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Problems in the Analysis of Food Consumption

By Marguerite C. Burk

The choice among several concepts of food consumption depends upon what is to be studied, whether a farm problem, a marketing problem, or a problem at the level of consumer purchase or food intake. That choice will largely determine the selection among possible measures of food consumption. No single measure of changes in food consumption can be designed to meet every need. In this paper, the meanings of food consumption that are set forth, together with their related measures, are those involved in questions frequently raised by Government analysts and information specialists, by nutritionists, farm organizations, advertising agencies, and journalists, and by businessmen in the food industries, and other interested individuals. As the author indicates, the intrinsic differences among the several meanings of food consumption are so significant that they materially affect the conclusions drawn from the analysis of specific problems.

A REVIEW OF WHAT WE CAN MEAN by food consumption and by changes in consumption shall be our first task. In this we shall limit our consideration to changes in food consumption per capita—total consumption or disappearance of food divided by the population—as opposed to total consumption in the United States. We shall consider only civilian consumption and annual averages. And we shall not go into the problem of errors in the measurement of food consumption. These limitations will enable us to avoid certain byways and much confusion, and they will not interfere with exploration of conceptual problems.

Quantity is the first meaning of food consumption that comes to mind. According to the dictionary the meaning of the term, "quantity," can be broadened to include value or expenditure, yet in referring to food it is usually restricted to weight or volume. In fact, people generally mean total poundage when they speak of total quantity of food consumed. Looking first at the problem of total poundage of all foods combined, we must distinguish among the poundages of food commodities in the forms in which they leave the farm gate, the processor, and the wholesale produce dealer, and as they are purchased at retail. Table 1 contains estimates of such poundages for 1939 and 1952.

Farm weights are usually in terms of the fresh or raw products. Because the inedible portion of meat animals is so great, farm weights of animals are rarely used in measur-

ing food consumption, although logically they should be. For example, the farm weight of a steer may be 1,000 pounds, including bones, blood, and hide; the wholesale distribution or carcass weight would be about 550 pounds; and the quantity of meat sold at retail would be about 470 pounds.

For commodities that are mostly edible, such as fruits and vegetables, we often use fresh equivalents of processed items and describe them as farm weights. If precision is not required, such data are generally not difficult to estimate because reasonably adequate conversion factors have been obtained, largely from trade sources. No doubt processing yields from raw farm products vary slightly from year to year. But, for lack of information, most of the factors are held constant until changes become sharply apparent.

Each issue of the National Food Situation carries a table containing primary distribution weights of per capita consumption of major foods. This classification includes farm or fresh weights of fruits and vegetables, carcass weights of meats, eviscerated weights of poultry, and processed weights of dairy products and margarine, fruits and vegetables, flour, and refined sugar. Accordingly, it is a mixture of farm weights and processed weights, but it represents the weights of the products at the several points in the process of distribution at which their disappearance or consumption is measured.

TABLE 1.—Selected measures of per capita consumption of all foods combined, 1939 and 1952, with percentage comparisons ¹

Concept used	Unit	1939	1952	1952 as percentage of 1939
				Percent
A. Quantity in terms of pounds				
1. Farm products ² -----	Pound-----	3,334	3,272	98
2. Primary distribution weights				
a. Including processed items on fresh weight basis ³	Pound-----	2,114	1,962	93
b. Processed plus farm weight of fresh items ⁴ ---	Pound-----	1,622	1,587	98
3. Retail weight equivalent ⁵ -----	Pound-----	1,547	1,519	98
B. Quantities times fixed prices				
1. At farm level—Index of per capita food utilization, using 1947-49 farm prices ⁶	1947-49=100---	93	100	108
2. At retail level—Index of per capita food consumption, using 1947-49 retail prices	1947-49=100---	94	101	107
C. Quantities times changing prices				
1. At farm level but including imported foods and fishery products ⁷	Dollar-----	53	165	311
2. At retail level—all products priced at retail store prices ⁸	Dollar-----	136	368	271
D. Market value of food consumed ⁸ -----	Dollar-----	126	366	290

¹ Fishery products are not included in A or in B 1.

² Meat and poultry, live weight basis; dairy products, whole milk equivalent; fats and oils, in terms of raw materials; farm weight of fruits and vegetables; sugar in terms of sugar beets and sugarcane; cereal products in terms of whole grain; includes coffee beans, tea, and cocoa beans on imported basis. Data prepared for these years only.

³ Differs from farm weight in that meat is on carcass weight basis; poultry, dressed weight; fats and oils in terms of products; sugar in terms of raw sugar; grain products as actual weight.

⁴ Differs from A 2 a in that this category includes processed fruits, vegetables, dairy products, and sugar in terms of manufactured products.

⁵ Approximate weight of all food items (except fish) as purchased in retail stores.

⁶ Derived from civilian food aggregates of index of supply-utilization of agricultural food products.

⁷ Preliminary estimates, include farm value of farm food products sold for domestic civilian consumption, farm home consumption, import values of imported foods, and total payments to fishermen for edible fishery products. Data available for these years only.

⁸ Based on estimates described in Distribution of the Food Supply of the United States, this journal, July 1952, with extrapolation to 1952, using quantity, price, and sales data.

In total weight at the retail level we may include processed weights of many foods, plus the trimmed weights of such commodities as meats, fruits, and vegetables.

The variety of weights that can be used for major food items points up the necessity for predetermining the level at which we want total poundage to be measured. It also casts much doubt upon the usefulness of any figure for total poundage of all foods consumed. Nearly always, careful consideration of the specific problem at hand leads to the use of some measure of overall food consumption other than total poundage. Our foods are too heterogeneous in their physi-

cal characteristics for any one physical measure to be satisfactory for analytical purposes. But with groups of foods that are relatively homogeneous, physical weight is a useful concept.

Consider next some of the problems involved in determining the quantity of a group of related foods consumed, such as dairy products. Some are joint products like butter and skim milk that cannot be converted separately to fresh milk equivalents without duplication. One possibility is to convert them back to whole milk equivalents on the basis of the proportion of all milk solids in the processed product compared with whole milk. But nutritionists are

particularly interested in the mineral and protein content of dairy products, so they often derive composite totals of consumption by using the ratio of these nutrients contained in each product to the content of whole milk, rather than total milk solids or butterfat (A 5, table 2).

If we want to know the total poundage of citrus products consumed, we must decide whether to add the extra water that will put concentrated fruit juices on the basis of the usual form of consumption, single-strength basis, or to include them on product-weight basis. For that matter, do we really want the water content of all foods to be counted in "natural state," or as processed? Or do we really want solids only?

Changes in food consumption in terms of these relatively quantitative meanings can be readily measured for some food groups, but not for others, as we shall presently demonstrate. The principal requisite for each comparison is a clear understanding of what is being measured, and why.

Quality Aspect of Consumption

A second and related concept of food consumption combines considerations of *quality* with those of quantity. This applies particularly when we assess changes in food consumption. To many people, an increase of 10 pounds in consumption of steak probably means a greater increase in food consumption than an increase of 10 pounds of hamburger or, perhaps, 10 pounds of potatoes. Applicable here is the following definition of quality, which was developed a few years ago by a group of food technologists, economists, statisticians, and home economists. "Quality is the combination of attributes of a product that have significance in determining the degree of acceptability of the product to a user"¹. It is difficult to evaluate quality, for it may mean food with less waste, or food that is more mature, or more tender, or more costly to produce or to market or to buy,

¹ United States Department of Agriculture, Agricultural Research Administration. MARKET DEMAND AND PRODUCT QUALITY. A report of the Marketing Research Workshop, July 13-21, 1951 at Michigan State College. Report of Work Group III, Quality, Its Measurement and Application, 188 pp. 1951. (Processed.)

or food that contains more of particularly needed nutrients. Does a shift from canned to frozen vegetables, or from potatoes to leafy, green, and yellow vegetables represent an increase in food consumption? Most people would agree that it does because a shift in consumption to a line that is higher priced and that usually requires more production and marketing services is generally regarded as an improvement in the quality of food consumed and, for certain analyses, as an increase in food consumption.

An important aspect of the quality of food is its nutritive value. From the standpoint of improving the general level of nutrition of our population, an increase in consumption of foods that supply significant quantities of nutrients which are relatively less plentiful in our diets, even at the expense of reduced consumption of foods high in more plentiful nutrients, represents a desirable increase in food consumption. Because obesity is currently recognized as one of the major problems of nutrition in this country, obviously some substitution of foods high in protein, minerals, and vitamins for foods high in carbohydrate and fat content is preferable to net increases in total quantity of food consumed. Accordingly, many nutritionists would view such shifts as improvements in food consumption. Although the Bureau of Human Nutrition and Home Economics regularly calculates the nutritive value of the per capita food supply in terms of 11 nutrients, as yet there is no satisfactory method for combining the various nutrients into an overall nutritional index.

Consumption in Terms of Value

By food consumption, people often mean the *value* of food, or they may mean what they spend for it. This is the type of concept commonly used by economists who are interested in both quantity and price aspects of the demand for food. But the introduction of value and price leads to complications. The food consumed per capita may be valued at the farm level (\$53 in 1939), the quantity of all food consumed may be multiplied by retail store prices (\$136 in 1939), or the money that consumers spend

for supplemental marketing services with food may be included (\$126 in 1939), (table 1).

Actually, all of these concepts are useful, each for a specific purpose.

Let us consider, for example, a hypothetical increase of 11 pounds (or 5 quarts) per capita in consumption of fluid whole milk concurrently with a 5-pound decrease in consumption of evaporated milk. No change has occurred in terms of fat solids. Farmers who sell milk for fluid consumption would regard this shift as an increase in milk consumption (farm value increasing 53 cents per capita in 1947-49 prices). But farmers who sell milk to processors would view it as a decrease (farm value decreasing 36 cents at 1947-49 prices). It would represent an increase in consumption of dairy products from the standpoint of retailers or of consumers' milk bills, because the retail cost of 11 pounds of fluid milk (\$1.02 at 1947-49 retail prices) exceeds the retail cost of 5 pounds of evaporated milk (64 cents). For analysis of farm income and of marketing costs, it is well to know that consumers would have paid 38 cents more to have their milk in fresh fluid form, of which 17 cents would go to farmers for extra costs of producing for the fresh market. The total cost of marketing 5 quarts of fluid milk in 1947-49 exceeded by 21 cents the cost of processing and marketing 5 pounds of evaporated milk.

Another example may be suggested by asking, Does the increased outlay for premixes to be made into cakes or cookies indicate an increase in consumption if a concurrent and equal reduction occurs in poundage of flour, sugar, and other ingredients bought by consumers as such? Or if such purchases result in a corresponding reduction in purchases of commercially baked cakes and cookies?

The foregoing review leads to the conclusion that the major problem in measuring changes in food consumption is to decide which precise meaning of consumption is pertinent to the question at hand. After the decision is reached, the choice among statistical data is fairly easy to make.

To demonstrate the significance of carefully matching the conception of food consumption to the particular problem being studied, we

shall take up several questions the analysis of which requires measurement of changes in food consumption.

Problems Related to All Foods

In a study of the demand for farm food products, we usually want to examine the effects of certain economic factors on takings of farm food products. For this purpose, a total poundage of cattle, vegetables, sugar beets, and other products is a nonsensical conglomeration. A total value figure of some kind would have much more meaning. Cash receipts by farmers can often be used, but price changes confuse the analysis of some questions. To avoid such confusion, we can use a price-weighted index of changes in quantities taken, such as the new index of supply-utilization of agricultural products with food uses (changing quantities times average farm prices in base period). This index was designed to measure the annual flow of farm products to food and nonfood uses, to civilians, to our Armed Forces, and to foreign countries. The aggregates for certain categories, such as domestic food and nonfood use, can be readily made into indexes to study major segments of the demand for farm products.

For the study of the demand for farm products arising from civilian food needs, we can use the index of per capita food utilization which was constructed from the percentage of total utilization allocated to the civilian food category.² This index does not measure precisely the quantities from each year's production taken in that year for civilian food use, because of changes in stocks and of problems involved in tracing raw products through processing plants to civilian purchasers. For example, civilian takings of processed vegetables in 1952 included some vegetables grown in 1951. Actual takings of processed items in the year, no matter when produced, were converted to farm-weight equivalents and added to total quantities of vegetables sold on the fresh market and produced in home gardens.

² The details of the construction of this index are given in United States Department of Agriculture, Agr. Handbook 62, CONSUMPTION OF FOOD IN THE UNITED STATES, 1909-52, pp. 2 to 28.

For most analyses, such complications are probably insignificant in the total picture. It is much more important to realize that this index does not measure purely quantitative changes, but also reflects the shifts in takings from lower to higher cost farm products, as from potatoes to other vegetables which require more farm resources. But we usually want to include the effects of such shifts, for our analysis of demand for farm food output is essentially a study of the demand for farm resources of several kinds, which can be combined only on the basis of price. So a value concept is preferable to a simple measure of avoirdupois weight.

With respect to the new index of per capita food utilization, it should be noted how close the figures are to the index of per capita food consumption. The latter index includes the effects of changes in demand for several marketing services, but apparently they have been offsetting, as indicated by the analyses of changes in commodity groups.

For study of changes in value of all productive resources demanded as opposed to costs of marketing, we must consider changing farm values of farm food products consumed (including farm home consumption) plus the import cost of imported foods, plus payments to fishermen for edible products. Figures to match this concept are given in C 1, table 1.

If the problem is to measure the flow of food to consumers at the retail level, we must decide whether we want a total poundage figure composed of meats, fruit juices, fluid milk, processed vegetables, and so on, or a price-weighted figure. The poundage figure is useful only if our interest is in sheer weight of foods handled, although it rarely is.

For economic analysis, a retail-price-weighted total is far more meaningful. At this point, we must remember that retail prices reflect marketing and processing costs as well as farm costs. Even if we use retail prices in a selected base period to derive value aggregates for all years, the value aggregates will be affected by shifts in consumption from fresh to processed items as well as by changes in the poundage of each product consumed. To some extent the shift from fresh to processed items represents a change in quality, if quality is defined as de-

scribed above, and therefore it may be construed as a change in food consumption. This complication precludes the development of a satisfactory measure of quantity alone for all foods together. For many purposes we really want quantity and quality of food to be combined as they are in the usual index of per capita food consumption. Such an index supplies a controlled measure of the changes in consumption of agricultural resources in the form of food and in the purchases of marketing services of particular types.

If changing quantities are multiplied by changing prices at retail, we obtain equivalent *retail values* of food consumed which are useful for comparisons with income and expenditure data in current dollars. An equivalent of this measure has been constructed for food products produced on farms in the United States by adjusting their farm value by the farm-to-retail price spread derived from market basket data. This series is described as the retail cost of farm food products sold to civilians.³ It can also be derived from data on food sales and use by applying markups and margins to convert sales through nonretail channels to approximate retail values. (The data for C 2, table 1 were estimated thus.) Because no data on food expenditures by food groups are reported or can be estimated directly from available information, it is necessary to build up estimates from information concerning price and quantity. The limitations of this technique are readily apparent and have been discussed elsewhere.⁴

But the use of a retail value concept does not provide for changes in some marketing services, such as a shift from home production and consumption to purchases from retail stores. To cover all marketing services we need a *market value concept*, pricing the flow of food into civilian consumption through all channels, not just at retail store prices. In effect, food expenditures meet such a need, but they include price changes for each channel of distribution. As yet no index of all marketing services plus food as produced, in constant dollars, has been

³ Ibid., pp. 132-151.

⁴ Ibid., p. 175.

devised. But such an index probably will be constructed as soon as we develop reasonably adequate measures of the flow of food through channels other than retail stores, and assemble data on prices paid for food sold by such agencies.

Perhaps we really need here an index of marketing services, but there seems to be no way of combining the services of processors with those of warehousemen, retailers, and other handlers except on a value basis. Changing prices for such services complicate any analysis, so we need a deflator. Because a deflator requires pricing of fixed amounts of services, we seem to be in a circle. In time, as we find out more about marketing services, some relatively satisfactory measures probably will be developed. Certainly as consumers buy more and more marketing services with their food and as investment of resources in marketing facilities grows, we shall have greater need for measuring tools. There seems to be no doubt that a quantitative measure of the good or service purchased is essential for demand analysis.

Another popular use (or misuse) of overall consumption data is in the study of the requirements for transportation facilities for food. Even here, the poundage of all foods combined is misleading because of differences in volume and in special facilities or handling required, particularly refrigeration. Therefore, it seems likely that no overall measure can be satisfactory and that detailed study of movements by type of commodity or groups of commodities requiring similar services is necessary.

During World War II, the index of per capita food consumption was frequently misused in attempts to measure the extent of inflation in food prices. An index of food expenditures per capita was derived from the Department of Commerce series on food expenditures and divided by the food consumption index. The resulting series was described as indicating price changes and it was used to criticize the cost of living index of the Bureau of Labor Statistics. This procedure overlooked completely the whole problem of changes in marketing services bought by consumers and in their prices. Similar to this procedure is the attempt to measure changes in domestic food consumption by de-

flating food expenditures by the retail food price series.

An index based directly on things to be measured is preferable to one derived indirectly. Furthermore, the food consumption index and the food price index are far more accurate than data on food expenditures because available statistical data are more complete in coverage and require relatively few assumptions to derive current estimates.

Problems Related to Groups of Foods

Let us turn now to the consideration of problems that involve analysis of a particular group of commodities. If we are studying the demand for vegetables, for example, we need to add farm-weight equivalents of processed items to the farm weight of the products purchased in fresh form. Or we may want to study changes in the consumption of canned and frozen vegetables as opposed to fresh vegetables, produced for commercial sale or for home use in home gardens. Sometimes, fresh equivalents are more meaningful; at other times, processed weights are better. But as vegetables produced for processing return different prices to farmers than do those sold for fresh market, we should often turn to the concept of value and its related measures. Here, we must decide whether we want to hold prices constant or use changing prices. This involves us in problems of price relationships, because the relative prices for fresh market and for processing may have changed during the period under consideration. As analysts we must resolve such problems by taking into account our assumptions as to the future course of price relationships in choosing the base period for each study.

Similarly, in work on problems of consumer demand for vegetables at the retail level, we must face up to and reach decisions on such questions as the following: Do we want to include potatoes and sweetpotatoes, dry beans and peas, melons? Is our problem concerned only with commercially produced vegetables for fresh market? Or should changes in home garden output be considered? Are we interested in differences in trend among certain groups of vegetables such as leafy, green and yellow, tomatoes, and all others? Are changes in consumption of frozen and canned vegetables af-

TABLE 2.—Selected measures of per capita consumption of dairy products, fruits, vegetables, sugars and sirups, and cereal products, 1939 and 1952, with percentage comparisons¹

Commodity and basis for measurement	Unit	1939	1952	1952 as percentage of 1939
A. Dairy products				
Quantity				
1. Whole-milk equivalent (fat solids basis) ----	Pound -----	813	694	85
2. Total solids content -----	Pound -----	72.5	74.6	103
3. Fat solids content -----	Pound -----	32.1	27.3	85
4. Nonfat solids content -----	Pound -----	40.4	47.3	117
5. Whole-milk equivalent (mineral and protein content) -----	Quart -----	213	249	117
6. Retail weight of products -----	Pound -----	379	413	109
Value				
7. At 1939 farm prices -----	Dollar -----	12.70	11.60	91
8. At 1952 farm prices -----	Dollar -----	35.40	33.00	93
9. At 1935-39 retail prices (major products ²) -----	Dollar -----	30.20	31.00	103
10. At 1947-49 retail prices (major products ²) -----	Dollar -----	55.60	55.40	100
11. At 1947-49 retail prices (excluding a few minor products) -----	Dollar -----	58.70	59.50	101
12. At current retail prices (preliminary) ³ -----	Dollar -----	31.30	67.70	216
B. Fruits⁴				
Quantity				
1. Farm-weight equivalent -----	Pound -----	252	242	96
2. Primary distribution weights, farm weight of fresh plus processed. -----	Pound -----	226	196	87
3. Retail-weight equivalent -----	Pound -----	210	189	90
Value				
4. At 1935-39 farm prices -----	Dollar -----	4.55	4.35	96
5. At 1947-49 farm prices -----	Dollar -----	8.15	7.50	92
6. At 1935-39 retail prices -----	Dollar -----	12.20	12.80	105
7. At 1947-49 retail prices -----	Dollar -----	23.50	23.40	100
8. At current retail prices (preliminary) ⁵ -----	Dollar -----	11.10	25.50	230
C. Vegetables⁶				
Quantity				
1. Farm-weight equivalent -----	Pound -----	284	289	102
2. Primary distribution weights, farm weight of fresh plus processed. -----	Pound -----	265	262	99
3. Retail-weight equivalent -----	Pound -----	247	243	98
Value				
4. At 1935-39 farm prices -----	Dollar -----	4.50	4.55	101
5. At 1947-49 farm prices -----	Dollar -----	9.85	9.90	101
6. At 1935-39 retail prices -----	Dollar -----	16.40	16.00	98
7. At 1947-49 retail prices -----	Dollar -----	36.60	36.80	101
8. At current retail prices (preliminary) ⁵ -----	Dollar -----	20.00	41.90	210

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fecting farmers' receipts or the retail costs to consumers?

The last question leads us back to the problem of price relationships. Price relationships existing at retail at any time in the past will reflect the processing and marketing cost structure of that time as well as consumers' economic choices. Considerable thought must be given to institutional factors such as marketing

agreements and reactions to price controls which may no longer be in effect but which might be frozen into our analysis by our choice of price relationships. Ordinarily we study past changes in consumption to obtain a basis for estimating future changes or for judging the effects of particular factors.

Because our economy is so dynamic, analysts concerned with trends in consumption and

TABLE 2.—Selected measures of per capita consumption of dairy products, fruits, vegetables, sugars and sirups, and cereal products, 1939 and 1952, with percentage comparisons ¹—(Continued)

Commodity and basis for measurement	Unit	1939	1952	1952 as percentage of 1939
D. Sugars and sirups				
Quantity				
1. Farm-weight equivalent	Pound	1,119	1,147	103
2. Refined sugars and sirups used in all forms	Pound	113	118	104
3. Sugars and sirups, excluding duplication in reported consumption of other foods.	Pound	107	115	107
Value				
4. At 1935-39 retail prices of refined sugars and sirups ⁷ .	Dollar	6.40	5.95	93
5. At 1947-49 retail prices, including higher prices for quantities used in processed products.	Dollar	18.80	20.20	107
E. Cereal products				
Quantity				
1. Farm-weight, grain equivalent	Pound	273	232	85
2. Product weight	Pound	199	163	82
Value				
3. At 1935-39 retail prices ⁷	Dollar	12.40	10.30	83
4. At 1947-49 retail prices, including higher prices for quantities used in bakery products, etc.	Dollar	24.50	22.80	93

¹ Most of the value data used in this table are available only for the two years indicated.

² Major products are fluid milk and cream, cheese, condensed and evaporated milk, ice cream, and butter. (Excluding butter, values at 1935-39 prices would be \$24.20 and \$28.00 in 1939 and 1952, respectively—a 16-percent increase in 1952 over 1939; at 1947-49 prices, values of \$42.20 and \$48.70, respectively—a 15-percent increase.)

³ Retail weight of quantities consumed times estimated retail prices. (Excluding butter, value in 1939 is \$26.00; in 1952, \$60.30—232 percent of the 1939 value.)

⁴ Includes melons.

⁵ Retail weight of quantities consumed times estimated retail prices.

⁶ Excludes melons, potatoes, sweetpotatoes, and dry beans and peas.

⁷ Does not reflect increasing proportion consumed in processed foods, entailing higher costs.

marketing of food cannot afford to apply their techniques blindly. Factors other than those being examined explicitly generally do not remain the same. This is especially true in times of stress when value, price, and quantity relationships seem to burst asunder and depart radically from beautifully fitted trend lines. Note A 9 and 10 in table 2, for example, for differences which the choice of 1947-49 price relationships makes in measurement of changes in consumption of dairy products from 1939 to 1952, as opposed to the use of 1935-39 prices.

The significance of the costs of processing and marketing in the measurement of changes

in consumption is accentuated in the cases of sugar products and cereal products. The price of sugar in candy or soft drinks is so much higher than the price of sugar bought in 5-pound bags in grocery stores that consumption of sugar in various forms measured in value terms, but using constant prices, appears to have risen sharply, whereas actual poundage per capita changed very little from 1939 to 1952.

Which concept should be used for the analysis of demand for specific farm products? Farmers are interested both in the prices they receive and in the quantities they sell. But cash receipts

do not supply the whole picture. Future prospects for cash receipts will depend on such factors as the uses of the product, the prices consumers are willing to pay for food processed from the farm commodity, and the cost of the raw farm product relative to total costs. For part of the analysis of demand, values of the product in constant dollars (derived by means of weighted average prices in a carefully selected base period) may be the most desirable measure. For other aspects, we may need to operate at the retail level in order to study the effect of increased demand for marketing services on demand for the farm product. In this case, we probably should use retail value or expenditures for the commodity group, if such information were available.

Effect of Meaning of Consumption upon Statistical Results

Having reviewed some of the problems associated with several different meanings or concepts of food consumption, we may proceed to match statistical data to each. Only those meanings that involve measurement of food consumption from one time to another will be considered. For convenience, data for 1939 and 1952 will be used.

Attention is directed first to the wide variation in degree of change indicated for all foods combined, though precisely the same basic quantities of individual foods were used (table 1).

The four measures of change in total poundage per capita from 1939 to 1952 come out surprisingly close. This may be coincidental, but time series have been prepared only on the retail-weight basis. Even so, the difference between the two sets of primary-distribution-weight data is sufficient to make the user beware.

The two indexes of consumption that use fixed prices as weights, one at the farm level and the other at the retail level, yield similar results for 1939-52, and their long-time series show only slight year-to-year differences. Accordingly, it appears that, despite the conceptual difference, the index of per capita food consumption may be used in studying overall demand for food at the farm level.

The changes from 1939 to 1952 in the two sets of value figures in section C of table 1 reflect the results of several economic phenomena. One is the shift toward foods for which farmers get a larger share of the consumer's dollar as from cereal products to livestock products. Another is the difference in the relative economic position of farmers and of farm prices between 1939, a depressed year for farming, and 1952, a prosperous year. Also, prices of imported foods had risen more than prices of domestically produced foods.

The greater increase in market value of food consumed than in retail value of food may be attributed largely to the reduction in the proportion of food consumed on farms where produced, some shift from rural to urban areas, and some increase in eating away from home.

In the study of the consumption of groups of foods, such as dairy products, we would expect to have fewer complications in measuring changes from one year to another. On the contrary, we often find more difficulty because like foods may be combined on the basis of special attributes not common to all foods.

Consider the case of dairy products where the fat content, the nonfat content, and the milk solids are each important for certain purposes. Referring to section A of table 2, we note the variation between 85 and 216 percent in statistical results of measuring the change in consumption from 1939 to 1952, depending upon the basis used in combining individual dairy products. If farmers are paid for their milk on the basis of fat content, then either whole-milk equivalent on a fat-solids basis or fat content alone may be used to measure consumption. But if we are interested only in the nonfat content of milk, perhaps for nutritional analysis, we should use nonfat milk solids as the basis for combining the many dairy products (A 5, table 2).

The differences between fat and nonfat content from 1939 to 1952 are readily attributable to reduced consumption of butter and increased consumption of whole-milk and skim-milk products. These same factors affect all other measures of change too. The greater degree of change indicated on a retail-value basis than on a farm-value basis arises largely from increased sales

of fluid milk and whole milk products with relatively high marketing costs. The different results in A 9 and A 10 in table 2 indicate the necessity for care in choosing the base period for prices to be used as weights in combining foods within a commodity group. The analyst must decide which set of relationships he considers most desirable for his problem.

Comparable analyses can be made for fruits and vegetables, as indicated in table 2. The greater cost of marketing fresh produce in recent years tends to offset the cost of processing and marketing the canned, dried, and frozen products. So the trend toward increased processing does not push up the revised index of per capita food consumption nearly as much as would be expected.

In contrast, the costs to consumers of sugar and flour in processed foods such as soft drinks, confections, and bakery products are so much higher than for just sugar or flour, that great care must be taken to ascertain the meaning of consumption pertinent to the problem at hand. Relatively satisfactory data on output of products manufactured from sugar and flour are available only for years covered by the Census of Manufactures and even these are not complete. Accordingly, the use of sugar and of flour in processed forms can be only approximated, although total consumption in all forms is measured quite accurately. Purchases of foods processed from sugar and sirups and from cereal products have increased so sharply that they cannot be disregarded. So in revising the index of per capita food consumption, an adjustment was made in the combination of (1) the prices of flour and of refined sugar purchased as such and (2) estimates of prices of these commodities bought in the forms of baked goods, or as candy and soft drinks. The effects of such higher prices on the value aggregates are indicated in table 2.

Conclusions

Data in tables 1 and 2 show how widely the

estimates of the degree of change in overall consumption of food and in consumption of groups of foods can vary, depending upon how food consumption is interpreted. We may conclude that the principal difficulties in measuring changes in food consumption lie in the analysis of the problems to which the measurements are to be applied. Is it a matter of weight? or of uses of farm resources? or of payments for farm resources used? or of use of farm resources plus fixed amount of marketing services? or of farm resources plus all marketing services? Is the analyst concerned with changing prices? Or does the problem narrow down to particular characteristics or attributes of all foods combined or of particular food groups?

On the other hand, the choice of the proper measure of food consumption may depend on whether the analyst considers the problem from the viewpoint of farmers, processors, transporters, retailers, or consumers. The definition of food as an object of consumption differs significantly from the definition of food as a production item. The longer the distribution system for food, the more services are combined with the raw farm products. Some consumers might prefer fewer such services and lower prices but, in general, they buy the services because they want or need them. The rise of self-service food stores concurrently with greatly increased sales of ready-to-serve food items indicates the effect of consumers' choices among services.

One of the causes of the increased expenditure for marketing services is social and economic change, like concentration of population in urban areas, which forces consumers to pay higher transportation and handling costs. But a more important cause is that consumers want certain services with their food. Here the separation of the services supplying time, place, and form utility from the raw commodity raised on the farm becomes academic. To the housewife, they are part and parcel of the can of frozen orange juice she buys.