

SOME FACTORS AFFECTING THE CONSUMPTION  
OF BUTTER

by

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## INTRODUCTION

Butter is by far the most important dairy product sold in Kansas, and it appears to hold the key position in the dairy industry for the United States as a whole. Because a large part of milk surpluses is made into butter, the factors affecting the consumption of butter have significant effect upon the development of the industry. A better understanding of the interaction of these factors should bring a better relation between production, consumption, and price of dairy products.

Since 1920, the rate of increase in the production of butter has been much greater than the rate of increase in the population. In spite of a marked expansion in production, there was no alarming surplus of dairy products until after 1930. Then production continued to increase in the face of declining consumer purchasing power until supplies were absorbed only at distressingly low prices to farmers. A large part of the surplus of dairy products came into the market as butter and an extremely critical price situation resulted. This critical condition called attention to the need for more adequate marketing information. The dairy industry does not have, and apparently does not contemplate,

a production control program, and any adjustments in the industry must be made by other means. If the industry expands, this will necessitate a greater per capita consumption of butter and other dairy products.

A study of the factors affecting the consumption of butter will not answer or explain all the problems of the dairy industry. Furthermore, a single study is not exhaustive, but the results may be of value and in turn lead to further studies which will be an aid toward solving marketing problems.

#### REVIEW OF LITERATURE

Research studies of the factors influencing the consumption of butter are relatively few in number. There are, however, a good many investigations of the factors affecting the consumption of dairy products as a group. From these, information on butter consumption may be obtained. There are, in addition to various scientific analyses, popular articles dealing with factors relating to the use of butter.

An attempt has been made to bring together under arbitrary headings some of the most important results and conclusions of studies regarding butter consumption.

### Incomes, Payrolls, and Employment

It has been shown that the percentage changes in consumer expenditures for butter during the period 1920-31 were practically the same as were made in industrial employment (5). Bean (6) found that on the whole consumers spent a certain percentage of their wages for butter, pork, beef, and mutton, and that with a given income level the volume consumed varied inversely as the price. Clemen (12) and McBride (21) state that industrial conditions and employment affect butter consumption to some extent but on the whole the demand for butter is fairly constant.

A number of studies carried on in various cities in the United States show that per capita income has a very decided effect on the consumption of butter. Howe and Waite (18) found that a general increase in income tended to affect butter consumption more than it did the consumption of other dairy products. The size of family and the per capita income were closely associated with butter buying. Waite (39), Waite and Cox (41), Cowden (13), and Lininger and Metzger (19) also found the use of butter was greatest in families with high per capita income. Families with children tended to use less butter than families of adults, probably because children ate less butter and at

the same time reduced the per capita income. Waite and Howe (42) found that most people in the high income group had all the butter they could use, and indicated that any increase in per capita consumption must be brought about by augmented resources for the middle and low income groups.

#### Price of Butter

The low consumption of butter in low income groups indicates that the price of butter affects the consumption, and, as a general statement, there seems to be a definite relationship between price and consumption of butter. There is no general agreement among writers as to whether the actual price or the relative price of butter is the more important consideration. Working (45) found that over a short period of time, money prices, rather than real or deflated prices, gave the best results for demand curves. Snodgrass (34) said that real wages and standard of living rather than money price determined butter consumption. She also stated that butter prices often become too high to allow its use by families with low incomes.

It is difficult to measure the effect of price on consumption because of interaction of other factors. Black

(9) stated that the studies to date on consumer demand curves have shown how much consumers buy at a given price and time and that it would be exceedingly difficult to ascertain how much they would purchase at a different time at a given price. He pointed out that the demand for butter sharply declines at a certain price level and further stated that he doubted whether studies so far made are satisfactory measures of consumer demand. Gilboy (16), in a study of price in relation to consumption of butter, used price-quantity data and found that butter is a highly elastic commodity. Its coefficients vary from -4 to -17. This elasticity, she explained, was partly due to the inverse movement in per capita consumption of butter and oleomargarine during the period studied.

There was some tendency to use slightly smaller amounts of butter in late winter (February and March) and in the fall months, according to Gilboy. This seasonal movement, however, was not marked. Gilboy studied consumer demand schedules by weeks over the period 1929-30 and found that there was some relationship of price to consumption of butter. She found that during the period there was a slight decrease in demand for butter, and at the same time prices fell rapidly. This was explained by the need for household economies because of reduced incomes. She found

considerable evidence to show that consumer demand for butter was fairly stable and continuous within a wide range of prices. She thought that only unusually large fluctuations in price might be expected to affect total consumption. However, she did indicate that a low price for butter might result in increased demand at the expense of butter substitutes. Furthermore, price-quantity shifts are equal to and correspond with supply and demand curves. These curves may indicate the quantities of butter taken at a given price irrespective of the seasonal character of the data, she said, but called attention to the fact that supply and demand curves are limited in their use to a specific group of agricultural commodities and do not apply to most manufactured products.

Waite (40), in studying the consumption of butter during the depression, found a high correlation between business activity and consumption. He stated that it is probable that changes in demand for butter may take place before the changes in income and business. He cited the years 1920 and 1929 supported by data from the years 1892-94, 1906, 1908, 1912, and 1914 as proof. In an earlier study (42) Waite and Howe concluded that the consumption of butter diminished about two-thirds as fast as income declined but rose at the same rate as income.



Adams (1) found that consumer demand schedules change at various times because of changes in the price of the commodity, consumer incomes, or for other reasons. He indicated that a small change in price had little effect on the demand for perishable products as a whole but that there was a great deal of substitution of one product for another when the price of any one product was too high.

A study of the literature shows that there is disagreement as to when price changes affect consumption of butter. Investigators concur in the statement that price is an important factor in butter consumption, but there is not entire agreement as to whether actual price or relative price is more important. The relative price levels seem to have the greater significance when applied to the use of substitutes for butter.

#### Butter Substitutes

It was generally agreed by writers discussing the subject of substitution that consumers preferred butter to substitutes when prices were not prohibitive but that substitution was readily made when butter price was out of line with other foods.

Bartlett (3) reported that the choice of food by consumers was guided by what appeared to be the best "buy" for

a given price. This is further substantiated by Bean (6), Adams (1), and others. Bean wrote that interchange of commodities is made on a price basis rather than on a supply basis. The studies of Schickole and Shultz (29), in addition to the others, showed that margarine was the keenest competitor of butter. He found that lard and cooking fats did not compete with butter because of price differences. He said that when margarine was used in the bakery business it replaced butter rather than lard. Thomas (36) asserted that margarine in most European countries was largely in competition with lard and other cooking fats. This was particularly true in Germany and other countries where animal fats are scarce.

In discussing margarine as a butter substitute, Snodgrass (34) called attention to the fact that it is used largely in temperate climates. The heaviest users are northern Europeans who also use large quantities of butter. She pointed out that the per capita consumption of margarine has gradually increased in the United States while butter consumption has decreased over a long period of years. Part of this decrease is due to changes in food habits of people, part to improved quality of margarine, and part to shifting demand traceable to modifications in purchasing power. Snodgrass also found that butter price and margarine

consumption were closely associated. This fact indicates that higher butter prices cause a shift to margarine and lower butter prices cause a return to the use of butter. Contrary to popular opinion, she stated, the consumption of margarine plus butter is about one-third higher in the summer than in the winter. According to Snodgrass' report, price played an important part in the substitution of margarine for butter in winter. Meat and other fatty foods may in part replace both butter and margarine in the winter diet. According to her studies, the margarine market is not wholly dependent on butter substitution for its sales. It has a market of its own, subject to factors of supply and demand. There are some people who use margarine exclusively, and others who use butter only. Then there is a group which shifts from butter to margarine and vice versa depending on relative prices.

Clemen (12) declared that margarine does not compete directly with butter because it serves a group of people in the low income group who cannot afford butter.

Gregory (17), Snodgrass (34), and Schickele and Shultz (29) found that the heaviest consumption of margarine is in agricultural regions. About one-fourth of the margarine production is consumed in rural areas, Snodgrass said. Studies on this point indicate that there is reason to

believe that when butter-fat prices are high, farmers tend to sell their butter fat and purchase margarine. Evidence seems to support the common belief that oleomargarine is a direct competitor for butter and that consumers tend to shift from butter to this product when butter prices are relatively high.

It is commonly known that cold storage holdings of butter tend to prevent extreme price fluctuations, but little information is available concerning the effect of storage holdings on consumption of either butter or margarine. Gilboy (16) found no important relationship between storage holdings and the consumer demand for butter. She did state, however, that storage butter has an effect on price. Large storage holdings decrease dealer demand and lower the price except when the dealers think prices will advance. In such a case, she found that storage holdings tended to support higher butter prices.

#### Age of Population and Character of Work

Various studies show that butter is a product which is used in greatest quantities by adults. In families where there are children, less butter per capita is used than in families of grown people. It seems probable that the increased use of milk by children restricts the use of

butter within the family.

Nature of occupation and food requirements are thought to have some effect on butter consumption but it is difficult to measure the amount of the effect, if any. Many persons with high food requirements are in the low income groups where butter consumption has been shown to be low. Waite (40) indicated that as the United States becomes a nation of older people the consumption of butter per capita may increase. However, Alsberg and Taylor (2) call attention to the fact that as people grow older they usually eat less fatty foods, such as butter, in proportion to their total diet, and more vegetables and fruits.

Climate, age, and character of the people also affect dietary habits, various writers point out, but the influence of these factors on butter consumption is largely a matter of conjecture.

### Nationality

The character of the people is of particular interest when it is considered from the standpoint of nationalities. On the basis of studies made in this country, native white people consume the largest quantities of butter per capita. Howe (18) ranks the nationalities on the basis of butter

consumption in the following order: Native whites, Germans, Jews, South Europeans, Negroes, and Italians. He found that the low consumption of butter by Italians is a matter of choice even in the higher income groups, but that the low consumption among the Polish people is chiefly due to low income. Certain peoples seem to prefer animal fats to vegetable fats, while others, particularly the southern Europeans, prefer soft fats from vegetable sources. It is also pointed out that a large number of southern European peoples are included among the laboring classes where families are large and incomes are small. In the case of Negroes, it appears that both income and preference are factors responsible for the limited use of butter. It is thought that low income may be as important as nationality in affecting low per capita consumption of butter among certain peoples.

#### Habits, Customs, and Psychology

Many writers refer to habits, customs, and psychology as intangible factors that affect the consumption of butter. Snodgrass (34) found that certain religious sects and vegetarians often go without butter. Clemen (12), Snodgrass (34), and others indicate that climate may be an

important factor affecting per capita consumption of butter. In a hearing on House Bill 9206 (1902), Public Document 4235, Springer (37) of Denmark stated that the cold, damp climate and the habits of the people of Denmark increase the use of butter, margarine, and other fatty foods. He said that butter is used widely in Denmark because people have become educated to its use. Clemen (12) said that certain people become accustomed to what is called the lactic flavor in butter and much prefer it to substitutes. This is particularly true of the northern European people. Nevins (25) believes that the influence of food habits and dietary changes have some bearing upon butter consumption. Alsberg and Taylor (2) report that there has been a growing tendency during recent years to consume less fat per capita; and the use of heavy fats such as "fat backs" and "scow belly" is markedly declining. The psychological and esthetic consideration, such as taste, color, and spreading qualities of butter have made it popular and as a result per capita consumption has tended to increase.

#### Quality

Closely associated with increased consumption of butter is the factor of quality. Alsberg and Taylor (2) found that manufacturers of substitutes have never been able to

duplicate exactly the fine lactic flavor of good butter and for this reason butter has remained popular in spite of competition offered in the form of margarine. Snodgrass (34) said that the shifting from butter to margarine depends not only on price but also on the quality of each of the products. Clemen (12) and others have indicated that the consumer demands flavor, color, and palatability. He believes that a uniformly high quality product will attract more consumers.

#### Advertising

There are those who believe that when a fine product has been developed, advertising will do much to further its consumption. Munn (24) said that ten million dollars spent in advertising the food value of butter would remove all surpluses. He later indicated that he believed butter consumption should be increased to about 30 pounds per capita annually and that advertising would help do this. He thought, however, that the greatest potential market for dairy products is largely in the form of milk, cheese, and ice cream. Snodgrass (34) has stated that expansion in the dairy industry must be absorbed mostly in the milk markets. Adams (1) found that the retail market for perishable products is relatively stable and he doubted the



advisability of advertising because of the nature of the product. He called attention to the fact that perishables are not bought until they are desired for immediate use, that they are not sufficiently standardized, and that they are sold in small lots. There are those who believe that advertising tends to switch a customer from one brand to another but does not increase the total consumption. On the other hand, Nevins (25), Gregory (17), Lininger and Metzger (19), and others advocate advertising on a national scale. The advertising should point out the dietary value of butter, they say. These writers advocate a campaign of an educational nature as a means of increasing per capita butter consumption.

In general, writers discussed the following as factors affecting the consumption of butter: (1) incomes, payrolls, and employment, (2) price of butter, (3) the use of substitutes, (4) age of population, (5) nationality, (6) habits and customs, (7) quality, and (8) advertising. Writers on butter consumption do not agree as to the relative significance of these factors but the consensus of opinion seems to be that incomes, the price of butter, and the use of substitutes are the most important.

#### PURPOSE OF STUDY

The purpose of this study was to determine, insofar as it was possible, which factors were most important in affecting the consumption of butter in the United States. No similar study is known to have been made, although Gilboy (16) made a study for a New England area using price alone as the basis for comparison. It is hoped that the study may, in a general way, measure the factors affecting butter consumption and stimulate interest which may lead to further studies. It might be desirable to consider this problem by areas or by states, but reliable data are not now at hand and for this reason figures for the entire United States were used in this thesis.

#### METHODS USED

To accomplish the purpose as stated, the study was divided into eight phases as follows: (1) index of factory payrolls, (2) index of factory employment, (3) retail price of butter in the United States, (4) retail price of margarine in the United States, (5) butter production and consumption in the United States, (6) margarine production and consumption in the United States, (7) cost of living

index for the United States, and (8) per capita consumption of butter and margarine in the United States. These phases were chosen arbitrarily because their apparent relation to the subject was such as to enable coverage of the problem in an orderly, comprehensive manner. The period 1920-34 was selected for study because a complete series of monthly and annual data of the factors studied was available. It was not possible to measure in this short study the effect of age of population, nationality, habits and customs, quality of the products, or advertising, but there is no doubt but that these factors are significant as affecting butter consumption.

#### SOURCE OF DATA

Per capita consumption was calculated by dividing the monthly consumption figures by the population of the United States interpolated from annual figures published in the United States Department of Agriculture Yearbook.

The United States Bureau of Labor monthly indexes of factory payrolls and employment were secured from the Survey of Current Business for June 1933, supplemented by current issues of the publication. Oleomargarine consumption figures and the cost of living index also were secured from various numbers of the Survey of Current Business.

Retail price of margarine was secured from the United States Bureau of Labor Statistical Bulletin No. 486 and the United States Bureau of Labor Retail Prices, January 1933, and current issues.

All other data were secured from the United States Department of Agriculture Yearbooks and Handbook of Dairy Statistics supplemented by current issues of the United States Department of Agriculture Crops and Markets and the Dairy Situation. (Table I.)

#### PROCEDURE

Time-series graphs of monthly and annual data for the factors selected were made. They were examined to determine the relationships of each of the factors to butter consumption and for the general characteristics and trends in the data. The graphs of monthly data were also studied for seasonal characteristics.

A study of the graphs and scatter diagrams indicated that similar relationships existed in the monthly and annual data and, for the sake of expedience, annual data were used in further studies. Also for simplicity and understanding, per capita consumption of butter was used in this study rather than total consumption. (Hereafter,

Table I. Annual Data Used in This Study

Year	<u>Consumption</u> Pounds per capita		<u>Retail Price</u> Cents per pound		<u>Index Numbers</u>			<u>Population</u> U. S.
	Butter	Margarine	Butter	Margarine	Factory Payrolls	Factory Employment	Cost of Living	
1920	14.6	3.49	70	40	117	108	122	105,711
1921	15.8	2.58	52	30	76	82	103	107,375
1922	16.2	1.73	48	28	81	91	97	109,040
1923	16.9	1.85	55	28	103	104	100	110,705
1924	17.3	2.11	52	30	96	96	102	112,370
1925	17.0	1.87	55	30	101	99	104	114,035
1926	17.8	2.12	53	30	104	101	104	115,700
1927	17.5	2.17	56	28	102	99	102	117,364
1928	17.1	2.48	57	27	102	99	100	119,029
1929	17.3	2.75	55	27	109	105	100	120,694
1930	17.3	2.84	46	26	89	92	96	122,359
1931	18.0	2.26	35	20	68	77	83	123,630
1932	18.1	1.76	27	15	46	64	78	124,511
1933	18.2	1.75	27	13	49	69	75	125,197
1934	18.2	2.02	32	15*	62	79	81	126,000
1935								127,000

\* Estimated.

consumption of butter refers to per capita consumption.)

Using annual data, scatter diagrams were made of consumption versus each of the other factors. No single factor seemed to account for variations in consumption of butter, although a number of factors seemed to show slight relationships.

It was decided that multiple correlation might bring out the true relationship between butter consumption and the most important of the other factors. The graphic method of curvilinear correlation described by Bean (4, p. 336) was used in a further study of annual data.

The retail price of butter per pound and factory payrolls seemed to be the most important factors affecting consumption of butter. Therefore, consumption of butter was used as the dependent variable, retail price of butter per pound as the first independent variable, and the index of factory payrolls, the second independent variable. The retail price of margarine, cost of living index, and the consumption of margarine each were used in turn as a third independent variable.

Further correlation studies were made using retail price of butter deflated by the cost of living index as the first independent variable instead of actual retail price. Finally, trend was removed from each of the factors and

actual data were expressed in per cent of trend. These figures were used in a correlation instead of the raw data. The correlations were then checked by a formal method to determine the reliability of the results. It is realized that the method and data used may be open to some criticism but it is believed that the study as outlined shows some general relationships that may lead to further research.

#### ANALYSIS AND DISCUSSION

The early part of the study was made to gain general information as to the nature and character of the factors selected, and from the time-series graphs of monthly data some pertinent information was secured.

An examination of the graph of butter production and margarine production (Figure 1) shows that the trend of butter production for the period 1920 to 1934 was definitely upward and that seasonal variation in production was marked and regular. On the other hand, the production of margarine showed a less definite upward trend and the seasonal production was irregular and less marked. It was noted that in general, however, the seasonal fluctuations of margarine production were inverse to that of butter. The peak of margarine production did not necessarily correspond to the low of butter production and vice versa. This

Pounds  
(000,000 omitted)

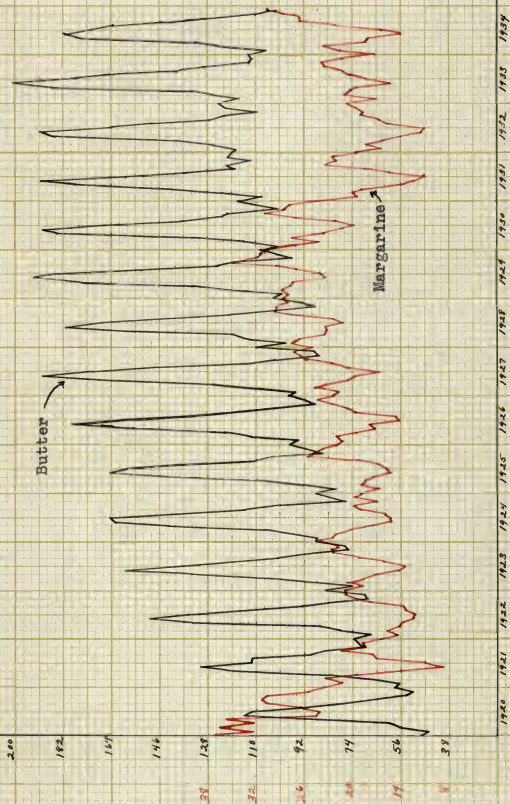


Fig. 1.— Production of creamery butter and margarine in the United States, by months, 1920-34.



led to an examination of butter price as related to margarine and butter consumption. (Figure 2.) It appears that margarine consumption is more closely associated with butter price than with butter consumption. This, no doubt, is due to the fact that margarine is a manufactured product and adjustments in its production are more easily made. Butter is a farm commodity and its production is not so quickly nor so easily adjusted to price changes. It will be noted that margarine price fluctuates much less widely than butter price although the trends for the two commodities are similar.

The figures for price and consumption were averaged for the period studied. (Figure 3.) Price was found to be inverse to consumption. There was a tendency for the largest quantities of butter to be consumed at the time when price was lowest. May and June were the months of highest consumption, and November and February were usually the months of lowest consumption. On the other hand, margarine consumption was highest when butter prices were highest usually in the months of low butter production. It is interesting to note that margarine prices are also high at this season of the year. This may be due to the fact that the price of butter tends to turn certain consumers to substitutes and this increases the demand for

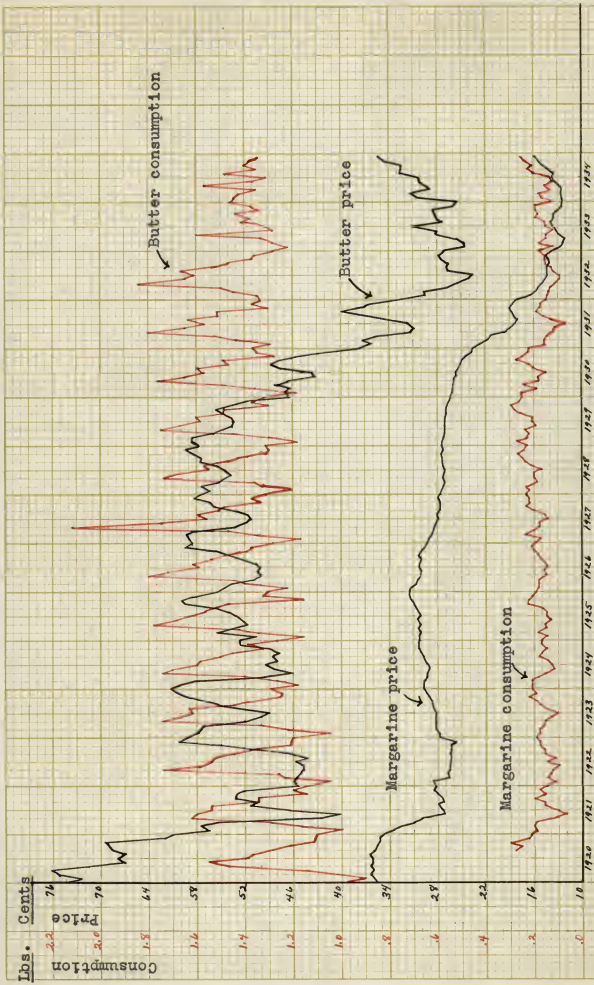


Fig. 2.—Retail price of butter and margarine, and per capita consumption of butter and margarine in the United States, by months, 1920-34.

Lbs.

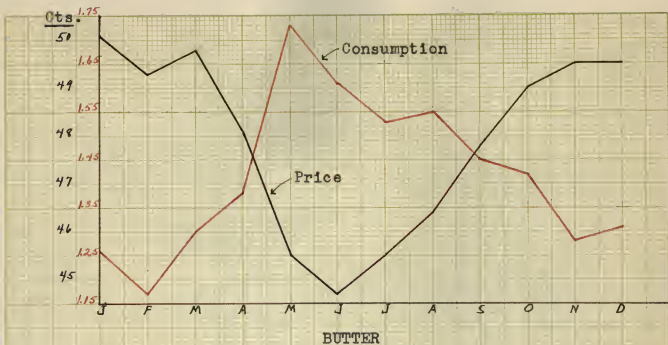
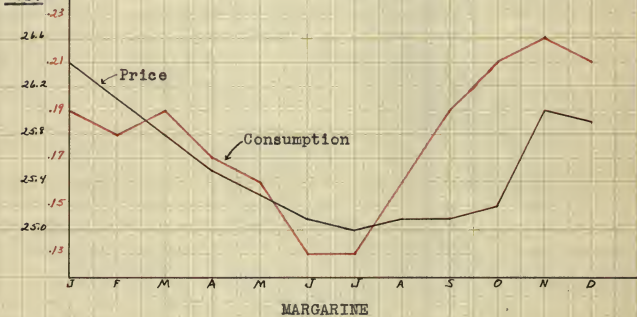
Lbs.  
Ots.

Fig. 3.— Monthly average retail price and per capita consumption of butter and margarine in the United States, 1920-34.

margarine and makes it possible to ask higher prices for it without materially affecting its consumption.

#### PRELIMINARY OBSERVATIONS

A study of time series graphs, scatter diagrams, and an examination of the data led to the following preliminary observations:

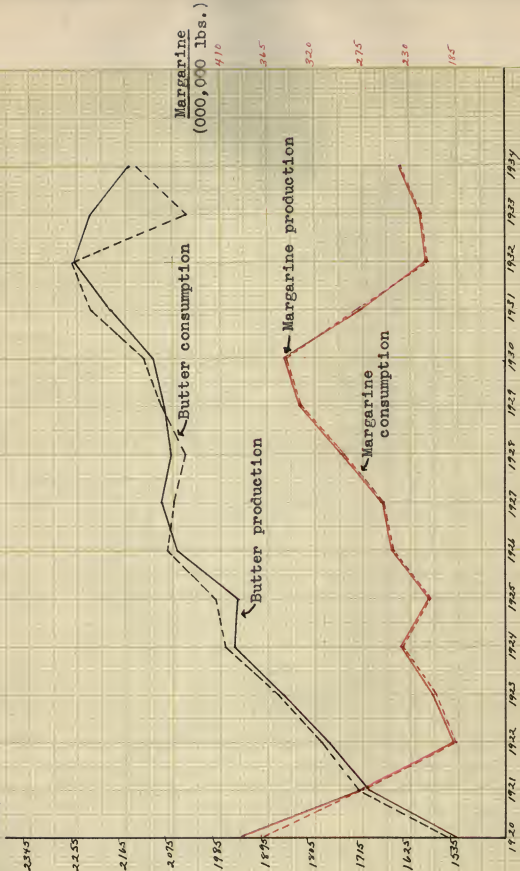
1. The production of butter is highly seasonal, the low point in production is usually November to February. In general the production moves up from this low point until the peak of production in June and then declines until November.

2. Margarine production is less highly seasonal than butter production and seems to be planned so as to correspond closely to butter price.

3. Consumption of butter varies inversely with the price, the largest quantities being consumed in April to July. Butter produced within a given year is consumed in the same year, relatively little storage butter being held over from one season to the next. (Figure 4.)

4. Margarine consumption varies directly with the price. The largest quantities are used when butter production is low and its price is high. Most of the margarine is consumed in the month it is produced and little is

Butter  
(000,000 lbs.)



Margarine  
(000,000 lbs.)

410

345

320

275

230

195

Fig. 4.— Annual butter and margarine production and consumption in the United States, 1920-34. (1934 figures estimated.)

carried over from year to year.

5. Butter prices fluctuate widely while margarine prices are relatively stable.

#### CORRELATION STUDIES

As has been previously stated, there was some relationship between per capita consumption of butter and the price of butter, factory payrolls, margarine consumption, and the cost of living index. A study of scatter diagrams of the above factors led to the conclusion that of these factors, the retail price of butter per pound and consumer income as represented by the index of factory payrolls were the most important factors affecting the consumption of butter.

An examination of the time-series graph showing retail price, index of factory payrolls, and per capita butter consumption on an annual basis (Figure 5) showed that consumption of butter was closely associated to both payrolls and retail price, but that consumption seemed to be somewhat more sensitive to price changes.

A scatter diagram of per capita consumption of butter versus retail price of butter showed a negative relationship. (Figure 6.)

Consumption of butter was highest when butter price was lowest and vice versa. A study of the scatter diagram

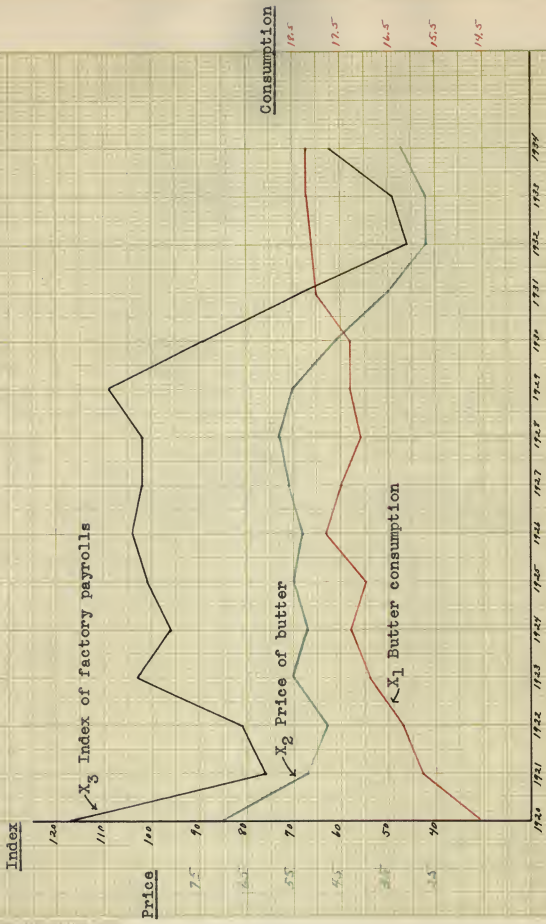


Fig. 5.— Annual index of factory payrolls, retail price of butter, and per capita consumption of butter in the United States, 1920-34.

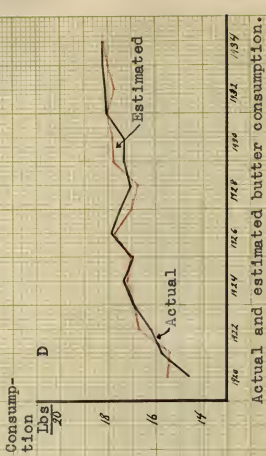
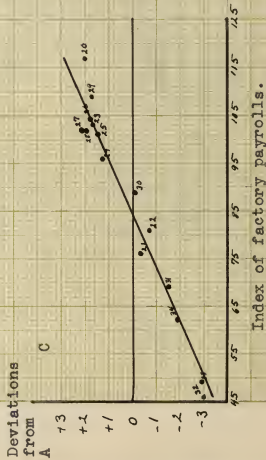
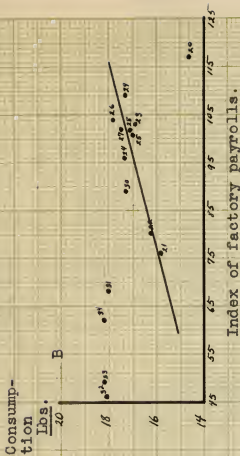
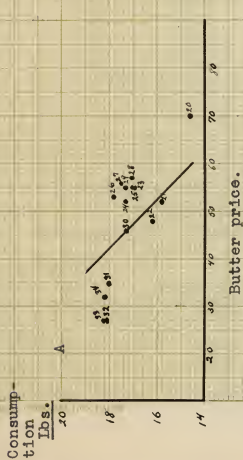


Fig. 6--The effect of retail butter prices and index of factory payrolls on per capita butter consumption in the United States. Section D shows actual consumption as compared to consumption estimated from a net regression.



of factory payrolls versus butter consumption revealed a positive relationship between payrolls and consumption of butter when the depression years of 1920 and 1930 to 1934 were omitted. (Figure 6.)

With these facts in mind, a line of best-fit was established showing the relationship of price to consumption of butter. The residuals from this line of best-fit were charted on a scatter diagram against the index of factory payrolls. This scatter diagram shows a close relationship exists between the consumption of butter and factory payrolls when the influence of price has been removed. A line of best-fit was then established on the scatter of payrolls versus per capita consumption of butter, with the effect of price removed, and an attempt was made to find other factors which might explain the deviation of butter consumption.

The index of cost of living, retail price of margarine, and the per capita consumption of margarine were shown in turn against the residuals of butter consumption with the effect of price and payrolls removed. (Figure 7.) None of these factors alone seems to account for the deviations found in Figure 6.

The results of this study indicated that the retail price of butter and factory payrolls are by far the most

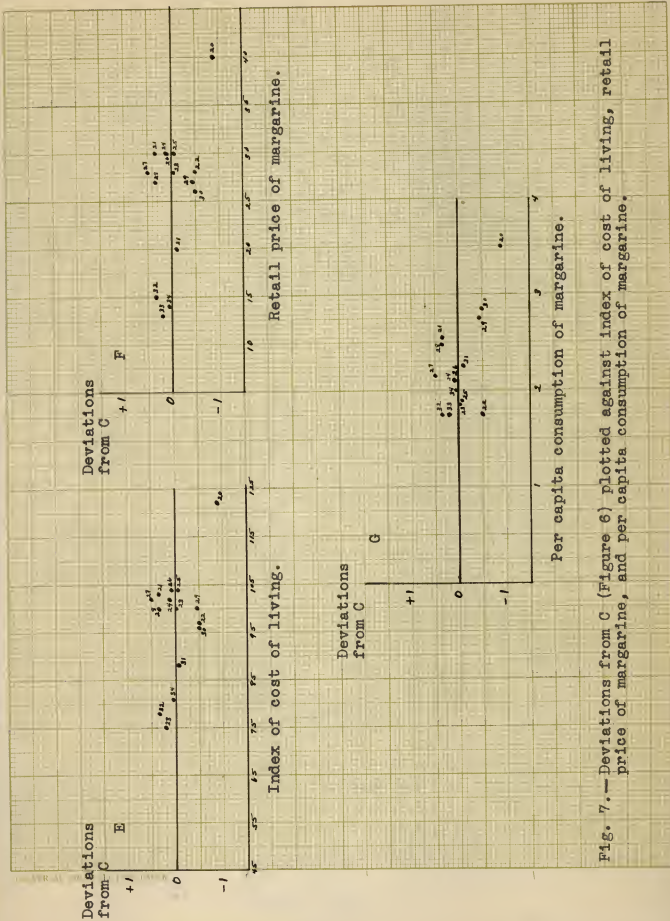


Fig. 7.—Deviations from C (Figure 6) plotted against index of cost of living, retail price of margarine, and per capita consumption of margarine.

Table II. Summary Sheet of Data Used in Figures 6 and 7.

Year	Primary Factors			Deviations Readings from Line of Regression		Estimated consumption	Additional Factors Tested for Relationship		
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	Butter consumption residuals from A	Butter consumption residuals from C		Index of cost of living	Retain price of margarine	Per capita margarine consumption
	pounds	cents	Index of factory payrolls					cents	pounds
1920	14.6	70	117	+ 2.00	- 0.90	15.50	40	3.49	
1921	15.8	52	76	- 0.35	+ 0.35	15.45	30	2.58	
1922	16.2	48	81	- 0.75	+ 0.50	16.70	28	1.73	
1923	16.9	55	103	+ 1.65	- 0.03	16.93	28	1.85	
1924	17.3	52	96	+ 1.15	+ 0.10	17.20	30	2.11	
1925	17.0	55	101	+ 1.45	+ 0.05	17.05	30	1.87	
1926	17.8	53	104	+ 1.85	+ 0.09	17.71	30	2.12	
1927	17.5	56	102	+ 2.10	+ 0.50	17.00	28	2.17	
1928	17.1	57	102	+ 1.95	+ 0.35	16.75	27	2.48	
1929	17.3	55	109	+ 1.75	- 0.45	17.75	27	2.75	
1930	17.3	46	89	- 0.05	- 0.50	17.80	26	2.84	
1931	18.0	35	68	- 1.50	- 0.08	18.01	20	2.26	
1932	18.1	27	46	- 3.00	+ 0.35	17.75	15	1.76	
1933	18.2	27	49	- 2.90	+ 0.20	18.00	13	1.75	
1934	18.2	32	62	- 1.90	+ 0.05	18.15	14	2.02	

important factors affecting consumption of butter. A multiple correlation of these two factors showed a positive coefficient of correlation of .91 +. Price and payrolls accounted for about 80 per cent of the changes in butter consumption for the period studied.

It may further be said that the retail price of butter was more important than payrolls during the depression years. For the rest of the period studied, the consumption of butter was somewhat more dependent upon factory payrolls.

In order to check the validity of the results obtained by graphic correlation, a formal correlation was made using the method described by Wallace and Snedecor (43, p. 29). The results of the two methods checked closely, the coefficients being .91+ and .89+ respectively. The gross correlation coefficient of price and consumption was -.699 and the coefficient of payrolls and consumption was -.49.

It was found that for the period 1920-34 a change of 10 cents in butter price was accompanied by a change of 11.9 pounds in butter consumption. When price was held constant a variation of 10 per cent in payrolls resulted in a change of  $\pm 7$  pounds of butter consumed. Butter consumption was calculated for each year of the period studied by using a net regression formula. The lines of net regression and the actual and calculated consumption of butter

are shown in Figure 8.

A number of writers were inclined to believe that relative price was perhaps more important than actual price in its effects on the consumption of butter. Therefore, the retail butter prices were deflated by the use of the National Industrial Conference Board index of cost of living, and these adjusted prices were used in the same manner as actual prices had been used in the previous studies, the other factors remaining the same. A scatter diagram of deflated prices versus consumption of butter was made and a line of best fit was established. The results of the graphic correlations made are shown in Figure 9.

The results of the correlation using actual prices showed a coefficient of  $.89+$  and the correlation using deflated prices showed a coefficient of  $.725$ . While deflated prices did not show as high a correlation as actual price, the same general relationship was found to exist.

To ascertain whether the high correlation found in the first study was due to trends, all the data were corrected and the actual data calculated in per cent of trend. A multiple correlation of these data showed a coefficient of only  $.02$ . The correlation of price to payrolls was  $+.95$ , but the relation of consumption to payrolls was  $-.01$  and

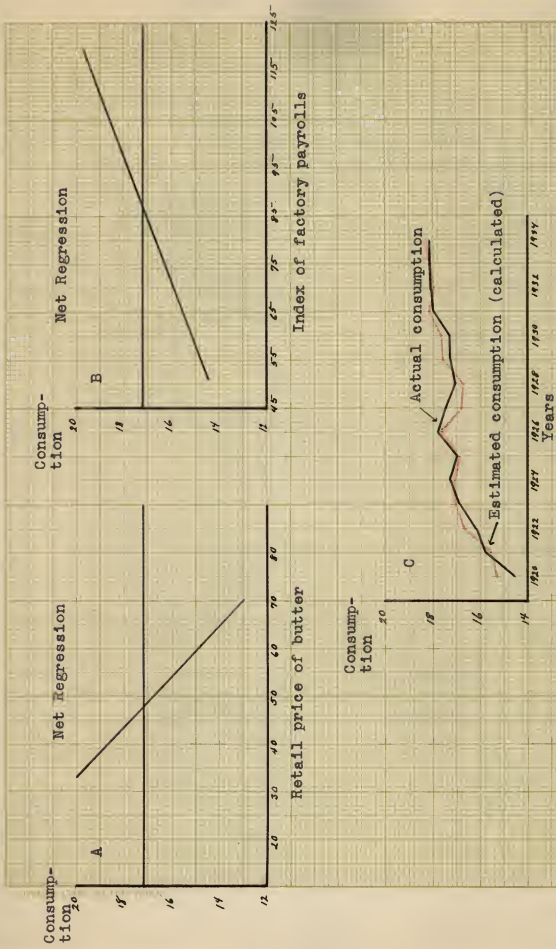


Fig. 8.— The effect of retail price of butter and index of factory payrolls on per capita butter consumption. Section C shows the actual consumption as compared to consumption estimated by the regression equation.

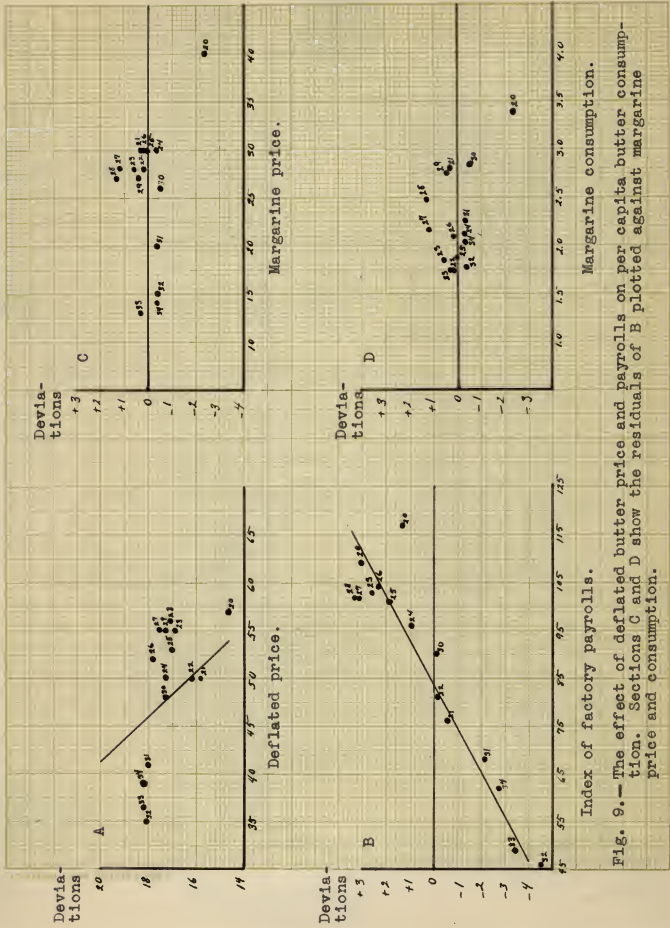


Fig. 9.—The effect of deflated butter price and payrolls on per capita butter consumption. Sections C and D show the residuals of B plotted against margarine price and consumption.

Table III. Summary Sheet of Data Used in Figure 9.

Year	Primary Factors		X <sub>3</sub> Index of factory payrolls	Deviations Reading from Line of Regression		Additional Factors tested for relationship	
	X <sub>1</sub> Per capita butter consumption	X <sub>2</sub> Retail price of butter de- flated by cost of liv- ing index		Butter consumption residuals from A	Butter consumption residuals from B	C Retail price of margarine	D Per capita margarine consumption
	<u>pounds</u>	<u>cents</u>			<u>cents</u>	<u>pounds</u>	
1920	14.6	57	117	+ 1.30	- 2.30	40	3.49
1921	15.8	50	76	- 0.05	+ 0.35	30	2.58
1922	16.2	50	81	- 0.15	+ 0.20	28	1.75
1923	16.9	55	103	+ 2.60	+ 0.55	28	1.85
1924	17.3	50	96	+ 0.95	- 0.35	30	2.11
1925	17.0	53	101	+ 1.85	+ 0.00	30	1.87
1926	17.8	52	104	+ 2.30	+ 0.12	30	2.12
1927	17.5	55	102	+ 3.20	+ 1.20	28	2.17
1928	17.1	56	102	+ 3.25	+ 1.30	27	2.48
1929	17.3	55	109	+ 3.05	+ 0.40	27	2.75
1930	17.3	48	89	+ 0.10	- 0.55	26	2.84
1931	18.0	41	68	- 2.10	- 0.35	20	2.26
1932	18.1	35	46	- 4.50	+ 0.40	15	1.76
1933	18.2	37	49	- 3.40	+ 0.35	13	1.75
1934	18.2	39	62	- 2.75	- 0.35	14	2.02



that of price to consumption was  $+0.03$ . It is altogether possible that the relationship of price and payrolls to consumption is more significant than the results show, since the relative change in consumption was small as compared to changes in price and payrolls. It is apparent from this study that trend influences the results obtained in the first two correlation studies, but it is probable that the trend is the result of, rather than the cause for, the existing relationships. If this is true, trend should be left in the correlations and the results of the first and second studies may be considered more reliable than the third study.

Since the use of margarine is commonly thought to be an important factor affecting butter consumption, special attention was given this subject. In the above studies it was impossible to measure the effect of margarine price on butter consumption because margarine price and butter price followed the same trends. The use of margarine price as a third variable partly eliminated the effect of butter price. Butter and margarine prices and their price ratios were plotted on a time-series graph. (Figure 10.) From this graph, price spread, price ratio, and actual price could be compared to butter and margarine consumption.

It is thought that oleomargarine price is not a major

Price  
Ratio

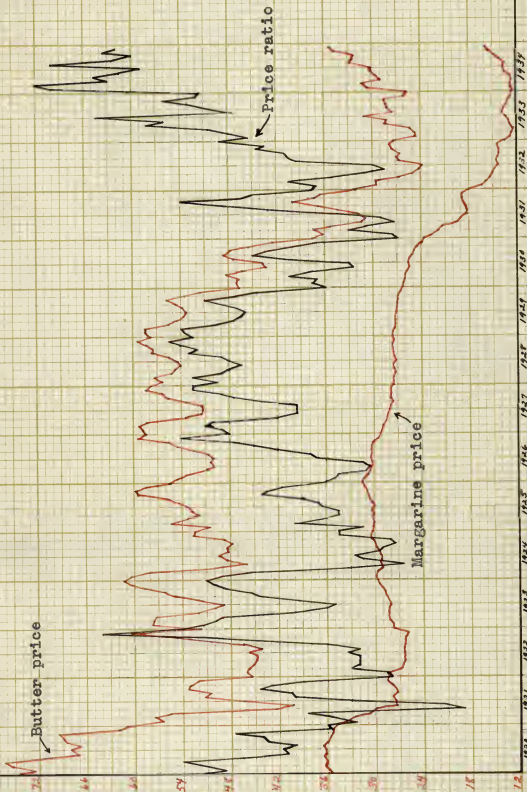


Fig. 10.— Retail prices of butter and margarine in the United States, by months, 1920-34, and the ratio of butter price in per cent of margarine price.

factor affecting the consumption of butter, but the price of margarine is so adjusted as to offer the most attractive "buy" when price or other factors turn consumers away from butter. In other words, butter consumption is largely dependent upon consumer income and the price of butter. When butter price becomes excessive because of income or other reason, either the use of butter is discontinued or less butter is used. In such a case the consumer looks for something cheaper to be used as a spread for bread. Margarine seems to be the most satisfactory substitute. Its price is set by the demand for the product. The demand for margarine represents regular users as well as the demand from users who substitute it for butter. The demand for butter substitutes is greatest when butter price is high, therefore margarine price and butter price follow the same general trends. There is no absolute proof to support this contention but there is evidence which may indicate that it is true.

An examination of time-series graphs of monthly and annual data led to the conclusion that there is no definite relationship between margarine-butter price spread and margarine consumption, nor is there a fixed price relationship which determines the point where substitution of margarine for butter begins. There is no doubt but that

margarine is used to a considerable extent as a butter substitute but it is probable that the use of margarine as a substitute depends on the change in butter price rather than changes in margarine prices. The fact that there is no general agreement among writers on this subject indicates the need for more exhaustive studies.

#### CONCLUSIONS

The retail price of butter and consumer income as represented by the index of factory payrolls, account for about 80 per cent of the changes in butter consumption. The quantity of butter consumed varied directly with the payrolls when butter prices were high, but when prices were extremely low, as during the depression years 1931-34, per capita butter consumption increased in spite of low payrolls. It is likely that people who ordinarily use substitutes the year around and consider butter a luxury, became butter users during this period.

Consumption of butter follows the same general trend as production but does not fluctuate so widely. Although the use of butter is fairly stable from year to year, there is considerable seasonal variation in both consumption and price. Monthly data failed to show any appreciable lag in consumption when compared to monthly price changes.

Actual prices showed a higher correlation to butter consumption than did deflated prices.

Oleomargarine price is not an important factor affecting butter consumption because of price differences. Oleomargarine prices are only about one-half those of butter. Many people use it because they cannot afford butter and if it were not available, other substitutes such as lard and vegetable oils would be used. When butter prices become too high, some of those who normally use butter shift to margarine. This increases the demand for margarine and its price is increased. No doubt this is at least partly responsible for the parallel movement of margarine and butter prices.

Consumer income, as well as butter price, affects the use of butter substitutes. Low and middle income groups of people tend to use margarine and it appears that its consumption is more closely associated with butter price changes than it is with butter production changes. It is altogether possible that low income to farmers is largely responsible for the use of butter substitutes among farm families.

Cost of living, as represented by the National Industrial Conference Board index, does not seem to affect butter consumption directly. Higher living costs are usually

accompanied by greater purchasing power and improved business conditions.

Margarine consumption shows an inverse relationship to that of butter. It is greatest during the months of relative scarcity of butter, November to February, and least during the months of peak butter production, May to July. When butter prices rise, margarine consumption increases and when butter prices fall, margarine consumption decreases. From this it would seem that the consumption of margarine during the fall and winter months is a matter of price substitution. A change in the price spread between margarine and butter does not necessarily affect the use of either product, nor does the relative price of one as compared to the other seem to determine the point of substitution.

This study indicates that an increase in per capita consumption of butter can be brought about by a low price of butter and by augmented incomes to low and middle income groups of people. When the price of butter is not too high, a uniform quality product and advertising of the food value of butter may aid in increasing its use.

It will always be possible to get large quantities of butter consumed if farmers are willing to take the low price necessary to move large quantities of butter into

retail channels. Large per capita consumption is possible only after prices are lowered to a point where consumers, at their current income levels, can afford to take the total quantities offered. Excessive butter production will result in higher levels of consumption but also in low prices.

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