \bar{B}_4n_1P_{c1},$$

where $\bar{B}_s = \bar{b}_s + \bar{c}_s$. Since $n_0 + n_1 = 1$, the first two terms can be written as $\bar{a}_0 + (\bar{B}_0 - \bar{a}_0)n_1$.

A linear approximation to the above demand curve would be

$$\frac{Q_m}{N} = a_0 + a_1P_{u0} + a_2P_{u1} + a_3P_{c1} + a_4P_{b0} + a_5P_{b1} + a_6\frac{\Sigma Y^*_{0i}}{N} + a_7\frac{\Sigma Y^*_{1i}}{N} + a_8n_1,$$

where the a_i now denotes new coefficients.

As it now stands, the equation requires that we have separate price series for each of the two groups of states. Lacking such data, a person might proceed in the following manner. The national average butter price, p_b, is a weighted average of P_{b0} and P_{b1}. The relationship between these two prices and the national average perhaps can be adequately represented by

$$P_{b0} = b'_0 + b'_1p_b + b'_2n_1 + b'_3\frac{\Sigma Y^*_{0i}}{N},$$

$$P_{b1} = c'_0 + c'_1p_b + c'_2n_1 + c'_3\frac{\Sigma Y^*_{1i}}{N}.$$

We can treat the margarine prices in similar fashion. Substituting these four price equations into the preceding demand function leads to the following macro-demand equation:

$$\frac{Q_m}{N} = b''_0 + b''_1p_m + b''_2p_b + b''_3\frac{\Sigma Y^*_{0i}}{N} + b''_4\frac{\Sigma Y^*_{1i}}{N} + b''_5n_1,$$

where p_m is the average margarine price.

To simplify the presentation, the preceding derivation was worked out with relatively few variables. The equation to be fitted in this study,

$$(2)\quad C_m = F_2(C_{mb},\ P_m,\ P_b;\ Y_0,\ Y_1,\ n_1,\ u_2),$$

is more involved. The variables are, respectively, per-capita margarine consumption, per-capita table fat consumption, deflated retail margarine price, deflated retail butter price, total disposable income in states in group zero divided by continental U. S. population and consumer price index, total disposable income in states in group one similarly deflated and proportion of the population residing in states permitting the sale of colored margarine.

Demand for Butter

$$(3)\quad C_b = F_3(C_{mb},\ P_m,\ P_b;\ Y_0,\ Y_1,\ n_1,\ u_3)\ .$$

The three demand equations presented thus far hypothesize that liquid assets affect the demand for total table fat but do not affect the distribution of that total between butter and margarine. Equations 2 and 3 further hypothesize that the distribution of total table fat consumption between butter and margarine depends upon the proportion of the population which has access to yellow margarine and upon the distribution of income between residents of states in group zero and residents of states in group one.

Retail Supply of Margarine

Within the past four decades, a number of states at one time or another have imposed excise taxes on margarine. Consequently, one variable to be included in this supply equation is a variable representing an average excise tax. Various states also have imposed license fees on margarine wholesalers and retailers. These might be expected to have some effect on the aggregate retail supply of margarine through their effect on the number of stores selling margarine.

The procedure used to measure relevant tax and license fee variables was to compute weighted averages of the state fees and taxes, using midyear state population as weights. It might be argued that the most appropriate weights would be the number of retail food stores in each state. For example, a given tax or license fee imposed in a state with 1,000 food stores would be less restrictive on total nationwide margarine supply than the same tax or fee in a state with five times that many stores. The number of retail stores by states is known only for census years, however. The only alternative weighting pattern seems to be midyear population.

The variables computed for each year are: E_w = average excise tax on uncolored margarine, E_c = average tax on colored margarine, L_{rw} = average license fee levied on retail distributors of uncolored margarine and L_{hw} = average license fee levied on wholesale distributors of uncolored margarine. The values of the state and federal license fees and excise taxes were determined from a study of the relevant laws. The results of this study are summarized in Appendix B.

It would save degrees of freedom and computational expense and reduce the problem of multicollinearity if the number of legal variables could be reduced from four to one or two. The method of principal components was used to accomplish this (19, pp. 102-114). The simple correlations between E_w, E_c, L_{rw} and L_{hw} indicated that at least two components would be required. It was decided to use E_w in the analysis and to try the first principal component, V, of E_c, L_{rw} and L_{hw}.

This component explains 91, 97 and 93 percent, respectively, of the variance of E_c, L_{rw} and L_{hw} and explains 94 percent of the sum of their variances. Since the simple correlation between E_w and V is 0.96, only E_w was used in the analysis.

The retail supply equation to be estimated is

$$(4)\quad P_m = F_4(Q_m,\ P_{mw};\ P_w,\ e_w,\ t,\ u_4)\ .$$

P_m is the deflated retail price of margarine, Q_m is total national consumption of margarine, P_{mw} is the deflated wholesale price of margarine and P_w is the deflated wholesale price index of all commodities other than farm products and foods. This variable is included as an approximate measure of costs of marketing margarine. $E_w/I = e_w$. The trend variable time is included to allow for a gradual increase in productivity in the distributive trades (3, pp. x, 52).

Processors' Supply of Margarine

At one time or another several states levied license fees on margarine processors, as did the federal government until June 30, 1950. In contrast with the retail equation, no measure of producers' license fees is included in the processors' supply equation. The reason is that most states did not levy such fees; therefore, a processor could avoid paying a state license fee by locating in a state which did not levy such a fee. The federal licensing requirement, which a manufacturer could not avoid by appropriate location, was a constant during the sample period studied.

The hypothesized equation is

$$(5)\quad P_{mw} = F_5(P_{mi},\ Q_m;\ W_1,\ F,\ u_5).$$

P_{mw} is the deflated average wholesale price of margarine, P_{mi} is a deflated index of the prices of principal margarine ingredients, Q_m is total national margarine consumption, W_1 is a deflated average wage rate of employees in chemical manufacturing industries and F is the ratio between the pounds of margarine produced and the pounds of ingredients used in margarine production. Data on wage rates of employees in fats and oils processing plants would be preferable as a measure of labor costs, but such data are available for only the last few years. Of the available data covering the period back through 1920, W_1 is the best choice on *a priori* grounds. The variable F is included to reflect improvements in technology which apparently have increased the efficiency with which raw materials are transformed into margarine. This ratio rose from an average of 0.819 in 1920-22 to 0.968 in 1940-41.

It has been pointed out that the cost of raw materials constitutes the principal cost of margarine production, and labor is a relatively minor item (10, p. 387). It is, therefore, reasonable to hypothesize a horizontal average variable cost curve. This, in turn, leads to the hypothesis that the prices charged by processors are independent

of the volume of production. The fact that the margarine-processing industry is imperfectly competitive does not make this hypothesis *a priori* untenable (6, pp. 198-226). These arguments lead to equation 5a.

$$(5a)\quad P_{mw} = F_{5a}(P_{mi};\ W_1,\ F,\ u_{5a})\ .$$

It appears that inventory changes can safely be ignored without danger of bias. In the interwar years, year-to-year variations in inventory change never exceeded about 8 percent of the changes in domestic disappearance. Annual values of inventory change were of the order of 1 percent of annual values of domestic disappearance. We also appear to be on safe ground in ignoring the effect of margarine exports on the domestic margarine economy. In only one interwar year did exports amount to as much as 1½ percent of domestic disappearance.

Margarine Ingredient Price Index

The explanation of the margarine ingredient price index by the use of structural equations would lead to a lengthy and involved model because of the great complexity of the fats and oils economy. The purpose of the present study is to illuminate some of the interrelationships between the dairy and the fats-and-oils economies and not to make an intensive investigation of the latter. To complete the system with a minimum number of equations, the following equation is used. It is a reduced-form equation in the sense that it might be derived from a more complete system of equations by a process of consolidating equations and eliminating variables.

$$(6)\quad P_{mi} = F_6(Y,\ S_o,\ S_L,\ P_{mi\,t-1},\ u_6)\ .$$

S_o is the sum of per-capita supply of food fats and oils —excluding butter and lard—and per-capita supply of coconut oil. S_L is the per-capita supply of lard. This form for the equation is suggested by Armore's work (1, pp. 56-58). The explanatory variables are all exogenous.

Margarine Quantity Identity

In the demand equations the margarine quantity variable is defined as per-capita quantity. In the supply equation it is defined as total quantity. The use of per-capita variables in demand equations has a long history and should require no explanation. The present departure from tradition is in the use of two separate quantity variables. One reason for using total quantity in the retail supply equation is that the theory of the firm has much to say about the total supply of the firm but says nothing about supply per customer. The supply function is derived from the production function and factor supply curves. The measurement of supply in per-capita terms carries the odd implication that the firm's marginal cost curve (the supply curve for a purely competitive firm) shifts up and down as the number of customers varies. An operational reason for using total, rather than per-capita, figures is that important trends in supply may be obscured by the use of per-capita figures.

To retain linearity in the system, the equation used to relate per-capita consumption and total consumption is not an identity but is a linear approximation to an identity,

$$(7)\quad C_m = F_7(Q_m;\ N_e,\ u_7)\ .$$

An alternative is to use an approximation of the type suggested by Klein (11, p. 121):

$$\frac{x}{y} \simeq \frac{\bar{x}}{\bar{y}} + \frac{x}{\bar{y}} - \frac{\bar{x}}{\bar{y}^2}\,y\ .$$

Rest of Model

The complete model contains 63 equations and 63 endogenous variables. The seven equations of immediate interest have been discussed—the remaining 56 equations are listed here:

- Consumer demand equations for fluid milk and cream, evaporated and condensed milk, cheese, other processed dairy products, meats, poultry, fish, eggs, lard and shortening; 10 in all.
- Retail supply equations for these 10 products and butter.
- Inventory demand equations for these 11 products.
- Domestic production equations for the five dairy products.
- Fifteen identities and linear approximations to identities.
- Exports of evaporated milk.
- Imports of cheese.
- Domestic shortening production.
- Shortening ingredient price index equation.

There are no equations of farm supply; the farm supplies of the various products are treated as exogenous. An analysis of the validity of treating farm supplies as exogenous can be found in Fox (7).

STRUCTURAL EQUATIONS ESTIMATES OF MODEL I

Sample Period

A sample period of 1920-41, 1947-49 was selected for several reasons. It is desirable to include the latest years possible in order to increase the size of the sample and to include the effects of recent experience in the estimated coefficients. On the other hand, certain factors reduce the advantage of using 1950 and later data in this study without first estimating from the earlier data. On July 1, 1950, margarine excises and license fees imposed by the federal government were repealed, thereby possibly inducing a substantial increase in margarine consumption. In August 1950, the Bureau of Labor Statistics sharply reduced the number of cities in which it collected prices of uncolored margarine, thereby reducing the reliability of this series, and began to collect prices of colored oleo in 37 cities. In July 1952, it discontinued entirely the collection of the white margarine prices. There is no reason to expect that the coefficient of the available post-July 1, 1950, price variable should

be the same as the coefficient of the previous price variable, whether we use the colored price or an average of the two prices for the later period.

Because of these changes, if one wishes to combine pre- and post-1950 data in one sample, it appears desirable to include a dummy variable which has the value zero in all years prior to 1950, one-half in 1950 and one in later years. It has, however, been in the years 1950 and 1953 to date that the consumption of butter furnished from CCC supplies or purchased wholly or partially with government funds has been sizable. Consequently, the dummy variable would reflect the repeal of taxes and fees and the operation of the government's surplus dairy products disposal activities.

The model used in the present study also was used to study the demand for other dairy products besides butter. In mid-1949, the Bureau of Labor Statistics ceased collecting retail prices for natural cheese and began collecting prices for process cheese. It was, therefore, necessary to estimate a retail price for natural cheese for 1949-55 to maintain comparability with the series for previous years. This made it desirable to stop the analysis with 1949 in order to include only the more accurate data in the sample.

Before combining pre- and post-1950 data in one sample, the minimum requirement would appear to be to obtain estimates from pre-1950 data and compare the predictions from these estimates with actual values in 1950 and later years.

Simultaneous Equations Estimation Procedure

The generalized classical (G.C.) or Theil-Basmann method of estimation was used in the estimation of the structural parameters (3) and (32). There are two reasons for using this method: (1) Because of the interrelationships among the dairy products and the interrelationship between butter and margarine, a simultaneous equations method of estimation is required. The method used has the same asymptotic properties as the limited-information single-equation method. (2) In this problem the G.C. method is more economical computationally than the limited-information method.

The G.C. method proceeds by performing a transformation on the explanatory endogenous variables in an equation to obtain variables which are distributed independently of the random disturbance term in the equation. (Explanatory endogenous variables are on the right side of the equality sign.) The transformed variables then are substituted for the original variables, and least squares estimates are obtained from the transformed equation.

G.C. and least squares (L.S.) estimates of the coefficients in equations 1 to 4 were computed. For comparative purposes, a coefficient of multiple determination was computed for each G.C. equation. The transformed values of the explanatory endogenous variables were used in this computation.

Since the explanatory variables in equation 6 are all exogenous, L.S. was used on this equation. Since equation 7 is quasi-definitional and has no structural significance, L.S. was also used on it.

Combining 1947-49 data with prewar data introduced one complication in connection with equation 5. The original National Industrial Conference Board series used for W_1 ends in 1939. The procedure used for obtaining estimates for later years seemed to give satisfactory results for 1940 and 1941. The postwar estimates, however, were about 30 cents higher than the figures in the corresponding Bureau of Labor Statistics series (which begins in 1947). The estimate for 1948 was about 10 percent higher than the figure obtained by the National Industrial Conference Board in a study covering half of that year.

These results indicated the undesirability of using the postwar estimates for this variable. The procedure adopted is a compromise. From the L.S. results for equation 6, $\hat{P}_{mi}$ was computed for the years 1921-41 and was substituted into equation 5. The values of $\hat{C}_m$ were estimated from the reduced form equations for 1920-41, 1947-49. The 1921-41 values were substituted into equation 5, which was then estimated for the period 1921-41

Results

The results of the time series analyses are presented as follows. The various equations are identified by the same numbers used in the earlier section. In addition, in a few cases, variants of the equations not previously discussed are presented. In equations 2a, 3a and 3b, $P_{r1} = P_b/P_m$; in equation 2b, $P_{r2} = P_m/P_b$. For each equation, the abbreviation G.C. or L.S. indicates generalized classical or least squares estimates, respectively. The standard error of each coefficient appears in parentheses under the coefficient. A single asterisk (*) following the standard error indicates significance of the coefficient at the 10-percent level, a double asterisk indicates significance at the 5-percent level and a triple asterisk indicates significance at the 1-percent level. A double asterisk following the value of d indicates that the Durbin-Watson test accepts the hypotheses of no serial correlation in the residuals at the 5-percent level. A dagger (†) indicates that the test is inconclusive; n.c. indicates it was not computed.

DEMAND FOR TABLE FAT

These results are shown in table 1. The two equations lead to the same conclusions. Liquid assets play no part in determining the price of butter and margarine. The other coefficients are of the expected signs and are significant.

TABLE 1. STATISTICAL RESULTS FOR TABLE FAT DEMAND EQUATIONS.

Equation number	Dependent variable	Coefficients and standard errors of explanatory variables							R^2	d
		C_{mb}	P_{sL}	C_{pf}	Y	A_y	A	1		
1.L.S.	P_{mb}	−3.00738 (1.46123)*	0.45651 (0.08966)***	0.29964 (0.04867)***	0.06060 (0.01108)***		−0.00133 (0.01303)	−51.02749	0.90732	2.03**
1a.G.C.	P_{mb}	−3.67882 (1.42098)**	0.57868 (0.10227)***	0.26090 (0.04852)***	0.05207 (0.01016)***	−0.13040 (0.13567)		−20.31066	0.91961	1.50†

TABLE 2. STATISTICAL RESULTS FOR BUTTER AND MARGARINE DEMAND EQUATIONS.

Equation number	Sample period	Dependent variable	Coefficients and standard errors of explanatory variables										R2	d
			C_{mb}	P_m	P_b	Y_0	Y_1	n_1	P_{r1}	P_{r2}	Y	1		
2.G.C.	1920-49	C_m	−0.30788 (0.15327)*	−0.01486 (0.08419)	0.02460 (0.05513)	−0.00306 (0.00327)	0.01411 (0.00779)*	−0.14929 (0.12343)				11.56050	0.85320	1.01
2.L.S.	1920-49	C_m	−0.25549 (0.14076)*	−0.00918 (0.05406)	0.02517 (0.03514)	−0.00332 (0.00336)	0.01519 (0.00734)*	−0.16180 (0.12360)				10.70017	0.84876	1.10†
3.G.C.	1920-49	C_b	1.29303 (0.15586)***	0.00400 (0.00856)	−0.01920 (0.05606)	0.00374 (0.00333)	−0.01605 (0.00079)***	0.17947 (0.12549				−12.34306	0.96304	1.29†
3.L.S.	1920-49	C_b	1.25549 (0.14076)***	0.00918 (0.05406)	−0.02517 (0.03514)	0.00332 (0.00336)	−0.01519 (0.00734)*	0.16181 (0.12360)				−10.70083	0.96316	1.10†
2a.L.S.	1929-49	C_m	−0.19950 (0.14321)	0.04092 (0.03635)	0.05010 (0.02494)*	−0.00727 (0.00187)***	0.01455 (0.00479)**	−0.16459 (0.06480)**				9.53927	0.97664	n.c.
3a.L.S.	1929-49	C_b	1.19947 (0.14275)***	−0.04097 (0.36232)	−0.05008 (0.02486)*	0.00726 (0.00186)***	−0.01455 (0.00478)**	0.16462 (0.06826)**				−9.53746	0.99463	n.c.
2b.L.S.	1929-49	$100\frac{C_m}{C_{mb}}$				−0.01254 (0.01775)	0.12764 (0.04115)**	−0.91601 (0.72720)		35.47614) (22.35636		9.63961	0.92499	n.c.
3b.L.S.	1929-49	$100\frac{C_b}{C_{mb}}$				0.01344 (0.01698)	−0.13033 (0.03882)***	0.95517 (0.68575)	0.09337 (0.04978)*			52.42277	0.93007	n.c.
2c.L.S.	1929-49	C_m	−0.47434 (0.18625)**	−0.03932 (0.04339)	0.09002 (0.03380)**			0.07472 (0.03049)**			−0.00239 (0.00195)	7.00466	0.94247	n.c.
2d.G.C.	1920-49	C_m	−0.35088 (0.15053)**	−0.06615 (0.07345)	0.04911 (0.05177)	−0.00005 (0.00216)	0.00530 (0.00279)*					7.21583	0.84205	0.94
2d.L.S.	1920-49	C_m	−0.28518 (0.17087)	−0.04368 (0.05806)	0.03702 (0.04177)	−0.00134 (0.00208)	0.00616 (0.00303)*					6.63398	0.75846	1.04†
3d.G.C.	1920-49	C_b	1.34476 (0.15441)***	0.06567 (0.07533)	−0.04867 (0.05310)	0.00012 (0.00221)	−0.00547 (0.00286)*					−7.11608	0.95951	1.25†
3d.L.S.	1920-49	C_b	1.28517 (0.22719)***	0.04370 (0.07720)	−0.03703 (0.05554)	0.00283 (0.00277)	−0.00618 (0.00403)					−7.57867	0.89600	0.94†

These statistical results are shown in table 2. Some equations were fitted to data for 1920-41, 1947-49; others were fitted to data for 1929-41, 1947-49. Because of the method used in constructing the series of disposable income by states for years prior to 1929, it seemed likely that the data were less accurate for these earlier years. Consequently, it was decided to compute some demand equations for the shorter, as well as for the longer, sample period.

The change in the sample period changes the sign of the coefficients of P_m, but none of these coefficients are significant. The coefficients of P_b and n_1 are significant in the smaller sample, but not in the larger, although the signs do not change. The signs of the coefficients of n_1 do not seem to make economic sense. There is no reason why making yellow margarine available to more people should reduce margarine consumption relative to butter consumption. There are, however, no strong *a priori* grounds for expecting one sign or another on the coefficients of n_1. In the derivation of the macro-demand equation for margarine, it was shown that the coefficient of n_1 is the sum of several coefficients. Three of these are the intercept terms in the aggregate demand equations for colored and for uncolored margarine. Two are coefficients of n_1 in the equations relating P_{b0} and P_{b1} to p_b; two are coefficients in the equations relating P_{m0} and P_{m1} to p_m. *A priori,* the sign of this sum may be either positive or negative.

A comparison of equations 2 and 3 with equations 2d and 3d is not helpful in determining the effect of n_1. An F test indicates that n_1 makes a significant contribution to the R^2 in the L.S. equations, but makes no significant contribution to the R^2 in the G.C. equations.

The coefficients of Y_1 are significant in every equation except in equation 3d.L.S. The coefficients of Y_0 are significant only in equations 2a and 3a. Nevertheless, the difference between the coefficients of Y_0 and Y_1 is significant at the 5- or the 1-percent level in all equations except 2d.G.C., 3d.GC. and 3d.L.S. The difference is significant at the 11-percent level in equation 3d.L.S. The coefficients of the two income variables always have the expected signs.

When any state legalized the sale of colored margarine, the effect was to reduce Y_0 and to increase Y_1 by an equal amount. The various forms of equations 2 and 3 show this increased maragarine demand relative to butter demand. From 1935 to 1955, 24 states repealed prohibitions on the sale of colored margarine. In the 1926-35 decade, an average of 24 percent of the nation's disposable personal income was received by residents of states permitting the sale of colored margarine. By 1949 the ratio had risen to 45 percent, and by 1955 it had risen to 96 percent. From 1926-35 to 1955, the proportion of United States residents residing in states in group one rose from an average of 35 percent to 96 percent.

The 1926-35 ratios were applied to postwar levels of income and population to estimate how total table fat demand would have been distributed between butter and margarine in these later years if no states had repealed their color prohibitions since 1935. The results are shown in table 3, along with actual consumption and the original estimates. For the margarine demand equations, the excess of the original over the adjusted estimates represents the increase in demand because of the repeal of prohibitions on the sale of colored margarine. For the butter demand equations, the deficiency of the original under the adjusted estimates represents the decrease in demand because of the increased availability of colored margarine. In the absence of any repeal actions, margarine demand would have been substantially less, and butter demand would have been substantially more.

The adjusted estimates were computed assuming the existing values of P_m, P_b and C_{mb}. These shifts in the demand curves would affect butter and margarine prices. Changes in these prices would affect the level of total table fat consumption and its distribution between butter and margarine. To trace all of these interactions through the system requires a complete economic model. Model I cannot be used for this purpose, since not all of the equations have been estimated. Model II—to be presented later—will be used to study the effects of shifts in demand on prices and quantities consumed.

Given the differences in the signs of the coefficients of Y_0 and Y_1 in each equation, it is not surprising that the coefficient of their sum, Y, in equation 2c is not significant.[2] Here is a situation in which the use of

[2]Actually, because of slight differences in persons and income covered, Y is not exactly equal to the sum of Y_0 and Y_1. Over the sample period, however, the mean difference is only $3.20, the minimum difference is 0, the maximum is 10 and the maximum relative difference amounts to less than 1 percent.

TABLE 3. ACTUAL, ESTIMATED AND ADJUSTED ESTIMATED PER-CAPITA BUTTER AND MARGARINE DEMAND, POUNDS, 1947-49.

Variable and equation	1947			1948			1949		
	Actual demand	Original estimate[a]	Adjusted estimate[b]	Actual demand	Original estimate[a]	Adjusted estimate[b]	Actual demand	Original estimate[a]	Adjusted estimate[b]
C_m	4.93			6.03			5.69		
2.G.C.		4.92	4.09		5.41	4.17		5.85	3.76
2a.L.S.		5.22	4.05		5.76	3.94		5.74	2.69
2d.G.C.		4.83	4.36		5.50	4.69		5.84	4.48
Average		4.99	4.17		5.56	4.27		5.81	3.64
C_b	11.07			9.85			10.35		
3.G.C.		10.97	11.89		10.62	11.98		10.14	12.43
3a.L.S.		10.78	11.95		10.12	11.94		10.29	13.34
3d.G.C.		11.07	11.55		10.52	11.35		10.15	11.54
Average		10.94	11.80		10.42	11.76		10.19	12.44

[a]Computed from actual 1947-49 values of C_{mb}, P_m, P_b, Y_0, Y_1 and n_1.
[b]Computed from actual 1947-49 values of C_{mb}, P_m and P_b. The adjusted values of the other variables used are:

	Y_0	Y_1	n_1
1947	917	285	34.8
1948	929	288	34.8
1949	926	288	34.8

national aggregative data obscures significant relationships which can be brought to light after the data are disaggregated.

The coefficients of C_{mb} in the margarine demand equations are negative because per-capita butter consumption far exceeded per-capita margarine consumption during most of the sample period, and the two were negatively correlated.

RETAIL SUPPLY OF MARGARINE

$$(4.G.C.)\quad P_m = 21.69312 + \underset{(0.00687)^*}{0.01280Q_m} + \underset{(0.13940)^{***}}{0.94023P_{mw}} - \underset{(0.05978)}{0.10155P_w} - \underset{(0.00783)}{0.00034e_w} - \underset{(0.17831)^{***}}{0.55176t}$$

$$R^2 = 0.94626$$

$$d = 2.307^*$$

The variable t has a significantly negative coefficient. This verifies the belief that productivity of resources used in food distribution has increased. According to equation 4, the retail supply curve for margarine is upward-sloping, and the margarine excise taxes and license fees have no effect on retail price. (The simple correlation between E_w and V—the first principal component of E_c, L_{rw} and L_{hw}—is 0.96; so only E_w is included, but its coefficient should reflect the effects of V.)

PROCESSORS' SUPPLY OF MARGARINE

The results, presented in table 4, support the earlier observation that ingredients are a major cost item and labor a minor cost item. The negative coefficients of F, which are significant in four equations, reflect the improvements in processing technology. The nonsignificance of the coefficients of Q_m and the negligible increase in R^2 caused by its inclusion support the hypothesis of a horizontal average variable cost curve and of a cost-plus method of pricing.

As pointed out previously, equations 5 and 5a were fitted to 1921-41 data because of the unreliability of the postwar figures for W_1. Since none of the coefficients of W_1 or Q_m are significant in equations 5 or 5a, equation 5b was fitted to 1921-41, 1947-49 data.

MARGARINE INGREDIENT PRICE INDEX

$$(6.L.S.)\quad P_{mi} = 88.15035 + \underset{(0.02020)^{***}}{0.13148Y} - \underset{(0.82680)^{***}}{3.73209S_o} - \underset{(0.76681)^{***}}{3.01320S_L} + \underset{(0.12003)^{**}}{0.33343P_{mi,t-1}}$$

$$R^2 = 0.86351$$

$$d = 1.23$$

MARGARINE QUANTITY IDENTITY

$$(7.L.S.)\quad C_m = 2.60051 + \underset{(0.00083)^{***}}{0.00705Q_m} - \underset{(0.01440)}{0.0187N_e}$$

$$R^2 = 0.99365$$

The size of the R^2 indicates that this is a satisfactory approximation to the identity. The coefficient of N_e lacks significance because of the high simple correlation between Q_m and C_m. In fitting this equation to data for 1909-55, the coefficient of N_e is significant, since the simple correlation between Q_m and C_m is lower.

Comparison of G.C. and L.S. Estimates

Perhaps the most noticeable thing is the similarity of the results obtained from the two different estimation procedures. This is no doubt primarily because the coefficients of multiple determination are high in the reduced form equations for the explanatory endogenous variables.

The change in the estimation procedure causes changes in the level of significance of only five variables. Changing from L.S. to G.C. raises the coefficients of Y_1 in equation 3d and C_{mb} in equation 2d from nonsignificance to significance at the 10-percent level, and it reduces the coefficient of F in equation 3a to nonsignificance. It raises the significance level of C_{mb} in equation 1 from 10 to 5 percent and the significance of Y_1 in equation 3 from 10 to 1 percent. Out of 33 coefficients in 7 equations, 32 differ by less than 1 L.S. standard error. The coefficients of P_{sL} in equations 1 and 1a differ by 1.4 standard errors.

In equations 1, 1a, 2 and 3, the two procedures give substantially the same value for R^2. In equations 2d, 3d, 5 and 5a, the G.C. method gives higher values of R^2.

The Durbin-Watson test accepts the hypothesis of no autocorrelation in the residuals for equations 1.L.S., 4.G.C., 5.G.C. and 5a.G.C. It rejects the hypothesis for equations 2.G.C. and 2d.G.C. For every other equation the results are inconclusive.

Extrapolations

G.C. structural equations were used to determine how well the estimated structural equations fit the post-sample data. Table 5 presents the results. The residuals are generally biased; some follow an explosive time path.

Some of the possible reasons for the poor predictions have been mentioned earlier. The federal government's price support purchases of dairy products have been of growing importance in recent years, as has government

TABLE 4. STATISTICAL RESULTS FOR PROCESSORS' MARGARINE SUPPLY EQUATION.

Equation number	Dependent variable	Coefficients and standard errors of explanatory variables					R^2	d
		P_{mi}	W_1	F	Q_m	1		
5.G.C.	P_{mw}	0.17255 (0.03554)***	0.05302 (0.06798)	−0.50967 (0.23263)**	0.00124 (0.01163)	54.96504	0.81502	2.32*
5.L.S.	P_{mw}	0.16549 (0.04576)***	0.10450 (0.07246)	−0.67925 (0.26324)**	0.00275 (0.01145)	65.16164	0.74257	1.39†
5a.G.C.	P_{mw}	0.17457 (0.05376)***	0.05607 (0.11036)	−0.51251 (0.41355)		55.17763	0.81489	2.20**
5a.L.S.	P_{mw}	0.17139 (0.03750)***	0.10962 (0.06749)	−0.67849 (0.25582)**		65.08950	0.74164	1.47†
5b.G.C.	P_{mw}	0.23634 (0.02423)***		−0.24397 (0.06892)***		33.58538	0.81922	n.c.

TABLE 5. RESIDUALS FROM G.C. STRUCTURAL EQUATIONS IN POSTWAR YEARS.

Year t	Equation and dependent variable: P_{mb} 1	C_m 2	C_m 2d	C_b 3	C_b 3d	P_m 4
1947	-4.1	0.01	0.10	0.10	0	0.7
1948	6.0	0.62	0.53	-0.77	-0.67	1.1
1949	1.5	-0.16	-0.15	0.21	0.20	-1.3
1950	3.0	-1.14	-0.74	1.30	0.81	-1.5
1951	-1.6	-2.47	-1.56	2.76	1.67	-1.4
1952	9.6	-2.42	-1.52	2.76	1.67	-4.9
1953	-0.2	-3.53	-2.01	4.03	2.20	-5.7
1954	-8.3	-2.72	-1.04	3.25	1.24	-5.3
1955	-8.3	-3.93	-1.72	4.58	1.93	-4.4

distribution of dairy products. The failure to adjust the consumption variables for government distribution may account for part of the bias in the residuals. Another possible reason is the 1950 action of the federal government in repealing margarine excise taxes and distributors' license fees. The fees and tax on colored margarine were substantially higher than on uncolored margarine, and only the excise tax on white margarine was included in the analysis. The repeal of these fees and taxes may have lowered the price and increased the consumption of colored margarine. This, in turn, would have tended to lower the price of uncolored margarine. This could account for the consistently negative residuals in equation 4. Lowering the margarine price would increase margarine consumption and reduce butter consumption. This could account for the negative residuals in equations 2 and 2d and the positive residuals in 3 and 3d.

Another factor mentioned previously was the changed specification of the margarine price. This might be expected to affect the results in the following way: The margarine demand equation might be written as

$$(8)\quad C_m = b_0 + b_1 P_{mu} + b_2 P_{mc} + b_3 P_b + \text{other terms.}$$

Because of a lack of data, the equation estimated here was of the form

$$(9)\quad C_m = b'_0 + b'_1 P_{mu} + b'_3 P_b + \text{other terms.}$$

Each variable in equation 9 which was correlated with P_{mc} would have a biased coefficient. These coefficients, although biased, might still be consistent and efficient predictors in a period when the observed variables are P_{mu} and P_b. For predicting in a period when P_{mc} and P_b are observed, however, one should have fitted the equation

$$(10)\quad C_m = b''_0 + b''_2 P_{mc} + b''_3 P_b + \text{other terms.}$$

The coefficients b''_0, b''_2 and b''_3 need not equal the coefficients b'_0, b'_1 and b'_3, respectively, and equation 9 need not be an efficient predicting equation in a period when P_{mc} is available and P_{mu} is not.

It is also possible that some of the relationships are not strictly linear. A straight line may be a good approximation in the range of values experienced in the prewar years but be a poor approximation in the range of values experienced in the postwar years. The cross-section analyses presented later suggest that margarine consumption rises and then falls with rising income. Only first degree income terms were included in the time series analyses because of the problem of intercorrelation among explanatory variables. It is possible that the linear relationships overestimate C_m and underestimate C_b at high values of Y_1, and that they also overestimate C_m and underestimate C_b at low values of Y_0. With one exception the post-sample values of Y_0 have been substantially below the range of sample values. Without exception the post-sample values of Y_1 and Y have greatly exceeded the largest sample values of these variables.

It has been suggested that improvements in the quality of margarine in the past 10 or 15 years are an important cause of the trend in per-capita butter and margarine consumption. It might be thought that these changes in quality were a cause of the poor predictions, since the quality of margarine was presumably lower during almost all of the sample period than during the post-sample period. It has also been suggested that the enforced consumption of margarine during the butter rationing period of World War II brought about a permanent change in consumers' preferences. Either one of these arguments would lead us to expect positive residuals for equations 2 and 2d and negative residuals for equations 3 and 3d, whereas the actual residuals have exactly the opposite sign. Thus we can explain the trends in butter and margarine demand during the sample period by changes in the institutional framework, and changing quality and changing preferences do not explain what has happened in the post-sample years.

MODEL II

It was previously pointed out that we must use a complete model to determine the effects of shifts in demand on prices and consumption. Model II can be used for this purpose, since all equations in the model have been estimated.

Model II consists of five equations from Model I—1a.G.C., 2d.G.C., 3d.G.C., 4.G.C. and 7.L.S.—the identity

$$(11)\quad C_{mb} = C_m + C_b$$

and the least squares regression

$$(12)\quad P_{mb} = 0.15827 + \underset{(0.06091)^{***}}{0.18694 P_m} + \underset{(0.03807)^{***}}{1.17342 P_b}$$
$$R^2 = 0.99947\ .$$

This model contains seven equations and seven endogenous variables: P_{mb}, C_{mb}, C_m, C_b, P_m, P_b and Q_m. It contains 10 exogenous variables: P_{sL}, C_{pf}, Y_0, Y_1, A_y, P_{mw}, P_w, e_w, t and N_e. P_{sL} and P_{mw} were classed as endogenous in Model I. For present purposes, the classification of P_{mw} as exogenous is reasonable, since P_{mw} depends on P_{mi} and F. P_{mi} is a function of exogenous and predetermined variables, and F is exogenous. The present classification of P_{sL} rests on the assumption of convenience — that variations in P_m and P_b have negligible effect on P_{sL}.

Equations 2d.G.C. and 3d.G.C. were selected because these structural equations generally fit the postwar data better than do the other G.C. demand equations and as well as or better than the L.S. equations. This would lead one to expect that prediction equations derived from these structural equations would be more useful than prediction equations derived from other

G.C. forms of equations 2 and 3. As would be expected on the basis of table 5, the residuals from the prediction equations for the post-sample years were large and biased.

Model II in matrix notation is

$$(13)\quad Y_tB = Z_tC + U_t$$

where each row of matrix Y_t consists of the year t values of each of the seven endogenous variables, and each row of Z_t consists of the year t values of each of the exogenous variables and of unity. B is a 7 x 7 matrix of coefficients, and c is an 11 x 7 matrix of coefficients. The prediction equations are derived from function 13 by solving for Y_t in terms of Z_t and the structural coefficients,

$$(14)\quad \hat{Y}_t = Z_tCB^{-1}.$$

Table 6 presents three sets of 1947-49 estimates from the prediction equations for each endogenous variable except Q_m. The first estimate, denoted by a caret as $\hat{Y}$, is computed from the actual 1947-49 values of the exogenous variables. The second estimate, denoted by a caret and superscript a as $\hat{Y}^a$, is computed from adjusted values of Y_0 and Y_1 and actual values of the other exogenous variables. The adjusted values are the same adjusted values used in computing table 3. The third estimate, denoted by a caret and superscript A as $\hat{Y}^A$, is computed from the same adjusted values of Y_0 and Y_1, adjusted values of C_{pf} and actual values of the other exogenous variables. The adjusted values of C_{pf} equal the actual 1926-35 average values of C_{pf}. This is 349, in comparison with a 1947-49 average of 268.

A comparison of the column labeled $\hat{Y}$ with the column labeled $\hat{Y}^a$ indicates how consumption and prices have been affected by the repeal of prohibitions on the sale of colored margarine. It indicates that these repeal actions have resulted in higher margarine prices and higher butter prices, in more margarine consumption but less butter consumption and in a smaller total consumption of butter plus margarine. Multiplying the estimates of P_b by the estimates of C_b indicates that these actions have reduced consumer expenditures on butter in spite of the higher butter prices.

It has sometimes been suggested that the upward trend in margarine consumption relative to butter consumption has been attributable to a steady rise in the butter/margarine price ratio. This is not a satisfactory explanation, for it leaves unanswered the question of why the butter/margarine price ratio rose in the face of a fall in the butter/margarine demand ratio. From 1926-35 to 1947-49, the ratio of butter price to margarine price rose from 1.9 to 2.2. Table 6 indicates that the ratio would have been between 1.9 and 2.0 in 1947-49 in the absence of legislative acts to repeal prohibitions on the sale of colored margarine. In 1926-35, C_m/C_{mb} averaged 0.11, by 1947-49 it averaged 0.35. The data in table 6 show that in the absence of the repeal of color prohibitions, it would still have averaged about 0.11 in 1947-49. This is evidence that the rise in the butter/margarine price ratio and the rise in the margarine/butter consumption ratio have been primarily the results of the same set of forces—namely, the legalizing of the sale of colored margarine.

A comparison of the columns labeled $\hat{Y}^a$ and $\hat{Y}^A$ indicates how the decline in potato and baked goods consumption has affected butter and margarine. By 1947-49, this decline would have reduced margarine price and butter consumption by 5 percent or less, reduced margarine consumption by about one-tenth and reduced butter price by about one-fifth, in the absence of offsetting forces.

The conclusion that the wider availability of yellow margarine resulted in higher butter prices requires some examination. The other findings are consistent with expectations and with the results in table 3. As states made it legal to sell colored margarine (i.e., shifted from group zero to group one) the result was to increase the demand for margarine and reduce the demand for butter in these states. This resulted in a higher margarine price and a lower butter price in these states. This attracted margarine supplies away from states still in group zero with a resultant increase in prices as dealers in states in group zero bid higher prices to obtain margarine to supply their customers. The price of butter in states remaining in group zero was affected by two forces acting in opposite directions. The increase in margarine prices in these states would tend to raise butter prices through its effect on butter demand. The reduction in butter prices in other states would tend to divert butter supplies to these states in group zero, which would have the effect of lowering butter prices. P_{b0} might rise or fall. Further P_{b0} might rise enough so that the national average butter price would rise even while P_{b1} was falling. Model II indicates that this is what did happen.

On the other hand, the conclusion that butter price rose in the face of a fall in butter demand may arise from the existence of specification error in Model II. One defect in the model is the exclusion of any consideration of butter supply and the impact of butter price on the supplies and prices of other dairy products. The classification of P_{sL} and P_{mw} as exogenous may also introduce specification error. The assumption of linear demand for butter and margarine may be an error.

If the results from Model II are affected by specification error, one would expect to find some warning of this in some of the other comparisons in table 6 as well as in the comparison of $\hat{P}_b$ and $\hat{P}^a_b$. The only other in-

TABLE 6. ESTIMATES AND ADJUSTED ESTIMATES OF ENDOGENOUS VARIABLES IN MODEL II, 1947-49.

Year	$\hat{P}_{mb}$	$\hat{P}^a_{mb}$	$\hat{P}^A_{mb}$	$\hat{P}_m$	$\hat{P}^a_m$	$\hat{P}^A_m$	$\hat{P}_b$	$\hat{P}^a_b$	$\hat{P}^A_b$
1947	103.8	92.3	106.5	42.7	39.4	39.9	81.5	**72.2**	**84.2**
1948	102.4	82.5	101.9	42.1	36.4	37.0	80.5	**64.4**	80.8
1949	101.2	68.1	86.8	36.4	26.9	27.6	80.3	53.6	69.5
	$\hat{C}_{mb}$	$\hat{C}^a_{mb}$	$\hat{C}^A_{mb}$	$\hat{C}_m$	$\hat{C}^a_m$	$\hat{C}^A_m$	$\hat{C}_b$	$\hat{C}^a_b$	$\hat{C}^A_b$
1947	17.85	20.97	21.80	4.08	2.26	2.53	13.78	18.71	19.27
1948	15.31	20.70	21.83	5.32	2.19	2.55	9.99	18.51	19.27
1949	11.65	20.63	21.72	7.53	2.31	2.66	4.12	18.33	19.06

dication of possible specification error is the small value for $\hat{C}_b$ in 1949.

The relationship between $\hat{P}_b$ and $\hat{P}^a{}_b$ does raise a question as to the reliability of Model II. It was suggested previously that one result of repealing prohibitions on the sale of colored margarine was to raise P_{b0} enough so that P_b was increased. If it could be shown that the data are consistent with this hypothesis, one would have greater confidence in all of the results from Model II. To show this, it would be necessary to analyze movements of butter and margarine prices by groups of states.

MODEL III: CROSS-SECTION ANALYSES

License Number Data

One way to test the effect of excise taxes, license fees and color prohibitions on the market for margarine would be to use data from the 48 states studied and the District of Columbia to estimate a supply and a demand curve. The requisite data are not available, but it is possible to use state data to test the effects of state laws on the number of retail stores licensed to sell margarine and on the retail price of margarine. Three equations were used for the analysis of the number of licensed stores:

$$(15)\quad Y_j = a_0 + \sum_{i=1}^{8} a_i X_{ij},$$

$$(16)\quad Y_j = b_0 + \sum_{i=1}^{9} b_i X_{ij},$$

$$(17)\quad Y_j = c_0 + c_1 X_{1j} + c_8 X_{8j} + c_9 X_{9j};$$

where:

the subscript j indicates the j-th state;

Y = number of retail stores in the state holding federal licenses to sell either colored or uncolored margarine on June 30 (31), divided by the midyear population of the state in thousands (24);

X_1 = weighted average state excise tax on uncolored domestic ingredient margarine in effect during the 12 months preceding June 30;

X_2 = weighted average state excise tax on colored domestic ingredient margarine in effect during the preceding 12 months;

X_3 = weighted average state excise tax on foreign ingredient margarine during past 12 months in states where $X_1 = X_2 = 0$;

X_4 = weighted average margarine wholesaler's license fee in effect during past 12 months;

X_5 = weighted average retail license fee in effect during past 12 months;

X_6 = fraction of preceding 12 months during which state law permitted the retail sale of colored margarine;

X_7 = number of retail stores falling into the food group and general stores classifications of the Bureau of the Census in 1948 (26)—in 1939, the number in the food group and general stores (with food) classifications (25) divided by the midyear population of the state;

X_8 = simple average of state per-capita personal incomes during the current and the immediately preceding calendar years (15);

$X_9 = X^2{}_8$.

In computing the weighted averages, the weights were the proportions of the year each tax or fee had been in effect.

The analyses for 1939 and 1948 are presented in tables 7 and 8. These two years were selected because data on number of retail food stores per state are available for them.

Variables X_1 through X_5 measure variations in distributors' costs due to variations among state laws. Variables X_6, X_8 and X_9 are intended to measure forces affecting demand differences between states—X_7 was included to permit the measurement of the net effect of the other variables independently of variations in the number of retail food stores.

The results will be treated as though the data repre-

TABLE 7. LICENSE NUMBER REGRESSION ANALYSES RESULTS FOR 1939.[a]

Equation	Independent variable	Coefficient	Standard error	R^2
15				0.391287***
	X_1	−0.069968	0.032093**	
	X_2	−0.071134	0.048006	
	X_3	0.005861	0.031204	
	X_4	−0.001724	0.001584	
	X_5	0.000004	0.004678	
	X_6	0.066947	0.259265	
	X_7	−0.169304	0.170754	
	X_8	0.000598	0.000725	
	1	2.017884		
16				0.547250***
	X_1	−0.072968	0.028049**	
	X_2	−0.078197	0.041984*	
	X_3	0.020356	0.027547	
	X_4	−0.002052	0.001387	
	X_5	0.000256	0.004087	
	X_6	0.321490	0.236930	
	X_7	−0.261328	0.151281*	
	X_8	0.009922	0.002624***	
	X_9	−0.000008	0.000002***	
	1	−0.187166		
17				0.300640***
	X_1	−0.090502	0.023568***	
	X_8	0.005755	0.002569**	
	X_9	−0.000047	0.000022**	
	1	12.201177		

[a]See text for questions concerning the interpretation of these data.

TABLE 8. LICENSE NUMBER REGRESSION ANALYSES RESULTS FOR 1948.[a]

Equation	Independent variable	Coefficient	Standard error	R^2
15				0.601057***
	X_1	−0.135876	0.029329***	
	X_2	−0.014123	0.038023	
	X_3	−0.006726	0.023850	
	X_4	−0.001457	0.001504	
	X_5	0.000565	0.004157	
	X_6	−0.305316	0.251868	
	X_7	−0.171067	0.159800	
	X_8	−0.001368	0.000487***	
	1	5.168524		
16				0.661120***
	X_1	−0.137030	0.027380***	
	X_2	−0.022261	0.035626	
	X_3	−0.011332	0.022331	
	X_4	−0.001449	0.001404	
	X_5	0.000439	0.003880	
	X_6	−0.156895	0.241777	
	X_7	−0.032221	0.158230	
	X_8	0.005522	0.002660**	
	X_9	−0.000003	0.000001**	
	1	0.217301		
17				0.594067***
	X_1	−0.144148	0.019894***	
	X_8	0.005600	0.002394**	
	X_9	−0.000003	0.000001***	
	1	−0.271414		

[a]See text for questions concerning the interpretation of these data.

sented a random sample from some multivariate normal population. It should be noted, however, that there is some question concerning the meaning of tests of significance applied to these data. It is not clear that these data actually do constitute a sample. If they do, two questions remain: What population was sampled? Was it sampled randomly? If the data for each year represent all items in the population, then each nonzero coefficient is significant, and the standard errors have no meaning.

In lower income ranges, the relation between income and margarine consumption may be positive as people replace lard or shortening with margarine in response to rising incomes. In higher income ranges, the relation between margarine consumption and income may be negative as people replace margarine with butter in response to rising incomes. To test the hypothesis that the response to income change is a function of income level, equations 16 and 17 were fitted. The results confirm this hypothesis, b_8 and c_8 being positive and b_9 and c_9 being negative for both years. In both years, the value of R^2 is significantly increased by the addition of X_9.

All coefficients of X_1 are negative and significant, indicating that excises do reduce the number of licensed stores per capita. Only one coefficient of X^2 is significant, although all are of the expected sign. It is quite possible that the main restrictive effect of excises on colored margarine was exerted by the federal 10-cent tax. This is consistent with the fact that b_2 is significant for 1939 when this tax amounted to 60 percent of the average price of uncolored margarine, but it is not significant for 1948 when the tax amounted to only 24 percent of the uncolored margarine price. It is quite possible that in 1939 the federal excise on colored margarine caused the ratio between colored and uncolored prices to be so high that the added effect of state excises on colored oleo was significant. In 1948, the federal excise had a much smaller effect on relative prices, and the addition of state excises on yellow margarine might have had no noticeable effect.

The coefficients of X_3 would not be expected to be significant unless a large proportion of all margarine contained foreign fats and oils. This ratio cannot be estimated from available information. Foreign ingredients amounted to 22 and to less than 1 percent of total fats and oils ingredients in 1939 and 1948, respectively. Consequently, there was probably sufficient margarine consisting entirely of domestic ingredients to satisfy the demand in those states levying foreign ingredient excise taxes.

From the nonsignificance of the coefficients of X_4 and X_5, it appears that state license fees exerted little restrictive effect on the number of stores selling margarine. One can only speculate whether the results would be any different had there been no federal license fees. The nonsignificance of the coefficients of X_6 indicates that the presence or absence of color prohibitions exerted little effect on the total demand for margarine.

Equation 17 was compared with equation 16 by an F test to test the significance of the increase in R^2 obtained by the addition of X_2 through X_7. These six variables do make a significant addition to the coefficient of determination for 1939, but not for 1948.

In these tables, *** following the standard error or R^2 indicates significance at the 1-percent level; ** indicates significance at the 5-percent level; * indicates significance at the 10-percent level.

Margarine Prices

Further evidence on the effect of state excise taxes and license fees can be drawn from another source. Consider the equation

$$(18) \quad Y_j = b_0 + \sum_i b_i X_{ij},$$

where the subscript j indicates the j-th geographic area,

- Y = average retail uncolored margarine price in a city,
- X_1 = weighted average excise tax on uncolored domestic ingredient margarine in the state where the city is located,
- X_4 = weighted average state wholesale margarine dealer's license fee,
- X_5 = weighted average retail license fee,
- X_6 = fraction of year during which state law permitted the sale of colored margarine,
- X_8 = disposable income per capita, and
- X_9 = X^2_8,
- X_{10} = average price of butter in the city, and
- X_{11} = price of lard plus price of shortening plus price of salad dressing.

All data used in this analysis refer to the calendar year 1948. The retail prices are Bureau of Labor Statistics prices (28). The income figures are Sales Management estimates of disposable personal income per capita in the city or metropolitan area to which the retail prices refer (17). The analyses cover 56 cities for which price and income data are available. The results are presented in table 9.

The coefficients of X_1 and X_4 are significantly different from zero and are of the expected sign, indicating that the presence of excise taxes and wholesaler's license fees increases the retail price of margarine. In the preceding analysis, the coefficients of X_4 were nonsignificant; this is not consistent with the significance of X_4 in the present analysis. The coefficients of X_4, however, were all negative, which is consistent with the present results.

TABLE 9. MARGARINE PRICE REGRESSION ANALYSES RESULTS.[a]

Equation	Independent variable	Coefficient	Standard error	R^2
18				0.623772***
	X_1	0.256540	0.072250***	
	X_4	0.021343	0.004561***	
	X_5	–0.049983	0.013377***	
	X_6	0.405197	0.597001	
	X_8	0.012948	0.018649	
	X_9	–0.003632	0.006052	
	X_{10}	–0.010897	0.102183	
	X_{11}	–0.012465	0.074457	
	1	32.328440		
18a				0.623681***
	X_1	0.256649	0.071496***	
	X_4	0.021273	0.004467***	
	X_5	–0.049672	0.012922***	
	X_6	0.376209	0.526280	
	X_8	0.012850	0.018434	
	X_9	–0.003592	0.005978	
	X_{11}	–0.016060	0.065705	
	1	31.862369		

[a]The same questions arise in the interpretation of these data as arose in the interpretation of the license number data. See text.

The negative sign of the significant coefficient of X_5 is the opposite of what one would expect. The hypothesis was previously put forth that retail license fees would increase the retail price. It has also been suggested that the retailer might consider an oleomargarine license fee to be levied on his total business and not just on his margarine sales. He might feel that a failure to carry margarine would lead to losing all of the business of those customers who desire to purchase margarine. In that case, a desire to sell margarine would not be the only reason for purchasing a license, and the license fee would be expected to have no effect on the price. The negative coefficient of X_5 is not consistent with either of these arguments.

The results of this price analysis must be interpreted with some caution. The reason is that the Bureau of Labor Statistics collects prices on the larger selling items in each community. Hence, the prices reflect the effects of the X_i and the geographic variations in the kinds of margarine priced. If these variations are independent of the X_i, their only effect is to increase the unexplained variance.

COMPARISON OF RESULTS FROM MODELS I AND III

The variable X_6 is the cross-section correspondent of n_1 in the time series analyses. The nonsignificance of the coefficient of X_6 is consistent with the nonsignificance of the coefficients of n_1. Although the cross-section analysis suggests a curvilinear relationship between margarine demand and income, linear equations were fitted to the time series data.

The fact that the time series analysis found no relationship between average margarine price and average excise tax, whereas the cross-section analysis did, can be explained simply. The maximum number of states levying excise taxes in any one year occurred in 1933, when 12 states levied excises. Only 17 percent of the population lived in these states. The maximum excise tax was 15 cents, and the cross-section analysis found that margarine price was increased by only ¼ cent for each 1-cent increase in tax rate. The resulting increases in prices in the few states levying taxes would have little effect on the Bureau of Labor Statistics national average price when they were combined with the prices from the greater number of states having no taxes.

No measure of margarine distributors' license fees were included in the time series analysis. Because of a high correlation of 0.96 between E_w and V — the first principal component of E_c, L_{rw} and L_{hw} — the coefficient of e_w is also an estimate of the impact of license fees. The time series analysis shows no relation between retail margarine supply and distributors' license fees. The cross-section analyses show no relation between license fees and the number of stores selling margarine, but do show a positive relation between price and the wholesale license fee and a negative relation between price and retail license fee. The negative relationship cannot be reconciled with our economic theory nor with the positive relationship. A logical conclusion seems to be that license fees have no discernible effect on retail margarine supply.

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APPENDIX A: TIME SERIES DATA

Jointly Determined Variables

C_m: per-capita margarine consumption $= \frac{Q_m}{N_e}$.

Q_m: total domestic civilian margarine consumption, (21) and (22).

N_e: total United States population, 1920-40, number eating out of civilian food supplies 1941 to date, (21) and (22). The population figures in (21) are adjusted census data; the figures in (22) are unadjusted. All population and per-capita figures taken from (22) had to be adjusted to maintain comparability with figures from (21).

C_b: per-capita butter consumption $= \frac{Q_b}{N_e}$.

Q_b: total domestic civilian butter consumption (21) and (22) minus relief distribution (23) and 43 percent of blue stamp consumption (23). The 43 percent comes from (8). This study of the blue stamp plan concluded that families participating in the plan would consume at least 75 percent more butter than nonparticipating families. Hence 43 percent $\left(= \frac{0.75}{1.75} \right)$ of the blue stamp distribution constituted a net addition to butter consumption and should be treated in the same way as relief distribution.

C_{mb}: $C_m + C_b$.

P_m: deflated average retail margarine price $= \frac{p_m}{I}$.

p_m: average retail margarine price, (19).

I: Bureau of Labor Statistics consumer price index, 1947-49 = 1.00, (21) and (22).

P_b: deflated average retail butter price $= \frac{p_b}{I}$.

p_b: average retail butter price, (19).

P_{mb}: deflated index of average retail prices of butter and margarine $= \frac{p_{mb}}{I}$.

p_{mb}: Fisher's Ideal Index of butter and margarine prices $= \sqrt{\frac{\Sigma p_{it} Q_{it}}{\Sigma p_{ia} Q_{it}} \times \frac{\Sigma p_{it} Q_{ia}}{\Sigma p_{ia} Q_{ia}}}$, 1947-49 = 100; i = margarine, butter; 1930-34 averages used as fixed base weights. Q_m and Q_b from (21) and (22).

P_{sL}: deflated index of average retail prices of shortening and lard $= \frac{p_{sL}}{I}$.

p_{sL}: Fisher's Ideal Index of shortening and lard prices, 1947-49 = 100; 1930-34 averages used as fixed base weights. Q_s and Q_L from (21); p_s and p_L from (2) and (29, 1956).

P_{mw}: deflated wholesale margarine price $= \frac{p_{mw}}{I}$.

p_{mw}: Chicago wholesale price of white animal fat margarine, 1920-35; of white domestic vegetable margarine, 1946 to date. From 1936-41 it is a weighted average of these two, the weights being in proportion to the amounts of the two types sold during the period. Prices from (2) and (29, 1956).

P_{mi}: deflated index of prices of principal margarine ingredients $= \frac{p_{mi}}{I}$.

p_{mi}: Fisher's Ideal Index of prices of seven margarine ingredients, 1947-49 = 100. It includes: (1) cottonseed oil (crude, tanks, Southeastern mills prices); (2) soybean oil (New York, imported barrels prices, 1920-29; tank cars, Midwestern mills prices for later years); (3) peanut oil (crude, tanks, mills prices); (4) coconut oil (crude, tanks, f.o.b. Pacific Coast prices); (5) lard (neutral, Chicago prices); (6) oleo oil (extra, Chicago prices); (7) oleo stearine (barrels, New York prices). Q_{it} from (2) except for 1920, which are quantities used in year ending June 30, 1921 (31). p_{it} from (2).

Exogenous Variables

C_{pf}: per-capita consumption of wheat flour, rye flour, corn flour, cornmeal, potatoes and sweet potatoes, (21) and (22). The variable C'_{pf} was also computed. It equals per-capita consumption of wheat flour and rye flour plus one-fourth the per-capita consumption of potatoes, corn flour and cornmeal. The simple correlation between the two variables is 0.989. This and the high inter-correlations among the various components indicate that the variable is not sensitive to changes in the weighting pattern.

Y: deflated disposable personal income per capita $= \frac{Y^*}{N'I}$, (21) and (22).

Y^*: total disposable personal income, (21) and (22).

N′: total July 1 United States population including armed forces overseas, (21) and (22).

A: deflated per-capita liquid assets in the hands of consumers at end of preceding year $= \left(\frac{a}{N'I} \right)_{t-1}$.

a_{t-1}: liquid assets in hands of consumers at end of preceding year. For 1939 to date, Federal Reserve estimates (A_{rt}) of personal holdings of currency, demand and time deposits, savings and loan shares and U. S. Government securities (5). For 1928-41, 1945-52, Klein and Goldberger (13) present a conceptually identical series on deflated liquid assets (L_t) and the price deflator (p_t). The product of these two gives current dollar estimates (pL_t).

Goldsmith (9, vol. 1) presents series through 1949 on individuals and miscellaneous end-of-year holdings of time deposits in operating commercial banks (p. 386), deposits in mutual savings banks (p. 413) and in credit unions (p. 427) (T); end-of-year holdings of currency

(C) (p. 382) and demand deposits (D) (p. 385) by individuals and miscellaneous holders; end-of-year holdings of cash by unincorporated businesses excluding agriculture, security brokers and dealers and professional (U) (p. 853); private repurchasable shares of operating savings and loan associations (S) (p. 441); change in farmers' holdings of direct and guaranteed U. S. Government securities ($\triangle G_1$) (p. 475); change in holdings of other individuals of U. S. Government securities ($\triangle G_2$) (p. 475); end-of-year holdings of U. S. Government securities by unincorporated businesses (G_3) (p. 853).

Assets of unincorporated businesses are included in C, D, $\triangle G_1$ and $\triangle G_2$. To obtain personal holdings of cash and demand deposits, C + D − U was calculated. To obtain personal end-of-year holdings of United States Government securities, the following series was computed.

$G_{39} = 8.8$; Federal Reserve Board estimate (5).

$$G_t = 8.8 + \sum_{i=40}^{t} (\triangle G_{1i} + \triangle G_{2i}) - \sum_{i=40}^{t} \triangle G_{3i},$$

$t > 1939$

$$G_t = 8.8 - \sum_{i=t+1}^{39} (\triangle G_{1i} + \triangle G_{2i}) - \sum_{i=t+1}^{39} \triangle^{-1} G_{3i},$$

$t < 1939$

where $\triangle^{-1} G_{3i} = G_{3i-1} - G_{3i}$.

These liquid asset series on holdings by individuals include the holdings of private nonfinancial nonprofit institutions, which must be deducted to obtain personal holdings. Goldsmith also presents data on A_{nt}, cash and United States Government securities held at end of year by private nonfinancial nonprofit institutions for the years 1912, 1922, 1929, 1933, 1939, 1945 and 1949 (9, vol. 3, p. 450). Values of A_{nt} for intervening years were estimated by simple linear interpolation. The final liquid asset series was computed as

$$A'_t = G_t + T_t + C_t + D_t - U_t + 0.95S_t - A_{nt}.$$

Assuming that A_{rt} is the most accurate figure for 1939 to date, and that pL_t is the most accurate for 1928-38, a_t was estimated as follows: For 1939 to date, $a_t = A_{rt}$. For 1928-38, $a_t = \hat{A}_{rt} = 0.14837 + 0.99677pL_t$; $R^2 = 0.9991$ for 1939-41, 1945-52. (It so happens that for these years, $\hat{A}_{rt} = pL_t$.) For 1919-27, $a_t = pL_t = -1.41904 + 0.99037A'_t$; $R^2 = 0.9994$ for 1928-41, 1945-49.

Y_0: deflated per-capita income of residents of states in group zero $= \frac{Y^*_0}{NI}$.

Y^*_0 total disposable personal income of residents of states prohibiting the sale of yellow margarine. For 1929-41,

$$Y^*_0 = Y'_0 \frac{Y^*}{Y'}.$$

Y'_0: total personal income of residents of states in group zero, (15), (16) and Appendix B.

Y': total personal income in the United States, (16) and (30).

Y^*: total disposable personal income in the United States, (16) and (30).

For 1920-28

$$Y_0 = 63.995 + 1.03842n_0Y;$$
$$R^2 = 0.9877,\ S_y = 10.4.$$

n_0: proportion of population of United States residing in states in group zero $= \frac{N_0}{N}$.

N_0: population of states in group zero, from (24) except for 1921 which is an average of 1920 and 1922 data, and Appendix B.

N: continental United States population (24).

Y_1: deflated per-capita income of residents of states in group one $= \frac{Y^*_1}{NI}$.

Y^*_1: total disposable personal income of residents of states permitting the sale of yellow margarine. For 1929-49

$$Y^*_1 = Y'_1 \frac{Y^*}{Y'}.$$

Y'_1: total personal income of residents of states in group one, (15), (16) and Appendix B.

For 1920-28

$$Y_1 = -75.423 + 0.95881n_1Y;$$
$$R^2 = 0.9905,\ S_y = 10.9.$$

n_1: $\frac{N_1}{N}$

N_1: population of states permitting the sale of colored margarine, (24).

P_w: deflated wholesale price index $= \frac{p_w}{I}$.

p_w: wholesale price index of all commodities other than farm products and foods. From 1926 to date p_w is a published Bureau of Labor Statistics index (24). For 1920-25

$$p_w = -5.4193 + 1.1094Z_1 - 0.3366Z_2,$$
$$R^2 = 0.996,\ S_y = 0.4.$$

Z_1: wholesale price index for all commodities, (24).

Z_2: wholesale price index for farm products, (24).

e_w: deflated weighted average excise tax on uncolored margarine $= \frac{E_w}{I}$.

E_w: weighted average excise tax on uncolored margarine. To compute E_w, E_c, L_{rw} and L_{hw}, it was necessary to summarize pertinent state laws (Appendix B). The values of f_{ij}, E_{wij}, E_{cij}, etc., were determined from this study.

W_1: deflated average hourly earnings of all production workers in chemical industries $= \frac{w_1}{I}$.

w_1: National Industrial Conference Board series on hourly earnings in 1920-39 (14). For 1940-41

$$w_1 = -0.1481 + 1.2040Z_3 + 0.0067t,$$
$$R^2 = 0.9593,\ S_y = 0.0003.$$

Z_3: Bureau of Labor Statistics series on average hourly earnings of production and related workers in all manufacturing industries, (27).

t: time, 1920 = 0.

F: ratio of pounds of margarine produced to pounds of ingredients used = F_1/F_2.

F_1: pounds of margarine produced, (29).

F_2: pounds of ingredients used in margarine production. Data for 1923 and later years from (29). Data for 1921 and 1922 computed as 2-year moving averages of fiscal year data, (31). Data for 1920 assumed to equal fiscal year 1921 data, (31).

S_0: per-capita supply of food fats and oils excluding butter and lard plus per-capita coconut oil supply $= \frac{Q_0}{N'}$.

Q_0: total supply of coconut oil, cottonseed oil, peanut oil, soybean oil, corn oil, sunflower oil, teaseed oil, edible olive oils, oleo stock, oleo stearine, oleo oil and edible tallow, all from (2).

S_L: per-capita supply of lard $= \frac{Q_L}{N'}$.

Q_L: total supply of lard, (2).

TIME SERIES

Year	t	P_{mb}	C_{mb}	P_{sL}	C_m	C_b	P_m	P_b	Q_m	P_{mw}
1919		119.5	.....	.....	.....	.....	.....	93.0	.....	.....
1920		105.2	18.02	113.1	3.37	14.65	47.6	81.9	364	37.8
1921		87.1	17.97	79.3	1.95	16.02	39.8	67.8	215	28.1
1922		85.7	18.51	82.3	1.65	16.86	37.6	66.9	184	26.3
1923		97.2	19.60	83.5	1.99	17.61	38.7	76.1	226	29.4
1924		91.0	19.58	90.2	1.99	17.59	40.4	70.9	230	30.5
1925		93.8	19.77	97.6	1.97	17.80	40.5	73.2	232	30.0
1926		90.3	20.07	93.8	2.02	18.05	40.1	70.4	240	28.2
1927		96.0	20.31	88.5	2.29	18.02	38.3	75.5	276	28.6
1928		98.4	19.88	89.8	2.57	17.31	37.4	77.4	314	28.6
1929		95.4	20.17	86.9	2.86	17.31	37.0	75.3	353	28.0
1930		82.4	19.91	84.7	2.59	17.32	35.7	64.6	323	26.6
1931		70.0	19.87	80.8	1.83	18.04	30.8	54.8	230	21.5
1932		60.3	19.81	68.8	1.60	18.21	26.5	47.3	202	19.2
1933		62.9	19.80	70.5	1.91	17.89	24.1	49.4	243	18.4
1934		69.8	19.86	79.0	2.05	17.81	23.8	55.2	263	17.1
1935		77.5	20.22	104.3	2.95	17.27	32.0	61.0	380	25.7
1936		84.0	19.56	96.0	3.01	16.55	31.2	66.3	391	25.5
1937		83.2	19.54	93.8	3.04	16.50	31.3	66.0	397	25.7
1938		72.6	18.99	81.1	2.93	16.06	29.0	57.2	385	25.5
1939		69.4	18.61	76.6	2.27	16.34	28.1	54.4	301	24.6
1940		75.2	18.94	67.9	2.37	16.57	26.5	59.8	318	24.2
1941		81.9	18.43	77.6	2.72	15.71	27.2	65.0	364	24.8
1946		105.0	.....	.....	.....	.....	.....	84.5	.....	.....
1947		106.5	16.00	117.7	4.93	11.07	42.7	83.8	713	38.6
1948		105.6	15.88	105.6	6.03	9.85	40.3	83.9	887	36.1
1949		88.1	16.04	77.5	5.69	10.35	30.3	70.8	851	26.2
1950		87.3	16.63	73.9	6.03	10.60	29.9	70.6	918	27.1
1951		90.9	15.93	84.2	6.50	9.43	31.7	73.3	996	28.6
1952		89.6	16.30	66.5	7.84	8.46	26.3	74.9	1,219	23.7
1953		83.3	16.30	69.4	7.92	8.38	25.7	69.1	1,256	24.0
1954		77.0	17.09	78.8	8.34	8.75	26.0	63.1	1,346	23.2
1955		76.1	16.95	71.4	8.04	8.91	25.4	62.2	1,322	22.8

TIME SERIES

Year	t	P_{mi}	C_{pf}	Y	$\frac{a}{N'I}$	Y_0	Y_1	n_1	P_w	e_w	W_1
1919		.....	.....	.....	534	.....	.....	.....	.....	.....	.....
1920		89.2	376	753	443	556	192	37.0	134.3	29.8	.....
1921		53.1	374	654	464	494	155	36.7	95.7	33.4	61.5
1922		55.4	380	746	489	557	184	36.4	98.2	35.8	63.6
1923		62.7	403	834	493	610	220	36.9	100.1	35.1	69.4
1924		66.5	374	824	499	609	211	36.3	95.5	35.0	72.8
1925		69.7	375	836	499	614	218	36.6	96.5	33.7	71.5
1926		64.6	352	849	486	625	222	36.4	94.6	33.1	73.0
1927		61.6	365	856	506	632	221	36.1	90.6	33.7	75.3
1928		62.0	365	879	499	648	229	36.1	90.6	34.1	76.9
1929		54.7	377	918	449	697	220	35.9	89.4	35.9	78.3
1930		48.7	340	835	442	638	195	35.9	85.3	38.0	77.0
1931		36.3	342	780	483	605	175	33.8	82.5	142.2	82.0
1932		31.2	347	658	516	517	140	36.2	86.0	271.4	83.0
1933		33.0	335	649	511	506	143	32.5	92.0	285.0	88.2
1934		46.3	332	710	528	550	158	32.5	97.9	281.6	101.4
1935		74.6	339	770	543	595	175	32.5	94.9	292.0	103.2
1936		72.6	327	860	579	663	195	32.6	96.0	305.2	105.1
1937		72.9	318	886	579	682	202	32.4	99.4	294.6	117.6
1938		54.4	322	828	587	634	192	32.5	96.8	298.5	124.0
1939		48.7	312	894	627	687	206	32.6	97.8	302.7	127.6
1940		44.2	307	948	649	726	219	32.6	99.2	300.2	130.6
1941		68.4	312	1,092	709	825	264	32.8	101.3	282.8	138.3
1946		.....	.....	.....	1,375	.....	.....	.....	.....	.....	.....
1947		118.6	283	1,212	1,230	827	375	39.6	99.8	151.5	.....
1948		118.3	259	1,228	1,131	775	444	44.3	100.6	140.9	.....
1949		64.0	262	1,222	1,138	667	547	51.6	99.5	110.3	.....
1950		75.9	255	1,304	1,132	554	741	62.4	102.1	85.5	.....
1951		78.4	254	1,302	1,064	384	934	73.8	104.4	67.1	.....
1952		53.1	245	1,314	1,072	182	1,119	86.8	99.7	65.1	.....
1953		62.3	244	1,351	1,089	66	1,271	94.7	99.6	57.7	.....
1954		.....	243	1,345	1,112	53	1,280	95.8	99.7	57.1	.....
1955		.....	240	1,410	.....	55	1,343	95.8	102.2	57.0	.....

TIME SERIES

Year	t	F	S_0	S_L	N_e (21, 22)
1919		.....	.....	.....	.....
1920		.....	.....	.....	108.0
1921		81.9	24.6	19.7	110.1
1922		81.5	21.6	21.1	111.6
1923		81.7	20.8	24.4	113.5
1924		81.3	21.8	23.4	115.7
1925		80.2	24.8	18.8	117.5
1926		80.7	27.2	18.9	119.0
1927		82.3	29.1	19.2	120.7
1928		80.2	27.6	20.6	122.2
1929		82.3	29.4	20.6	123.5
1930		82.4	28.9	18.5	124.8
1931		84.9	27.2	18.7	125.8
1932		88.7	26.9	19.2	126.6
1933		90.0	28.6	19.8	127.3
1934		89.9	28.0	17.4	128.1
1935		92.1	28.4	10.8	129.0
1936		93.1	28.5	13.3	129.8
1937		95.0	31.0	12.1	130.6
1938		95.4	32.6	13.5	131.6
1939		95.4	31.9	16.2	132.7
1940		96.5	30.9	18.3	134.0
1941		97.1	32.8	18.6	133.7
1946		.....	.....	.....	.....
1947		98.2	32.6	17.2	144.6
1948		98.5	33.9	16.7	147.2
1949		98.3	39.0	17.9	149.6
1950		.....	.....	.....	152.3
1951		.....	.....	.....	153.2
1952		.....	.....	.....	155.5
1953		.....	.....	.....	158.3
1954		.....	.....	.....	161.3
1955		.....	.....	.....	164.6

APPENDIX B: HISTORICAL SUMMARY OF SELECTED STATE AND FEDERAL OLEOMARGARINE LAWS, 1919-56[3]

As pointed out in the text, the laws analyzed were those which did one or more of the following: (1) levied an excise tax on margarine, (2) levied a license fee on wholesalers or retailers of margarine, (3) prohibited the retail sale of colored margarine.[4]

The procedure followed was to read a number of secondary sources dealing with margarine legislation. (The most useful of these are in the list of references at the end of this appendix.) References (9), (8), (1), (5), (11), (12) and (4) contained rather complete information on the laws of each state for the years 1909 and 1929, 1935, 1939, 1941, 1948, 1949 and 1953, respectively. This information made it possible to bracket the years within which changes had been made in state laws. In many cases, the references carried information on the exact years in which changes had been made. In a number of cases, the references carried the legal citation. Most relevant court cases were also discussed in these references.

To eliminate certain inconsistencies and to obtain more complete information on the state laws, requests for additional information were addressed to state law librarians and state supreme court librarians. After the replies were received from these and from other state officials, it was possible to write a reasonably complete history of the laws of each state, including legal citations, and of decisions in pertinent court cases.

To fill in the remaining gaps in the historical compilations and to check their accuracy, the pertinent margarine laws and court decisions of each state were checked by Mr. Jenkins using the facilities of the library of the State University of Iowa College of Law. The procedure in summarizing the federal laws was similar to the one followed for state laws. The final compilation is as follows:

STATE LAWS[5]

ALABAMA

1935 Acts 183, effective June 15, 1935, imposed a 10-cent per pound excise tax on oleomargarine sold, offered or exposed for sale, or exchanged in the state, containing any fat or oil other than the following: oleo oil, oleo stock, oleo stearine, neutral lard, corn oil, cottonseed oil, peanut oil, soybean oil or milkfat. By the terms of § 9, Title 1, Code, 1940, this act was repealed effective May 31, 1941.

Several studies (1, 5, 9) stated that Alabama prohibited the retail sale of yellow margarine. An Attorney General's report in June of 1944, in response to an inquiry from the State Department of Agriculture and Industries held that a criminal statute prohibiting the sale of "imitation butter" did not apply to yellow margarine as long as the oleomargarine was plainly marked. The Attorney General held:

> ". . . imitation butter within the meaning of this [1895] statute is a product which intentionally resembles butter, and impliedly attempts to deceive, whereas oleo's similarity is only incidental similarity. Oleomargarine, though similar to butter, has a distinct identity of its own and the mere fact that some consumers preferred to substitute it for butter does not constitute it an imitation of butter by the manufacturers within the meaning of the statute."

The statute in question clearly did not prohibit the sale of colored oleomargarine. It simply provided criminal liability for anyone selling margarine or any other butter substitute as butter, with the intent to deceive the public. Yellow margarine had been sold in the state all along.

ARIZONA

No laws applicable to this study.

ARKANSAS

In 1885 an act was passed defining "butter," prohibiting the sale of other substitutes than margarine and defining and limiting the contents of oleomargarine.

Act 56, effective July 1, 1935, enacted a 10-cent excise like Alabama's. Act 351, approved March 28, 1947, repealed the tax on oleomargarine. "Since this act contained no emergency clause, it would have been effective 90 days after adjournment. We do not have the actual adjournment date, but for all practical purposes the effective date of repeal would have been July 1" (3).

CALIFORNIA

The first prohibition on the sale of colored oleomargarine was passed in 1895.

An act effective June 25, 1911, levied the following annual license fees: $100 for manufacturers; $50 for wholesalers or importers; $5 for retailers; $2 for hotels, restaurants and boarding houses. The licenses were to expire on June 30 of each year and could be issued for 1 year or for less than 1 year upon payment of a proportionate part of the fee.

In 1925 a law was passed requiring a 2-cent per pound tax on oleo. A referendum petition was filed, and the act was rejected by popular referendum Nov. 2, 1926.

A law imposing a 10-cent per pound tax on oleomargarine containing other than specified domestic fats was enacted to be effective in April, 1935. It was delayed from going into effect by referendum petition filed with the Secretary of State and was rejected by the people on Nov. 3, 1936.

The retailer's license fee was repealed effective April 23, 1943. 23 Apr. 1943, Stats 1943, p. 1,086.

The prohibition on yellow margarine was repealed effective Oct. 1, 1949. 28 June 1949, Stats 1949, p. 1,489.

A 1953 act placed licenses on a fiscal year basis with no provision for fractional fees for fractional parts of the license year. 8 June 1953, Stats 1953, p. 2,544.

COLORADO

Legislation of April 1, 1895, prohibited the sale of colored oleomargarine. A 1913 statute provided that colored oleomargarine could be sold if properly labeled. Chapter 141, Session Laws of 1933 repealed the 1913 statute.

An act effective May 18, 1931, placed a 15-cent tax on all oleomargarine containing less than 45 percent animal fats and levied an annual tax of $25 on manufacturers and wholesalers. Laws 1931, pp. 623-24. By petition of referendum filed June 26, 1931, the act was referred to the voters and it was disapproved Nov. 18, 1932.

An act of April 14, 1933, levied a 10-cent excise tax which was like Alabama's except that soybean oil was omitted from the list of untaxed ingredients. It also levied an annual license fee of $25 on margarine manufacturers and wholesalers; this fee was for the fiscal year ending June 30 or any part thereof. The fee and tax became effective 90 days after passage. Laws 1933, pp. 741-42. An act effective March 19, 1945, added soybean oil to the list of ingredients exempt from the tax, Laws 1945, p. 312.

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[3] Mr. J. D. Jenkins of the Agricultural Law Center, State University of Iowa, is a co-author of this appendix. In making these summaries, the authors received a great deal of help from state law librarians, state supreme court librarians, various other state officials and some federal officials. The authors are deeply grateful for their help and regret that, because of their number, their names cannot all be listed here. Thanks are due to Dean Mason Ladd of the State University of Iowa College of Law and to John F. Timmons of Iowa State University of Science and Technology for their help.

[4] The words "margarine" and "oleo" are sometimes used here, although the laws listed generally referred to it as oleomargarine.

[5] For brevity, the qualifier "margarine" is left off when referring to laws levying license fees on manufacturers or distributors of margarine. These laws are described as levying fees on "manufacturers," "wholesalers," etc.

CONNECTICUT

In 1902 a law was passed prohibiting the sale of colored oleomargarine. 1930 G. S. § 2446. This prohibition was repealed effective March 9, 1951, by 1951, G. S. 854b.

Laws 1917, Ch. 264, § 1 provided for annual license fees for manufacturers; wholesalers; retailers; and hotels, boarding houses and dining rooms of $25, $5, $2 and $1, respectively. The fee was payable on a fiscal year basis, with the fiscal year beginning July 1, and the law provided for prorating. Laws 1921, Ch. 120, § 2, effective July 1, 1921, raised the fees to $100, $50, $6 and $3.

Public Act 334, effective July 1, 1949, repealed the requirement for a license fee for the manufacture and sale of oleomargarine.

DELAWARE

An act of May 5, 1895, prohibited the sale of colored margarine. 20 Del. Laws Ch. 209, § 1. The prohibition was repealed effective March 8, 1951. 48 Del. Laws Ch. 14, § 1.

DISTRICT OF COLUMBIA

No pertinent legislation.

FLORIDA

An act of 1913 provided for a $20 annual license fee for all wholesalers. This fee was required of all wholesalers, not only of those handling margarine, and was repealed effective October 1937.

Laws of 1931, Ch. 14762, § 5, effective June 11, 1931, provided that imitation butter could not be colored yellow. A court decision of Dec. 8, 1944, held that the statute did not apply to oleo since oleo was not imitation butter within the meaning of the statute. 155 Fla. 318, 19 So (2d) 867. On this date it became legal to sell yellow oleo; until this ruling it was believed that the statute did prohibit the sale of yellow oleo.

On June 8, 1935, a 10-cent per pound foreign ingredient excise tax became effective. The list of ingredients exempt from the tax was like Alabama's except that beef and sheep fats were included. Anno. Code § 202.01-.04.

GEORGIA

An act effective March 21, 1935, levied a 10-cent excise tax on margarine. The law was like Alabama's, with pecan oil added to the exemptions. Acts 1935. p. 81. The act was held constitutional and valid by 198 S. E. 26.

IDAHO

The first law prohibiting the retail sale of colored oleomargarine was enacted in 1905.

Chapter 70, § 1, Session Laws of 1929 fixed oleomargarine wholesalers and retailers annual license fees of $200 and $50, respectively, effective July 1, 1929. It allowed prorating fees of $100 and $27.50 for ½ year but allowed no other prorating; it defined the license year to be the calendar year.

Session Laws of 1931 repealed the prohibition on colored oleo and enacted excise taxes of 5 cents per pound on uncolored and 10 cents per pound on colored oleo, effective March 7, 1931. Ch. 93, Sec. 2, p. 157, found in Annotated Code § 37-1402.

Chapter 13, § 1, Session Laws of 1949 reduced fees to $25 for wholesale licenses and $5 for retail licenses. It made no provision for prorating the fee for a fraction of a year and became effective for the license year commencing Jan. 1, 1949.

ILLINOIS

All manufacture and sale of yellow oleomargarine was prohibited from June 14, 1897, to June 11, 1951. 14 June 1897, § 38-31. 11 June 1951, Food Ch. 56½, § 46e-46p.

INDIANA

No legislation pertinent to this study.

IOWA

The sale of yellow margarine was prohibited from Feb. 12, 1894, to July 4, 1953. 25 GA Ch. 46, § 3. Acts 1953, Ch. 97, § 2.

A uniform 5-cent excise tax on all oleomargarine was in effect from March 23, 1931, to May 22, 1953. 44 GA (1931) Ch. 63. Acts 1953. Ch. 103, § 1.

KANSAS

Laws 1933, Ch. 321 was a 10-cent foreign ingredient excise tax like Colorado's. The law became effective June 25. Laws 1945, Ch. 368 § 1 added soybean oil to the list of ingredients exempt from the tax, effective June 28.

KENTUCKY

Statutes of 1920 levied a $10-per-year tax on oleo retailers. The tax covered the calendar year, and no prorating was allowed for. The exact date in March on which it became effective is unavailable, since it was passed without the approval or disapproval of the governor. 1920 Stats., p. 678.

Chapter 158, H. B. 111, effective Feb. 19, 1932, established annual license fees of $5 for manufacturers, $3 for wholesalers and $2 for retailers. The license fee was for the calendar year, and there was no provision for prorating the fee for a fractional year. These license fees and the retailer's license tax were repealed effective March 12, 1938. Stats 1938, Ch. 63, § 2.

Chapter 158 also levied a 10-cent excise on all kinds of oleomargarine. On April 20, 1933, the Federal District Court, W. D. Kentucky enjoined the tax as invalid, 5 F. Supp. 4. A Supreme Court decision (290 U. S. 177) on Dec. 4, 1933, upheld the District Court decision. The law, however, remained on the statute books until repealed in 1938.

LOUISIANA

No. 178 § 1 Acts 1934 levied a 12-cent excise tax with the same exemptions as the Alabama law. The tax became effective Sept. 13, 1934.

MAINE

On March 27, 1895, the legislature passed a prohibition on the sale of colored margarine. The Maine Attorney General in a ruling dated June 1, 1948, held colored margarine may be sold if properly labeled.

Laws 1935 Ch. 54 § 2 levied a 10-cent per pound excise tax like Alabama's. Laws 1953, Ch. 210 repealed the excise tax effective Aug. 8, 1953.

MARYLAND

In 1888 a law was enacted prohibiting the sale of colored oleomargarine. This law was repealed before 1910.

According to various studies (9, 8, 1, 5) covering the years 1929, 1935, 1939 and 1941, Maryland prohibited the sale of yellow oleomargarine. Annotated Code of Maryland (1939), § 170, art. 27, however, prohibits its sale only if it is not properly labeled as colored oleomargarine and not free from harmful coloring matter. The State Food and Drug Commissioner also held that this was the meaning of the law in a letter of May 6, 1948. Detailed investigation of the Maryland statutes revealed no other statutes in effect since 1910 which prohibited the sale of yellow oleo under any conditions.

1910 Ch. 437, p. 87. 1957 Anno. Code Art. 27, § 187.

MASSACHUSETTS

A law levying a 50-cent annual license fee on oleomargarine retailers was passed in 1886. Annotated Code. 94:53.

Laws 1891, Ch. 58 § 1, 2 prohibited the sale of colored oleomargarine. Laws 1948, Ch. 453, § 1 repealed the prohibition effective Sept. 4, 1948.

MICHIGAN

A law prohibiting yellow oleomargarine was passed in 1901. This prohibition was repealed by Public Act. No. 1,

1949, which permitted the manufacture and sale of colored oleo. Before its effective date a referendum petition was filed. On Nov. 7, 1950, the act was confirmed by popular vote.

Public Act No. 55, 1931, provided for license fees of $100 for manufacturers and wholesalers and $5 for retailers. Before its effective date a referendum petition was filed, and the law was rejected by the voters on Nov. 8, 1932.

MINNESOTA

Chapter 295, General Laws, 1899, prohibited the sale of colored oleo. This prohibition has been effective under one law or another continuously since this time. The present law was enacted in 1931. Laws 1931, Ch. 344, § 1.

Laws 1931, Ch. 344, § 2, effective April 25, 1931, required manufacturers, wholesalers and retailers to pay $1 license fees each fiscal year (July 1 to June 30). The bill made no provision for prorating the tax for a part of a fiscal year. Laws 1955, Ch. 820, raised the license fees to $3, effective July 1 1955. Anno. Code Ch. 33.05.

Laws 1933, Ch. 175, § 1, levied a 10-cent per pound tax on oleomargarine containing less than 65 percent animal fats and oils and on oleomargarine containing any fats and oils other than animal fats and oils, milkfat, peanut oil, cottonseed oil or corn oil. The tax became effective July 1, 1933.

MISSISSIPPI

Ch. 114, § 3842, Code 1906 levied a dealer's tax of $5. Laws 1920, Ch. 104 levied a $100 privilege tax on wholesalers and a $5 privilege tax on retailers, effective May 1, 1920, amending § 3842. The tax was for a 12-month period, renewable on the date on which the tax was paid the preceding year. The statute applied to a variety of wholesale and retail dealers, to some services and to some manufacturers, including creameries. The list of taxable businesses runs to approximately 80 pages. All retail grocery stores were taxed, thus taxing an oleomargarine retailer once as a grocery store and once as a margarine retailer. The law contains no provision for taxing wholesalers as such; wholesalers handling certain commodities, margarine among them, were subject to the tax.

Laws 1932, Ch. 89 increased the retail privilege tax to $10 effective June 1. Laws 1940, Ch. 120 amended the law to apply to any dealer who:

> ". . . sells any oleomargarine, butter substitute or other manufactured butter, which contains any fat or oil other than any one of the following: cottonseed oil, peanut oil, corn oil, soybean oil, oleo oil from cattle, oleo stock from cattle, oleo stearine from cattle, neutral lard from hogs, beef fat or milkfat."

This law became effective June 1, 1940. Laws 1944, Ch. 137 and 138 repealed the privilege tax law effective June 1, 1944.

MISSOURI

Section 14073, Revised Statutes of 1939, enacted in 1895, prohibited the sale, keeping for sale, or offering for sale of any oleomargarine colored to resemble butter. § 196.775, 1949 Code.

1949 Code, § 561.770, approved June 7, 1929, and effective Aug. 27, 1929, made lawful the sale of yellow colored oleomargarine if the container had printed thereon the word "oleomargarine," according to a June 29, 1948, ruling of the Missouri Attorney General. At the author's request, several lawyers went over the Attorney General's ruling and the statutes he referred to. All of them interpreted § 561.770 to apply only to the manufacture of oleomargarine and not to its sale; none of them put the same interpretation on the statutes as did the Attorney General. It seems valid to believe that, up until 1948, many people in Missouri interpreted the law in the same way as did these lawyers, consequently the statute must have kept many, if not all, dealers from handling colored oleomargarine for intrastate sales.

MONTANA

A "license fee" of 10 cents per pound on all oleomargarine sold in Montana was imposed March 16, 1895. The fee was reduced to 1 cent in 1901. Laws 1925, Ch. 188 § 1, effective July 1, 1925, levied quarterly license fees of $250 on oleomargarine wholesalers and $75 on retailers. The fee was payable at the beginning of the calendar quarter, and there was provision for prorating the fee for licenses in effect for less than the entire quarter. Laws 1929, Ch. 93, § 40 reenacted these license fees. Laws 1931, Ch. 87, § 1, effective March 2, 1931, increased the retail fee to $100 per quarter. On Nov. 8, 1948, the license fees were ruled unconstitutional; 199, P 2d, 971. As of that date, the law was no longer in force. Laws 1949, Ch. 138, § 15, established annual license fees of $20 for wholesalers, effective March 1, 1949; no provision was made for prorating the fee for a fractional part of a year. Laws 1949, Ch. 138, § 16, also effective March 1, set annual manufacturers' license fees at $20 per year for plants manufacturing 100,000 pounds or less per year, with a $5 increase in the fee for each additional 100,000 pounds or fraction thereof.

Laws 1929, Ch. 93, § 38, effective March 11, 1929, prohibited the sale of colored oleo by implication by its wording. Laws 1931, Ch. 120, § 1, effective March 9, directly and specifically prohibited the sale of colored oleo. Laws 1953, Ch. 99, § 6 and § 9, effective Feb. 27, repealed both of the above sections legalizing the sale of yellow margarine.

NEBRASKA

A prohibition on yellow oleomargarine was enacted in 1895 and was repealed by Chapter 90, Article 10 of the 1919 Session Laws, approved April 18.

Laws 1919, Ch. 190 § 4 imposed annual oleomargarine manufacturers, wholesalers and retailers license fees of $100, $25 and $1, respectively. The license expired the July 1 next after its issue with no provision for prorating. The act was approved April 18 and became effective April 19, 1919. Laws 1955, Ch. 333, p. 1035, effective March 13, increased the retail license fee to $3, each license to expire 1 year after issuance.

Laws 1931, Ch. 131, § 1, p. 366, levied a 15-cent per pound excise on all imitation butter. It provided that any oleomargarine containing more than 50 percent animal fats or oils produced in the United States and containing no imported fats or oils should not be considered imitation butter for tax purposes. The act provided that the federal tax be credited against the state tax up to 15 cents. This made the tax effectively 5 cents on colored and 14¾ cents on uncolored oleo. The act became law on May 1. The tax first applied, however, on sales made during August 1931. A court decision of May 11, 1945, held the act to be unconstitutional as discriminatory between oleo containing more than 50 percent domestic animal fats and oils and that containing less.

NEVADA

No legislation pertinent to this study.

NEW HAMPSHIRE

A prohibition on the sale of yellow oleomargarine was enacted in 1895 and declared unconstitutional in 1901. Laws 1931, 176: 1, effective June 1, 1931, prohibited colored margarine. Laws 1949, 222:1 repealed the prohibition effective June 1, 1949.

NEW JERSEY

In 1886 an act was passed forbidding the sale of margarine colored in imitation of butter. Laws 1948, Ch. 36 repealed the prohibition effective April 22, 1948.

NEW MEXICO

Acts 1935, Ch. 110, § 2, enacted Feb. 25 and effective immediately, was a 10-cent excise tax law like Alabama's with beef fat and sheep fat added to the list of exemptions.

Acts 1941, Ch. 24 repealed the excise tax effective April 3.

NEW YORK

An act of 1893 prohibited the sale of colored oleomargarine. Laws 1952, Ch. 97, § 6 repealed the prohibition effective July 1, 1952.

NORTH CAROLINA

Laws 1931, Ch. 229, § 2, effective April 1, 1931, prohibited the sale or manufacture of colored oleo. Laws 1945, Ch. 523 repealed this prohibition effective March 13, 1945.

Laws 1931, Ch. 229, § 3, effective April 1, levied manufacturers' and wholesalers' license fees of $1,000 and $100 annually. Each license expired Dec. 31, and there was no provision for prorating the fee over a fraction of the year. Laws, 1939, Ch. 282, § 1,2 eliminated the manufacturers' fee and reduced the wholesalers' fee to $75 per annum, effective March 31, 1939. Effective April 15, 1949, the wholesalers' fee was reduced to $25 by Laws 1949, Ch. 978, § 3.

Laws 1935, Ch. 328, effective May 7, 1935, was an excise tax law like Alabama's.

NORTH DAKOTA

Session Laws 1931, Ch. 211, § 2 levied license fees of $10 on manufacturers, $5 on wholesalers and $2 on retailers. The fees are for a 2-year period, July 1 to June 30 of second year. Session Laws 1931, Ch. 211, § 3 imposed a 10-cent per pound tax on all oleomargarine sales. Session Laws 1949, Ch. 170, § 1 raised the tax on yellow margarine to 20 cents. Each of these laws took effect on July 1 of the year of enactment.

OHIO

A prohibition on colored margarine was enacted in 1891. 1939 G.C. § 12733. An initiative law repealing the color prohibition was approved by the voters Nov. 8, 1949, effective that date. 123 v. 963 § 1.

OKLAHOMA

Laws 1931, Ch. 24, Art. 4, H.B. 68 levied a stamp tax of 10 cents per pound on all oleomargarine. The question of its repeal was submitted to the people at the general election of 1932, and the law was approved by the voters. The same law also prohibited the sale of oleomargarine unless it was "kept free of all color or ingredients causing it to look like butter." It also levied license fees of $10 on manufacturers, $10 on wholesalers, $5 on retailers and $2 on hotels, restaurants and boarding houses. This act became law on March 11, 1931, without the signature of the governor. Its effective date was June 10, 1931, the 91st day after being passed without an emergency clause. The licenses expired on Dec. 31 of each year, and there was a provision whereby the license could be transferred back to the state and a refund made for the unexpired portion of the year. The fee was not, however, prorated if the license would be in effect for less than 1 year after time of purchase.

The tax law required manufacturers and dealers to operate under license and provided for administration by the State Dairy Commissioner. It made no provision for enforcement by the Dairy Commissioner or the Tax Commission. In 1936 the Tax Commission wrote that funds had not been appropriated for the purchase of stamps and that the law was generally disregarded (1, p. 25). The number of retail dealers having federal licenses to sell white oleo declined by 90 percent, however, from 1927-28 to 1937-39 (1, p. 12).

S. B. 217, amending the 1931 tax law to apply only to foreign ingredient margarine, was approved in May 1937. It was delayed by referendum petition and was defeated Nov. 8, 1938.

Laws 1943, Title 63, Ch. 7. H. B. 7 repealed the yellow prohibition, the excise and the license fees. Its effective date was Feb. 4, 1943.

OREGON

Laws 1915, Ch. 343, § 72 provided that oleomargarine was not to be colored or sold as butter. Laws 1951, Ch. 174 repealed this color prohibition effective Aug. 2, 1951.

Laws 1923, Ch. 168 prohibited the use of dairy products in the manufacture of oleomargarine. It was rejected in a referendum held Nov. 4, 1924, and never became effective.

Laws 1931, Ch. 286 levied an excise tax of 10 cents per pound and levied license fees of $5 on wholesalers, retailers and restaurants. It was submitted to the electors and rejected Nov. 8, 1932. A 4-cent excise tax was enacted March 15, 1933, and rejected by referendum July 21, 1933.

PENNSYLVANIA

Public Law 327, § 1, effective May 29, 1901, prohibited colored oleomargarine. Public Law 1298, § 3, Laws 1951 repealed the prohibition effective Aug. 24, 1951.

In 1899, oleomargarine license fees were enacted as follows: manufacturers, $1,000; wholesalers, $500; retailers, $100; hotels and restaurants, $50; boarding houses, $10. The license fee could be prorated over a fraction of the year, and each license expired on Dec. 31. A court decision of Jan. 30, 1947, declared that part of the act levying fees on wholesalers and retailers to be unconstitutional. As of that date, that much of the law became ineffective. (51 A. 2d 54) Public Law 1154, 1947, effective June 30, 1947, repealed the remainder of the license fee law and imposed $2 annual fees on manufacturers, wholesalers and retailers. The license fee covered the calendar year and could be prorated.

RHODE ISLAND

No legislation pertinent to this study.

SOUTH CAROLINA

A prohibition on the sale of yellow oleomargarine was enacted in 1896. Acts 1944, No. 403, p. 1219 repealed the prohibition effective March 2, 1944.

Laws 1934 (38), p. 1469, was approved April 7, 1934, and became effective in April; the exact date is not available. This was a foreign ingredient excise tax law like Alabama's.

SOUTH DAKOTA

A prohibition on sale of colored oleomargarine was enacted in 1897. So. Dak. Code 22.0512. Laws 1953, Ch. 90, § 1 repealed the prohibition effective July 1, 1953.

Laws 1931, Ch. 258, § 1 levied a 10-cent excise tax on oleomargarine effective Feb. 25, 1931.

TENNESSEE

A prohibition on colored oleo was enacted in 1895. Laws 1931, Ch. 19, § 19 repealed the yellow prohibition. Ch. 19, § 5 levied license fees as follows: manufacturers, $5; wholesalers and hotels, $3; retailers and restaurants, $2; boarding houses, $1. Ch. 19, § 10 levied a 10-cent per pound excise on all oleomargarine. Ch. 19 was enacted March 21 and became effective April 21, 1931.

Laws 1941, Ch. 71, § 5 raised license fees for manufacturers, wholesalers and retailers to $300, $75 and $5, respectively, effective Feb. 14. Under this law, as under the 1931 law, the fees were for a period of 1 year, expiring each Dec. 31, and there was no provision for prorating fees over a fraction of a year.

Laws 1949, Ch. 6 and 8 amended the excise tax law to exempt margarine containing specified domestic ingredients. The list of exempt ingredients is the same as Alabama's, with the addition of beef fat. Chapter 6 also repealed the license fee requirements. This amendment became effective Feb. 8, 1949.

TEXAS

Laws 1934, Ch. 6 was a foreign ingredient excise tax law like Alabama's. It became effective Dec. 24, 1934.

UTAH

A prohibition on the sale of colored oleomargarine was passed in 1894. Laws 1929, Ch. 18, § 1 superseded the prohibition by indirection and allowed the sale of colored oleomargarine, effective May 14, 1929. R. S. 1933, 3-10-27, effective June 26 allowed the sale of colored oleo by specific statute.

Laws 1929, Ch. 91 levied excise taxes of 5 cents on white oleo and 10 cents on colored oleo and levied $5 license fees on wholesalers and retailers, each license good for 1 year after date of issuance. This chapter became effective May 14, 1929. Laws 1947, S. B. 50 repealed the license fees effective May 13.

VERMONT

No. 106, § 2, Laws 1925 prohibited the sale of colored oleo effective March 20. This prohibition was repealed by No. 1, p. 3, Laws 1953, effective Feb. 6, 1953.

No. 168, § 1, Laws 1910 levied annual license fees of $25 on wholesalers and retailers of oleo, license to expire 1 year from date of issuance. No. 101, Laws 1925 changed the license expiration date to July 1, and allowed prorating. No. 222, Laws 1945, effective July 1, 1945, set up a graduated scale of fees for retailers, based upon the amount sold during the fiscal year.

VIRGINIA

A prohibition on colored oleo was enacted in 1898. Laws 1916, p. 18 permitted the sale of colored oleo if it was properly labeled.

WASHINGTON

Legislation of 1895 prohibited colored margarine. On Dec. 4, 1952, the sale of colored margarine was legalized. Laws 1953, Ch. 1, § 2.

Laws 1923, Ch. 22 prohibited the use of dairy products in the manufacture of oleomargarine. It never became effective as it was submitted by referendum to the voters at the November 1924 election and failed to pass.

Laws 1931, Ch. 23, effective March 9, 1931, levied a 15-cent excise tax on all margarine containing less than 80 percent butterfat. Laws 1949, Ch. 13, § 5 repealed the excise tax effective June 8, 1949.

WEST VIRGINIA

Ch. 8, Acts 1891 required that all oleo sold in the state must be colored pink. The law was declared unconstitutional in 1904. 47 S. E. 146.

According to Snodgrass (9), in 1929 West Virginia had a regulation but not a law prohibiting colored oleo. Dewees (1) states that at the time of her study (1939), the sale of yellow margarine was prohibited by a regulation of the Public Health Council. The Secretary of the Medical Licensing Board of West Virginia reported, however, that a search of the records of the Public Health Council revealed no such regulation in effect between 1929 and 1948. He also wrote that all of the regulations of the Council enacted after 1915 were recodified and brought up to date in March 1931 to become effective April 1, 1931, and these regulations did not include anything regarding yellow margarine (2).

WISCONSIN

Laws 1895, Ch. 30, § 3 prohibited the sale of colored oleomargarine.

Laws 1925, Ch. 279 prohibited the use of dairy products in the manufacture of oleomargarine. It was to go into effect on Sept. 1. In August, however, the Dairy and Food Commissioner was enjoined from carrying out its provisions. On Jan. 18, 1927, the act was declared unconstitutional by the Circuit Court, and the Commissioner was permanently enjoined from enforcing it. In the case of John F. Jelke Co. v. Emery, 193 Wis. 311, it was declared unconstitutional by the Wisconsin Supreme Court; this case was decided June 20, 1927.

Laws 1931, Ch. 96, § 3, enacted May 7 levied annual fees of $1,000, $500 and $100 on manufacturers, wholesalers and retailers, restaurants and boarding houses, respectively. The act was effective 120 days after passage. Laws Special Session 1931, Ch. 3 set bakers' and confectioners' licenses at $5, levied a $1 fee for a license "to consume margarine not purchased from a retailer" and reduced the rates for retailers, restaurants and hotels to $25 and for boarding houses to $5. Licenses expired on each Dec. 31 and could be granted for half a year upon payment of half of the annual fee. Ch. 3 took effect Jan. 1, 1932.

Laws 1932, Ch. 17, approved Jan. 27, levied a 6-cent tax on white margarine. This chapter took effect upon passage and publication. Laws 1935, Ch. 210 increased the tax to 15 cents effective June 29.

WYOMING

Laws 1913, Ch. 109 forbade the coloring in any way of any substance designed as a substitute for butter. Laws 1951, Ch. 117 repealed this prohibition effective Feb. 17.

Laws 1931, Ch. 137 levied a 10-cent excise on vegetable oleomargarine containing less than 20 percent of animal fat. This tax took effect June 1, 1931, and was repealed by Laws 1949, Ch. 38, effective April 1, 1949.

FEDERAL LAWS

Legislation enacted in 1902 set the following excise tax and annual occupational tax rates:

Excise taxes	
Uncolored oleo	¼¢
Colored oleo	10¢
Imported oleo	15¢
Occupational taxes	
Manufacturers	$600
Wholesalers	
Colored	$480
Uncolored	$200
Retailers	
Colored	$ 48
Uncolored	$ 6

This act made dealers, hotels, restaurants and boarding houses liable to the manufacturers' license fee if they colored oleomargarine. Under this act dealers licensed to sell the artificially colored product could also sell the white and natural colored products.

Public Law 540, enacted July 10, 1930, redefined oleomargarine to include products containing more than 1-percent moisture. This act took effect 12 months after its enactment.

Public Law 540, enacted March 4, 1931, did not change the excise tax rate, but it specified that the 10-cent tax applied to all "oleomargarine which is yellow in color" and defined "yellow in color."

Public Law 459, signed by the President on March 16, 1950, repealed all federal taxes and license fees on the manufacture and sale of oleomargarine. The law went into effect July 1, 1950.

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