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EXPENSE FACTORS IN CITY DISTRIBUTION OF PERISHABLES [1]

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CONTENTS

Marketing fresh fruits and vegetables presents certain difficulties that are intensified by the perishable nature of these commodities. This makes it especially important that efficient methods be employed in distributing them to consumers. An attempt is made here to explain some factors which account for the large proportion of the expenditures of consumers which under present methods is absorbed in the expenses of city distribution.

CITY DISTRIBUTION EXEMPLIFIED BY NEW YORK METROPOLITAN AREA [3]

The analysis deals with distribution of perishables in the metropolitan area in and about New York City, as exemplifying conditions that prevail generally in urban centers throughout the United States. The wide geographical extent of producing regions which supply the

[1] This is one of a series of marketing analyses made through cooperation of the U. S. Department of Agriculture with the Port of New York Authority.

[2] Acknowledgment is made to H. D. Comer, formerly Research Agent in Marketing, for assistance in the statistical analyses and interpretations included in this bulletin.

[3] For description of the New York marketing system and statistical tables, see ARTMAN, C. E. FOOD COSTS AND CITY CONSUMERS, New York. 1926.

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perishable food requirements of this area gives the New York City market national importance from the standpoint of producers. Similarity of distribution methods for serving this metropolitan population to those employed in other large cities makes analysis of these methods likewise a matter of general interest to consumers.

More than 180,000 carloads of fresh fruits and vegetables, having an estimated wholesale value exceeding $200,000,000, were shipped or hauled in the calendar year 1923 for consumption in the New York market. Ninety per cent of this food supply came from producing sections ranging from 30 to 3,000 miles distant. Over one-half of the total was transported 500 miles or more. Neighboring States produced only about 30 per cent of the total. Over one-fourth came from the Pacific coast, and one-seventh from Florida. The average length of haul for perishables consumed in the New York market area in 1923 was 1,500 miles.

THE METROPOLITAN DISTRIBUTION SYSTEM

The system by means of which perishables are distributed from the New York wholesale market to consumers in the metropolitan area is illustrated by Figure 1. Most of the fresh fruits and vegetables for the entire metropolitan area pass through a highly centralized wholesale district on the lower west side of Manhattan Island. From this wholesale market the produce is hauled by motor truck or team to five jobbing markets in different parts of the area. The car-lot receipts of the wholesale markets are thus broken down into jobbing lots con venient for handling by jobbing firms. The jobbers in turn split up their purchases into small-sized lots required by individual retailers.

The principal function of the wholesaler is to receive certain commodities in large quantities from the producing points, whereas the function of the jobber is to assemble from various wholesalers a considerable variety of different commodities in relatively small quantities. The retailer carries the process of breaking up the shipping units one step further, and expands greatly the variety of articles which he distributes.

In distributing perishables in the New York metropolitan area, the greater part—from 75 to 80 per cent of the total receipts—passes through retail stores. The remainder is disposed of by pushcarts, hucksters, hotels, restaurants, and other agencies. Consideration is given here to this major group of retail stores. These are subdivided into three general types: (1) Independent grocery stores, carrying perishables as an adjunct to their grocery business, which comprise nearly three-fifths of the total number of food stores; (2) specialized fruit-and-vegetable stores which handle no other commodities, and which comprise about one-fourth of the total number; and, (3) chain grocery stores, whose number in the metropolitan area is estimated to be approximately one-fifth the total number of retail food stores. The trade of the unit and chain grocery stores is estimated to consist of about 20 per cent fruit and vegetables, whereas these commodities constitute practically the entire business of the specialized fruit-and-vegetable stores. Giving consideration to the numerical importance of these three store types and the proportion of perishables sold by each, it is estimated that each type handles approximately the following proportion of fruits and vegetables retailed through

How the New York District receives and distributes its fresh fruit and vegetable supply

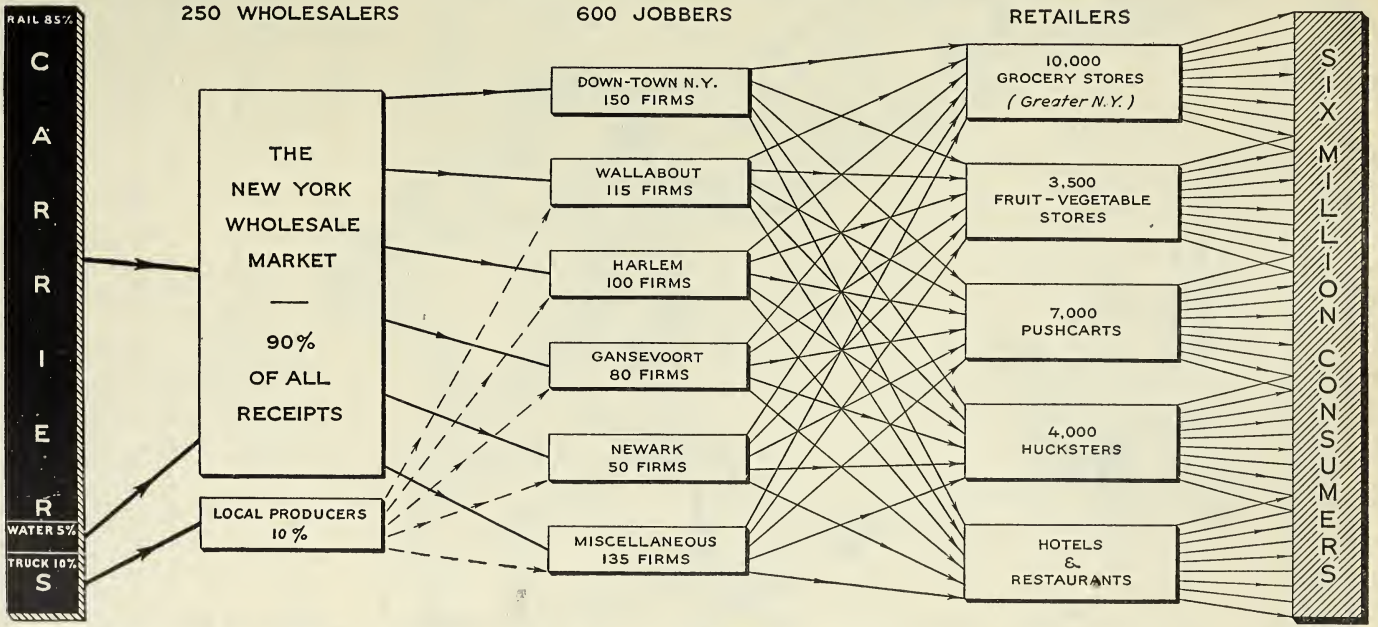

FIG. 1.—Ninety per cent of the perishables consumed in the New York metropolitan area are shipped long distances, averaging 1,500 miles, to a highly concentrated wholesale market. They pass thence through regional jobbing markets for distribution by several types of retailing agencies. More than three-fourths of the total receipts are distributed to consumers through local grocery stores and specialized fruit-vegetable stores

metropolitan stores: Fruit-and-vegetable specialists, two-thirds of the total; independent grocery stores, one-fourth of the total; and chain grocery stores, one-tenth of the total.

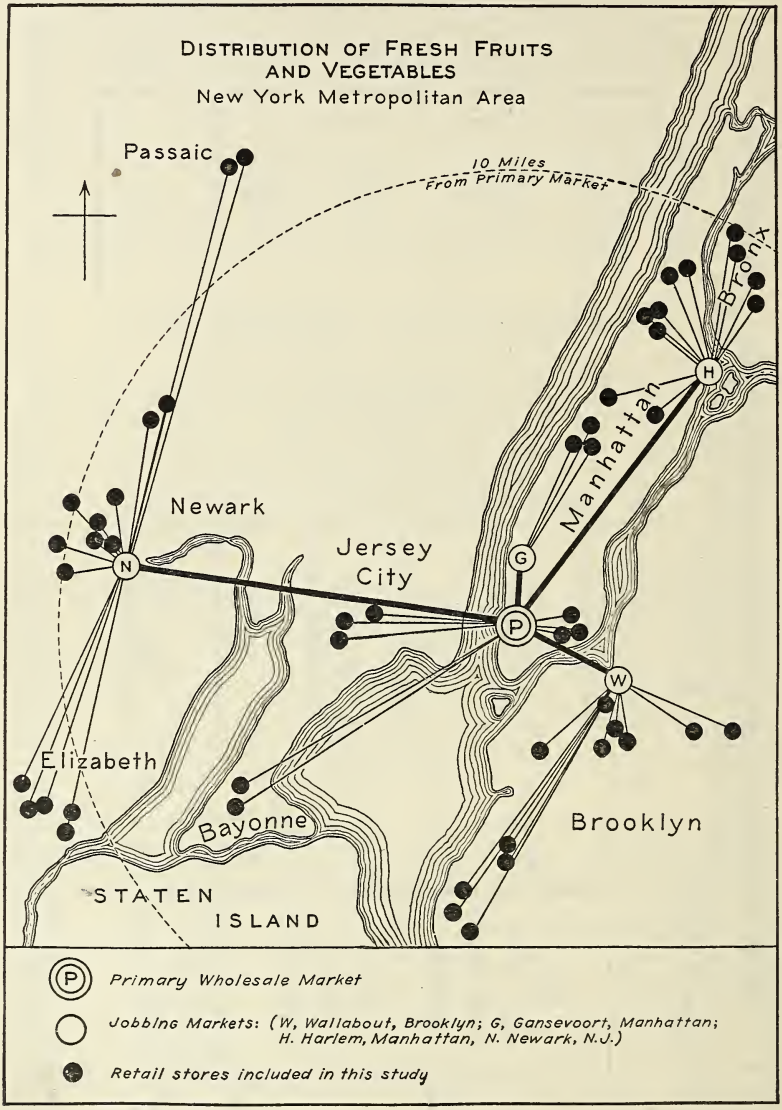

FIG. 2.—From the primary New York wholesale market, P, channels of distribution lead through regional jobbing markets—W, G, H, N, (Wallabout in Brooklyn, Gansevoort and Harlem in Manhattan, Newark Market in Newark, N. J.) to local retailers. Location of stores supplying retail price data is shown by dark circles.

BASIS OF ANALYSIS OF DISTRIBUTION EXPENSE

In attempting to determine the influence of various factors on the expense of distributing perishables, the plan was to collect a large number of original price records for several commodities from stores

representing different kinds of management, varying degrees of service, and diverse types of trade, in a number of representative localities in different parts of the New York metropolitan area.

COLLECTION OF ORIGINAL PRICE DATA

Nearly 14,000 sets of individual price records were made, covering a continuous period of 16 months, from February, 1923, to May, 1924, inclusive, records being taken for an identical day in each week of this period. Fifty retail stores cooperated in supplying retail prices. Most of the quotations were obtained from 30 retailers located in Manhattan, Brooklyn, Bronx, Newark, Passaic, and Elizabeth.[4] The geographical location of these stores and their relation to the primary wholesale market and the intermediate jobbing markets, are indicated in Figure 2.

The retail price quotations were collected on Friday of each week by regularly accredited reporters who were actively interested in the project. They were principally housewives and representatives of women's clubs or home organizations in the respective localities, who obtained the prices from shops in their immediate neighborhoods where the family trading was done. Wholesale prices for corresponding dates were taken from the daily market reports of the United States Department of Agriculture, with an allowance of one day's lag for distribution from the wholesale market to the retailers. Representative dealers in four jobbing markets of the area supplied jobbing prices for the days corresponding to the retail quotations.

The commodities chosen included the fruits and vegetables which are consumed in largest quantities as shown by records of annual car-lot receipts in the New York market. The selection was made to embrace only articles which are generally sold in retail stores, and of a sort that admitted ready identification and comparison. With subdivisions due to differences in varieties or sources and in methods of marketing, the commodities were classified in the 14 groups shown in Table 1

TABLE 1.—*Commodity classes and number of price quotations, New York metropolitan area, February, 1923, to May, 1924*

Commodity	Number of quotations	Commodity	Number of quotations
California oranges	2,017	Southern cabbage	688
Yellow onions	1,757	Southern potatoes	538
Northern potatoes	1,606	Western lettuce	484
Boxed apples	1,435	Cantaloupes	353
Barreled apples	1,284	Peaches	270
Eastern lettuce	1,276	White onions	237
Sweet potatoes	1,252		
Northern cabbage	774	Total, 14 commodities	13,971

Retail prices were stated in terms of quantities prevailingly quoted by retail stores—by the pound, quart, peck, head, dozen, or single unit, or for an advertised value such as 25 cents worth. These

[4] Aid in collecting price data was given by: Women's City Club of New York; New York League of Women Voters; Teachers College of Columbia University; Henry Street Settlement, New York; Pratt Institute of Brooklyn; Brooklyn Society of Ethical Culture; Contemporary Club of Newark, N. J.; Housewives' Economic League of Passaic N. J.; Women's Club of Elizabeth, N. J.

prices were converted to the original package or hundredweight basis, to correspond with units quoted in the wholesale and jobbing markets. Reporters gave description of sizes and qualities in each case, so that prices for the various marketing stages would represent corresponding grades of goods. All possible care was taken to procure typical selling prices that were truly representative of the situations studied. By restricting the reports to standard varieties and grades, the error from comparing unlike conditions was reduced to a minimum.

ADJUSTMENT FOR SHRINKAGE IN RETAILING

To make the retail prices exactly comparable with wholesale prices, a correction was made for shrinkage of contents of packages in retail selling. This was done by multiplying the mean retail package price by the percentage of the shipping package which is prevailingly sold at retail. This shrinkage factor does not allow for the indefinite and irregular losses that occasionally arise because of deterioration or decay, but only for actual physical shrinkage in contents of original packages. The adjustments were made as noted in Table 2.

TABLE 2.—*Adjustment for shrinkage in retail selling, New York metropolitan area, February, 1923, to May, 1924*

Commodity	Shipping unit	Gross weight per unit [1]	Quantity usually retailed	Percentage of shipping unit retailed
		Pounds	*Pounds*	*Per cent*
Northern potatoes	100 pounds	100	95	95
Southern potatoes	do	100	92	92
California oranges	Box	75	75	100
Peaches	Crate	35	33	94
Sweet potatoes	100 pounds	100	90	90
Cantaloupes	Crate	60	60	100
Boxed apples	Box	40	40	100
Southern cabbage	100 pounds	100	90	90
Barreled apples	Barrel	150	135	90
Eastern lettuce	Hamper	34	34	100
Western lettuce	Crate	48	48	100
Yellow onions	100 pounds	100	95	95
Northern cabbage	do	100	90	90
White onions	do	100	95	95

[1] As used in converting original quotations.

Against each retail quotation was matched the wholesale figure for the corresponding date. Jobbing prices also were added for independent unit stores. No jobbing prices were entered for chain stores, since these buy their goods mainly in the wholesale market, whereas unit stores deal through jobbers. Especial care was taken to have each of the stages in the price series represent identical goods and conditions. In the absence of bias in obtaining the price data, errors in particular quotations should compensate one another so that the records for the succession of weeks which are included in the analysis period should be an accurate representation of prevailing price conditions. The care taken in selecting data, the variety of conditions included, the length of time covered, the volume of data obtained, and the carefulness in the method of analysis, unite therefore to make this analysis an accurate and representative presentation of actual conditions.

METHOD OF DATA ANALYSIS

The individual price records, received on printed cards, were transcribed to working sheets, and thence to punched cards for machine tabulation.[5] The information was thus classified according to the different conditions to be analyzed. In making comparisons of the different groups of data, the arithmetic mean of prices was used because this was found to be the most representative and the most workable kind of average.

Since the purpose of the analysis is to compare spreads between wholesale and retail prices, under various market conditions, it is necessary to relate these prices to uniform bases. The method commonly employed for this purpose is to express price spread in terms of a uniform outlay of $1 by the consumer. In this case the spread represents the number of cents of the consumer's dollar that are absorbed by the expense of city distribution. In other words, it is the difference between the value of the dollar's worth of goods at retail and the value of the same goods at wholesale.

With such a base the spread is conveniently expressed also as a *percentage margin.* This may be derived by dividing the price difference for any quantity of goods by the retail price of the same quantity. Thus, if R represents retail price, and W represents wholesale price for a given quantity of goods, the price difference, or spread, is represented by R–W. The percentage margin is then represented by $\frac{R-W}{R}$.

A preliminary inspection of the average percentage margins in the various classifications of data was made to find out which of the different market factors considered were accompanied by the greatest margin differences. The widest divergence was found to exist between the different individual commodities in the series of 14 articles. Next to the contrasts in commodities, the divergence of margins was greatest in different types of retail stores, as indicated by differences in management and in selling policy. These two sources of contrast overshadowed all other distribution factors that were considered. The analysis was therefore focused upon the factors which appeared to account for the greater amount of difference in distribution expense: (1) The nature of the commodity and (2) the type of store operation.

ANALYSIS OF COMMODITY DIFFERENCES

The composite means of retail and wholesale prices of each commodity as a whole for the entire period embraced in this analysis are shown in Table 3. Retail store prices are weighted according to the importance of different store types, and are adjusted for shrinkage in retailing. The average distribution expense per package is the difference between mean retail price and mean wholesale price. It is expressed as a percentage of the retail price in the last column. These average prices and percentage margins are the basic figures used in making the commodity analyses.

[5] The work of tabulating and classifying the large number of compilations was done by the machine tabulation section of the Bureau of Agricultural Economics in Washington, under the direction of E. J. Way.

TABLE 3.—*Mean prices and percentage margins, New York metropolitan area, February, 1923, to May, 1924*

Commodity	Physical unit	Mean retail price	Mean wholesale price	Percentage margin
				Per cent
Northern potatoes	100 pounds	$3.87	$2.43	37
Southern potatoes	do	6.76	4.18	38
California oranges	Box	8.21	4.86	41
Peaches	Crate	3.97	2.20	45
Sweet potatoes	100 pounds	8.00	4.44	44
Cantaloupes	Crate	4.57	2.45	46
Boxed apples	Box	4.35	2.33	46
Southern cabbage	100 pounds	8.42	4.42	48
Barreled apples	Barrel	10.76	5.53	49
Eastern lettuce	Hamper	4.43	2.16	51
Western lettuce	Crate	7.05	3.37	52
Yellow onions	do	6.70	3.17	53
Northern cabbage	100 pounds	4.68	1.96	58
White onions	do	8.59	3.22	63
14 commodity weighted mean				45

In the series of articles, there is a range in the margins from a minimum of 37 per cent for northern potatoes to a maximum of 63 per cent for white onions. The question at hand is to determine what differences exist in the marketing conditions of these commodities which are adequate to explain so wide a divergence in the portion of consumers' outlays required for retail distribution of such similar articles.

Some of the conditions which might reasonably be expected so to influence the manner of handling as to establish these commodity differences, are: (1) Total volume of commodity marketed throughout the season; (2) regularity of supply; (3) perishability; (4) variability in price; (5) value of total quantity marketed; (6) comparative value per unit of commodity. Various detailed tests were made to ascertain the association of each of these conditions with the variations in the percentage margins. A great many tabulations were compiled and numerous diagrams and curves were applied to test the relationships. In no case was the relation sufficiently regular to account for the margin contrasts. It was therefore necessary to seek further for an explanation of the differences in the methods of marketing the different articles.

CONTRASTS IN SERVICE REQUIREMENTS

It was suggested that variations might exist in the extent of services required for distributing different commodities, which would suffice to explain the margin differences. Services rendered by the retail storekeeper may be considered as of several distinct kinds: (1) Assembling a considerable variety of different articles in a single place conveniently accessible to consumers; (2) maintaining at all times a fresh daily supply of articles available in the market; (3) selecting, grading, and arranging goods for retail sale; (4) displaying his stock of goods for inspection and selection by customers; (5) breaking up the original packages or jobbers' units into smaller quantities required by the retail trade; (6) waiting upon individual customers.

A typical display of fruits and vegetables of a Manhattan grocery store is shown in Figure 3. The different services maintained for the convenience of consumers, require on the part of the retailer

the expenditure of a great deal of time and effort. In addition to the general services enumerated in the first five items, the filling of customers' orders alone involves a number of separate acts. These include (1) taking the goods desired by the customer from the display space or from the reserve stock of goods, (2) weighing or measuring or counting the desired quantity, (3) putting this up in a satisfactory package for delivery to customers, (4) computing the amount of the sale, (5) making a record of the transaction, and (6) obtaining payment. These several acts have to be repeated with each sale, requiring the personal attention and time of the retailer or his employee.

Retail sales in the metropolitan area are prevailingly made in small quantitites of a few pounds or quarts, a dozen, or a single unit, according to commodity. Individual sales range in volume from

FIG. 3.—A typical retail store display of fruits and vegetables

1 pound to 7 or 8 pounds of articles sold by weight, from 1 to 5 quarts when sold by measure, half a dozen to a dozen fruits, 1 or 2 heads of lettuce, 1 or 2 melons, and corresponding small quantities of other perishables. From 15 to 50 separate retail transactions are usually required to dispose of a single shipping package or hundredweight. Although sales to customers are occasionally made in larger volumes than these, this small-sized retailing is the prevailing practice in the New York metropolitan area, and exists to a great extent in other large cities. Accompanying the multiplication of services required in such small-unit retailing, there is also a considerable element of shrinkage, arising from division of original packages into numerous small-sale units. The smaller these units, the more numerous are the opportunities for loss from this item of shrinkage.

The quantity of goods bought at one time by an individual customer bears little relation to the amount of service and attention

required from the retailer. Practically as much of the storekeeper's or clerk's time is needed to wait upon a customer who purchases a small quantity of goods as for the person who makes a large purchase. It is a reasonable supposition, therefore, that the selling expense should be fairly uniform for each retail sale, irrespective of its size.

SIZE OF SALE AS CRITERION OF SERVICE REQUIREMENTS

Careful inquiries in the retail trade revealed the fact that the size of the average retail sale varies distinctly with different commodities. These specific inquiries embraced the extensive experience of two large metropolitan chain-store systems, several independent retailers, and a considerable number of individual families whose size of purchase were included with the original price data.

Although retail prices are advertised in terms of uniform physical units, such as the number, quart, head, dozen, or a similar magnitude, actual sales are made in various multiples of these individual units. To be sure, there is a great deal of variation in the size of individual sales on account of differences in buying habits of individual customers. Yet sufficient regularity exists throughout the retail trade to establish a typical or prevailing size of sale for a given commodity.

In retail selling the significance of the variation in quantities of goods sold per sale lies in their relation to the money value of the goods so sold. The value of the retail sale is determined by two variable elements. One of these is the physical quantity of goods disposed of; the other is the price per physical unit of goods.

From the representative sources referred to, which may be considered typical of retailing practices in the metropolitan area, it was possible to ascertain with considerable definiteness the prevailing range in size of sale for each commodity. The size of the typical or standard retail sale for each commodity may reasonably be regarded as approximating the mid-point of the prevailing range. Use of the mid-point is justified as an approximate indicator of prevailing size of sale, in view of the fact that extremes, such as unusually small sales and unusually large sales, were excluded from the ranges given. This method involves some degree of approximation, but in the absence of more definite data for arriving at specific accuracy, which could be obtained only by recording exact details of a large number of individual sales under representative conditions, the method here employed is justified as the best that was available.

Retail price per unit of goods, which is the second variable in the value of the retail sale, was computed uniformly per pound, on the same basis as that used for expressing the size of sale. Retail price per pound was calculated from the mean retail price of each commodity as derived from the original quotations. These were first converted to the package or hundredweight basis and thence to the mean price per pound.

The value of the standard retail sale was calculated as the product of the mean retail price per pound and the number of pounds in the standard retail sale. The prevailing range in size of sale for each of the 14 commodities, the mid-point of this range, and the value of the standard retail sale, are shown in the first three columns of Table 4. Spread between the wholesale cost of goods and their retail value may be computed either by subtracting the wholesale price of a given quantity from its retail price, or indirectly by multiplying a given

retail value by the computed percentage margin for the commodity. The percentage margins and the resulting price spread in terms of the standard retail sale are shown in the last two columns of this table.

TABLE 4.—*Size and value of standard retail sale, percentage margins and price spread per sale for 14 commodities in all store types, New York metropolitan area, February, 1923, to May, 1924*

Commodity—	Prevailing range in size of retail sale	Midpoint of range	Mean retail price per pound [1]	Value of standard retail sale	Percentage margin	Price spread per standard retail sale
	Pounds	*Pounds*	*Cents*	*Cents*	*Per cent*	*Cents*
Northern potatoes	5–8	6.50	4.1	26.7	37	9.9
Southern potatoes	3–4.5	3.75	7.4	27.8	38	10.6
California oranges	2–3	2.50	11.0	27.5	41	11.3
Sweet potatoes	2.5–3	2.75	8.9	24.5	45	11.0
Peaches	1.5–3	2.25	11.9	26.8	44	12.1
Boxed apples	1.5–3	2.25	10.9	24.7	46	11.4
Cantaloupes	3–3.5	3.25	7.6	24.7	46	11.4
Southern cabbage	2–3.5	2.75	9.4	25.9	48	12.4
Barreled apples	2.5–3.5	3.00	8.0	24.0	49	11.8
Eastern lettuce	1.5–2	1.75	13.0	22.8	51	11.5
Western lettuce	1–2	1.50	14.7	22.1	52	11.6
Yellow onions	2.5–4	3.25	7.1	23.1	53	12.2
Northern cabbage	3–5	4.00	5.2	20.8	58	12.1
White onions	1.5–3	2.25	9.0	20.3	63	12.8
Weighted mean	----------	3.28	7.7	25.3	45	11.3

[1] Adjusted for shrinkage in retailing.

SIZE OF SALE AS AN ADEQUATE EXPLANATION OF PERCENTAGE MARGINS

When price spread is expressed in cents per standard retail sale, instead of being shown as a percentage margin, it is seen to have a remarkable degree of uniformity among the 14 commodities. This spread varies only from a minimum of 9.9 to a maximum of 12.8, a difference of less than 3 cents per sale. Moreover, there is a high concentration about the mean of 11.3 cents for the series.

The mean size of the standard retail sale for the 14 commodities weighted for each commodity according to its total volume marketed is approximately 3¼ pounds. There is a variation in size of sale among the different articles of 5 pounds, nearly twice the mean size of the standard sale for the series.

The mean value of the standard retail sale for the series is 25.3 cents. There is a total variation in its value among the 14 articles of 7.5 cents—from a minimum of 20.3 to a maximum of 27.8. This is less than one-third the mean for the series. The value of the standard retail sale is thus decidedly less variable than is the size of sale. This results from the fact, as shown graphically in Figure 4, that variations in size of sale within the series are generally offset by reciprocal variations in price per pound, in such a manner that variation in their products is diminished materially.

Furthermore, despite high variation in size of sale and a considerable variability in its value, price-spread per sale is found to be very nearly constant for each article of the series. The relations are shown graphically in Figure 5.

Thus it appears that commodities with low value per retail sale require practically the same monetary amount per sale for distribution as do articles with high value per sale. Variations in percentage

margins result from a combination of uniformity in price-spread per sale and variability in the value of the sale. It is the variable amount of money prevailingly spent for the consumer's single purchase, accompanied by a constant spread per sale, which fixes the variable proportion of the consumer's expenditure which is absorbed in city distribution. Variations in size of the standard retail sale, accompanied by constancy in distribution expense per sale, thus yield an adequate explanation of differences in percentage margins within the series of commodities here analyzed.

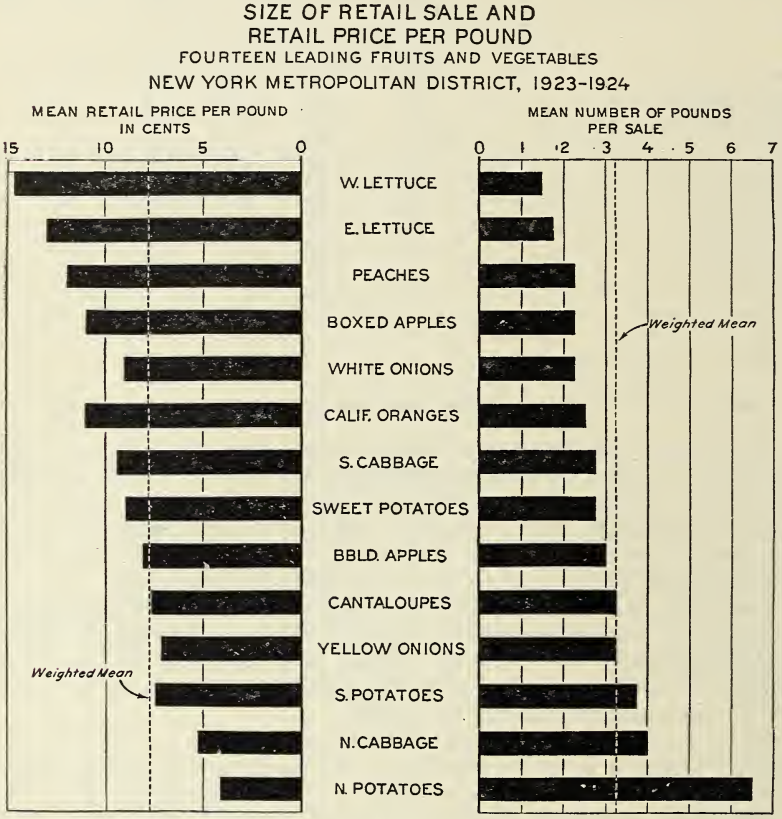

FIG. 4.—Commodities such as lettuce, sold in small retail quantities, have high retail price per pound, whereas staples like potatoes, which are retailed in larger-sized lots, have low retail price per pound

DEDUCTIONS FROM SIZE-OF-SALE ANALYSIS

This analysis of variations among different commodities in the margin or distribution expense per dollar's worth, demonstrates that the dominating factor in the variability of percentage margins is the size of the prevailing retail unit of sale. The quantity of goods prevailingly taken at a time by the individual customer is definitely and regularly associated with the proportion of the consumer's outlay which is required in the services of city distribution.

The percentage margin signifies the amount of money in a retail dollar's worth of goods which is absorbed in these services. A

dollar's worth of goods, expressed in number of retail sales, is the reciprocal of the value of the retail sale. It requires only four individual sales to dispose of a dollar's worth of goods if the value of each sale is 25 cents, whereas five sales would be required if the value of the sale were reduced to 20 cents. Thus, because of the prevailing uniformity in distribution expense for each sale, regardless of its size, the amount of money required to sell a dollar's worth of goods varies directly with the number of sales which the retailer must make to receive $1. As the number increases the distribution

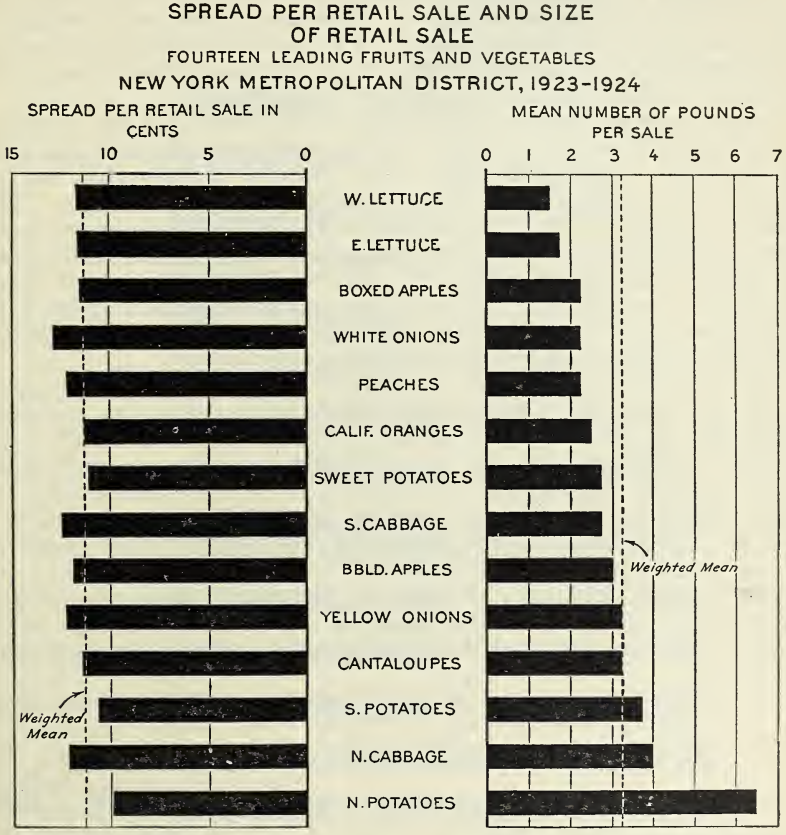

FIG. 5.—Commodities differ widely in the prevailing size of retail sale, but the difference between wholesale cost and retail value per sale is nearly uniform

expense per dollar increases likewise. Hence the greater the number of sales per dollar the greater is the proportion of the dollar which is required in distributing the goods; that is to say, the greater is the percentage margin. Differences in margins are thus found to be directly due to differences in size of the retail sale.

The practice of marking retail prices so that they will yield for different articles a fairly constant money spread per sale, regardless of the size of sale, thus explains the differences in percentage margins so adequately that the influence of other factors which might appear to be effective is obscured by this one. Such characteristics as total

annual volume, total value, regularity of supply, perishability, or variability in wholesale price, in so far as they influence the percentage margins, are of secondary significance, because they operate indirectly through prices. The dominating factor is the size and value of the standard retail sale.

APPORTIONMENT OF DISTRIBUTION EXPENSE BETWEEN JOBBER AND RETAILER

Two kinds of distribution services are included in the spread between wholesale and retail prices. One set of services is rendered by the distinctive retailing agents, whereas the other is performed by intermediate jobbers who break up the wholesale shipments into lots of convenient size for handling in retail stores.

To ascertain the relation which these two portions of the distribution expense bear to each other, the spread per retail sale was split into its two component parts. The portion attributable to the jobber was measured separately from that of the retailer. The retailers' portion of the price-spread is the difference between retail price and jobbing price; the jobbers' portion is the difference between the jobbers' selling price and the cost of goods in the New York wholesale market. Analysis of these two portions is restricted to independent unit stores, since in chain stores the functions of jobber and retailer are performed by a single agency.

The retailers' portion and the jobbers' portion of the total price-spread per standard retail sale in unit stores are shown for each commodity in Table 5. Comparison of the two portions which make up the total spread per sale shows that the retailers' part is more nearly constant throughout the series than is the jobbers' portion. The coefficient of deviation from the mean jobbers' spread of 2.1 cents is 18 per cent of the mean spread. For the retailers' portion, on the other hand, the coefficient of deviation from the mean retailers' spread, 9.7 cents, is only 8 per cent. Deviation of the jobbers' price-spread from the mean for the 14 articles is over twice as great as the deviation of the retailers' price-spread from its mean.

TABLE 5.—*Retailers' and jobbers' portion in standard retail sale for unit stores only, New York metropolitan area, February, 1923, to May, 1924*

Commodity	Value of standard retail sale	Total spread	Jobbers' spread	Retailers' spread
	Cents	*Cents*	*Cents*	*Cents*
California oranges	28.0	11.8	2.0	9.8
Southern potatoes	27.8	10.8	1.6	9.2
Northern potatoes	27.3	10.4	1.7	8.7
Peaches	27.0	12.2	2.5	9.7
Southern cabbage	26.4	12.7	2.9	9.8
Sweet potatoes	25.9	11.9	1.8	10.1
Boxed apples	25.2	11.8	2.7	9.1
Cantaloupes	24.7	11.6	2.0	9.6
Barreled apples	24.6	12.3	2.0	10.3
Eastern lettuce	23.5	12.2	3.0	9.2
Yellow onions	23.4	12.4	1.6	10.8
Western lettuce	22.4	11.9	1.8	10.1
Northern cabbage	21.6	12.5	1.9	10.6
White onions	20.9	13.4	2.5	10.9
14-commodity weighted mean	25.9	11.8	2.1	9.7

Comparison of the two spreads shows that there is no regularity of association between them. The greater regularity in distribution services rendered per sale *by the retailer* accounts chiefly for the uniformity found in total spread throughout the commodity series. Figure 6 shows graphically for each article the split up of the standard retail sale in unit stores into its three component parts. The dark

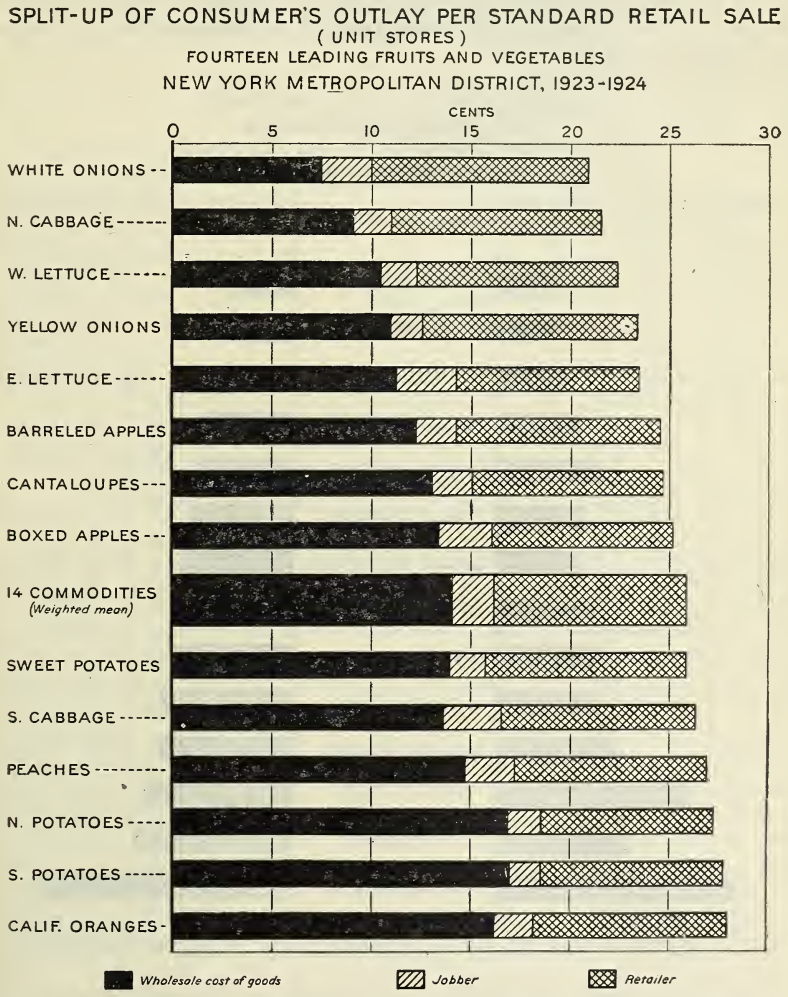

FIG. 6.—Among different commodities wide variability exists in wholesale value of goods per retail sale. The retailer's return per sale is fairly constant, but the jobber's portion varies considerably

portion of each bar represents the wholesale value of the goods sold, the middle part of the bars indicates the portion required for jobber's service, and the right-hand section represents the amount required by the retailer. These bars bring out the general uniformity of the retailers' portion, and the variability in the portion ascribed to the jobber.

REASONS FOR VARIABILITY OF JOBBERS' PORTION

Variability in jobbers' spreads might be explained by demonstrating its association with variations in size of the jobber's sale, in a manner similar to the explanation of variablity in percentage margins. To test the existence of such association, the prevailing size of the jobber's sale was ascertained for each commodity of the series and this was compared with the size of the retail sale. The figures for size of jobber's sale were obtained from the books of representative jobbers in Brooklyn and Newark, covering transactions extending over several weeks.

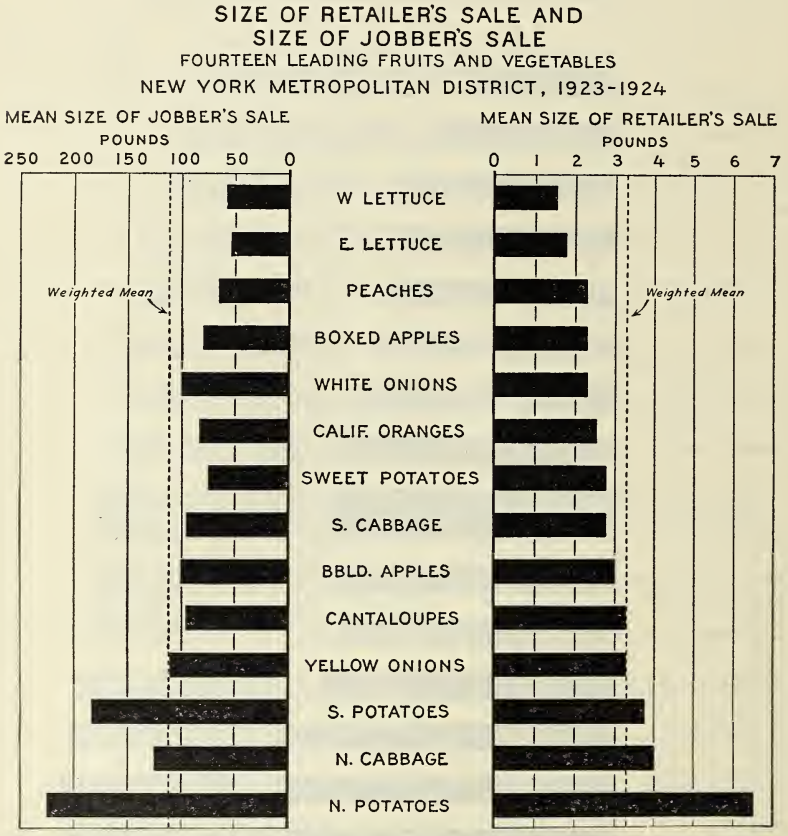

FIG. 7.—General symmetry in these two series of bars shows that the quantity of a commodity purchased by the retailer is proportional to the quantity prevailingly sold to the individual customer

The relationship of size of jobber's sale to size of the standard retail sale was found to be substantially regular throughout the series, as shown in Table 6. There was a range in the number of retail sales per jobber's sale among the 14 articles from a minimum of 24 to a maximum of 45 sales, but the grouping around the weighted mean number, 32.5, was fairly close. With 8 of the commodities, moreover, the ratio was between 30 and 35; with 3 of the remaining 6 it was below 30; and with the remaining 3 it was above 35. A general tendency is thus apparent for size of the jobber's sale to

vary directly with the size of the retailer's sale, as shown graphically in Figure 7. Since general regularity exists in the association of size of jobber's sale with size of retail sale, and since there is also no association between jobbers' spread and retailers' spread, it is not possible to explain variations in jobbers' spreads by the variability in size of the jobber's sale.

TABLE 6.—*Relation between size of jobber's sale and size of retailer's sale, New York metropolitan area, February, 1923, to May, 1924*

Commodity	Mean number of pounds per jobber's sale	Mean number of pounds per retailer's sale	Number of retail sales per jobber's sale [1]
Eastern lettuce	54	1.75	31
Western lettuce	58	1.50	39
Peaches	65	2.25	28
Sweet potatoes	75	2.75	24
Boxed apples	80	2.25	35
California oranges	84	2.50	34
Southern cabbage	95	2.75	31
Cantaloupes	96	3.25	30
Barreled apples	100	3.00	30
White onios	100	2.25	43
Yellow onions	110	3.25	32
Northern cabbage	125	4.00	28
Southern potatoes	133	3.75	45
Northern potatoes	225	6.50	33
Weighted mean	112	3.28	32.5

[1] Allowing for shrinkage in retail selling according to Table 2.

INFLUENCE OF WHOLESALE PRICE CHANGES ON JOBBERS' SPREAD

Speculative risks due to price variations in the wholesale market might, with some reason, be expected to influence the selling policies of dealers in the jobbing market and thus to account for variability in jobbers' price spreads for different kinds of commodities. Tests were therefore made to ascertain if any regular association existed between the jobbers' portion in the standard retail sale and variability in wholesale price.

A measure of variation is required that will avoid the effects of pronounced seasonal price trends. The usual measures of dispersion, such as average deviation and standard deviation, are unsatisfactory for this purpose. An adequate quantitative measure is required to indicate comparable price changes in the variable seasons when different articles are in the market. For this purpose, the wholesale price of each commodity was taken for an identical day in each week of the season during which it was officially reported in the New York wholesale market.[6] The average week-to-week change in price, either up or down, was determined and expressed as a percentage of the season's mean wholesale price for the given commodity.

This percentage is an accurate measure of tendency-to-change in wholesale price, which may be used as an index for comparing the different commodities. The price variability of eastern lettuce, for example, is shown by its index of 26.4 per cent to be very much

[6] Prices for Thursday of each week were taken from the Daily Market Report of the United States Department of Agriculture. Orange prices were secured from the Daily Fruit Reporter, published by a private company.

greater than that of northern potatoes, whose index is only 3.2 per cent. The meaning of these figures is that the average week-to-week change in wholesale price throughout the market season for lettuce is 26.4 per cent of the mean price for the lettuce season, whereas for potatoes the mean week-to-week change in wholesale price is only 3.2 per cent of the average price for the potato season.

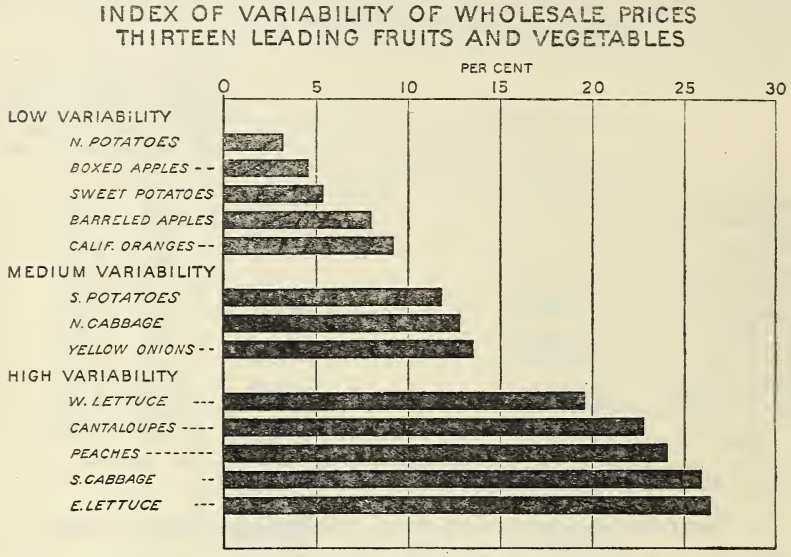

FIG. 8.—Highly perishable and seasonal commodities have high variability in wholesale price, while staples have low variability. Wholesale price changes, however, do not appear to influence the jobbers' portion of the retail sale

Naturally a wide range exists in the indices, as shown in Table 7. The commodities are seen to fall rather definitely into three distinct groups. Five of the articles have a distinctly low index—less than 10 per cent. Three of them are in a medium group, with indices between 10 and 15 per cent. With the remaining five articles there is high variability, near or above 20 per cent. Graphic comparison of the three groups is afforded in Figure 8.

TABLE 7.—*Index of variability in wholesale price, New York metropolitan area, February, 1923, to May, 1924*[1]

Low	Per cent	Medium	Per cent	High	Per cent
Northern potatoes	3.2	Southern potatoes	11.8	Western lettuce	19.6
Boxed apples	4.6	Northern cabbage	12.8	Cantaloupes	22.8
Sweet potatoes	5.4	Yellow onions	13.5	Peaches	24.1
Barreled apples	8.0			Southern cabbage	25.9
California oranges	9.2			Eastern lettuce	26.4

[1] White onions omitted because of lack of continuous price quotations.

This grouping of commodities according to variability in wholesale prices agrees in general with their relative perishability. The low-variability group includes the more staple articles which keep fairly well. These may be supplied to the market or withheld from it according to its demands, so that variation between supply and

demand is kept fairly evenly balanced throughout the season. In the high-variability group, on the other hand, are the distinctly seasonal articles with limited keeping qualities. They must be shipped from producing areas as soon as ready for market, and they are thrown upon the market immediately after arrival. Consequently, because the erratic seasonal changes in supply are not balanced by corresponding adjustment in consumers' demand, they suffer wide price fluctuation in the New York wholesale market.

Does any regular association exist between indices of wholesale-price variability in these three groups and jobbers' spread in the retail sale? Apparently not, judging from comparison of the two columns in Table 8. Two of the articles whose spread per sale is lowest are in the middle-variability group; boxed apples, which have a high price spread, are in the low-variability group; and three other articles which also have high price spread per sale are in the high-variability group. From the data on which these comparisons are based there appears to be no regularity of association between variability of wholesale prices and the portion of the consumer's outlay required for jobber's service. The results are generally negative.

TABLE 8.—*Relation of jobbers' price spread to wholesale price variability, New York metropolitan area, February, 1923, to May, 1924*

	Jobbers' spread per retail sale	Wholesale price variability		Jobbers' spread per retail sale	Wholesale price variability
	Cents	*Per cent*		*Cents*	*Per cent*
Yellow onions	1.6	13.5	California oranges	2.0	9.2
Southern potatoes	1.6	11.8	Barreled apples	2.0	8.0
Northern potatoes	1.7	3.2	Peaches	2.5	24.1
Sweet potatoes	1.8	5.4	Boxed apples	2.7	4.6
Western lettuce	1.8	19.6	Southern cabbage	2.9	25.9
Northern cabbage	1.9	12.8	Eastern lettuce	3.0	26.4
Cantaloupes	2.0	22.8			

CONCLUSIONS REGARDING VARIABILITY OF JOBBERS' PRICE SPREAD

When the proportional expense of distribution is assigned to jobber and retailer, there is found to be considerably greater constancy in the retailers' portion than in that of the jobbers. The distribution services rendered by the retailer are thus the dominant factor in determining the regularity of distribution expense. Variability in jobbers' spread is not accounted for by variations in size of jobber's sale. Neither does variability in the jobbers' portion of the price spread appear to be associated with variations of price in the wholesale market. It must be accounted for by factors outside of those considered here.

ANALYSIS OF TYPES OF STORE OPERATION

The present analysis is concerned with measurement of the influence of some typical forms of store operation in the expense of distributing perishable commodities. A two-fold classification of store types is here considered for the purpose of determining the extent to which the form of operation affects the expense of distribution and cost of goods to consumers.

CLASSIFICATION OF STORE TYPES

The first classification divides all retail stores into two groups, based on the kind of management: (1) Unit stores under independent operation by individual proprietors, and (2) chain stores operated as parts of centrally organized systems. The other classification distinguishes stores on the basis of special services extended. The service distinctions, which apply to unit stores only, divide these into three general groups. In the first service group are unit stores whose regular policy is to extend credit and to deliver orders to a majority of their customers. The second group includes stores which operate prevailingly on a cash basis, but grant a limited amount of delivery service. The third group comprises unit stores which do a strict cash-and-carry business, extending neither credit nor delivery. No stores of a credit-and-carry type were represented in the data. Subdivisions of chain-store data were not attempted on the basis of service, since the price averages in all reporting chain stores were nearly identical with those of the prevailing cash-and-carry type.

Distinctions between retail stores as to class of trade or clientele coincide generally with distinctions on the basis of service rendered. The more discriminating high-class trade of well-to-do neighborhoods is generally served by stores which operate on a full credit-and-delivery basis. Many independent retailers in thrifty middle class neighborhoods conduct their business on a cash basis, but render a limited amount of delivery service to regular customers. The poorer and middle-class neighborhoods, where low prices are the main consideration, are served mainly by cash-and-carry stores, which dispense entirely with credit and delivery services. Chain stores do an extensive business in the low-price sections also.

Although the original data for unit stores were carefully tabulated in two additional groups on the basis of specialization, as grocery stores and fruit-vegetable stores, the slight contrasts in their distribution expense indicated that, in comparison with management and service factors, the factor of specialization is of minor significance. Further study of the influence attributable to specialization was therefore discontinued, in order that attention might be concentrated upon the factors of major significance.

The present analysis thus takes into consideration distinctions between five types of retailing agencies, classified as to form of management and extent of service in the following manner:

Management: Unit stores,[7] chain stores.

Service policy (unit stores only): Credit-delivery, cash-delivery, cash-carry.

EXTENT OF DATA

Only 7 of the 14 commodities previously considered were used for these store-type analyses. The insufficient number of quotations for the other articles in some store groups did not permit representative comparisons. Approximately three-fourths of the original number of quotations are included here, however. The 7 commodities retained comprise 68 per cent of the total annual volume of the larger series, and 70 per cent of their total annual retail value. Moreover

[7] In the subsequent comparisons, the all-unit or typical-unit-store figures are regarded as representing the degree of service generally prevailing in metropolitan unit stores. The typical unit store is thus to be considered as a composite, rather than an actual type, since the figures are based upon averages of original quotations, which were obtained from stores with all three types of service policy.

the weighted mean percentage margins for these 7 articles are practically the same as those for the complete series. The smaller number of articles may therefore be regarded as representative of fruits and vegetables in general. Table 9 shows the number of price quotations for each commodity and their total in each of the five groups and the proportion of the 14-commodity series in each group.

TABLE 9.—*Number of quotations, by store types, New York metropolitan area, February, 1923, to May, 1924*

Commodity	Total for all stores	Unit stores	Unit credit-delivery	Unit cash-delivery	Unit cash-carry	Chain stores
Northern potatoes	1,650	1,399	833	457	109	251
California oranges	2,064	1,843	1,109	631	103	221
Sweet potatoes	1,281	1,148	698	387	63	133
Boxed apples	1,453	1,285	811	367	107	168
Barreled apples	1,317	1,184	706	389	89	133
Eastern lettuce	1,331	1,219	775	391	53	112
Yellow onions	1,806	1,524	903	515	106	282
Total 7 commodities	10,902	9,602	5,835	3,137	630	1,300
Proportion of 14-commodity series ----per cent--	76	73	74	72	75	77

MANNER OF MAKING COMPARISONS

The relative advantage of each of the five forms of store operation in the distribution of these typical commodities is indicated by the contrasts or differentials in their respective prices and in their price spreads. These differentials are presented in two forms. The first form shows contrasts in the expense of distribution, as represented by the spread between wholesale price and retail price, in each of the five types of store. These differentials in cost of retailing are of primary interest to dealers and other food-handling agencies, which deal in large quantities of goods. The contrasts are therefore presented on a per-car basis, in terms of dollars per car. The second form shows contrasts between different store types in retail selling prices. Since it is the final retail prices, rather than the intermediate handling costs, which are of primary interest to the individual consumer, the price differentials of the various store types are expressed in cents per standard retail sale, the unit which is of direct interest to the consuming public.

ADJUSTMENT OF DATA

To make entirely valid comparisons of results from the various groups of data, it was necessary to adjust retail prices to allow for certain discrepancies occuring in the original wholesale prices. These irregularities arose from lack of identity in dates of quotations, or from variability in grades of goods reported by different store types. To accomplish the adjustment, a common weighted average wholesale price per car was computed as a base for the five store types, giving chain stores and unit stores the respective weights of 1 and 9, according to their relative importance as metropolitan distributors. An adjusted retail price for each store group was then constructed, with this weighted average figure as a base, by adding to this the same spread as existed between the original wholesale and retail figures.

Spreads between the weighted average wholesale and adjusted retail prices per car remain the same as before adjustment, but retail prices now reflect only the contrasts due to variations in type of store. The weighted average wholesale price for the seven commodity series is $1,180 per car. In Table 10 are given the figures for the original wholesale and retail prices, with the spread in each of the five store groups. The same figures after adjustment, based upon the uniform wholesale figure of $1,180 per car, are given in Table 11. The spread in Table 11 for each store type is identical with that derived from the original prices. The price spread for each of the seven commodities in the five store groups is shown in Table 12.

TABLE 10.—*Original (unadjusted) wholesale and retail prices, and price spread per car in five store types, seven commodity weighted averages, New York metropolitan area, February, 1923, to May, 1924*

Store type	Wholesale	Retail	Spread
Chain	$1,130	$1,700	$570
All unit	1,185	2,180	995
Cash-carry	1,135	1,960	825
Cash-delivery	1,190	2,095	905
Credit-delivery	1,200	2,275	1,075

TABLE 11.—*Adjusted wholesale and retail prices and price spread per car in five store types, seven commodity weighted averages, New York metropolitan area, February, 1923, to May, 1924*

Store type	Wholesale	Retail	Spread
Chain	$1,180	$1,750	$570
All unit	1,180	2,175	995
Cash-carry	1,180	2,005	825
Cash-delivery	1,180	2,085	905
Credit-delivery	1,180	2,255	1,075

TABLE 12.—*Price spread per car for each commodity in five store types, New York metropolitan area, February, 1923, to May, 1924*

Commodity	Chain stores	All unit stores	Cash-carry stores	Cash-delivery stores	Credit-delivery stores
Northern potatoes	210	615	600	580	645
California oranges	870	1,465	985	1,260	1,635
Sweet potatoes	330	880	470	815	990
Boxed apples	1,010	1,575	1,340	1,445	1,685
Barreled apples	570	960	830	880	1,045
Eastern lettuce	695	940	885	845	990
Yellow onions	675	905	745	870	970
Weighted mean	570	995	825	905	1,075

DIFFERENTIALS SHOWING CONTRASTS IN DISTRIBUTION EXPENSE PER CAR

Contrasts of store types in distribution expense are shown by differences in their respective price spreads. These indicate the relative advantage of each store type as a retailing agency. Differentials in distribution expense per car are shown in Figure 9. A summary of these price-spread differentials is given in Table 13. In the last column of this table they are shown as percentages of the

respective price spreads of the indicated store types. Table 14 shows the actual differentials per car for the individual commodities.

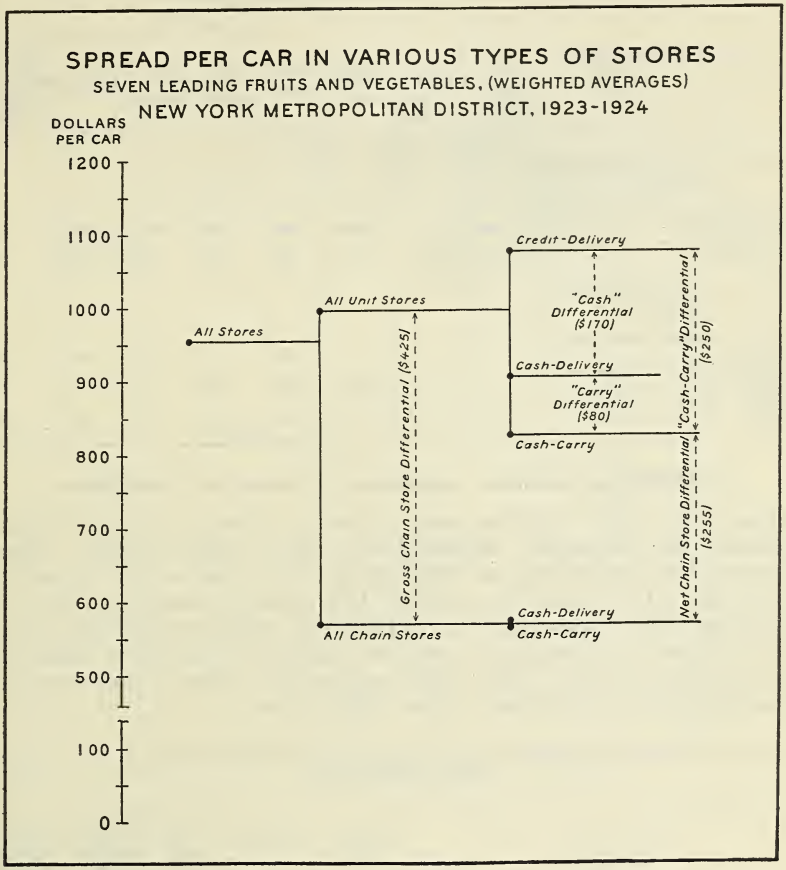

FIG. 9.—Differentials among store types are here shown in distribution expense per car. The "net" chain store differential of $255 indicates the advantage of the chain type of management over the independent type of store. The "cash-carry" differential of $250 shows the saving to independent stores from eliminating credit and delivery services

TABLE 13.—*Differentials in price spread per car in five store types, seven commodity weighted averages, New York metropolitan area, February, 1923, to May, 1924*

Types of store operation compared	Dollars per car	Percentage of price spread [1]
MANAGEMENT: CHAIN STORES WITH UNIT STORES		
Gross chain decrease below typical unit store	425	43
Net chain decrease below cash-carry unit store	255	31
SERVICE: DIFFERENT UNIT STORE TYPES		
Cash-carry decrease below credit-delivery	250	23
Cash-delivery decrease below credit-delivery	170	16
Cash-carry decrease below cash-delivery	80	9

[1] These percentages are rounded, hence they do not harmonize exactly.

TABLE 14.—*Differentials in five store types in price spread per car for each commodity, New York metropolitan area, February, 1923, to May, 1924*

Types of store operation compared	Differential per car							
	Northern potatoes	California oranges	Sweet potatoes	Boxed apples	Barreled apples	Eastern lettuce	Yellow onions	Weighted mean for seven commodities
MANAGEMENT: CHAIN STORES WITH UNIT STORES								
Gross chain-store decrease below typical unit store	$405	$595	$550	$565	$390	$245	$230	$425
Net chain-store decrease below cash-carry unit store	390	115	140	330	260	190	70	255
SERVICE: DIFFERENT UNIT-STORE TYPES								
Cash-carry decrease below credit-delivery	45	650	520	345	215	105	225	250
Cash-delivery decrease below credit-delivery	65	375	175	240	165	145	100	170
Cash-carry decrease below cash-delivery	−20	275	345	105	50	−40	125	80

DIFFERENTIALS SHOWING CONTRASTS IN PRICES TO CONSUMERS

Contrasts of the various store types in prices to the individual consumer are shown by differences in their selling prices. These contrasts are expressed as differentials in value of the standard retail sale. The value for each of the seven commodities in each of the five store types is given in Table 15, with the weighted mean for the series, as computed from the classified retail price data and from the size-of-sale data. The values are thus uncompensated for adjustments in wholesale price differences.

TABLE 15.—*Value of standard retail sale,*[1] *New York metropolitan area, February, 1923, to May, 1924*

Commodity	Chain stores	All unit stores	Cash-carry stores	Cash-delivery stores	Credit-delivery stores
	Cents	*Cents*	*Cents*	*Cents*	*Cents*
Northern potatoes	19.9	27.7	26.0	27.4	28.2
California oranges	23.8	28.1	24.2	26.3	29.7
Sweet potatoes	16.5	25.9	18.2	23.8	27.6
Boxed apples	19.5	25.4	22.9	24.3	26.4
Barreled apples	19.1	24.6	22.1	23.7	25.8
Eastern lettuce	18.4	23.4	22.8	22.1	24.6
Yellow onions	20.4	23.5	21.2	23.4	24.4
Weighted mean	20.2	25.9	23.3	24.9	27.0

[1] Unadjusted for wholesale price differences.

Differentials in the value of the retail sale for the various store types, when the retail prices are compensated for the wholesale differences noted above, are synonymous with the original differentials in price spread per retail sale. For convenience in computation, therefore, the original price spreads per car were employed here. By dividing the per car figure by the computed average number of

retail sales per car for each commodity, the real spread in value of the retail sale is derived for the various store groups. The average price spread for the series was obtained by dividing the per car figure by 8,405, the weighted mean number of retail sales per car for the seven-commodity series.

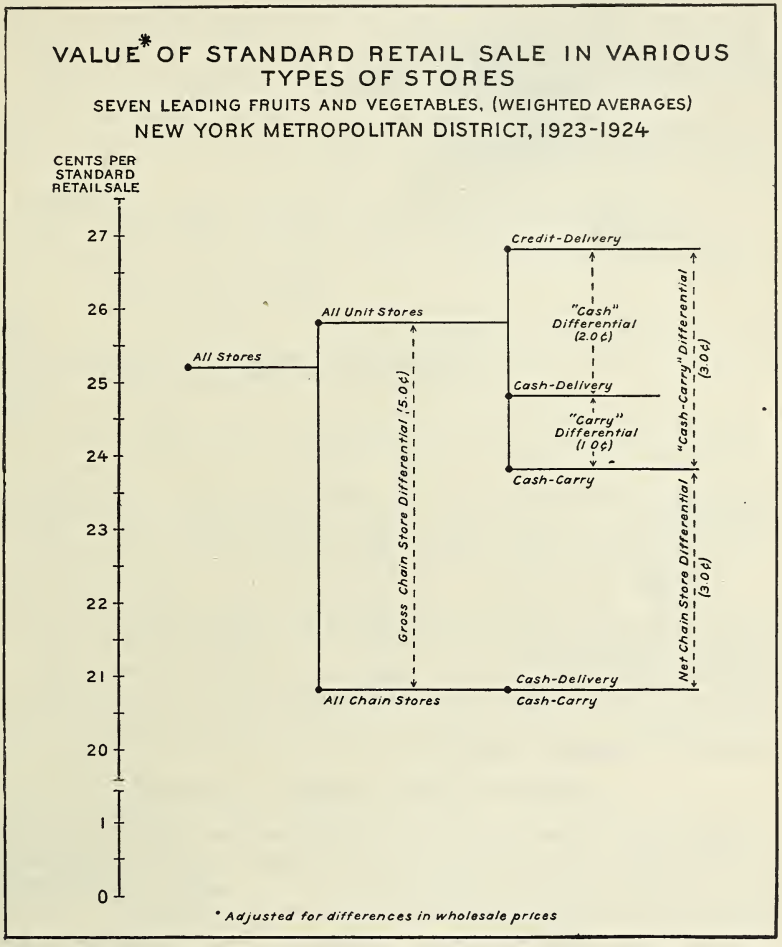

FIG. 10.—Differentials among store types in cost to consumers of a uniform quantity of goods are shown in cents per retail sale. The chain store form of management accounts for a difference of 3 cents per sale, in contrast to the independent store; while in unit stores the elimination of credit and delivery service accounts for a further difference of 3 cents per sale.

The summary of differentials in value of the standard retail sale among the five-store groups for the commodity series as a whole is presented in Table 16. In the last column these differentials are given also as percentages of the retail price for each store-type. Figure 10 shows these contrasts in value of the retail sale. Differentials for each of the seven commodities are given in Table 17.

TABLE 16.—*Differentials between store types in value of standard retail sale,*[1] *weighted for seven commodities, New York metropolitan area, February, 1923, to May, 1924*

Store types compared	Cents per retail sale	Percentage of retail price [2]
Gross chain-store decrease below typical unit store	5	17
Net chain decrease below unit cash-carry store	3	13
Cash-carry decrease below credit-delivery	3	11
Cash-delivery decrease below credit-delivery	2	8
Cash-carry decrease below cash-delivery	1	4

[1] Adjusted for differences in wholesale prices.
[2] These percentages are rounded, hence the last three do not agree exactly.

TABLE 17.—*Differentials in five store types in value of the retail sale for each commodity, New York metropolitan area, February, 1923, to May, 1924*

Types of store operation compared	Differentials per retail sale [1]							
	Northern potatoes	California oranges	Sweet potatoes	Boxed apples	Barreled apples	Eastern lettuce	Yellow onions	Weighted mean for seven commodities
MANAGEMENT: CHAIN STORES AND UNIT STORES								
Gross chain store decrease below typical unit store	*Cents* 7.0	*Cents* 4.8	*Cents* 7.5	*Cents* 4.3	*Cents* 5.0	*Cents* 3.2	*Cents* 3.2	*Cents* 5
Net chain-store decrease below cash-carry unit store	6.7	.9	1.9	2.5	3.3	2.4	1.0	3
SERVICE: DIFFERENT UNIT STORE TYPES								
Cash-carry decrease below credit-delivery	.8	5.2	7.1	2.6	2.7	1.4	3.1	3
Cash-delivery decrease below credit-delivery	1.1	3.0	2.4	1.8	2.1	1.9	1.4	2
Cash-carry decrease below cash-delivery	−.3	2.2	4.7	.8	.6	−.5	1.7	1

[1] Adjusted for wholesale price differences.

SUMMARY OF STORE OPERATION CONTRASTS

Consideration has been given to differences resulting from contrasted kinds of store management and service policy, the contrasts being expressed both by differences in their respective distributing expense, and by differences in price paid by consumers.

Comparison of different store types as to their respective spreads between wholesale and retail prices indicates the relative efficiency of various forms of store operation. Between the typical unit store and the chain-store type, there was an average gross difference in selling expense, in favor of the chain-store form of management and service, of $425 per car. The average spread in wholesale and retail prices for chain stores was 43 per cent below the spread prevailing in the typical form of unit store. In other words, cash-and-carry chain stores required for distributing expenses 43 per cent less than the amount required for these expenses by typical unit stores which gave their customers the prevailing amount of special service. When the cash-and-carry chain store is compared with the cash-and-carry

unit store, both types being on the same nonservice basis, the contrast in favor of the chain store is reduced to $255 per car. Chain stores distributed fruits and vegetables at an expense 31 per cent below that required in unit cash-and-carry stores. The form of management in the chain store thus accounted for a saving of nearly one-third of the total distribution expense.

In the comparison of independent unit stores offering various degrees of special service the cash-and-carry type required in the process of distribution $250 per car less than the amount required for distribution by the credit-delivery type. The spread between wholesale and retail prices was thus 23 per cent less than that in the unit stores giving credit and delivery service. In other words, nearly one-fourth of the credit-delivery store's distribution expense was accounted for by the expense of delivery service and the granting of credit.

To the individual consumer the meaning of these differentials in selling expense is more clear when they are expressed as differences in retail prices. Between the chain store and the typical unit store there was found a gross price difference of 5 cents per standard retail sale. Retail prices in chain stores averaged 17 per cent below those prevailing in typical unit stores which gave the prevailing amount of service. When the cash-and-carry chain store is compared with the cash-and-carry unit store, both types being on the same nonservice basis, there is a net difference in retail prices of 3 cents per sale, in favor of the chain store. This is 13 per cent below the cash-and-carry unit store price. This figure is the truer measure of the advantage of the chain store form of management, as the former larger percentage difference includes some difference in service.

Comparing unit stores by themselves according to service policies, credit-and-delivery service together are found to have cost the consumer 3 cents per retail sale, in contrast to selling prices in cash-and-carry unit stores. This service differential is 11 per cent of the retail price in the full-service type of store. From the data from which these differences were derived, the credit element accounts for a greater proportion than does the delivery element, but this may be due in a measure to the limited nature of delivery service maintained by reporting stores in the cash-and-delivery group.

A presentation of the differences found in this analysis of management and service factors, showing the split-up of the consumer's outlay under various forms of store operation, is given in Figure 11. In the bars for different store types the dark portion represents the wholesale cost of the goods disposed of in the standard retail sale. This wholesale portion is made uniform for each type—14 cents. The remaining part of each bar shows the distribution expense for services. In the chain store all distribution services were rendered at a total expense of 6.8 cents per sale. In the unit-store types there is added a charge for jobber's service of 2 cents per sale. The general retailer's service in the cash-and-carry unit store costs 7.8 cents. Total distribution expense for retailer and jobber in the cash-and-carry unit store was thus 3 cents per sale greater than in the chain store. In the unit store which operated on a cash basis with limited delivery service the expense of delivery adds 1 cent more. In the type which grants credit in addition to delivery, 2 cents are added again to cover the added credit service.

GENERAL CONCLUSIONS

This study brings to light three features of metropolitan distribution which are of outstanding significance in determining the expense of distributing perishable foods to city consumers.

The first is the fact that the expense of city distribution is influenced to a remarkable extent by the purchasing habits of consumers. The prevailing size of the individual retail sale has great influence in determining the proportion of the consumer's expenditure which is absorbed in the distribution process. The price spread necessary to cover the services involved in bringing supplies from the city wholesale market to metropolitan consumers is found to be fairly

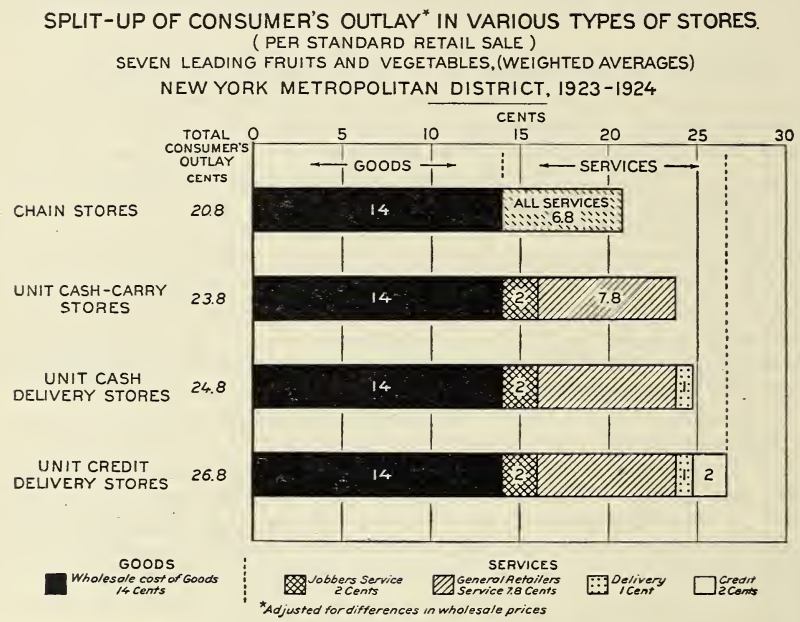

FIG. 11.—The consumer's outlay per standard sale in different types of stores is apportioned thus: Cost of goods in the wholesale market, 14 cents; total services in chain stores, 6.8 cents; retailers' service in unit stores, 7.8 cents, with 2 cents additional for jobbers' service. Delivery service adds 1 cent and credit 2 cents more to the consumer's outlay

constant per individual retail sale, irrespective of the physical size of sale.

Selling prices seem to be fixed by retailers at such a point above cost of goods in the wholesale market as will yield a fairly uniform money return per sale, to cover the expense of service which is rendered. The extent of service involved in distributing a given quantity of goods thus fixes the proportion which the retailer must charge above cost to cover his operating expenses. The larger the consumer's purchase the smaller is the proportion of the outlay which is absorbed by distribution charges and the greater is the proportion left to pay for merchandise.

All services involved in city distribution have to be paid for out of the price charged by the retailer for the individual sale. Since every sale is a profit-making opportunity, the retailer must so appor-

tion his expense among the individual sales as to yield him a living above the cost of the goods he sells and the distribution expense which he undergoes. The great number of conveniences given to the consumer under present methods of city distribution must be paid for by the spread between cost of the retailer's goods and their selling price. Maintenance of a continuous, well-selected stock, readily accessible in wide variety at all times, and the splitting up of this stock into small portions to meet the day-to-day needs of consumers in the immediate neighborhood require a large outlay by the retailer for the services involved. The expense occasioned in rendering these services is influenced by the number of separate transactions required to dispose of a given quantity of goods rather than by the gross volume of goods sold. Prices to consumers are therefore established at a point that will assure a fairly uniform money surplus on each individual transaction. The retailer has to adjust his price policy to the prevailing buying habits of his customers. Retail prices are thus scaled to accord with consumers' predominating practice of making many oft-repeated small purchases.

This analysis shows further that the special services involved in delivery of goods and in extension of credit require a material addition to the consumer's food outlay. Stores which operate on a cash-and-carry basis are able to sell goods at considerably lower prices than those which operate with a credit-and-delivery policy. Although many consumers doubtless find the convenience of the credit-and-delivery store well worth the added expense, those to whom economy is the first consideration may enjoy a material saving by buying from stores whose prices are based upon a cash-and-carry policy.

A third significant factor in the expense of distributing fruits and vegetables is the form of organization or management of the retail store. The standardized operation of chain stores, centralized purchase of supplies in large quantities, and sale of goods on a cash-and-carry basis give this form of management distinct advantage in economy of distribution. Demonstration of the saving in distribution expense by the chain-store method points to this form of organization as a practical means for reducing prices of goods to city consumers.

Offsetting the economy of the chain form of operation, distinct advantages are offered by the independently operated neighborhood unit store. The personal atmosphere of the independent store, its readiness to serve the preferences of individual customers, and the generally greater variety and wider choice of qualities give the neighborhood unit store a strong hold upon its local clientele. As with the option regarding special credit-and-delivery service, the preference between chain store and unit store is a matter of relative emphasis upon economy or convenience. One portion of the consuming public prefers the fuller advantages of the neighborhood unit store with its higher prices, whereas another portion prefers to dispense with these advantages for the economy of lower prices prevailing in chain stores.

Of the consumer's outlay for fruits and vegetables, these studies show that from one-third to more than three-fifths is absorbed by distribution expense after arrival of goods in the city wholesale market. Such a portion is required to cover the expense of various services that inhere in the prevailing methods of city distribution. With all refinements that are possible for reducing service requirements, the task of meeting the daily food demands of large city populations remains

primarily a matter of splitting up the centralized stocks of goods that arrive annually in the wholesale markets into millions of separate small retail parcels for daily consumption. Any generally effective program for reducing the expense of distribution to city consumers must therefore take into consideration the basic proposition of reducing the expense on the individual retail sale.

Establishment of the size of the individual retail sale as a determinant of distribution expense, and application of this principle to the distribution of perishable commodities supported by extensive statistical information, are results of far-reaching importance in marketing science.

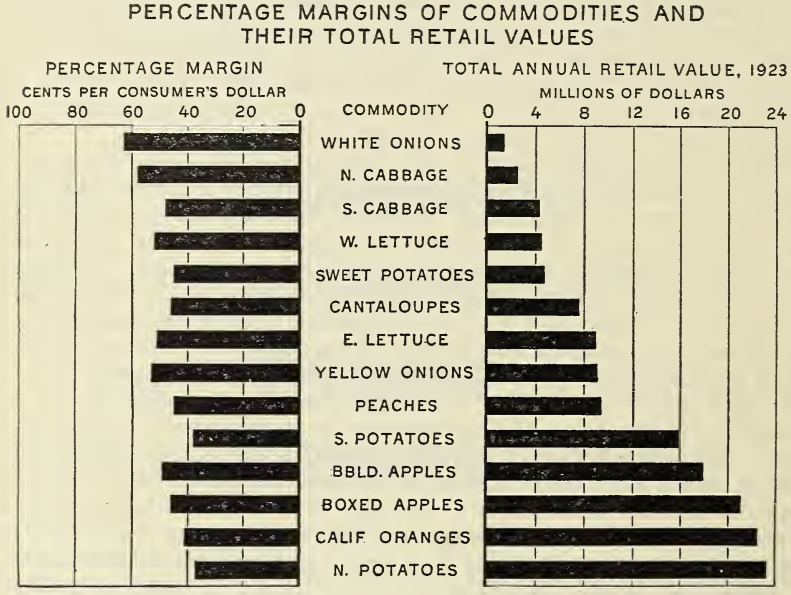

FIG. 12.—When commodities are arrayed according to their total annual retail values, the corresponding percentage margins lie generally in inverse order. The article with least annual value has the highest margin, and the commodity with greatest annual value has the lowest margin

IMPLICATIONS IN COMMODITY DIFFERENCES[8]

Certain theoretical implications are revealed in the analysis of commodity differences, whose interpretation in mathematical form will explain how the theory of a constant price spread per retail sale accounts for the contrasts in distribution expense of different articles.

INFLUENCE OF COMMON MONETARY AND PHYSICAL UNITS

In the early part of the analysis of commodity differences, an inverse curvilinear relationship was discovered between percentage margins and total retail values in 1923, when these two magnitudes for the 14 commodities were plotted in a scatter diagram. The articles with the greater total retail values had generally lower percentages than those with lesser total retail values. The proportion absorbed by distribution expense varied somewhat inversely with the respective total commodity values, as is shown in Table 18 and Figure 12. The chart is a graphic presentation of the fact that when the series of articles is arrayed in ascending order according to total retail values in 1923 the corresponding percentage margins lie in generally descending order.

[8] The analysis here presented was developed with the assistance of H. D. Comer.

TABLE 18.—*Relation of margins to total annual retail sale, New York Metropolitan area, February, 1923–May, 1924*

Commodity	Total 1923 retail value	Percentage margin	Commodity	Total 1923 retail value	Percentage margin
	Thousands of dollars	*Per cent*		*Thousands of dollars*	*Per cent*
Northern potatoes	23,111	37	Eastern lettuce	8,944	51
California oranges	22,419	41	Cantaloupes	7,469	46
Boxed apples	21,040	46	Sweet potatoes	4,601	44
Barreled apples	17,936	49	Western lettuce	4,404	52
Southern potatoes	15,855	38	Southern cabbage	4,211	48
Peaches	9,288	45	Northern cabbage	2,373	58
Yellow onions	9,037	53	White onions	1,290	63

To illustrate the general relationship, let special consideration be given to three of the articles whose total values differ widely—northern cabbage, barreled apples, California oranges. Whereas the items in the total retail value series are in ascending order, the items in the percentage margin series are in descending order, thus:

	Total 1923 retail value	Margin (per cent)
Northern cabbage	$2,370,000	58
Barreled apples	17,940,000	49
California oranges	22,420,000	41

The question arises: Do not the differences in total retail value explain adequately the differences in percentage margins? Is not the lower margin on barreled apples, in comparison with that of northern cabbage, due simply to the fact that the metropolitan area as a whole spends more money per year for apples than it does for cabbage? Such a supposition might arise from the view that merchants could handle articles which yield their principal income at less expense per dollar's worth of goods than they could distribute commodities which bring a minor return.

The meaning of the inverse association between total values and percentage margins is made clear by a little mathematical analysis. Let the total annual retail value of a commodity be indicated by R. and its total annual wholesale value be represented by W. The difference between R and W will then represent the total annual expense of distributing the given commodity in the metropolitan area. The ratio of this total distribution expense to the total retail value, $\frac{R-W,}{R}$ will then indicate the percentage margin for the given commodity.

The statement that margins vary inversely with total retail values is expressed in mathematical terms by the formula $\frac{R-W}{R}$ varies as $\frac{1}{R}$. Now in the series, the percentage margin $\frac{R-W}{R}$ may be diminished concurrently with an increase in the total retail value R, by any one of three conditions affecting the relation between R and W, namely: (1) if R–W remains constant, (2) if R–W declines, (3) if R–W advances less rapidly than R increases. The last one of these conditions really embraces all three, for with constancy in R–W or with a decline in R–W, the total retail value R shows greater increase than that of total distribution expense R–W. The statement that the percentage margin varies inversely with the total retail value of an article therefore means merely that within the commodity series an increase in total retail value is accompanied by a proportionally smaller increase in total distribution expense. A satisfactory explanation of this peculiar relationship is needed to interpret the general inverse association between margins and total retail values.

Total retail value, total distribution expense, and percentage margin for each of the three illustrative commodities are

	R Total retail value	R–W Total distribution expense	$\frac{R-W}{R}$ Margin
			Per cent
Northern cabbage	$2,370,000	$1,380,000	58
Barreled apples	17,940,000	8,710,000	49
California oranges	22,420,000	9,150,000	41

In each case a change in R is accompanied by a relatively smaller change in R–W; thus

While R for apples is 7.5 times R for cabbage,
yet R–W " " " only 6.3 " R–W " " ;
and R for oranges is 1.3 times R for apples,
but R–W " " " only 1.1 " R–W " " .

Now the percentage margin for each commodity is a quotient derived by dividing the figure in the second column by that in the first column. The decline in the margin for apples (49) from that for cabbage (58), results from the fact that R–W for apples is only 6.3 times R–W for cabbage, whereas R for apples is 7.5 times R for cabbage. The margin for apples is therefore $\frac{6.3}{7.5}$ times 58, which is 49 per cent. Similarly, the decline in the margin for oranges (41) from that for apples (49), results from the fact that R–W for oranges is only 1.1 times R–W for apples, whereas R for oranges is 1.3 times R for apples. The margin for oranges is therefore $\frac{1.1}{1.3}$ times 49, which is 41 per cent. Throughout the 14-commodity series, it may be demonstrated similarly that the inverse association between percentage margins and total retail value results from the fact that total retail value increases from one article to another more rapidly than does the total distribution expense.

It remains still to explain why increases in total retail values are accompanied by relatively smaller increases in distribution expense. The total retail value of any commodity may be conceived of as the product of (1) retail price per pound and (2) total number of pounds sold annually. The total distribution expense may be regarded either as the product of price spread per pound and total number of pounds, or as the difference between total wholesale value and total retail value. If for any commodity, r represents the retail price per pound, w the wholesale price per pound, and P the total number of pounds sold in the metropolitan area in 1923, then the total retail value R is equivalent to r times P; the total wholesale value is equivalent to w times P; and the total distribution expense R–W is rP minus wP. The percentage margin is therefore $\frac{rP-wP}{rP}$. By cancelling out the P's in this fraction, the percentage margin becomes $\frac{r-w}{r}$. This means that for any commodity in the series the percentage margin is the same, whether based on total values or on values per pound. The conclusion is, therefore, that percentage margins are independent of physical volume as a separate factor. Any influence exerted by physical volume is expressed already in the prices themselves.

The analysis shows that a difference in physical volumes of two given commodities affects R–W and R identically. The reason why R–W fails to increase as rapidly as R, within the series of articles, is that r–w does not increase as rapidly as r. In other words, price-spread per pound does not increase proportionally with retail price per pound. Calculations from the per pound figures for the three illustrative commodities shows it to be true that an increase in retail price is accompanied by a relatively smaller gain in price-spread, thus:

	r Mean retail price per pound [1]	w Mean wholesale price per pound [1]	r–w Mean price spread per pound	$\frac{r-w}{r}$ Margin
	Cents	*Cents*	*Cents*	*Per cent*
Northern cabbage	5.20	2.18	3.02	58
Barreled apples	7.97	4.10	3.87	49
California oranges	10.95	6.48	4.47	41

[1] Adjusted for shrinkage in retailing.

The percentage margin for cabbage is the quotient of 3.02 divided by 5.20. The decline in the margin for apples from 58 per cent, the margin for cabbage, results from the fact that while r–w for apples is only 1.28 times r–w for cabbage, yet r for apples is 1.53 times r for cabbage. The percentage margin for apples is therefore $\frac{1.28}{1.53}$ times 58, which is 49. Similarly for oranges, r–w is only 1.16 times r–w for apples, while r for oranges is 1.37 times r for apples. Hence the margin for oranges shows a decline from the margin for apples, because of the difference in these two ratios. It is $\frac{1.16}{1.37}$ times 49, which is 41 per cent.

Thus is demonstrated the simple but important fact that margin variations in the series of commodities are synonymous with the varying relation of distribution expense per pound to the respective retail price per pound. The statement that one article has a lower percentage margin than another is synonymous with the statement that the ratio of price spreads per pound is less than the ratio of the respective retail prices per pound. The margin is the same for a given commodity regardless of the physical quantity of goods considered in computing it.

INFLUENCE OF A NEW UNIT OF DISTRIBUTION

In the comparisons and analyses of commodities thus far, the consumer's dollar's worth and the pound were the assumed common units of measurement. Differences were noted in the expense of distribution per dollar's worth and per pound of the various commodities, but no satisfactory explanation of these differences has been found.

Upon reflection, no sound reason exists for expecting either the margin per dollar's worth, or the price spread per pound to be uniform. The expense incurred in distribution arises from various services rendered to consumers by distribution agencies. If more service is required to retail a dollar's worth or a pound of one article than to sell a dollar's worth or a pound of another article, the cost of the additional service is logically reflected in a higher retail price. The amount of service given by the dealer with each dollar's worth of commodity depends to a great extent upon the number of separate sales he must make to receive a dollar from his customers. This depends in turn upon the average size of sale to the individual purchaser.

Although retail sales of some articles are prevailingly made in larger quantities and larger monetary amounts than are sales of other commodities, yet each sale, irrespective of size or value, entails an approximately uniform expense for retailer's service. Apportionment of the service expense on the basis of the dollar's worth or the pound ignores the contrasts of different commodities in their service requirements. A logical means of comparison should place all commodities on a comparable service basis. This is done when the comparisons are made on the basis of the individual retail sale.

HOW RETAIL PRICES ARE SET

Determination of how retail prices are set is the vital part of this theoretical discussion. Here is where the size of sale to the consumer enters into the analysis.

The size of the retail sale, among the series of commodities, has been shown to vary inversely with the retail price per pound, as illustrated in Figure 4. Commodities having low retail price per pound are sold to consumers in lots of several pounds at a time, whereas articles with high price per pound are sold in smaller lots. The average retail price of northern potatoes was about 4 cents a pound, and the prevailing size of sale was 6½ pounds. Western lettuce, whose retail

price averaged about 15 cents per pound, had a prevailing size of sale of but 1½ pounds. For the three illustrative commodities, the retail price of each per pound and the number of pounds per retail sale were found to be:

	Mean retail price per pound	Size of mean retail sale
	Cents	*Pounds*
Northern cabbage	5.20	4.0
Barreled apples	7.97	3.0
California oranges	10.95	2.5

When these commodities are arranged in ascending order of retail price per pound, it is observed that size of retail sale is in descending order. This is representative of the general tendency for all commodities, as shown in Figure 4.

A means is now at hand for explaining what determines retail price per pound, and the price spread per pound. The difficulties arising from the unsuitableness of the pound as a unit for comparison of distribution factors are removed by using the standard retail sale as the unit of distribution. With the size-of-sale data, price spread may be computed per mean retail sale. The spread per sale is the product of the price spread per pound and the number of pounds per sale. For the three illustrative articles the mean spread per pound, the mean size of retail sale, and the mean spread per sale, are:

	Mean spread per pound	Mean size of retail sale	Mean spread per retail sale
	Cents	*Pounds*	*Cents*
Northern cabbage	3.02	4.0	12.1
Barreled apples	3.87	3.0	11.6
California oranges	4.47	2.5	11.2

When the commodities are arranged in ascending order of spread per pound, the size-of-sale series is seen to be in descending order, as was true in the preceding instance with the price-per-pound series. In consequence of the inverse relationship of the spread-per-pound series and the size-of-sale series, the mean spread per retail sale, which is the product of these two, is nearly constant (fig. 13). This is illustrative of the general tendency for all 14 commodities, as shown in Figure 5. The general conclusion is therefore that retail prices are set at such levels above wholesale prices as will tend to make the spread between wholesale and retail values of the standard retail sale the same for all commodities.

This theory of a constant spread per sale throws light upon several perplexing problems. It explains why the portion of the consumer's dollar which is absorbed in the expenses of city distribution should be greater for some articles than for others. It indicates the existence of a peculiar price-setting practice which is based on the prevailing size of the consumer's individual purchase. Furthermore, it shows that any significant relationship between physical volumes and margins may be traced to associated differences in size of sale.

SUMMARY OF APPLICATION OF THEORY

Steps in application of the theory of a constant spread per retail sale as an explanation of contrasts in percentage margins among the 14 commodities are shown graphically in Figure 13. The interpretation of these steps is set opposite the respective diagrams.

Differences in percentage margins within the commodity series, ranging from 37 for northern potatoes to 63 for white onions, come about from use of the dollar's worth of goods as the unit of measurement. These differences are merely a reflection of the fact that to distribute a dollar's worth costs more for some commodities than for others. The assumption that distribution expense per dollar's worth should be uniform for different commodities is illogical, because it ignores the fact that more service is absorbed with a dollar's worth of some articles than with a dollar's worth of others, in consequence of differences in their pre-

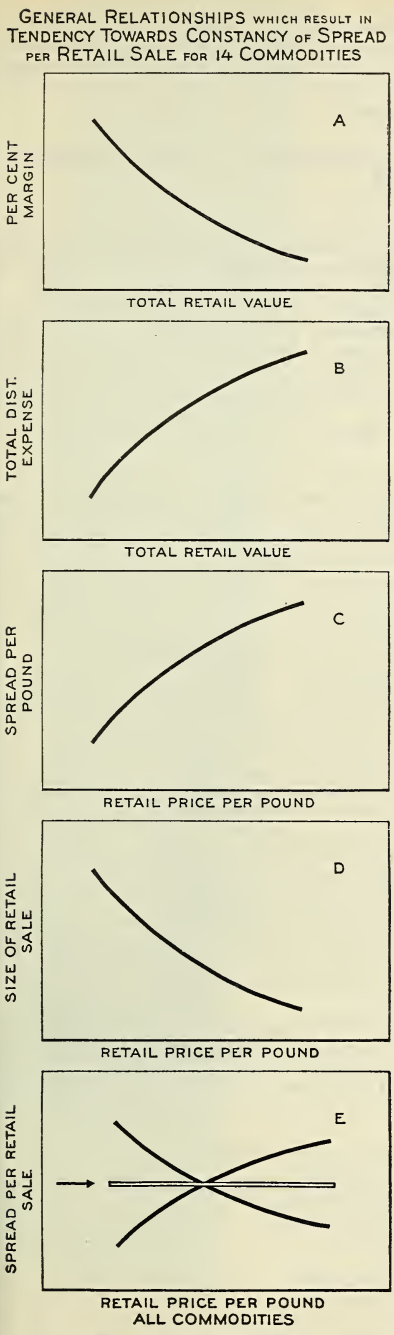

FIG. 13.—Inverse relationship between percentage margins and total retail value of different commodities is explained by constancy of spread per retail sale

A. Among the 14 commodities there is an inverse curvilinear relationship between percentage margins and total retail values.

B. The above association is the result of a direct curvilinear relationship between total distribution expense and total retail value, with the curve bending toward the total-retail-value axis.

C. Analysis of the relationship between total distribution expense and total retail value reveals a direct curvilinear association between spread per pound and retail price per pound, with the curve bending toward the retail-price axis.

D. There is an inverse curvilinear relationship between size of the retail sale and retail price per pound.

E. Spread per retail sale is the product of spread per pound and number of pounds per retail sale. Combination of the direct relationship in "*C*" and the inverse relationship in "*D*" results in a tendency toward constant spread per retail sale for all commodities.

vailing size of sale. Variation in percentage margins is therefore the result of wrongly using the dollar's worth, with its variable service requirements, as the unit of distribution. When the individual retail sale is taken as a new distribution unit, the actual margin per sale is nearly uniform for all commodities, and no appreciable differences remain to be explained.

LIMITATIONS OF PERCENTAGE DIFFERENTIALS FOR COMPARING PRICES

Use of percentages for analyzing price differences incurs certain mathematical difficulties which may vitiate their meaning. This made it necessary to abandon the original plan of making detailed comparisons of margins as percentages of retail prices and to analyze the actual prices and price differences in their stead.

The margin concept assumes a constant money expenditure by the consumer, representing a dollar's worth of goods under given price conditions. Any variation in retail price involves, therefore, a change in the quantity of goods secured for $1. The margin represents in cents of the consumer's dollar the spread between wholesale and retail prices for a variable quantity of goods, whose volume changes with any change in the selling price. Use of differentials between percentage margins to measure the relative efficiency of a given money outlay is therefore logically unsound.

The difficulty in interpreting percentage differentials may be illustrated by making a comparison of percentage margins in two types of retail stores. The general margin in independent credit-delivery stores for the whole commodity series is 47 per cent of the mean retail price, while in cash-and-carry stores it is only 42 per cent of the retail price. This is equivalent to saying that of a dollar's outlay by the consumer in a credit-delivery store, 47 cents are required to cover handling expenses, leaving 53 cents to pay for the goods in the wholesale market; whereas of the dollar spent in a cash-and-carry store only 42 cents is required for handling and 58 cents is left to pay for goods in the wholesale market.

Thus the apparent difference in handling cost of 5 cents on a dollar's worth of goods, actually turns out to be quite otherwise than a difference of 5 per cent of the retail price. Out of the dollar expended by the consumer, 58 cents of the cash-and-carry customer's money is used to buy goods in the wholesale market, whereas only 53 cents of the credit-delivery customer's money may be so used. Hence the cash-and-carry customer will obtain $\frac{58}{53}$ times the quantity of goods received by the credit-delivery customer. For an identical quantity of goods, therefore, the cash-and-carry customer would pay only $\frac{53}{58}$ of the other's outlay. The latter fraction, for the cash-and-carry store, is 91.4 per cent of the amount required for the same quantity of goods in the credit-delivery store. The actual differential between prices in the two store types is therefore 100–91.4, or 8.6 per cent, of the credit-delivery price, instead of the apparent 5 per cent. If it were desired to express the differential in terms of the cash-and-carry price, then the corresponding inverted fraction, $\frac{58}{53}$, would be used, which is 109.4 per cent. This indicates that the selling price for a given quantity of goods in a credit-delivery store is 9.4 per cent higher than that for the same quantity in a cash-and-carry store.

The difficulty here illustrated exists wherever comparisons of percentages derived from varying or noncomparable bases are attempted. Any effort to make accurate price comparisons by comparing percentage margins is therefore likely to be misleading and to confuse the real differences.

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