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In discussing the first three of these measures in preceding sections it has been pointed out that, although the coefficients are low, there is evidence of a significant relationship between the degree of variability of commodity prices and the pre-war trends of these prices. The first of the measures listed above is equal to 4.3 times its standard error, the second to 4.7 times that measure, while the third is 6.1 times its standard error.[1]

In computing the last three measures in Table 55 averages relating to cyclical behavior during the five cycles which occurred between 1897 and 1913 have been paired with the measures of rates of increase between 1896 and 1913. During this period there was no apparent relation between the average time of recession and the rate of increase. There is some indication that commodities with the sharpest rates of increase tended to rise in price early, during revival, but the coefficient (—.16) is equal only to 2.01 times its standard error, and does not furnish conclusive evidence on this point. Similarly, there is a suggestion that commodities with the steepest trends were subject to price cycles of wider amplitude than those which rose at lower rates, but again the evidence is not conclusive. The coefficient (+.17) is equal to 2.12 times its standard error.

VII Summary

As a first step in the study of price behavior a number of measures describing characteristics of the prices of individual commodities have been computed. In addition to price relatives of the customary type there have been discussed in this chapter measures of variability and trend, measures relating to the behavior of individual commodity prices during cycles in general business, and measures descriptive of the relations between the prices and quantities of specific commodities. These measures furnish raw materials for the study of prices in combination and for the analysis of the price system. For this reason, and because of their probable

[1]There is reason to suspect that these positive correlations are wholly or in part due to the influence of farm products, which as a group are highly variable in price, and which, during the several decades prior to the war, were increasing in price at rates well above the average. When farm products are excluded there remain 182 articles. For these commodities the correlation between the average annual rate of price increase and the year-to-year variability of prices is +.23. This coefficient is smaller than the measure for all commodities, but must still be adjudged significant of a real relationship, since it is more than three times as great as its standard error. An identical figure is secured when the average annual rate of increase is correlated with the measure of monthly variability.

utility to those interested in particular commodities and in commodity markets, the results have been presented in considerable detail.

1. Three indexes of price variability have been employed in the present study. One of these measures the amplitude of monthly price fluctuations, another measures the frequency of monthly price changes, and a third measures the amplitude of year-to-year movements.

a. As a measure of monthly price movements within each year the mean deviation from the average price for the year has been employed. Such a measure, in both absolute and relative form, has been computed for each commodity for each year from 1890 to 1925, employing wholesale price quotations. (The number of commodities varies, in different years, from 204 to 214.) Commodity averages secured from these annual measures have been used in the general study of price behavior.

b. The index of year-to-year variability is the mean deviation of link relatives, computed from average annual prices. The years from 1890 to 1913 are covered by one set of computations, while another includes the period 1890-1924. Measures of this type have been obtained for 206 commodities at wholesale, for 13 foods at retail, and for 8 agricultural products, employing prices at the farm.

c. The ratio of the number of changes in the price of a given commodity to the total number of months, less one, for which price quotations on that commodity are available, furnishes the index of frequency of price change. The maximum value of the ratio is unity, indicating a change in price every month during the period covered, and the minimum value is zero. Such a measure has been computed for each of 206 commodities for each eight-year period from 1890 to 1921, and for the four-year period from 1922 to 1925. Price quotations at wholesale have been employed.

2. A study of the annual measures of monthly price variability during the 24 years preceding the war (1890-1913) reveals a definite tendency toward a decline in the variability of commodity prices during this period. The measures of frequency of price change show a less pronounced movement in the same direction.

Both sets of measures indicate that the variability of prices was greater during the years from 1922 to 1925 than during the 8

years preceding the war. The influence of war-time disturbances upon individual prices appears to have persisted, rendering post-war prices more variable than the prices which prevailed during the years immediately preceding the war.

3. The trends of commodity prices have been expressed as average annual rates of increase or decrease over a stated period. The period employed for this purpose covers the years from 1896 to 1913, during which the general level of wholesale prices in the United States was rising at a fairly constant rate from year to year. Differences in the trends of individual prices during this period represent shifting economic relations which are of considerable economic importance. A measure of this type has been computed for each of 223 commodity price series, at wholesale.

Measures of rates of change in the per unit purchasing power of individual commodities (in terms of other commodities at wholesale) have been derived from the measures of rates of change in prices.

4. The study and comparison of price trends suggests certain conclusions concerning relations between commodity prices. It is assumed in many discussions that there is a certain "normal" relation between the prices of individual commodities and commodity groups, and that this relation is disturbed during such price disturbances as were brought by the war. The present evidence indicates that there was no normal pre-war relation between prices, in their absolute form. What was constant in the pre-war price situation was not a set of fixed price differences, but relations which changed at fairly regular rates year by year. To assume that the actual prices in a given year stand in a normal relation to each other is to attempt to crystalize a cross-section of a constantly changing situation.

5. In measuring the timing, duration and amplitude of individual price changes during price cycles there have been secured eight measures descriptive of the movements of each of 209 individual price series during each of the ten cycles which occurred between 1890 and 1925. These measures are:

Date of low point preceding price revival (expressed as a deviation in months from the date of the low of the wholesale price index of the Bureau of Labor Statistics)

Duration of rise during revival and prosperity
Percentage of rise during revival and prosperity
Date of high point preceding recession (expressed as a deviation in months from the date of the high of the wholesale price index of the Bureau of Labor Statistics)
Duration of decline during recession and depression
Percentage of decline during recession and depression
Duration of cycle
Amplitude of cyclical movement

These have been averaged and correlated in various ways in the detailed study of price behavior.

6. A number of significant relationships among the measures of cyclical price movements have been observed.

a. The commodities which rise first on revival are subject, in general, to wider cyclical fluctuations than are the commodities which lag on revival. Similarly, the commodities which decline first on recession are marked by wider fluctuations than are those which lag.

b. The commodities which rise first during revival tend to decline first on recession, but the correlation between the sequence of change on revival and the sequence of change on recession is far from perfect.

c. When measures relating to individual cycles are paired, it is found that the correlation between the timing of recession and the timing of revival on the next succeeding turn is significantly higher than the correlation between the timing of revival and the timing of the following recession. The order of price recession in a given cycle exercises a stronger influence upon the order of the succeeding revival than the order of revival exercises upon the order of the succeeding recession. There is evidence in both cases, however, of a significant relationship. Although each phase of a price cycle bears the imprint of novel factors, there are definite bonds which tie it to the phase that has preceded it.

d. There is a clear tendency for the sequence of revival to follow a common pattern during different cycles. The same tendency is observed in studying the sequence of recession in different cycles. The common pattern is slightly more in evidence for the data relating to recession than in the figures measuring the time of revival. Other evidence bears out this suggestion that the consis-

tency of price movements during different periods of recession is greater than it is during revival.

7. The evidence upon which the preceding statements are based is of considerable general significance in showing that there are true economic regularities in the price movements which accompany cycles in general business. In cycle after cycle there has been observed a degree of uniformity in the sequence of revival and recession in commodity prices and in other aspects of price behavior. If cyclical movements represented the play of mere variability about a mean or a trend, one would expect the sequence of price change in each cyclical swing to be unique, except for certain chance resemblances to movements at other times. Yet the odds against chance alone accounting for the regularities we have found are infinitely great. In period after period there is a recurrence of price movements which have something in common, in respect to sequence of change, amplitude and duration. These changes in different periods are far from showing perfect uniformity, but there is unmistakable evidence that the observed resemblances would not be found if the cyclical movements of individual prices represented random fluctuations alone. The phenomena of business cycles show just those regularities and uniformities which it is the business of the scientist to discover, trace and, if he can, explain.

8. During the pre-war years there was some correlation between the variability of commodity prices and the slopes of their lines of trend. The commodities having the steepest trends tended to be more variable in price than those with less pronounced trends. (This conclusion must be qualified somewhat because the different measures of variability are in varying degree affected by changes in price which represent direct trend movements.)

9. Five measures have been used in studying the relations between the prices of specific commodities and various price-determining factors. These are:

a. An equation of average relationship
b. A measure of the reliability of this equation (the standard error of estimate)
c. The coefficient of correlation
d. The coefficient of determination

e. The coefficient of price flexibility, which measures the sensitivity of the price of a commodity to changes in quantity

In the treatment of this aspect of price behavior the inadequacy of the data render it impossible to secure measures relating to a considerable number of price series. Accordingly, only a few illustrative examples have been included in this section of the report.

In assembling and discussing the measures described in the present chapter the emphasis throughout has been upon differences between *commodities* in respect to price behavior. We now proceed to a discussion of differences between *markets* in respect both to absolute prices and to the behavior of prices.