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TABLE 68

MEASURES OF REGIONAL DIFFERENCES IN DISCOUNT RATES AND IN SELECTED COMMODITY PRICE SERIES.

(1) Series	(2) Period covered by original quotations	(3) No. of markets represented	(4) Average measure of regional difference (relative)
Discount rates	1918–1927	26 to 35	8.5
Farm prices			
Cotton	1922–1925	13	4.0
Wheat	1922–1925	42	11.2
Corn	1922–1925	45	17.2
Barley	1922–1925	28	18.7
Oats	1922–1925	45	20.7
Rye	1922–1925	32	23.4
Potatoes	1922–1925	46	27.2
Building materials			
Portland cement	1922–1925	24	9.9
Wire nails	1922–1925	16	13.8
Lime	1922–1925	22	13.8
Brick	1922–1925	24	14.0
Pine boards	1922–1925	16	18.1
Sand	1922–1925	21	21.1
Gasoline	1920–1927	50	8.8
Dry goods at retail			
Sheeting, bleached	1923	51	4.2
Muslin, bleached	1923	51	4.4
Percale	1923	51	5.2
Flannel, outing	1923	51	5.6
Gingham, apron	1923	51	5.7
Fuels, at retail			
Anthracite coal	1924	28	6.7
Electricity	1924	51	13.9
Gas, manufactured	1924	42	18.9
Bituminous coal	1924	38	21.6

The degree of regional diversity in discount rates is somewhat greater than might have been expected. In spite of the traditionally wide market for credit, regional differences in discount rates appear to be greater than those found among many commodities in retail markets, and are not materially lower than the differences prevailing in the prices of certain staple commodities in wholesale markets.

II Regional Differences in Price Behavior

An example of obvious regional differences in price behavior is afforded by index numbers of wholesale prices in different countries. That American and German prices followed somewhat different courses between 1915 and 1925 needs no demonstration. Our present concern, however, is not with international differences in the movements of wholesale price index numbers. The objects of immediate interest are the less obvious differences between the behavior of the prices of individual commodities and commodity groups in different markets and in different geographical areas. The aspects of price behavior which should be studied in making

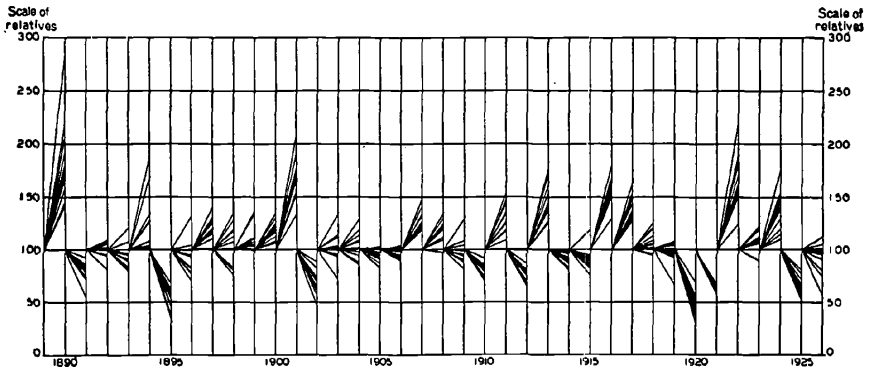
this regional comparison include all those which have been discussed in the preceding chapter. Only a few illustrative examples may be given in each case.

1. Regional Differences in Degree of Price Change between Given Dates

Material differences in the degree of change in the prices of a given commodity from year to year, in different markets, are revealed by the data plotted in Figure 16. Here are shown link relatives computed from December 1st farm prices of corn in ten states, during the period 1889-1926. The scatter of the relatives for the separate states, from year to year, indicates the diversities in the movements of corn prices. (Since, for the purpose in hand, interest attaches only to the differences between the degree of change in different states, no attempt is made in this chart to distinguish the relatives for individual states.) To accept as representative of changes in the farm price of corn the figures relating to any one state, or even the average for the entire country, is to ignore the striking differences which are shown by the separate state figures.

FIGURE 16

Link Relatives of the Average Farm Prices of Corn in Ten Important Producing States, 1889-1926.



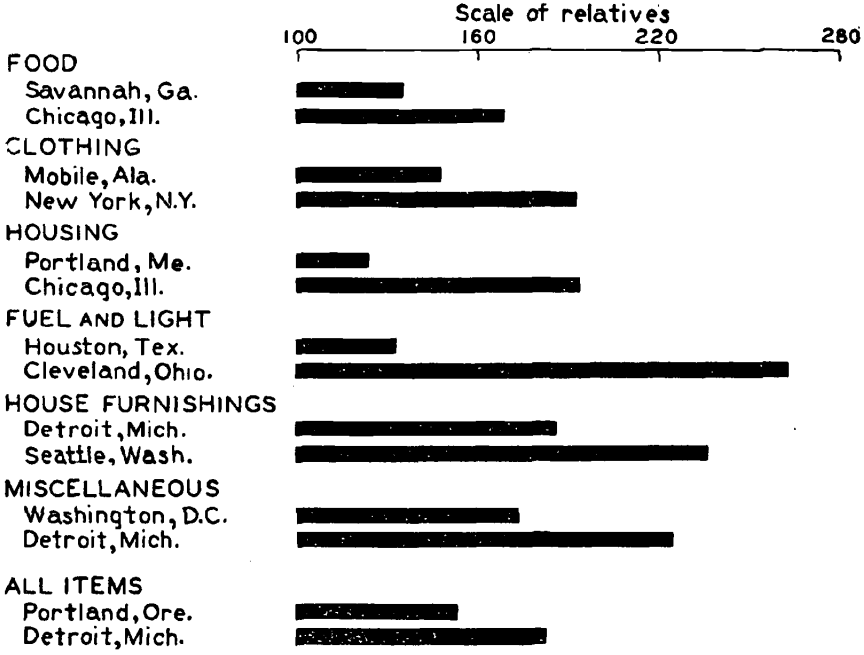
More striking evidence of the differences which may develop between different parts of the country in the matter of price changes is found in the cost of living figures compiled by the Bureau of Labor Statistics. Index numbers showing changes in the cost of living and changes in the cost of items falling in certain sub-groups

have been constructed for 19 cities. The following diagram shows the city in which the smallest change was recorded for each of these groups and for the general index between December, 1914, and June, 1927, and the city in which the greatest change took place. The data upon which the chart is based appear in Table 69.

FIGURE 17

DIAGRAM SHOWING REGIONAL DIFFERENCES IN THE DEGREE OF CHANGE IN COST OF LIVING IN THE UNITED STATES BETWEEN 1914 AND 1927.

The bars indicate the minimum and maximum changes in the cost of living, and in the cost of certain important groups of items in the cost of living, between December, 1914, and June, 1927, as recorded for 19 American Cities. (Costs in December, 1914=100)



The differences between cities are doubtless somewhat greater than would be found if corresponding wholesale price index numbers were available. They indicate, however, that any study of the price structure must take account of regional variations in price behavior. This is particularly true of a country having the diversity of economic and social conditions found in the United States.

TABLE 69
REGIONAL DIFFERENCES IN THE DEGREE OF CHANGE IN COST OF LIVING IN THE UNITED STATES BETWEEN 1914 AND 1927.

Price group	City in which smallest change was recorded	Index June 1927 (Dec. 1914 =100)	City in which greatest change was recorded	Index June 1927 (Dec. 1914 =100)
Food	Savannah, Ga.	135.4	Chicago, Ill.	168.2
Clothing	Mobile, Ala.	147.6	New York, N. Y.	192.9
Housing	Portland, Me.	123.6	Chicago, Ill.	193.9
Fuel and light	Houston, Tex.	132.8	Cleveland, O.	263.9
House furnishing goods	Detroit, Mich.	186.8	Seattle, Wash.	236.8
Miscellaneous	Washington, D. C.	173.6	Detroit, Mich.	225.1
All items	Portland, Ore.	153.7	Detroit, Mich.	182.7

2. REGIONAL DIFFERENCES IN THE VARIABILITY OF PRICES

a. *Year-to-Year Variability.* In a preceding section measures of price variability for a number of commodities were presented. In considering such a figure for a given commodity one tends to think of this variability as an attribute of the commodity. But it is also an attribute of the market, or of the region, from which the quotations are drawn. Price habits and other price determining factors may differ from place to place. Quite different measures might be secured, for the same commodity, by employing prices drawn from different markets. The figures in column (2) of the following table indicate the degree of difference in year-to-year variability found in the farm prices of corn, in 10 states.

TABLE 70
REGIONAL DIFFERENCES IN YEAR-TO-YEAR VARIABILITY OF FARM PRICES OF CORN, 1889-1913[1]
(The measures of variability are based upon December 1st farm prices.)

(1) State	(2) Measure of year-to-year variability (mean deviation as percentage of mean)	(3) Percentage of total U. S. corn crop, 1906
Tennessee	15.1	2.9
Minnesota	19.4	1.7
Ohio	19.6	4.8
Kentucky	20.2	3.6
Illinois	20.7	11.8
Indiana	21.3	6.3
Texas	22.2	5.3
Missouri	24.6	7.8
Iowa	29.6	12.7
Nebraska	33.6	8.5
United States	20.8	100.0

[1]A similar set of measures relating to oats appears in the footnote on pp. 54-55.
The measure given above for the United States is slightly greater than that given on an earlier page. The earlier figure was based upon data for the period 1890-1913.

The measures of variability run from 15.1 for Tennessee to 33.6 for Nebraska, a very considerable range of variation. There is some positive correlation between the year-to-year variability of corn prices in given states and the percentage of the total corn crop produced in those states, as listed in column (3). (The percentages are based upon the crop in 1906, a year near the middle of the period covered by the measures of price variability.) The correlation coefficient has a value of +.75. A similar coefficient for oats has a value of +.76. Each of these coefficients is based, it should be noted, on only 10 observations.

We may next inquire whether there are differences in price behavior, similar to the above, in wholesale markets in different countries. The figures in Table 71 relate to the behavior of a number of commodities, in four countries. Certain of these are compared graphically in the accompanying diagram.

FIGURE 18

INTERNATIONAL DIFFERENCES IN THE VARIABILITY OF WHOLESALE PRICES, 1890-1913.

Comparison of Four Commodities in Four Countries in respect to Year-to-Year Variability.

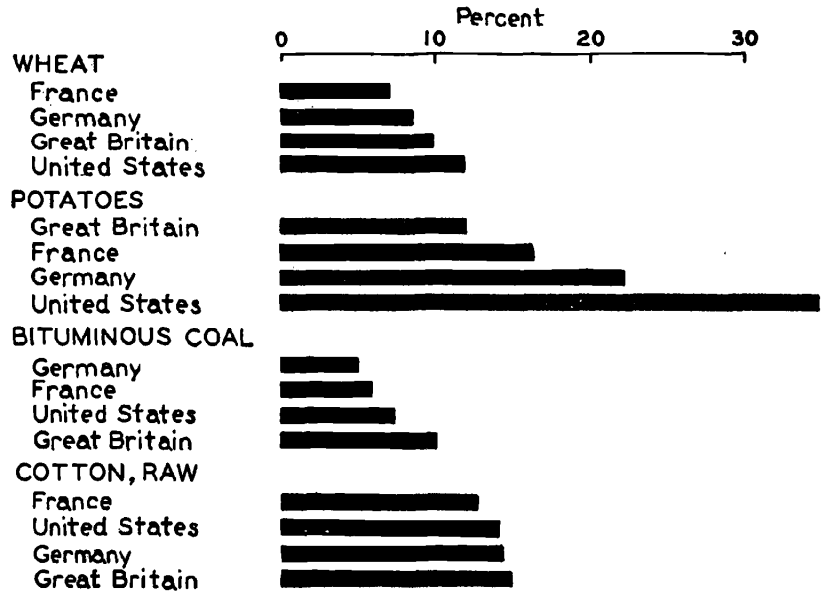


TABLE 71

COMPARISON OF MEASURES OF YEAR-TO-YEAR VARIABILITY OF THE PRICES OF SIXTEEN COMMODITIES IN FOUR COUNTRIES, 1890-1913[1]

(Calendar year measures)

(1) Commodity	(2)	(3)	(4)	(5)
	Measures of year-to-year variability			
	United States	Great Britain	Germany	France
Wheat	11.7	9.7	8.4	7.0
Rye	14.4		9.2	
Potatoes	34.5	12.0	22.1	16.3
Sugar, raw	9.4	8.5	12.2	
Sugar, refined	7.9		7.7	10.8
Cotton, raw	14.2	14.9	14.4	12.8
Cotton yarn	9.9	12.3	12.8	
Pig iron	15.5	9.3	9.0	
Copper	13.3	9.5	11.9	
Coal, bituminous	7.4	10.0	5.0	5.8
Petroleum	19.4	9.1		14.2
Wool	8.8	5.6		
Silk	10.4	4.7		
Rubber	15.9	10.6		
Hides	12.9	4.1		
Coffee	17.3	9.2		8.8

[1]The sources of the quotations used in computing the above measures, and the character of the quotations, are described below:

United States:

Average annual prices as compiled and published by the Bureau of Labor Statistics. For detailed descriptions see Table I, in the Appendix. For commodities represented by duplicate quotations, the following series were used:

Cotton yarns, carded, cones, 10/1
Pig iron, basic
Coal, bituminous, Pocahontas
Wool, fine clothing
Silk, raw, Kansai No. 1

Great Britain:

Wheat, good average quality red wheat, Liverpool (From *Yearbook*, U. S. Dept. of Agriculture. Compiled from *Broomhall's Yearbook* and *Corn Trade News*.) Cotton, middling upland. Annual average prices computed from closing prices on first or near the first of each month, as quoted in *Commercial and Financial Chronicle*. Cotton yarns, 32's, cop twist. Annual average prices computed from average low price for first week in each month, as quoted in *Commercial and Financial Chronicle*. The remaining British measures were computed from price relatives as given, without detailed description, in the *Abstract of Labor Statistics*, Great Britain. Wool prices relate to imported wool, while the copper quoted 'includes ore and regulars.'

Germany:

The German prices, with the exception of those for coal, are taken from *Monatshefte zur Statistik des Deutschen Reichs*. The quotations on coal are from *Vierteljahrshefte zur Statistik des Deutschen Reichs*.

France:

The French prices, with the exception of those for wheat and coal, relate to import values, as determined by customs officials. Quotations are from *Annuaire Statistique de la France*. Wheat prices are from the *Statistique Agricole Annuelle*, and coal prices are from the *Statistique de l'Industrie Minérale*.

In comparing the figures in Table 71 we cannot be sure that we are dealing with precisely identical commodities, nor that the quotations are fully comparable in all respects. There is no reason for doubting, however, that the differences in variability revealed by this table represent, primarily, regional differences in price behavior.

A more refined comparison would doubtless give somewhat different results, in detail, but the general picture would be much the same.

Judging from the group of commodities here listed, American prices seem to be more variable, on the whole, than prices abroad. Direct comparison between the United States and Great Britain is possible in 14 cases. For only 3 commodities (raw cotton, cotton yarn and coal) are the American prices less variable, from year to year, than the British. Comparison of American with German figures is possible in 10 cases. In only 3 of these cases (with respect to raw sugar, raw cotton and cotton yarn) are the American prices less variable. Seven American and French price series may be compared. For only one commodity (refined sugar) are the American prices less variable.

An attempt to explain these differences would carry us beyond the limits of the present discussion. It may be that the rapid rate of industrial development in the United States has had, as an accompaniment, more variable prices than are found under more stable economic conditions. Comprehensive international comparisons of this sort might be expected to yield valuable information concerning international differences in economic processes.

b. *Monthly Variability.* Measures of monthly price variability may be utilized in a similar comparison of markets in different geographical areas. Data for an adequate survey of this type are not at present available. A single example relating to domestic differences and several relating to international differences will serve to illustrate the procedure.

Quotations relating to tank wagon prices of gasoline on a date near the first of each month in 14 different cities, during the years 1919 to 1925, inclusive, were compiled[1], and measures of monthly variability similar to those presented in an earlier section were computed for these years. The mean price and the average value of the measures of monthly variability for each city during this period are given in Table 72.

The mean price varies from 18.5 cents per gallon, in Los Angeles, to 23.5 cents, in Boston, while the measure of monthly variability ranges from 6.9 per cent in Birmingham, to 11.1 per cent in Omaha. There appears to be a slight inverse relation between the mean price and the measure of variability, the variability tending to be less with a high price than with a low. The relation-

[1]The prices were taken from the *National Petroleum News*. They are wholesale tank wagon prices, excluding local taxes.

TABLE 72

REGIONAL DIFFERENCES IN MONTHLY VARIABILITY OF TANK WAGON GASOLINE PRICES, AT WHOLESALE
1919-1925

(1) City	(2) Mean monthly price (in cents)	(3) Mean deviation as percentage of mean Average of annual values
Birmingham	21.5	6.9
New York	23.2	7.1
Seattle	19.8	7.1
San Francisco	18.9	7.2
Pittsburgh	22.4	7.4
Boston	23.5	7.6
Los Angeles	18.5	8.4
Atlanta	21.8	8.9
Oklahoma City	19.0	9.2
Detroit	21.0	9.3
Denver	21.3	9.5
El Paso	19.9	9.6
Kansas City	18.9	10.5
Omaha	20.1	11.1

ship is not pronounced, however, and the sample is too small to permit of generalization. For our present purpose the point of importance in the above table is the evidence it affords that the degree of variability of the price of a given commodity depends not only on the characteristics of that commodity, but upon the characteristics of the particular market from which the quotations are taken.

The following table permits a comparison of markets separated by national boundaries. As in all international comparisons, there must be some doubt as to whether the series are comparable in all respects. Nevertheless, the chief reason for the differences in variability noted is probably to be found in the geographical separation of the markets from which the quotations are drawn, and it is the effect of this separation which is of present interest.

TABLE 73

COMPARISON OF MEASURES OF MONTHLY VARIABILITY OF THE PRICES OF FOUR COMMODITIES IN AMERICAN AND BRITISH MARKETS

(Calendar year measures)

(1) Commodity	(2) Measures of monthly variability 1890-1925 (excluding 1914-1921) United States	(3) Great Britain
Cotton, raw	8.1	8.0
Cotton yarn	5.4	5.5
Pig iron	6.5	4.3
Wheat	6.8[1]	4.9

[1]This is reduced to 5.5 if crop year figures be used.

The measures show only slight differences between the wholesale prices of raw cotton and cotton yarn in the United States and Great Britain in respect to monthly variability, but pig iron and wheat appear to be appreciably more variable in the United States in their monthly price movements. This result agrees with that secured in the comparison of year-to-year measures.

§ Regional Differences in the Monthly Variability of Discount Rates

In an earlier section measures of regional differences in discount rates in the United States were discussed, and compared with similar measures for commodity prices. Equal interest attaches to regional differences in the variability of discount rates.

Using the data previously employed, measures of monthly variability have been computed. As with commodity prices, variation within each calendar year has been measured by the *mean deviation* of the monthly values, expressed as a percentage of the annual average. These measures, averaged for each of 34 cities for the years 1922-1926 are shown below.

TABLE 74

MEASURES OF VARIABILITY OF DISCOUNT RATES ON CUSTOMERS' LOANS IN THIRTY FOUR AMERICAN CITIES, 1922-1926.

(1) Rank	(2) City	(3) Measure of variability	(1) Rank	(2) City	(3) Measure of variability
1	Nashville	.99	18	Salt Lake City	2.99
2	Helena	1.16	19	Chicago	3.28
3	Louisville	1.79	20	Los Angeles	3.36
4	Buffalo	1.87	21	Richmond	3.51
5	Houston	1.97	22	Kansas City	3.61
6	Little Rock	2.31	23	El Paso	3.83
7	Seattle	2.33	24	Birmingham	3.88
8	Cincinnati	2.34	25	Omaha	3.92
9	Portland, Ore.	2.38	26	Oklahoma City	3.97
10	Baltimore	2.42	27	Philadelphia	4.30
11	Detroit	2.46	28	Boston	4.31
12	Atlanta	2.52	29	New York	4.41
13	Spokane	2.60	30	Minneapolis	4.54
14	New Orleans	2.64	31	Dallas	4.54
15	Cleveland	2.65	32	Denver	4.56
16	San Francisco	2.93	33	St. Louis	4.93
17	Pittsburgh	2.99	34	Jacksonville	6.11

These figures are presented graphically in Figure 19.

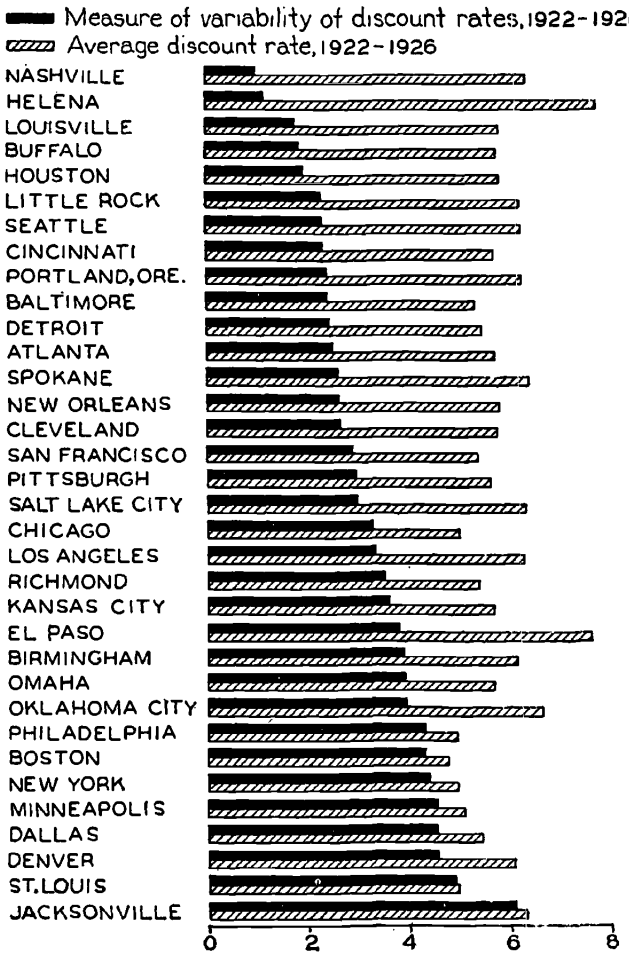
Differences between cities in respect to the stability of discount rates are much greater than are the differences in the average rates. The range from the lowest to the highest value extends from .99 to 6.11 as compared with a range from 4.77 to 7.73 in average rates. Although the big eastern cities, Philadelphia, Boston and New York, stand near the lower end of the scale with relatively variable rates, there is no clear division in the matter of variability between the smaller centers and the

FIGURE 19

DISCOUNT RATES IN AMERICAN CITIES.

Customers' Rates and Measures of Variability of Customers' Rates in 34 Cities. Averages of Monthly Measures During the Period 1922-1926.

(Cities ranked in order of magnitude of the measures of variability.)



larger, nor between the east, on the one hand, and the south and west on the other. In some centers a standard rate prevails with little change from month to month or from year to year, while in others rates are flexible and variable. In so far as may be judged from the present figures local conditions and customs, rather than broad geographical or economic factors, account for these regional differences in the variability of discount rates.

c. *Frequency of Price Change.* In the general discussion of price variability in an earlier section a measure of the frequency of price change was employed. This is the ratio of the number of changes in price to the number of monthly quotations.[1] In determining whether there are significant differences in respect to frequency of change in the prices of an identical commodity in different markets, data relating to tank wagon gasoline prices may be employed. The results appear in the following table.

TABLE 75

REGIONAL DIFFERENCES IN FREQUENCY OF MONTH-TO-MONTH CHANGE IN TANK WAGON GASOLINE PRICES, AT WHOLESALE, 1919-1925

City	Measure of frequency of price change
Los Angeles	.23
San Francisco	.23
Seattle	.23
Detroit	.40
Omaha	.40
Kansas City	.42
New York	.44
Boston	.46
Pittsburgh	.46
Birmingham	.46
El Paso	.47
Atlanta	.48
Denver	.52
Oklahoma City	.53

Since these figures relate only to a seven year period, and that a period marked by extreme price changes, they are not comparable to the measures of frequency of change presented in an earlier section for a long list of commodities. The measures for the different cities listed above are fully comparable, however.

[1]More accurately, it is the ratio of the number of price changes to the number of monthly quotations minus 1. This gives a measure which will have a value of unity if there is a price change every month, and a value of zero if the price is constant during the entire period covered.

There is considerable variation in the frequency of price change, the ratio varying from .23 for Los Angeles, San Francisco and Seattle, to .53 for Oklahoma City. The tank wagon price of gasoline changed about 1 month in 4 in the three Pacific Coast cities, and about 1 month in 2 in Oklahoma City.

The ranking, it may be noted, differs considerably from that based upon monthly variability (Table 72). That is, the cities in which the monthly price variation is most extreme are not necessarily those in which the frequency of change is highest.

International comparison of commodities in the matter of frequency of monthly price change reveals similar differences. The difficulty, previously mentioned, of securing quotations that are fully comparable is encountered in making such comparisons. The results given below must be interpreted with this difficulty in mind.

TABLE 76

COMPARISON OF MEASURES OF FREQUENCY OF MONTH-TO-MONTH CHANGE IN THE WHOLESALE PRICES OF THREE COMMODITIES IN AMERICAN AND BRITISH MARKETS

(1) Commodity[1]	(2) Measures of frequency of price change 1890-1925 (excluding 1914-1921) United States	(3) Great Britain
Pig iron	.77	.94
Cotton, spot	.99	.95
Cotton yarn	.74	.91

[1]The descriptions of these commodities follow:

Pig iron: United States: foundry no. 1 to 1913, basic thereafter. The monthly price is an average of prices on Tuesday of each week.

Great Britain: Scotch, to 1904, Cleveland No. 3 thereafter. The monthly price used is that quoted in the *Monthly Trade Supplement* of the *London Economist.*

Cotton, spot: United States: middling upland, N. Y. The monthly price is an average of closing prices on Tuesday of each week.

Great Britain: middling upland, Liverpool. The monthly price used is the closing price on the first or near the first of each month, as given in the *Commercial and Financial Chronicle.*

Cotton yarn: United States: carded cones, 10/1; average monthly price.

Great Britain: 32's, cop twist, Manchester. The monthly price used is the low for the first week of each month, as given in the *Commercial and Financial Chronicle.*

These figures indicate that spot cotton prices are subject to more frequent change in the United States than in England, but that pig iron and cotton yarn prices in this country change less frequently than in England. The pig iron figures are in notable contrast to those in Table 73. The measures of monthly variability show pig iron to be distinctly more variable in price in the United States than in Great Britain. (The American figure is 6.5, as compared with 4.3 for Great Britain.) Yet the British price changes much more frequently than the American price. (The British index

is .94, as compared with an American index of .77, where a value of 1.00 would indicate a change during every one of the months covered.) There is no contradiction here, however. It is probable that the ready response of British pig iron prices to changing market conditions, evidenced by the high index of frequency of change, results in a decrease in the magnitude of monthly price fluctuations.

Since the American cotton and cotton yarn prices are averages of weekly prices, while the British monthly prices relate to specific dates, comparability is not perfect for these commodities. The averaging would hardly reduce the frequency of change, however, so that the lower cotton yarn figure for the United States is probably not attributable to this difference.

3. Regional Differences in Commodity Price Trends

In the section devoted to the trends of commodity prices marked differences were found in the rates at which individual commodities had changed in price between 1896 and 1913, though the general index had increased during this period at a uniform annual rate. The economic importance of these differences was suggested. A question now arises as to whether these differences are due entirely to characteristic differences between commodities, or whether there are significant differences between the rates at which the price of a single commodity changes in different regions. The behavior of certain farm prices in this respect may be first considered.

TABLE 77

Regional Differences in Commodity Price Trends, 1896-1913

A. Comparison of Trends of Farm Prices of Corn in Ten States

(1) State	(2) Average annual rate of increase in price, 1896-1913[1] percent
Texas	3.7
Tennessee	4.2
Kentucky	4.4
Ohio	4.5
Minnesota	4.6
Indiana	4.7
Illinois	4.9
Missouri	5.2
Iowa	5.4
Nebraska	5.9
United States	4.8

B. Comparison of Trends of Farm Prices of Oats in Ten States

(3) State	(4) Average annual rate of increase in price, 1896-1913[1] percent
California	1.8
Texas	3.2
Minnesota	3.6
South Dakota	3.7
Ohio	3.9
Indiana	3.9
Illinois	3.9
Wisconsin	4.0
Iowa	4.1
Nebraska	4.7
United States	3.5

[1]The prices employed in deriving these values were December 1st farm prices.

This table reveals very considerable differences in the behavior of farm prices in different parts of the country. The rate of increase in the price of corn at the farm has varied from 3.7 per cent in Texas to 5.9 per cent in Nebraska. The rate for oats has varied from 1.8 per cent in California to 4.7 per cent in Nebraska. Reasons for these differences may be found in the relations between prices and production, in cheapening transportation costs, or in other factors. Improvement of transportation and lowering of freight charges have undoubtedly tended to equalize prices, and one effect of such equalization would be the varying rates of increase which are here shown.[1] While such differences constitute additional complexities in the price structure, their recognition simplifies the process of analyzing that structure, and enables the behavior of its component parts to be more readily understood.

International differences of the same sort are shown by the following table. Certain of the data are plotted in Figure 20.

TABLE 78

COMPARISON OF PRICE TRENDS OF SIXTEEN COMMODITIES IN FOUR COUNTRIES*

(1) Commodity	(2) Average annual rates of change in price, 1896–1913	(3)	(4)	(5)
	United States percent	Great Britain percent	Germany percent	France percent
Wheat	2.6	1.7	2.0	1.5
Rye	4.1		2.0	
Potatoes	4.3	— .4	2.7	4.4
Sugar, raw	.2	1.2	.4	
Sugar, refined	.1		—1.2	2.9
Cotton, raw	3.9	3.8	3.8	3.9
Cotton yarn	2.6	3.1	3.1	
Pig iron	1.0	1.7	— .2	
Copper	1.0	1.5	1.0	
Coal, bituminous	.9	1.1	1.7	1.9
Petroleum	3.5	— .2		2.2
Wool	1.6	1.5		
Silk	— .1	— .1		
Rubber	2.3	3.7		
Hides	3.4	3.2		
Coffee	2.7	—2.4		—.1

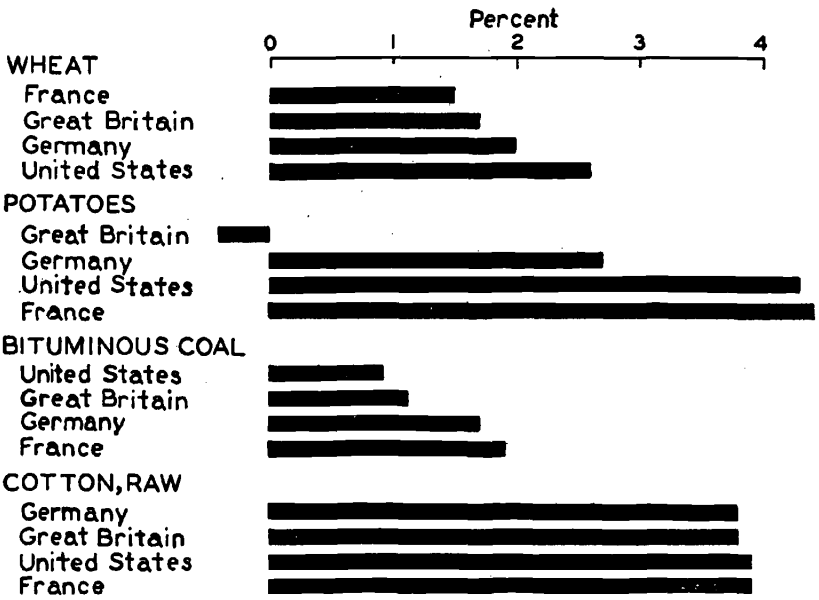
*For descriptions of the price quotations employed see the note to Table 71.

[1]The presence of a tendency toward equalization is evidenced by the measures of regional differences in farm prices (in percentage form) given in Table 65. This measure for corn declined from 22.8 for the period 1890-1897 to 17.1 for the period 1906-1913. For oats, the decline was from 20.8 to 17.1.

FIGURE 20

INTERNATIONAL DIFFERENCES IN COMMODITY PRICE TRENDS.

Comparison of Four Commodities in Four Countries in respect to Average Annual Rates of Change in Wholesale Prices from 1896 to 1913.



Explanation of the differences revealed by Table 78 would call for a detailed comparison of the several countries in respect to their industrial development between 1896 and 1913. No such comparison can be attempted. The significant fact, for the present purpose, is that there are distinct differences in the price trends of identical commodities in different countries. Raw cotton is conspicuous in that the rates of increase have been almost identical in all four countries. The reason for the resemblance is found, probably in the fact that cotton prices are fixed in an international market. At the other extreme stand potatoes, for which the rate of change varies from $-.4$ per cent, in England, to 4.4 per cent, in France. The price of potatoes in each country is largely determined by domestic conditions. Wheat, though resembling cotton in respect to the scope of the market, has increased in price at varying rates in the four countries compared. The rate was lowest in France and greatest in the United States. One factor responsible for the

sharper rate of increase in American prices is probably found in the diminishing surplus available for export from this country, though tariffs and changing transportation charges have doubtless played a part.

There is apparent no tendency, such as was observed in studying the variability measures, for the rates of change, considered collectively, to be greater in any one country than in the others.

4. Regional Differences in the Cyclical Movements of Commodity Prices

There is a promising and hitherto largely unexploited field for research in the investigation of differences from market to market and region to region in the cyclical movements of commodity prices. That there are important differences is revealed by even a slight study of the field. Just as commodities differ in the timing, amplitude and duration of their cyclical swings, so do quotations relating to the same commodity but drawn from different regions. In the present account it is possible to do no more than indicate the type of results which may be expected.

The monthly quotations of tank wagon gasoline prices drawn from 14 cities over the period 1919-1925 will furnish illustrative material.[1] The period covered is brief and the commodity is not in all respects suitable, but the data will serve our present purpose.

We may follow the movements of gasoline prices in these 14 cities in the recession of 1920, the revival of late 1921 and early 1922, the recession of late 1922 and early 1923, and the revival of 1924. We thus have four turning points and the periods between for study. The sequence of change at each of these turning points is shown in the table on the next page.

For the group of cities here included the first recession began in Birmingham in August, 1920, three months after the date of the highest point attained by the general wholesale price index. Southern cities felt it first, then came a general down-turn on the Eastern seaboard and in the Middle West. Not until February, 1921, nine months after the high of general prices, did the recession in gasoline prices begin on the Pacific Coast. There was a six months interval between the recession in Birmingham and the turn on the Pacific Coast. The average date of recession in the 14 cities came 7.1 months after the reference date.

[1]The prices are for tank wagon gasoline, at wholesale (less taxes), as quoted in the *National Petroleum News*. Each monthly price is that for a single date near the first of the month.

TABLE 79

REGIONAL DIFFERENCES IN THE SEQUENCE OF RECESSION AND REVIVAL IN TANK WAGON GASOLINE PRICES, AT WHOLESALE[1]

A. Sequence of Recession, 1920-21 (Ref. date, May, 1920)

City	Date of high preceding recession
Birmingham	+3
El Paso	+4
Atlanta	+6
Oklahoma City	+6
Denver	+7
Pittsburgh	+7
Boston	+8
New York	+8
Detroit	+8
Kansas City	+8
Omaha	+8
Los Angeles	+9
San Francisco	+9
Seattle	+9
Average	+7.1

B. Sequence of Revival, 1921-22 (Ref. date, January, 1922)

City	Date of low preceding revival
Birmingham	—3
El Paso	—3
Atlanta	—3
Pittsburgh	—3
Detroit	—3
Kansas City	—3
Omaha	—3
Oklahoma City	+3
Denver	+3
Boston	+3
New York	+3
Los Angeles	constant
San Francisco	constant
Seattle	constant
Average	— .8

C. Sequence of Recession, 1922-23 (Ref. date, April, 1923)

City	Date of high preceding recession
El Paso	—9
Atlanta	—9
Pittsburgh	—9
Detroit	—9
Kansas City	—9
Omaha	—9
Oklahoma City	—9
Denver	—9
Boston	—9
New York	—9
Birmingham	—8
Los Angeles	—8
San Francisco	—8
Seattle	—8
Average	—8.7

D. Sequence of Revival, 1923-24 (Ref. date, June, 1924)

City	Date of low preceding revival
Detroit	—6
Kansas City	—6
Denver	—6
Atlanta	—5
Los Angeles	—5
San Francisco	—5
Seattle	—5
Boston	+4
New York	+4
Oklahoma City	+5
Pittsburgh	+6
El Paso	+6
Birmingham	+7
Omaha	+7
Average	+.1

[1]In this table the figures measure deviations, in months, from the origin. The sign (—) indicates that the turn in price occurred before the date serving as origin. The sign (+) indicates that the turn occurred after that date.

The turn upward, which was generally reflected in wholesale price movements after the depression of 1921, appears in the prices of gasoline in 11 of these 14 cities. In 7 cities prices rose 3 months before the reference date and in 4 cities prices rose 3 months after this date. The average date of turn, for these 11 cities, came .8 of a month before the reference date.

The recession of prices which was general in 1923 appears in the movement of gasoline prices from 8 to 9 months before the turn in the wholesale price index. The movement was practically synchronous in the 14 widely separated cities from which the present price quotations have been drawn. The average date of turn came 8.7 months before the reference date, when general prices started downward.

There is more diversity in the dates of revival in 1923 and 1924. Although the price revival was felt in all these cities, there was an interval of 13 months between the turn in Detroit and the turn in Omaha. The sequence shown in Table 79-D does not suggest any clear regional grouping in respect to the date of the price turn. The average date of turn, in these 14 cities, came .1 of a month after the turn in the general price index.

Differences between the movements of prices in different regions are not imited to differences in the dates at which price turns are felt. Other aspects of cyclical price behavior are summarized in the tables which follow. Only brief comments are appended.

TABLE 80

REGIONAL DIFFERENCES IN CYCLICAL MOVEMENTS OF TANK WAGON GASOLINE PRICES, AT WHOLESALE[1]

A. Duration of Fall, 1920-22. B. Percentage of Fall, 1920-22.

City	Duration of fall (in months)	City	Percentage of fall (percentage of high price preceding recession)
Detroit	9	New York	22.6
Omaha	9	Boston	25.0
Kansas City	9	Pittsburgh	31.4
Pittsburgh	10	Atlanta	36.7
Atlanta	11	Omaha	37.3
El Paso	13	Denver	37.5
Birmingham	14	Detroit	37.9
Boston	15	Birmingham	39.7
New York	15	Kansas City	40.8
Denver	16	Oklahoma City	44.8
Oklahoma City	17	El Paso	48.4
Average	12.5	Average	36.6

TABLE 80 (Cont.)

C. Duration of Rise, 1921-22.

City	Duration of rise (in months)
Boston	3
New York	3
Denver	3
Oklahoma City	3
Atlanta	9
Detroit	9
El Paso	9
Kansas City	9
Omaha	9
Pittsburgh	9
Birmingham	10
Average	6.9

D. Percentage of Rise, 1921-22.

City	Percentage of rise (percentage of low price preceding revival)
Boston	12.5
New York	12.5
Birmingham	21.0
Pittsburgh	23.8
Denver	25.0
Omaha	27.0
Detroit	30.7
Atlanta	36.8
Kansas City	36.9
Oklahoma	37.5
El Paso	43.7
Average	27.9

E. Duration of Fall, 1922-24.

City	Duration of fall (in months)
Denver	17
Detroit	17
Kansas City	17
Atlanta	18
Boston	27
New York	27
Oklahoma City	28
Pittsburgh	29
Birmingham	29
El Paso	29
Omaha	30
Average	24.4

F. Percentage of Fall, 1922-24.

City	Percentage of fall (percentage of high price preceding recession)
Birmingham	43.5
Pittsburgh	46.2
New York	48.2
Kansas City	49.3
Boston	51.9
El Paso	52.2
Omaha	53.2
Detroit	53.9
Denver	56.0
Oklahoma City	56.8
Atlanta	57.7
Average	51.7

[1]The three Pacific Coast cities are omitted from this table, since there was no price rise in these cities immediately following the recession of 1920-21.

It is significant that the percentage of fall from 1920 to 1922 was least in the large eastern cities which are far removed from the sources of supply, while the fall was greatest in two cities close to important extractive centers. A similar relationship prevails among the figures showing the percentage of rise during 1921 and 1922.

In order to compare the three Pacific Coast cities with the other cities, in respect to price movements during the major re-

cession which extended from 1920 to 1924, the following table has been prepared. In computing these measures the fairly short revival of 1921-22 has been ignored and account has been taken only of the major down-swing from the latter part of 1920 to 1924.

TABLE 81

REGIONAL DIFFERENCES IN CYCLICAL MOVEMENTS OF TANK WAGON GASOLINE PRICES, AT WHOLESALE

A. Duration of Fall from the Recession of 1920-21 to the Revival of 1924

City	Duration of fall (in months)
Los Angeles	35
San Francisco	35
Seattle	35
Detroit	35
Kansas City	35
Denver	36
Atlanta	38
Boston	45
New York	45
Oklahoma City	48
Pittsburgh	48
Omaha	48
El Paso	51
Birmingham	53
Average	41.9

B. Percentage of Fall from the Recession of 1920-21 to the Revival of 1924

City	Percentage of fall (percentage of high price preceding recession)
Pittsburgh	54.3
New York	54.8
Seattle	57.2
Birmingham	58.7
Kansas City	58.9
San Francisco	59.3
Boston	59.4
Detroit	62.5
Omaha	62.7
Los Angeles	63.0
Atlanta	63.4
El Paso	64.5
Denver	65.6
Oklahoma City	67.3
Average	60.8

The results given in the preceding tables are summarized in the table on next page in a form convenient for comparison with similar measures for other commodities.

If our interest relates to the United States as a unit, the averages in Table 82 describe the cyclical behavior of gasoline prices more faithfully than would measures based upon a series of prices drawn from a single market. The averages must be interpreted, however, in connection with the standard deviations in the last column. The first four standard deviations measure the degree of association, in time, between gasoline price movements in different cities at four important turning points. The regional differences were least (standard deviation = .7 mo.) during the recession which began about the middle of 1922. The differences between markets were greatest (standard deviation = 5.6 mos.) during the price revival which occurred between December, 1923, and January, 1925.

TABLE 82

CYCLICAL MOVEMENTS OF TANK WAGON GASOLINE PRICES, AT WHOLESALE, 1920-1924

AVERAGES AND MEASURES OF REGIONAL DIFFERENCES

(1) Measure	(2) No. of cities	(3) Arithmetic mean of measures relating to individual cities	(4) Standard deviation of measures relating to individual cities
1. Date of high, 1920-21	14	+ 7.1[1]	1.9
2. Date of low, 1921-22	11	— .8[1]	2.9
3. Date of high, 1922-23	14	— 8.7[1]	.7
4. Date of low, 1923-24	14	+ .1[1]	5.6
5. Duration of fall, 1920-22	11	12.5	3.1
6. Percentage fall, 1920-22	11	36.6	7.1
7. Duration of rise, 1921-22	11	6.9	3.0
8. Percentage rise (as percentage of low), 1921-22	11	27.9	9.9
9. Duration of fall, 1922-24	11	24.4	5.3
10. Percentage fall, 1922-24	11	51.7	4.5
11. Duration of fall, 1920-24	14	41.9	6.9
12. Percentage fall, 1920-24	14	60.8	4.2

[1]For the reference dates to which these measures relate, see Table 79.

The various other standard deviations are to be interpreted in a similar fashion. Without attempting further analysis we may conclude that there are material differences between markets in respect to the behavior of wholesale gasoline prices during business cycles, differences as great as many of those which have been noted in comparing commodities. In computing these measures of regional difference we have dealt with a commodity which is fairly well standardized in quality, and the prices employed have been those quoted by a relatively small group of companies. There is no reason to doubt that similar regional differences in the price behavior of a great many commodities would be found if a general study of this character were made. There is an important field for exploration in the study of the regional incidence of business cycles, as well as in the study of their industrial incidence.

The utility of measures of the type presented in Table 82 may be illustrated by a comparison of such results for two different commodities. This comparison has been worked out on a very limited scale, but it will serve as an example. In the following table are given measures relating to the cyclical behavior of gasoline prices and Portland cement prices, at wholesale, during the cyclical swings

of general business between 1920 and 1924. The data cover one major cycle, from the high which centered in 1920 to the high centering in 1923. The measures compared were computed, in each case, from price data for the same cities, which varied in number from 6 to 10.[1]

TABLE 83

COMPARISON OF GASOLINE AND PORTLAND CEMENT PRICES IN AMERICAN CITIES, IN RESPECT TO REGIONAL DIFFERENCES IN CYCLICAL MOVEMENTS†

(1) Measure	(2) No. of cities	(3) Arithmetic means of measures relating to individual cities		(4) Standard deviations of measures relating to individual cities	
		Gasoline	Portland cement	Gasoline	Portland cement
1. Date of high, 1920-21	10	+ 7.9*	— 8.5*	.9	4.3
2. Date of low, 1921-22	7	— .4*	— 3.3*	3.0	5.0
3. Date of high, 1922-23	9	— 8.7*	+ 6.3*	.5	4.9
4. Duration of fall, 1920-22	7	12.1	16.1	3.0	4.5
5. Percentage fall, 1920-22	7	33.1	32.8	6.6	11.8
6. Duration of rise, 1921-23	6	7.0	15.7	2.8	3.3
7. Percentage rise (as percentage of low), 1921-23	6	25.5	19.6	10.3	6.9

†The gasoline prices employed are those for tank wagon gasoline, at wholesale (less taxes), as quoted in the *National Petroleum News*. Prices are for dates near the first of each month. Portland cement prices are taken from the section on Portland cement in *Mineral Resources of the United States*, published by the U. S. Geological Survey.

*For the reference dates to which these measures relate, see Table 79.

Differences between the averages for gasoline and cement in the above table possess some interest, but our present purpose is the comparison of these commodities in respect to regional differences in their price movements. Our attention centers, therefore, on the standard deviations. With only one exception the regional dif-

[1]The ten cities were Atlanta, Boston, Denver, Detroit, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco, Seattle. Three of these (Los Angeles, San Francisco and Seattle) were omitted in computing the measures covered by the second, fourth and fifth entries, because the rise of 1921-22 in general prices was not reflected in gasoline prices on the Pacific Coast. One city (Denver) was omitted in computing the measures covered by the third entry, since there was no recession in Portland cement prices in that city during the general downward movement of 1923-24. Four cities (the three Pacific Coast cities and Denver) were omitted in computing the measures covered by the sixth and seventh entries.

An objection may be raised to this procedure of omitting the cities which did not share in the particular movement being studied. That prices in a given city were not affected is an important and thoroughly relevant fact, which must be noted. But account cannot be taken of it in computing the statistical measures presented. These are to be interpreted as describing the behavior of prices in those cities which were affected by the general movement. In each case precisely the same cities are included for the two commodities, hence there is a reasonable basis for comparison.

ferences in cyclical price behavior have been materially less for gasoline than for Portland cement. The price turns in the different cities during the three major turns covered by the first three entries were much closer together in time for gasoline than for cement. This is particularly marked for the first and third entries, in which standard deviations of .9 and .5 for gasoline are paired with values of 4.3 and 4.9 for cement. (The smaller the standard deviation, of course, the less are the regional differences and the more compact are the price movements in question.) Among the seven cases here covered, differences from market were greater for gasoline than for cement only in respect to the last entry, showing the percentage rise from the low of 1921-22 to the high of 1923-24. The rise was greater for gasoline than for cement (25.5 per cent as compared with 19.6 per cent) and the regional differences were materially greater for gasoline (standard deviation of 10.3, as compared with 6.9 for cement).

Adequate data would permit extensive comparison of commodities according to some such scheme as that outlined above. The data at present available permit only fragmentary studies of the type illustrated.

5. Regional Differences in the Flexibility of Commodity Prices

That there exist regional differences in the flexibility of prices was pointed out by Henry L. Moore in his important memoir "Elasticity of Demand and Flexibility of Prices."[1] Holbrook Working has given a specific example of regional differences in elasticity of demand, the commodity being potatoes and the markets Cincinnati and St. Paul. In terms of prices at St. Paul the elasticity of demand for potatoes varied from .36 at a consumption of 80 per cent of normal to .57 at a consumption of 120 per cent of normal. In terms of Cincinnati prices the elasticity ranged from .41 at a consumption of 80 per cent of normal to .78 at a consumption of 120 per cent of normal.[2]

In an earlier section[3] the relation between the price and production of tame hay in the United States was described. We may

[1] "It is always necessary to specify the market for which the empirical laws of demand apply. The values of ϕ and η vary from market to market." *Journal of the American Statistical Association*, March, 1922.

[2] "The Statistical Determination of Demand Curves," *Quarterly Journal of Economics*, August, 1925.

[3] See pp. 144-147.

determine whether there are material differences from state to state in the flexibility of hay prices and in the other basic measures used in defining the relationship between prices and quantities. In studying these relations by states it has been necessary to employ data which differ somewhat from those used in the broader study. For each of six states the average relationship between the December 1st farm price of hay and the average yield of hay per acre during the preceding year was measured.[1] Prices were deflated by the wholesale price index of the Bureau of Labor Statistics. Data for the period 1890-1925 were employed. The results are given in the following table. The symbol Y is used for link relatives of deflated prices and X for link relatives of yield.

TABLE 84

MEASURES DEFINING THE RELATIONS BETWEEN DECEMBER FARM PRICES OF HAY AND YIELD PER ACRE, IN SIX STATES.

(1) State	(2) Equation of relationship	(3) Standard error of estimate (in percentage form)	(4) Coefficient of correlation	(5) Coefficient of determination	(6) Coefficient of flexibility
California	log Y=2.80539 —.40323 log X	25.6	—.27	.07	—.40
Iowa	log Y=3.15261 —.57601 log X	16.0	—.68	.46	—.58
Ohio	log Y=3.55814 —.78012 log X	17.7	—.73	.54	—.78
Wisconsin	log Y=3.72212 —.85963 log X	13.6	—.79	.63	—.86
Pennsylvania	log Y=3.77909 —.88819 log X	14.1	—.74	.54	—.89
New York	log Y=3.86301 —.93123 log X	15.5	—.77	.59	—.93
United States*	log Y=3.93434 —.96454 log X	10.7	—.73	.53	—.96

*The variables in this case are crop year averages of Chicago wholesale prices and total United States production.

The measures derived in describing the relation between Chicago wholesale prices of hay and total production in the United States are included in this table, although they are not directly comparable to the measures relating to the separate states.

The coefficients of correlation between December farm prices and yield per acre vary from $-.27$ for California to $-.79$ for Wisconsin. California stands by itself at the lower extreme, since the coefficients for all the other states lie between $-.68$ and $-.79$. There is a corresponding variation in the coefficients of determina-

[1]Price and yield figures were obtained from the *Yearbooks* of the Department of Agriculture.

tion. On the reasonable assumption of a causal relationship between yield per acre and farm price, these coefficients indicate that in four of the six states covered above variations in yield per acre account for more than 50 per cent of the squared variability of deflated prices. The two states with coefficients below .50 are California with .07 and Iowa with .46.

The farm price of hay appears to be inflexible in all the states named. The price is least flexible in California, for which the coefficient is $-.40$, and most flexible in New York, for which the coefficient is $-.93$. This latter figure is very close to the figure $-.96$, obtained in the general analysis relating to total domestic production and Chicago prices.

III Conclusion

The first part of the present chapter contains measures of regional variations in price for a number of building materials and for gasoline, at wholesale, for a diversified list of foods, fuels and dry goods at retail, and for seven important agricultural products, as priced at the farm. Similar measures for discount rates have been presented for the purpose of comparison. The *mean deviation*, both in absolute form and as a percentage of the mean, has been used as a measure of regional variations. The second half of the chapter deals with differences from city to city, from state to state, and from country to country in the behavior of prices. Measures relating to all the aspects of price behavior which were described in the first chapter are compared in this survey of regional differences.

The various examples given in this chapter indicate the degree of diversity in price movements found within the United States. There is diversity not only in respect to the absolute prices prevailing at a given time, but there appear to be wide differences in the price behavior of identical commodities in different markets. The materials here presented have been fragmentary, but scattered as the examples have been they furnish conclusive evidence that the United States cannot be treated as a single homogeneous market in a study of the structure of prices. If the United States is to be treated as a unit in measuring changes in the price level and in dealing with other aspects of the behavior of prices in combination, it can only be done on the basis of adequate regional sampling, with full recognition of existent regional diversities.