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Changes in the Recession Behavior of Wholesale Prices in the 1920's and Post-World War II

ABSTRACT: Wholesale prices show a smaller decline in the recessions after 1948–49 than formerly, but the aggregate index hides some important details of this change in behavior. This study examines the frequency distributions of price changes in nonwar business recessions since the 1920's. The main finding is that the dispersion of the distributions declined from the 1920's to the post-World War II recessions, indicating a decline in general price volatility, but that, while the dispersion has remained about the same in the recessions after 1948–49, the distributions have shifted bodily rightwards, indicating a declining response of prices to recessions. This rightward shift has been consecutive from one recession to the next, and is not solely the consequence of the fact that postwar recessions as a group are milder

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I wish to thank the Board of Director's Reading Committee of Gardner Ackley, Harold Halcrow, and Geoffrey H. Moore.

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than formerly. The shift is not attributable to the changing mix of the wholesale price index, because the distributions are composed of the same set of 1,100-odd wholesale product prices. A rightward shift in the distributions of the rates of price change in recessions occurs in part because the trend of the rates has increased over the postwar period. But the diminishing response of prices to recessions is also evident in the distributions of *changes* in the rates of price change from cyclical expansions to succeeding recessions, which are not affected by the trend of the rates. ¶ There has clearly been a gradual decline in price response to recessions over the postwar period, except mainly for raw materials prices. Further analysis shows that it is not confined to high valued-added or concentrated manufacturing industries, or to the use of BLS reported prices rather than the transactions prices presented in the Stigler-Kindahl study. The interpretation offered here is that an intensification of general anticipations of inflation over the postwar period has lessened the response of manufacturing prices to short-run variations in demand. This has contributed to the postwar difficulty of curbing inflation through policy restraints on aggregate demand.

[I] INTRODUCTION

Although cyclical fluctuations in business activity have on the whole been milder since World War II than ever before and price increases during cyclical expansions (before 1973) have been correspondingly moderate, prices have declined less than they used to in periods of mild business recession, with the result that the price level has risen to higher and higher levels with no significant reversals. This change in the cyclical behavior of prices lies at the heart of the "inflation problem" in the postwar period.

The present study examines the recession behavior of wholesale prices since World War II and compares it with the mild recessions of the 1920's. The focus is on changes in recession behavior, possible bias in the data, and differences in behavior among various groups of wholesale prices. (Differences between wholesale and consumer prices, though important, are not examined here.) The purpose is to extend the evidence on the extent and uniformity of changes in price behavior and to test various interpretations of those changes.

The Reduction of Cyclical Amplitude in Aggregate Price Indexes

Table 1 shows the cyclical behavior of the Bureau of Labor Statistics (BLS) index of all wholesale prices and all items excluding farm products and

TABLE 1 **Rate of Change of Wholesale Prices over Business Cycles 1891–1970**
(per cent per year)

Reference Cycles			All Items			All Items Excl. Foods		
Trough	Peak	Trough	Expansions	Recessions	Rec. minus Exp.	Expansions	Recessions	Rec. minus Exp.
May 1891	Jan. 1893	June 1894	−0.9	−12.4	−11.5	−4.8	−4.3	0.6
June 1894	Dec. 1895	June 1897	1.7	−4.5	−6.2	4.0	−4.5	−8.5
June 1897	June 1899	Dec. 1900	6.3	5.0	−1.3	9.5	−1.2	−10.7
Dec. 1900	Sep. 1902	Aug. 1904	4.6	−0.7	−5.3	6.1	−1.6	−7.8
Aug. 1904	May 1907	June 1908	3.7	−4.0	−7.7	6.8	−10.9	−17.7
June 1908	Jan. 1910	Jan. 1912	8.3	−4.0	−12.3	4.2	−5.5	−9.7
Jan. 1912	Jan. 1913	Dec. 1914	6.1	−1.8	−7.9	15.3	−4.3	−19.6
Dec. 1914	Aug. 1918	Mar. 1919	18.8	−4.1	−22.9	26.6	−12.1	−38.7
Mar. 1919	Jan. 1920	July 1921	19.9	−33.8	−53.7	34.0	−23.2	−57.2
July 1921	May 1923	July 1924	4.8	−5.3	−10.1	4.4	−7.8	−12.2
July 1924	Oct. 1926	Nov. 1927	1.6	−2.6	−4.2	0.8	−5.8	−6.6
Nov. 1927	Aug. 1929	Mar. 1933	−0.1	−13.2	−13.1	−1.1	−7.8	−6.8
Mar. 1933	May 1937	June 1938	9.0	−10.1	−19.1	7.4	−5.1	−12.6
June 1938	Feb. 1945	Oct. 1945	4.4	1.2	−3.2	3.3	1.1	−2.2
Oct. 1945	Nov. 1948	Oct. 1949	13.6	−7.1	−20.6	15.3	−5.4	−20.7
Oct. 1949	July 1953	Aug. 1954	3.2	0.0	−3.2	3.9	−0.2	−4.0
Aug. 1954	July 1957	Apr. 1958	2.3	1.7	−0.6	3.4	−0.1	−3.6
Apr. 1958	May 1960	Feb. 1961	0.1	0.3	0.2	1.1	−0.3	−1
Feb. 1961	Nov. 1969	Nov. 1970	1.4	2.6	1.2	1.4	2.6	

	Averages					
By Period						
6 cycles 1921–49	5.6	−6.2	−11.7	5.0	−5.1	−10.2
4 cycles 1949–70	1.8	1.2	−0.6	2.4	0.8	−1.7
By Period and Similar Severity[a]						
2 cycles 1921–27	3.2	−4.0	−7.2	2.6	−6.8	−9.4
2 cycles 1954–61	1.2	1.0	−0.2	2.2	−0.2	−2.4

SOURCE: Bureau of Labor Statistics, *Wholesale Prices and Price Indexes* (issued monthly).

NOTE: Rates of change are computed between average levels of three months surrounding peaks and troughs. Series are seasonally adjusted.

[a]Severity of business recessions is based on Geoffrey H. Moore, ed., *Business Cycle Indicators* Vol. 1 (New York: National Bureau of Economic Research, 1961), p. 104, and updated in *Annual Report* (New York: National Bureau of Economic Research, 1973), p. 18.

processed foods. In the four business recessions following 1949 the aggregate index did not decline and in the last three it rose. In previous recessions this index had failed to decline only twice (in 1900 and the short recession following World War II in 1945).[1] In 1961 and 1970 it even rose faster in the recessions than in the preceding expansions, a perverse cyclical behavior which it never exhibited before. The rate of change of the aggregate index is graphed in Chart 1.

The index for all items excluding foods, which avoids the vagaries of agricultural supply conditions, shows a similar change in behavior. Although this index declined in all recessions since 1891 except 1945 and 1970, the declines were much smaller in the four following 1949. In 1970 this index exhibited the perverse cyclical behavior of the recession rate exceeding the expansion rate, which occurred only once before, in 1894.

Appendix Table A shows the cyclical behavior of three major subgroups of wholesale prices available since 1912, basic materials, intermediate goods, and finished goods. A sharp decline in cyclical amplitude occurs for all three subgroups in the recessions following 1949, thus demonstrating that the decline for the aggregate index cannot be attributed to the decreasing weight of the volatile prices of basic materials.

The rates of price change during business expansions have also declined, though not uniformly. Some expansions in the 1920's and earlier had rates of price change as low as or below those of some postwar cycles. Although it was not unusual in the 1920's and earlier for the expansion rates to be low, it was rare for prices to fail to decline appreciably in recessions. Chart 1 makes the reduction in amplitude of price fluctuations before and after 1950 readily apparent. Such a reduction in month-to-month amplitude has occurred in other economic series as well, including the rate of growth of the money stock.[2] It reflects in part better data but also the fact that cycles in business activity have been milder on the average since World War II than formerly. Still, a change in behavior of prices is evident even after allowing for differences in the cyclical amplitude of business activity. A pairing of two mild recessions in the 1950's with two in the 1920's at the bottom of Table 1 shows that the later price swings were considerably smaller, though less so for expansion rates alone. Although expansion rates have come down (the current expansion since 1970 is an exception) at the same time that recession rates have moved up toward and past zero, recession rates have moved farther.

The present study is generally concerned with the response of prices to recessions, to represent periods of general slack in market demand. For reasons given later, the main emphasis is on the difference between recession rates and the preceding expansion rates. This difference is equivalent to an analysis of the overall cyclical amplitude of rates of price change.

CHART 1 Rate of Change of Wholesale Prices Monthly and Centered Six-Month Moving Average, 1890–1971

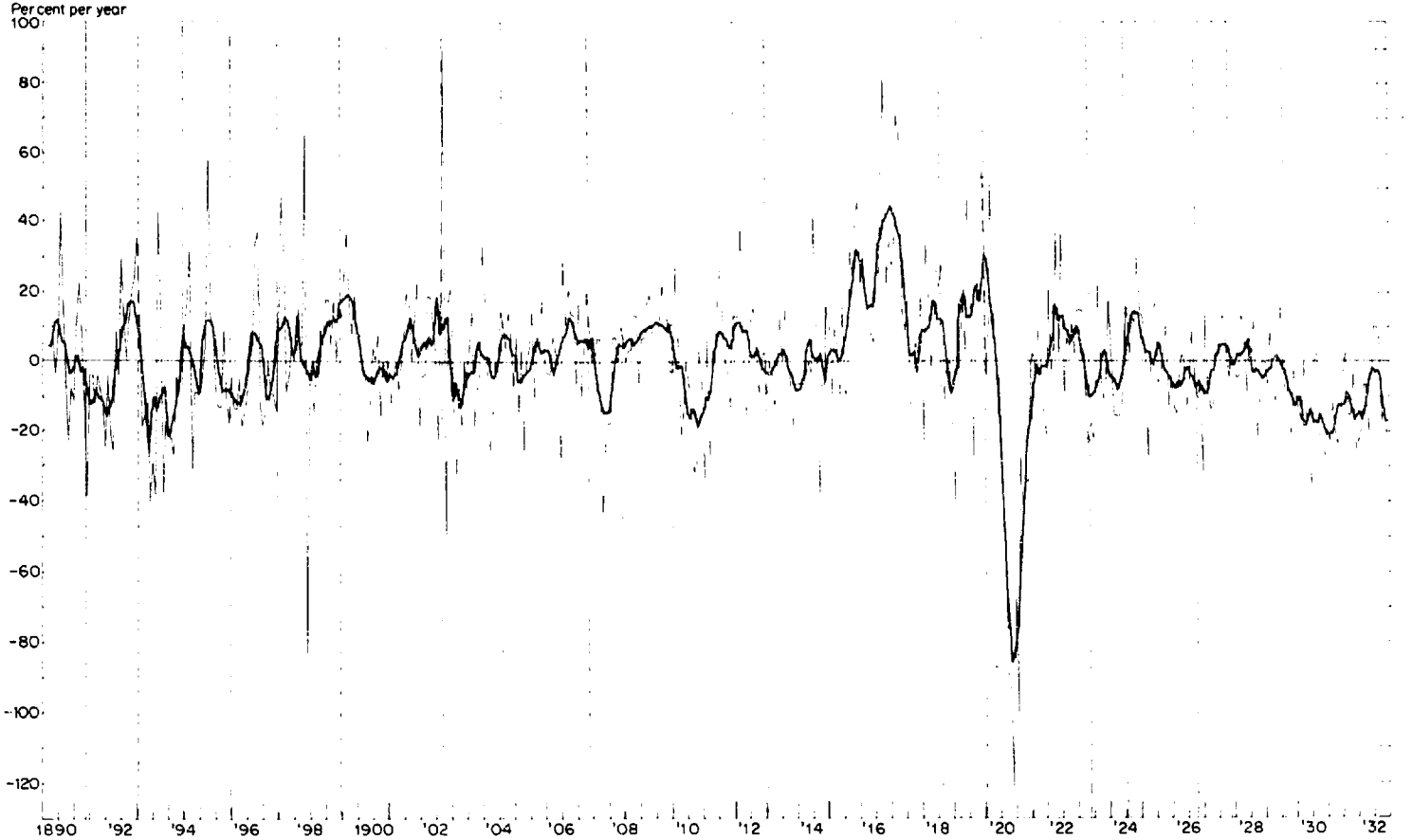
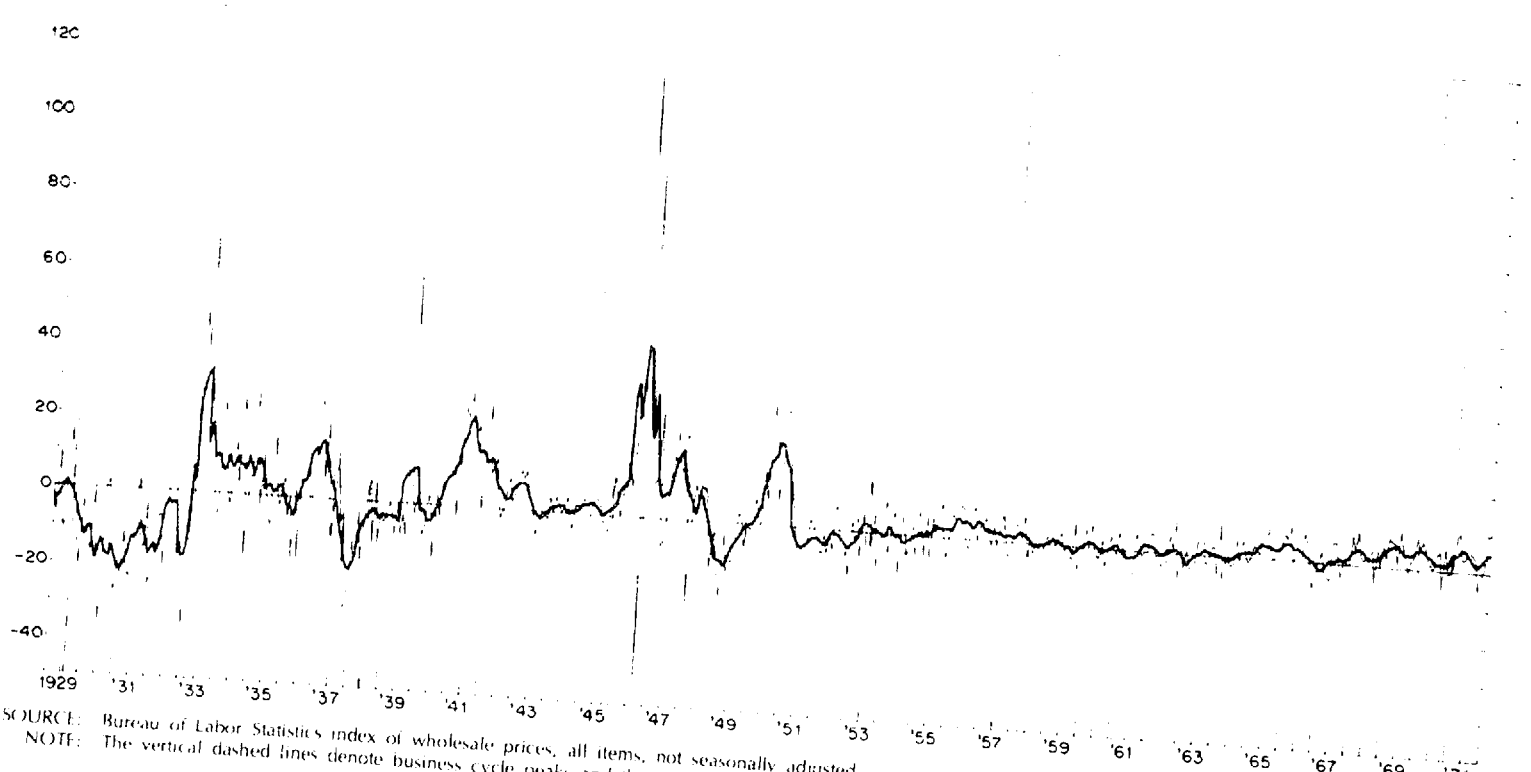


CHART 1 (concluded)



SOURCE: Bureau of Labor Statistics index of wholesale prices, all items, not seasonally adjusted.
NOTE: The vertical dashed lines denote business cycle peaks and the vertical solid lines are troughs.

Possible Bias in Aggregate Indexes

Although the decline in measured price changes has been widely discussed, its statistical basis deserves reexamination. Because we want to distinguish broad changes in market behavior from changes in statistical composition of the data, there are several difficulties in relying exclusively on the aggregate indexes. They are disproportionately influenced by certain product groups, and the composition and weighting have shifted over time toward the less volatile prices of manufactured goods. Although the index of finished goods in Table A shows the same change in cyclical behavior as that for basic materials and intermediate goods, the composition of each of these subindexes has also shifted over time; the substitution of new series for old and increases in the total number have given more weight to the highly fabricated products which characteristically exhibit less price fluctuation. A 1952 revision of the index reduced the recession rate of decline for intermediate and finished goods, though not for basic materials, as is shown by the overlap in Table A.

A study by McAllister[3] found that an increase in the index from 550 to 784 items in 1931 produced an average reduction in amplitude of 15 per cent for cyclical movements in the period of overlap, 1926–31. For an increase from about 900 to 1,900 items in 1952, the average reduction in amplitude was 21 per cent for the period of overlap, 1947–51. (These amplitudes are based on cyclical highs and lows in the index rather than the change from the peak to the trough dates of business cycles as in Table 1, but they should be indicative of the effect of the revisions on the Table 1 amplitudes.) The 1931 and 1952 revisions encompass most of the enlargement from about 530 items in the early 1920's to about 2,100 by 1960.[4] Their combined effect on cyclical amplitude was to reduce it by one-third ($.85 \times .79 = .67$). The actual reduction in amplitude, as Table 1 shows, was much greater than this.

McAllister's tables indicate that nearly all the reduction after the first revision was due to the reduced amplitude of the finished goods index. For the later revision, the 1945–49 overlap in Table A shows that all the reduction occurred in the components for intermediate and finished goods; the amplitude of the materials component actually rose. These reductions appear to reflect the addition of less volatile prices. Simply adding more items, once the number already exceeds a few hundred, would not reduce the amplitude much further.[5]

To avoid the problem of changing coverage and weighting, the present study analyzes frequency distributions of price changes for the same products. Section II presents distributions of subindexes of wholesale prices for which the coverage of products has continued from the 1920's to 1970 without major change. They make up most of the aggregate index in the

1920's but only half by weight in the 1960's. These subindexes allow us to compare the behavior of the same price series in the two mild recessions of the 1920's with the five after World War II. (The dates are those shown in Table 1.) The 1930's and World War II are omitted as not being comparable with the mild postwar cycles. Section III analyzes frequency distributions of the prices of 1,100 individual products which have no gaps or major changes in specification from 1947 to 1970. Section IV utilizes the Stigler-Kindahl data on prices collected from buyers in order to determine whether and to what extent BLS reports from sellers are biased. These sections are designed to identify and circumvent possible bias in the cyclical behavior of the aggregate indexes.

Possible Explanations of the Reduction in Cyclical Amplitude

As a first step toward explanation of the changes in price behavior, Section V analyzes prices according to three characteristics of products and markets: the degree of processing and durability of products, the fraction of value added in production, and the market concentration of firms. These three were chosen because they are relevant to various theories of price behavior and also because the necessary data are available. Durable products are held in inventory, high value added reflects a preponderance of wage costs, and high market concentration can lead to tacit collusion or strategies on pricing. All of these are thought to make prices less subject to shifts in demand and less variable. It is conceivable that the effects on prices of wages and concentration have intensified over the postwar period to produce the observed decline in the response of prices to recessions. A grouping of prices by the degree to which they are subject to each of these characteristics helps to determine the importance of such influences.

Section VI summarizes and interprets the findings. An important question about changes in price behavior is the effect of inflationary anticipations compared with the effect of developments in the structure of product markets. Anticipations have presumably been influenced by the postwar policy commitment to maintain full employment and might be important to actual price behavior insofar as they heightened uncertainty over the trend of prices or otherwise made prices less responsive to short-run fluctuations in demand. On the other hand, it is not clear how various structural changes might affect price behavior. The evidence here shows certain differences in behavior based on durability of product, market concentration, and fraction of value added in production. Except for differences between raw materials and other manufacturing products, none of these accounted for the declining response of prices to recessions. The distributions of price changes for the same set of products, which avoids any

effects of a changing mix, show the declining response to occur broadly throughout manufacturing. Although no evidence on anticipations is presented, their effect on prices would be broad and would be consistent with these results.

[II] COMPARISON OF POST-WORLD WAR II WITH THE 1920's

Does the long-run decline in cyclical amplitude from the 1920's to post-World War II pertain to most of the individual price series or is it largely a reflection of changes in the composition of the aggregate indexes? It is desirable to examine indexes which have had little change in coverage. Price series from the 1920's to 1970 are available without breaks for only a small number of individual products, but many continuous series exist for groups of essentially the same closely related products. There are 48 major component series of the wholesale price index which are available from 1926 to 1970, and 44 of these can be extended back to 1923. The 48 series make up 93 per cent by weight of the 1926 aggregate index though only 50 per cent of the 1970 index. (The 44 series make up 92 per cent of the 1924 index.) These are mostly the second-level price indexes in BLS coding which are just below the first level of industry aggregates, though some available third-level series were substituted where the corresponding second-level index began too late and did not cover the full period. The 48 series are identified in Appendix Table B.

The components and internal weighting of these series have changed over the years, of course, but the products covered by them have remained largely the same, except perhaps for a few of the more highly fabricated manufactures. These series necessarily exclude groups which have undergone major product changes, such as machinery (though agricultural equipment is included), and groups which are entirely new since the 1920's, such as most chemicals and electrical equipment. Manufactured goods are included for some groups which have remained essentially the same in functional purpose, such as automobiles, household furniture, and footwear, though the specifications of their individual components have changed over time. These changes in specification do not greatly affect the rates of price change within a single business cycle, but over a longer period such changes may reflect developments in the product which alter price behavior. So far as these series are concerned, such developments cannot be distinguished from the changes in coverage which accompany them. Nevertheless, these 48 series, though of restricted importance in the later period, avoid much of the composition and weighting bias of the

aggregate index. (In Section III, which deals with individual product prices, it was feasible to cover only the post-World War II cycles.)

To determine the range and pattern of price changes among these series, we may plot frequency distributions rather than construct an aggregate index. The average level of each series was calculated for the three months surrounding the peaks and troughs of seven National Bureau reference cycles, the two mild ones in the 1920's and the five since World War II. The rate of change (compounded continuously) from peak to trough of each cycle was calculated for every series.[5] These series have not been seasonally adjusted, which produces distortion mainly for the highly seasonal farm prices in recessions of length other than 12 months (all but 1970). All the rates for each recession were classified as being in one of 14 intervals from −20 to 10 per cent per year; the width of each interior interval is 2½ percentage points and the two extreme classes are open-ended. Zero was made the beginning of the first positive interval in order to distinguish price declines from no change. (The plotted frequencies are the percentage of rates up to but not including the rates shown on the horizontal axis.)

The results are presented in two sets of distributions for the seven recessions: one in Chart 2 of the rates of change in recessions; and the other in Chart 3 of the rates for recessions in relation to expansions, that is, the recession rate for each series minus its preceding expansion rate.

Rates of Change in Recessions

Chart 2 shows that the distributions shift in successive recessions toward smaller negative and larger positive rates of change, except the distribution for 1949 which lies to the left of most of the 1927 distribution and of the upper half of the 1924 distribution. In the 1949 recession, prices declined from the inflated levels carried over from wartime, so that this episode may not represent typical peacetime behavior.

The distributions for 1927, 1949, and 1970 have similar shapes and differ mainly in horizontal position. Compared with these three, the dispersion of price changes is much greater for 1924, as indicated by its flatness, and much less for the three recessions from 1954 to 1961, as indicated by their steepness. Dispersion is discussed further later.

The successive rightward shifts of the distributions except for 1949 are summarized by various measures of the average price change in Table 2. The two constant-weight mean rates differ from the rate of change of the aggregate index in the last column, reproduced here from Table 1, not only in coverage but also in the method of calculation. Here the rates of change of each component are averaged, whereas for the aggregate index

CHARTS 2 & 3 Cumulative Frequency Distributions of Rates of Change of Wholesale Prices in Seven Business Recessions, 1920's and Post-World War II

Chart 2
Recession Rates

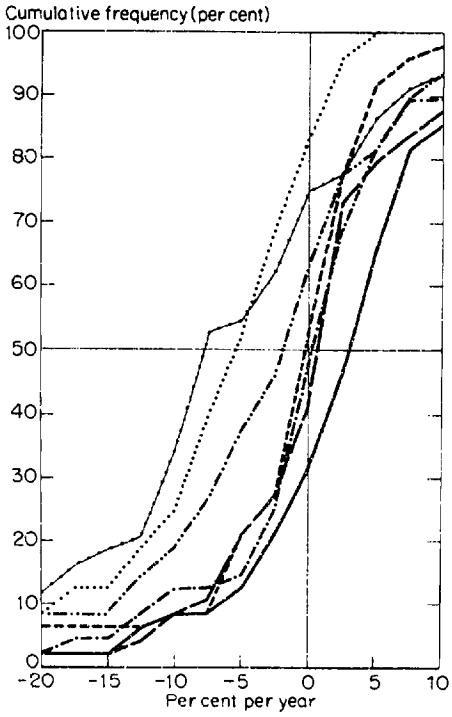
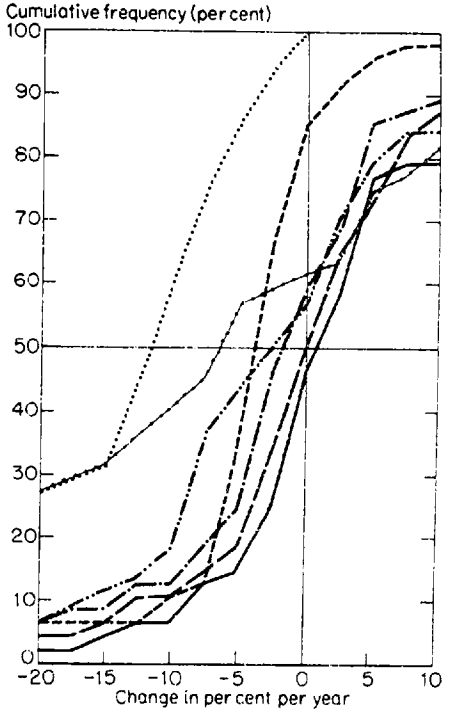
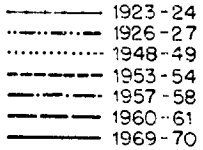


Chart 3
Recession Rates
Minus Preceding Expansion Rates





SOURCE: See Appendix Table B.

TABLE 2 Mean and Median of the Rates of Change of 48 Subindexes of Wholesale Prices in Seven Mild Recessions (per cent per year)

Recession	Median	Mean			Rate of Change of Aggregate Index
		Unweighted	Weights of 1926[a]	Weights of 1970[b]	
1923–24[c]	−7.8	−6.3	−3.8	n.c.[d]	−5.3
1926–27	−1.9	−2.2	−3.0	−4.2	−2.6
1948–49	−5.4	−7.8	−8.6	−8.6	−7.1
1953–54	−0.2	−1.5	−1.5	−1.0	0.0
1957–58	0.2	0.4	2.0	1.7	1.7
1960–61	0.7	0.7	−0.0	0.3	0.3
1969–70	3.1	3.0	3.7	2.2	2.6

[a]By 1926 weights the 48 subindexes cover 93.1 per cent of the total index.
[b]By 1970 weights the 48 subindexes cover 50.5 per cent of the total index.
[c]Forty-four series only, which cover 92.0 per cent by 1924 weights and 92.8 per cent by 1926 weights.
[d]n.c. indicates not computed.

the rate of change is calculated after the levels of the component series have been averaged.

These measures of price response rank the recessions generally in the same order, but the use of weights does lead to some sizable differences. For the last three recessions in particular, the weighted indexes reduce the rightward shifts shown by the unweighted mean and median. The weighted indexes rank the 1958 and 1961 recessions out of chronological order, while the median and unweighted mean show progressive rightward shifts in the postwar distributions.[7] The weights attach more importance to prices which happened to rise more in 1958. Weighted indexes are generally preferable as indicators of aggregate behavior, but they can unduly emphasize developments in a relatively small number of markets for which the value of shipments underlying the weights is very large.

Changes in Rates of Change from Expansion to Recession

To derive the distributions of Chart 3, the expansion rates for each series were calculated for the seven cycles and subtracted from the succeeding recession rates. The subtraction removes any trends in the rates of price change. The expansions ran from the trough to the peak of the business cycles, modified for four of the cycles. Calendar-year averages were used for the beginning of the two expansions in 1921 and 1924 instead of the three months surrounding the troughs because not all the needed monthly

data have been published. (The use of annual averages reduces the magnitude and probably the dispersion of the expansion rates. Also, four of the subindexes are not available before 1926, so here the 1927 as well as the 1924 distribution comprises only 44 series.) The first expansion after World War II was shortened to run from February 1947 to November 1948 in order to conform to the period used later in Section III where data before 1947 are not available. And the last expansion was started in December 1965 instead of the 1961 trough, because the inflationary second half of this unusually long phase seemed more appropriate for these purposes than the full period. Except for the two truncated phases, the difference between recession and expansion rates is equivalent to a measure of total cyclical amplitude.

All seven distributions in Chart 3 lie further to the left than their mates in Chart 2 for recession rates alone, because expansion rates are typically positive and the subtraction moves the recession rates in a negative direction. The distributions in Chart 3 are also generally flatter, indicating greater dispersion among the components.

The post-World War II distributions shift progressively to the right, as is especially apparent from the medians and percentages of declining series. These shifts, which are more prominent here than in Chart 2, are not a mechanical result of the method of computation. Even when the rates have an upward trend as was true in the 1960's, there is no arithmetical reason for the *change* in rates of change from expansions to succeeding recessions to be higher or lower than in previous cycles. Even allowing for escalating price trends, therefore, recession responses have attenuated.

[III] CHANGES SINCE WORLD WAR II

The subindexes used above are adequate to demonstrate a decline in amplitude and dispersion of price responses since the 1920's, but those data lack breadth of coverage and precision. Since they are subject to not only internal changes in weighting, which are generally minor, but also to changes in components, which may often be important, composition bias is not absent. We may obtain a more precise picture of changes in cyclical behavior since World War II by confining the analysis to individual product prices (the fifth level of the BLS code). Although few of the individual price series comprising the wholesale price index span the period from the 1920's to 1970, 1,106 run from 1947 to 1970, and an additional 32 series cover all but the 1970 recession. These 1,100-odd price series are all that the BLS publishes which have no break and pertain to the same product over the period, though even these undergo unavoid-

able minor changes from time to time in the specification of products. The coverage by industry is shown in Appendix Table C.

Magnitude of Price Responses

The cumulative frequency distributions of the rates of change in recessions of these 1,138 price series are presented in Chart 4. (Although 32 series are omitted from the 1970 distribution, this makes little difference.) As before, the series have not been seasonally adjusted. These distributions are broadly the same in shape and position as those in Chart 2, but also are smoother and provide a sharper picture of differences between the recessions. Chart 4 differs from Chart 2 mainly in the center segment of the distributions, which is steeper here—showing less dispersion—because of the inclusion of many more of the less volatile prices of manufactured goods. The middle three distributions for 1954, 1958, and 1961, which are very close together, are steeper around zero than the other two, suggesting a downward rigidity of prices in which the rates bunch at low positive rates (mainly zero). This bunching reduces the number of declining series in these three recessions to almost 30 per cent; this is discussed in Section IV.

The bunching at zero partly obscures the relative position of the distributions, though they clearly shift rightward from recession to recession. As was done for Chart 3, we may eliminate most of the zero bunching and obtain more distinctive distributions by taking the changes in rates of change from expansion to recession. This is presented in Chart 5 for the same 1,100-odd series covered by Chart 4. The expansions run from the trough to the peak with the exceptions previously used for the first and last cycles: the first runs from February 1947 to the 1948 peak because most of the series are not available earlier, and the second runs from December 1965 to the 1969 peak in order to focus on the inflationary second half of that phase. The truncation of these two phases generally increases the measured expansion rates of price change and so tends to turn the changes in rates from expansion to recession into larger negative numbers. Thus the 1949 distribution stands out even more here than in Chart 4 because its short expansion period catches the bulge in prices following the termination of World War II price controls in mid-1946 and records high rates of change and moves the distribution of changes in the rates to the left.

Chart 5 can be viewed as measuring the recession rate of each price relative to its trend, where the trend is estimated by the preceding expansion rate. (A better estimate would be the average rate of change for the three cyclical phases of preceding expansion, recession, and succeeding expansion. However, this more elaborate computation was not done.) Recessions generally work to reduce rates of price change, but the level of prices can continue rising until—if ever—the rate gradually declines to

CHARTS 4, 5 & 6 Cumulative Frequency Distributions of Rates of Change of 1,100-odd Wholesale Prices in Post-World War II Recessions

Chart 4
Recession Rates

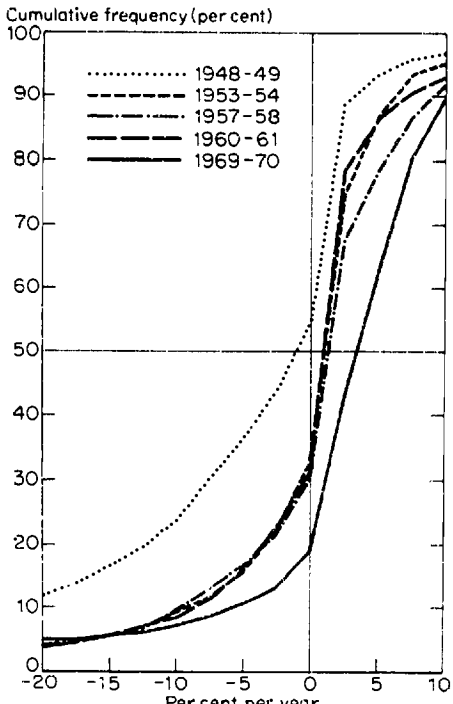


Chart 5
Recession Rates
Minus Preceding Expansion Rates

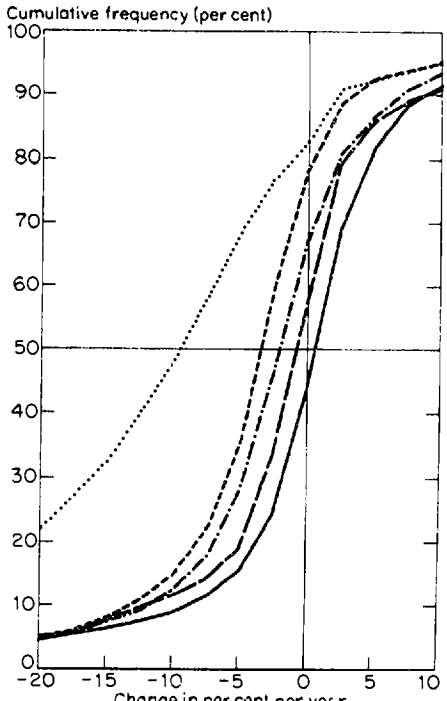
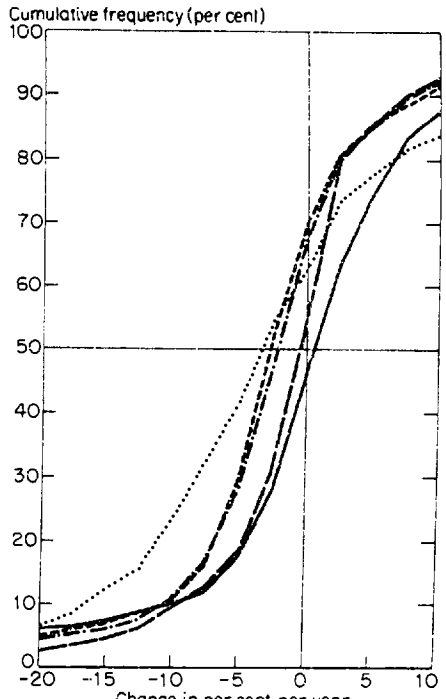


Chart 6
Rates for Eight Months Following Trough
Minus Preceding Expansion Rates



SOURCE: BLS product prices.

zero. Consequently, if a price has a high expansion rate, the ensuing recession rate may be lower but can still be a comparatively high positive rate. The postwar phenomenon of inflationary movements persisting in the face of slack markets reflects the carry-over of expansion rates, with only small reductions, on the average, into recessions.

The significant development in the postwar period is that, despite a reduction in amplitude of price expansions, inflation persisted because of a decline in the response of rates of price change to recessions. As shown in Chart 5, the responses have progressively declined fairly uniformly along the entire range of price changes except for the very large declines. By 1970 the median response of the rates to recession was slightly positive. The magnitude of the decline in responses is recorded by two measures of the distributions in Table 3. By the mean or median, the changes in the rates from expansion to recession (bottom section) became less negative or more positive in sequence from one recession to the next. The rates of change themselves (top section) also moved in a positive direction, though not entirely in sequence. The 1966-67 minirecession has been added to

TABLE 3 Mean and Median of the Distribution of Rates of Change of 1,100-odd Wholesale Prices in Post-World War II Recessions (per cent per year)

Recession	Unweighted Mean	Median
	Rates of Change in Recessions	
1948–49	−6.3	−1.0
1953–54	−0.4	1.0
1957–58	0.5	1.3
1960–61	−0.3	1.0
1969–70	2.7	3.4
	Recession Rates Minus Preceding Expansion Rates	
1948–49	−11.7	−9.5
1953–54	−4.0	−3.5
1957–58	−2.2	−2.0
1960–61	−1.1	−0.7
1969–70	0.1	0.6
1966–67	−1.3	0.2

NOTE: Expansion periods are February 1947 to November 1948, October 1949 to July 1953, August 1954 to July 1957, April 1958 to May 1960, and December 1965 to November 1969. Recession periods are given in Table 1. Dates for the 1966–67 minirecession are November 1966 to May 1967, and the preceding expansion period begins in February 1961.

Number of series is 1,138 for 1947–61, 1,106 for 1969–70, and 1,131 for 1966–67.

the bottom group to provide a further test of the chronology of the shifts in price behavior. It falls in its chronological order for the median and is only slightly out of order with 1961 for the mean.

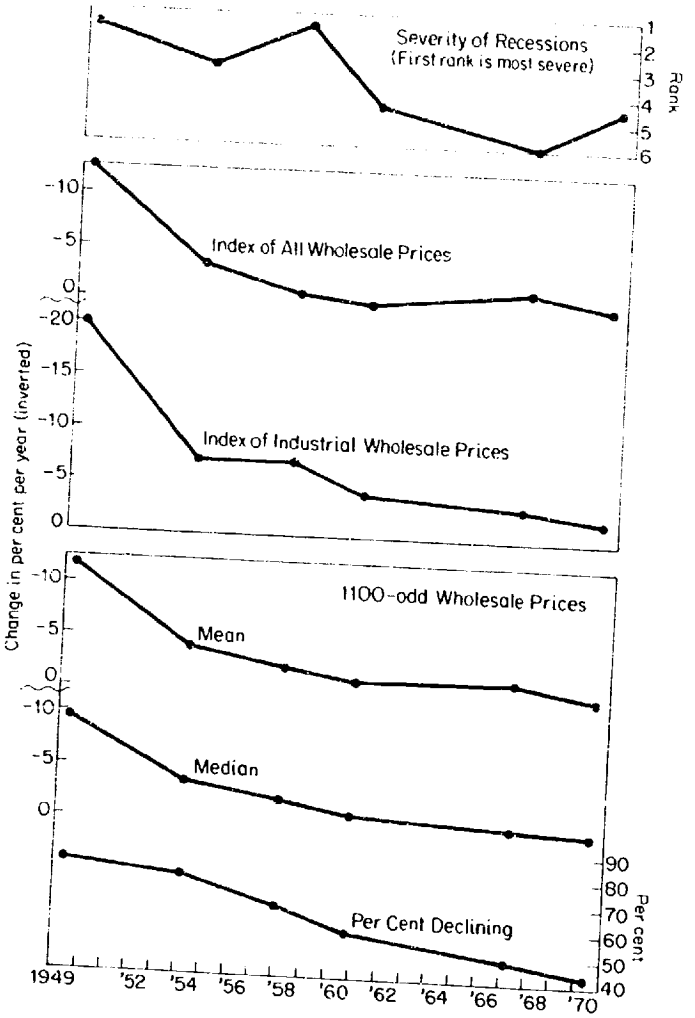
The severity of postwar business cycles has generally been decreasing in real terms, which conceivably might account for the declining response of prices. This cannot be said of the decline in response from the 1920's to the later postwar recessions, because that decline is too large to reflect the small differences in severity. But it is a possible reason for the declines following 1949. The evidence on this point has been assembled in Chart 7. Various measures of the distributions of recession-minus-expansion rates are plotted for the five postwar recessions and the 1966–67 minirecession. The chart graphs the distributional measures of Table 3 and Table 5 (presented later), the change in rate of change of the weighted aggregate index, and the change from peak to trough rates of corresponding specific cycles in the industrial component of the aggregate. A ranking of the severity of the recessions in business activity is also presented. (This ranking omits the expansions. The severity of the total amplitude of cycles in business activity including the expansions has also been diminishing, but by less.)

All the measures of price response decrease over the period as a whole, and the median and percentage of declining rates show significant decreases from each recession to the next. Here the slight overall response of prices to the 1970 recession does not appear as a new phenomenon but as simply another step in the postwar progression. By contrast, the ranks of severity do not decrease in exact sequence: 1949 and 1958 tied for most severe and 1961 and 1970 tied for next to least severe. None of the price measures follow the time pattern of the ranks. The price responses in the 1966–67 minirecession are conspicuously out of order with its severity. Based on this evidence, therefore, the diminishing response of prices appears to have occurred sequentially, due presumably to a set of institutional and expectational developments, and not due solely to the overall reduction in severity of recessions, though it no doubt contributed.[8]

It also appears that the degree of inflation in the expansion is not crucial either, because the 1958 distribution in Chart 5 followed upon a more inflationary expansion than did the 1961 distribution which is farther to the right.

Since the response of prices to recessions has progressively diminished, it is natural to ask whether the time lag of the response has lengthened. To provide an answer we may examine the distribution of price changes for the eight months following each trough. This span was selected because it terminates the first cycle in June 1950 as prices erupted at the outbreak of the Korean War, and the last cycle in August 1971 as a price freeze was imposed. To allow comparison between the cycles, eight months was used

CHART 7 Severity of Post-World War II Recessions and Measures of Price Response (midpoint of recessions)



SOURCE: Rank of severity: *Annual Report* (New York: National Bureau of Economic Research, 1973), p. 18. Index of Industrial Wholesale Prices: Geoffrey H. Moore, "Price Behavior During Growth Recessions," *Perspectives on Inflation*, The Conference Board in Canada, 1974. Table 4, p. 30. Index of all wholesale prices: same as Table 1, except that expansion for first cycle is February 1947 to November 1948, for minirecession of November 1966-May 1967 is February 1961 to November 1966, and for last cycle is December 1965 to November 1969. 1,100-odd wholesale prices: Tables 3 and 5.

NOTE: Price responses show recession rates minus preceding expansion rates except for the index of industrial wholesale prices, which shows the difference between the trough and preceding peak rates of change (centered six-month averages) for specific cycles in the rate of change of the index corresponding to business cycles.

for the other recovery periods as well. To facilitate comparison with Chart 5, the rate of change of each price in the preceding expansion phase was subtracted from these rates for the eight-month period following the trough. The cumulative distributions of these rate differences are shown in the accompanying Chart 6.[9]

Although the distributions in Chart 6 are quite similar in shape to those in Chart 5, they are closer together. Compared with the recession distributions in Chart 5, there was a shift to the right in the recoveries following 1949 and 1954, almost no shift following 1958 and 1961, and a slight shift to the left following 1970. Thus, while the recoveries from the 1949 and 1954 recessions brought the usual acceleration of prices from the recession rates, the recession pressures on the rates of price change continued unabated after 1958 and 1961, and to some degree intensified after 1970. Chart 6 hints at a delay in the response of prices from the 1970 recession to the 1971 recovery period, but the shift in all these distributions relative to their positions in Chart 5 is too slight to be of any significance. The amplitude of price responses has changed far more than can be accounted for by any minor changes in the lag time.

Dispersion and Skewness of Price Responses

Along with rightward shifts, the distributions display considerably less dispersion of rates among products in the post-1949 period than in the 1920's. This was evident from the flatter distributions for the 1920's and 1949 in Charts 2 and 3. The 1924 and 1949 recessions may be atypical, to be sure, in that they brought forth large declines in some prices still inflated from wartime increases. Yet the mild recession of 1928 also elicited much larger changes in a substantial number of prices than has occurred in the post-1949 recessions. There is no doubt that large price swings have become less prevalent.

While the reduction in response and dispersion of price changes might appear to be related phenomena, the response has continued to decline and the dispersion has not. The shapes of the distributions in Charts 4 and 5 exhibit little change in dispersion after 1949, and the measure of dispersion in Table 4 confirms it. This measure is the average (absolute) deviation from the mean.[10] The dispersion for 1949 is by far the largest; the others differ very little and show no tendency to decline further. (Standard deviations, given in Table 6 and Appendix Table C, also show no trend.) Whatever the change in cyclical behavior which reduced the dispersion of price changes since the 1920's, it appears so far to have been a one-time change. As a result, the continuing decline in the response of prices following 1949 has occurred fairly uniformly in all segments of the distributions.

TABLE 4 Dispersion and Skewness of the Distribution of Rates of Change of 1,100-odd Wholesale Prices in Post-World War II Recessions (per cent per year)

Recession	Dispersion (Average Deviation from Mean)	Skewness: Mean Minus Median	Skewness: Per Cent Below Mean	Skewness: Momental[a] (per cent)
		Rates of Change in Recessions		
1948–49	10.1	−5.2	33.1	n.c.[b]
1953–54	5.6	−1.4	30.8	n.c.[b]
1957–58	6.3	−0.9	37.3	n.c.[b]
1960–61	5.6	−1.3	30.2	n.c.[b]
1969–70	6.6	−0.7	44.1	n.c.[b]
		Recession Rates Minus Preceding Expansion Rates		
1948–49	11.8	−2.2	42.5	−16
1953–54	6.2	−0.5	45.5	3
1957–58	7.3	−0.2	48.5	−23
1960–61	7.0	−0.4	46.4	−22
1969–70	6.5	−0.5	44.7	26
1966–67	6.8	−1.5	36.2	n.c.

NOTE: Dates and number of series are the same as for Table 3.
[a]The formula is

$$\frac{\Sigma(x-\bar{x})^3}{n} \Big/ 2\left[\frac{\Sigma(x-\bar{x})^2}{n}\right]^{\frac{3}{2}}.$$

[b]n.c. indicates not computed.

Table 4 also presents measures of skewness which give a picture of somewhat erratic shifts but no trend. The distributions are all skewed to the left—the means are less than the medians. This implies that the size of changes below the mean was larger on balance than the size of changes above the mean, as we might expect in recessions. (The measure of momental skewness is positive for 1954 and 1970, however, indicating that the extreme changes above the mean outweighed the extreme changes below the mean. The use of the third power in this measure puts great weight on very large deviations from the mean.)

Judging by the difference between the mean and median, the skewness was high in 1949 but was about the same in the subsequent recessions, particularly for the recession-minus-expansion rates. (The larger leftward skewness for the 1967 minirecession is a surprising exception which, since its dispersion was not out of line with the other recessions, means that a relatively small number of prices had unusually large declines in rates of change from expansion to recession.) The lack of trend in the skewness for

the recessions after 1949 is another indication, along with unchanged dispersion, that the decline in response of price changes does not reflect major shifts in the distribution of price changes across the economy.

[IV] THE BUNCHING OF PRICE CHANGES IN THE MIDDLE OF THE DISTRIBUTIONS

Two related characteristics of the distributions of price changes deserve closer examination. First, the rates of change during recessions bunch at zero, as noted, indicating a tendency for a large number of prices to remain unchanged. This has been discussed in the literature as downward rigidity of prices and has been attributed to a statistical bias in the BLS indexes due to a failure to catch market discounting and shading of prices or, alternatively, to a tendency of prices *in fact* not to decline in slack markets due to the rigidity of so-called "administered" prices.[11]

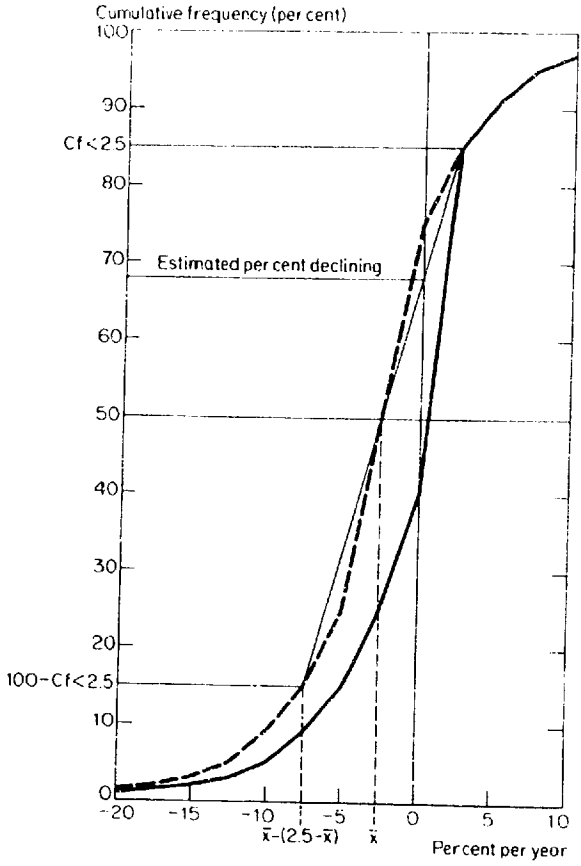
The distributions for recession-minus-expansion rates do not exhibit this characteristic to the same degree when the trend of prices is significantly upward, since firms can reduce the rate of price increase without reducing the absolute level. But the changes in rates do exhibit a related characteristic of bunching at the mean, which is measured by a high kurtosis. This reflects a tendency of prices to change at the same rate during recessions as during the preceding expansion and is symmetrical between increases and decreases, in contrast to downward rigidity in which the level of many prices does not fall. Downward rigidity does not preclude a reduction in a positive rate of change, and therefore the two phenomena, though producing similar statistical distributions, appear to have different economic explanations.

The Bunching of Recession Rates at Zero

Bunching at zero was noted in Charts 2 and 4. It is indicated there by the jump in the cumulative frequency in the 0 to 2½ interval, which is plotted at 2½. Tabulations not shown indicate that most of the bunching represents zero price changes. Since many prices change infrequently, a short recession would register more zero changes than would a long recession. The recessions studied here vary from 9 to 14 months, not enough variation to make a great difference.

A small percentage of declining series is sometimes taken to indicate such bunching, but the unrelated rightward shifts in the distributions can account for the reduction in the percentage declining. Another possible indication of bunching is leftward skewness—as measured by the mean

FIGURE 1 Hypothetical Distributions of Rates of Price Change Symmetrical (dotted) and Bunched at Zero (solid)



NOTE. For explanation of estimated per cent declining, see text.

minus the median—but this may result from very large rates of decline in a subgroup of volatile prices. To measure the effect on the distributions due to bunching per se, we may rely on a simple method illustrated in Figure 1 and calculated for the postwar recessions in Table 5. Bunching at zero is illustrated in Figure 1 by the solid curve relative to a symmetrical distribution (dotted).

The method is based on the assumption that a distribution without bunching would be symmetrical around the mean. The measure of bunching is the ratio of the actual percentage declining to the hypothetical percentage for a symmetrical distribution. A lower ratio indicates more bunching, and unity indicates no bunching. The hypothetical percentage is approximated by assuming that the frequency of price changes above 2½ per cent per year is unaffected by the bunching at zero. Given a symmetri-

TABLE 5 Measures of Bunching at Zero in the Distribution of Rates of Change of 1,100-odd Wholesale Prices in Post-World War II Recessions

Recessions	Per Cent Declining	Ratio of Actual to Hypothetical Per Cent Declining[a]
	Rates of Change in Recessions	
1948–49	54.3	.70
1953–54	32.4	.61
1957–58	30.5	.66
1960–61	31.2	.59
1969–70	19.0	.81
	Recession Rates Minus Preceding Expansion Rates	
1948–49	82.7	.99
1953–54	78.0	1.06
1957–58	66.9	1.04
1960–61	56.9	.97
1969–70	43.7	.89
1966–67	48.5	n.c.[b]

NOTE: Dates and number of series are the same as for Tables 3 and 4.
[a]The hypothetical per cent declining is based on a symmetrical distribution. See Figure 1 and text explanation.
[b]n.c. indicates not computed.

cal distribution, the frequency above 2½ per cent equals the frequency below a point equidistant to the left of the mean. The distribution between these two points is assumed to lie along a straight line (in that middle range the distributions with little bunching do appear to be linear), and the hypothetical percentage of declining prices is read from this line. This percentage is biased downwards, thus overstating the bunching ratio, because bunching increases the mean. Recalculation of the ratio with an adjusted mean to correct for this bias indicates that this overstatement of the ratio is minor. (The corrected ratio for 1961 is reduced from .59 to .54.)

By this measure of bunching, the ratio was largest for the recession rates in 1961, which had only 59 per cent of the hypothetical number of declining prices, and almost as large in 1954 and 1958. The bunching was somewhat less in 1948 because so many prices declined sharply in that recession, and it was considerably less in 1970 because the hypothetical percentage declining was small.

The phenomenon of price changes bunching at zero has received wide attention. It has been attributed to the rigidity of "administered" prices, which allegedly do not respond to short-run shifts in demand. Chart 4 demonstrated its prevalence in postwar recessions. Could it be simply a

statistical artifact of the data? For prices fixed by contract, for example, no change occurs until they are reset (assuming no prearranged escalation). It is not clear how many of the BLS series reflect contract prices. Even for noncontract prices, the BLS compiles reports from sellers who may fail to report (though requested to do so) the unannounced discounting and shading of prices often made in actual transactions.

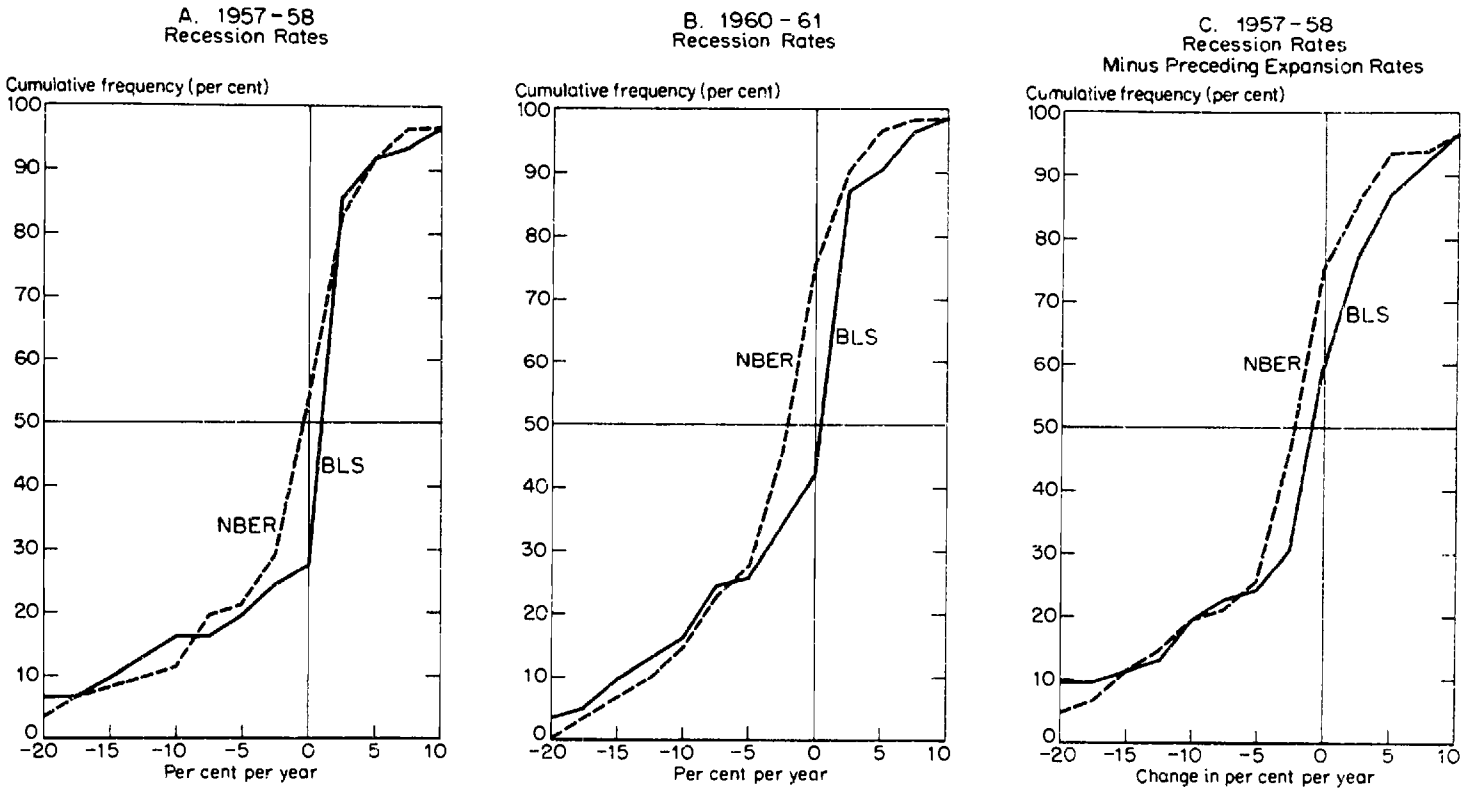
We may analyze this omission with the aid of the National Bureau collection of prices compiled from buyers, largely of products for which "administered pricing" was likely to be strong.[12] These data cover the 1958 and 1961 recessions only. Chart 8 presents three sets of cumulative frequency distributions of 62 National Bureau price groupings compiled by Stigler and Kindahl and the corresponding BLS indexes. Two panels show the 1958 and 1961 recession rates, and the third panel shows recession-minus-expansion rates for 1961.

It is apparent that the BLS series underreport price decreases, mainly small ones. The paired distributions are fairly close except between −5 and 2½ or 5 per cent per year. It is clear from the underlying data not shown here that the main exception occurs at zero. This result presumably reflects a tendency of the quoted or list prices reported to the BLS to omit market shading when no change in the list price has occurred, but to include them when the market strays too far from the list price and the list is changed. Thus the paired price series display the same cyclical behavior overall, as is indicated by a correlation coefficient between the two sets of price changes for 1958 of .81. (This correlation was not computed for 1961, but it would give similar results.)

The rightmost panel of the chart which shows changes in the rates of price change reveals similar differences between these two sets of data. Although such changes in rates of change usually do not bunch at zero, the expansion rates for this cycle were fairly small and partially replicate the results for recession rates alone.

There may be other reasons, to be sure, for the difference between these two sources of price data. The NBER data involve some interpolation of price observations, which spreads a change occurring in one month over the intervening months back to the previous observation. This makes less difference for the 9 to 12 month recession periods used here, however, than for individual months. Also, buyers who shift to lower-priced sellers when prices rise would report a price decline even though many sellers reported an increase. This causes the NBER data based on buyers to show price changes below those of the BLS indexes. On the other hand, the BLS apparently does not list contract prices except in the month they are set, while Stigler-Kindahl list them in all months of the contract period as having no change. These differences in buyer and seller reports are difficult to evaluate, but the tentative conclusion seems valid that the greater zero

CHART 8 **Cumulative Frequency Distributions of Rates of Change of 62 NBER Buyers' Prices Indexes and Corresponding BLS Indexes in Two Recessions**



SOURCE: George Stigler and James Kindahl, *The Behavior of Industrial Prices* (New York: National Bureau of Economic Research, 1970), Appendix C.

bunching in the BLS series mainly reflects the omission of market discounting from list prices.

If we take the difference in bunching between the BLS and NBER data in Chart 8 at face value, the percentage of declining series reported in Table 5 can be adjusted for artificial bunching. The adjustment[13] raises the percentage of declining series from 30.5 to 40.2 for 1958 and from 31.2 to 48.9 for 1961. The ratio of these adjusted figures to the hypothetical percentage declining in Table 5 is raised from .66 to .87 for 1958 and from .59 to .92 for 1961. The adjustment therefore accounts for a substantial part of the bunching, though apparently not all. The downward rigidity of wholesale prices, though not entirely a statistical artifact of list instead of transaction prices, is certainly minor. The persistence of inflation since World War II is not, therefore, characterized by downward rigidity so much as a general tendency of prices in the whole range of rates of change to respond progressively less and less to recessions.

The Bunching of Recession-minus-Expansion Rates at the Mean

The distributions of the recession-minus-expansion rates display the related phenomenon of extremely high kurtosis—that is, compared with the standard normal distribution, they are denser around the mean and extended in the tails. Table 6 gives the sample kurtosis and standard deviation for these distributions in the postwar recessions. The kurtosis (a pure number) is many times the size expected from a normal population, which is 3. A high kurtosis has been noted elsewhere as characteristic of distributions of price changes.[14] More than most other economic variables, changes in prices are

TABLE 6 Kurtosis and Standard Deviation of Distributions of Rates of Change of Wholesale Prices, Post-World War II Recessions (recession rates minus preceding expansion rates)

	1948–49	1953–54	1957–58	1960–61	1969–70
Kurtosis	8.9	16.8	25.8	12.9	16.4
Standard deviation (per cent per year)	17.5	11.4	13.9	12.9	11.9

NOTE: Computed from rates of change of prices covered in Chart 5. Kurtosis is defined as the fourth moment divided by the square of the variance,

$$\frac{\Sigma(x-\bar{x})^4}{n} \Big/ \left[\frac{\Sigma(x-\bar{x})^2}{n}\right]^2.$$

abnormally clustered at a modal value (usually zero) relative to their total dispersion.

One common example is the sequence of price changes over time in commodity markets, in which daily price changes are usually small but infrequently interspersed with very large changes.[15] Such a sequence is not pertinent here to price changes among products over the same period of time, however. Individual product prices deviate from the mean rate of price change because of a large number of influences, and we might at first expect the combined effect to follow a normal frequency distribution. However, the central limit theorem for a normal distribution assumes that the probability distributions of the contributing influences do not differ too greatly, and this is not likely here. Basic commodity prices are typically more volatile than the prices of highly fabricated products, because of differences in the operation of their respective markets. Even aside from such characteristic differences among prices, the deflationary pressures of a recession can hit different sectors with varying severity and speed.

Table 6 shows considerable variation in kurtosis over the period. The kurtosis of the 1949 distribution is the lowest and its standard deviation the highest, because the price changes are widely dispersed. This is evident from examination of the histogram of its price changes (not shown). The 1954 and 1970 distributions have practically equal values in Table 6, indicating that the fundamental determinants of the distributions had no trend over this period. Relative to these two, the 1958 distribution has a high kurtosis and standard deviation because of a greater number of very large values out in the tails, and the 1961 kurtosis is low because the distribution is less peaked.

As an analytical explanation of these high values of kurtosis, we may describe price changes in a recession as generated by a set of normal distributions whose variances are not the same for each price. The variance of the normal distribution from which each price change is drawn reflects the degree of volatility and deflationary pressures among prices. Then the kurtosis of the resulting distribution of price changes depends upon the ratio of the variance to the mean (squared) of a generating distribution which determines the variance of the normal distributions.[16] The resulting distribution of price changes has a kurtosis necessarily greater than the 3 of a normal distribution.

In these terms a change in kurtosis reflects a change in the aforementioned generating distribution. An increase in the ratio of its variance to its mean raises the kurtosis of the resulting distribution of price changes. On certain assumptions an increase in uniformity of price anticipations among firms would decrease the mean but not the variance of the generating distribution, and hence would increase the ratio of variance to the mean and also increase the kurtosis. Since kurtosis has not been increasing over

the inflationary postwar period, we might at first conclude that the anticipated rate of inflation, even though it rose, did not become more uniform. As is shown in the Appendix, however, the effect of a greater uniformity of price anticipations on the kurtosis is very slight, and an inference about their uniformity from the kurtosis of these distributions cannot be drawn.

[V] PRICES GROUPED BY DURABILITY, VALUE ADDED, AND CONCENTRATION

To what extent does the reduced response of prices in successive business recessions following 1949 reflect the behavior of particular groups of prices? The answer will help identify which of various possible influences may underlie this development. Three classifications of prices were selected for examination. They pertain to the durability of the product, the ratio of value added in production to shipments, and the concentration of firms in the industry. The classification by durability follows the fourfold BLS grouping of wholesale prices as of 1967 into durable and nondurable manufactures, and durable and nondurable raw or slightly processed goods. While the durable nonmanufactures comprise very few series in our sample and have been omitted, the other three groups are large enough to allow comparison of the frequency distributions of their prices. Value added and concentration can be derived from the BLS assignment of each wholesale product price to a five-digit SIC industry, for which the 1963 census of manufactures provides data on value added and shipments[17] and concentration.[18] These data are not published for every five-digit industry, so that some manufacturing prices had to be omitted from these distributions in addition to the exclusion of all nonmanufacturing prices (farming and mining). However, to minimize exclusions, value added and shipments for unavailable five-digit product codes were approximated by the corresponding four-digit code where the five-digit product was the only one in the four-digit group, though this inadvertently incorporates other miscellaneous products of the four-digit industry. Individual price series were classified according to these ratios into low, middle, or high ratios of value added to shipments and similarly for concentration.[19] Since these two classifications are based on 1963 data, they are less appropriate for other years, but these characteristics of the products and the industries are not likely to have changed greatly even over the two decades from 1948 to 1970; the task of reclassifying the prices using other survey years was not deemed worthwhile.

Although these classifications are quite different in concept, they may in fact overlap for many prices. Such interdependence of characteristics

makes identification of influences on price behavior difficult. Still, with the large number of prices in our sample, there is sufficient diversification to allow some indication of differences in behavior.

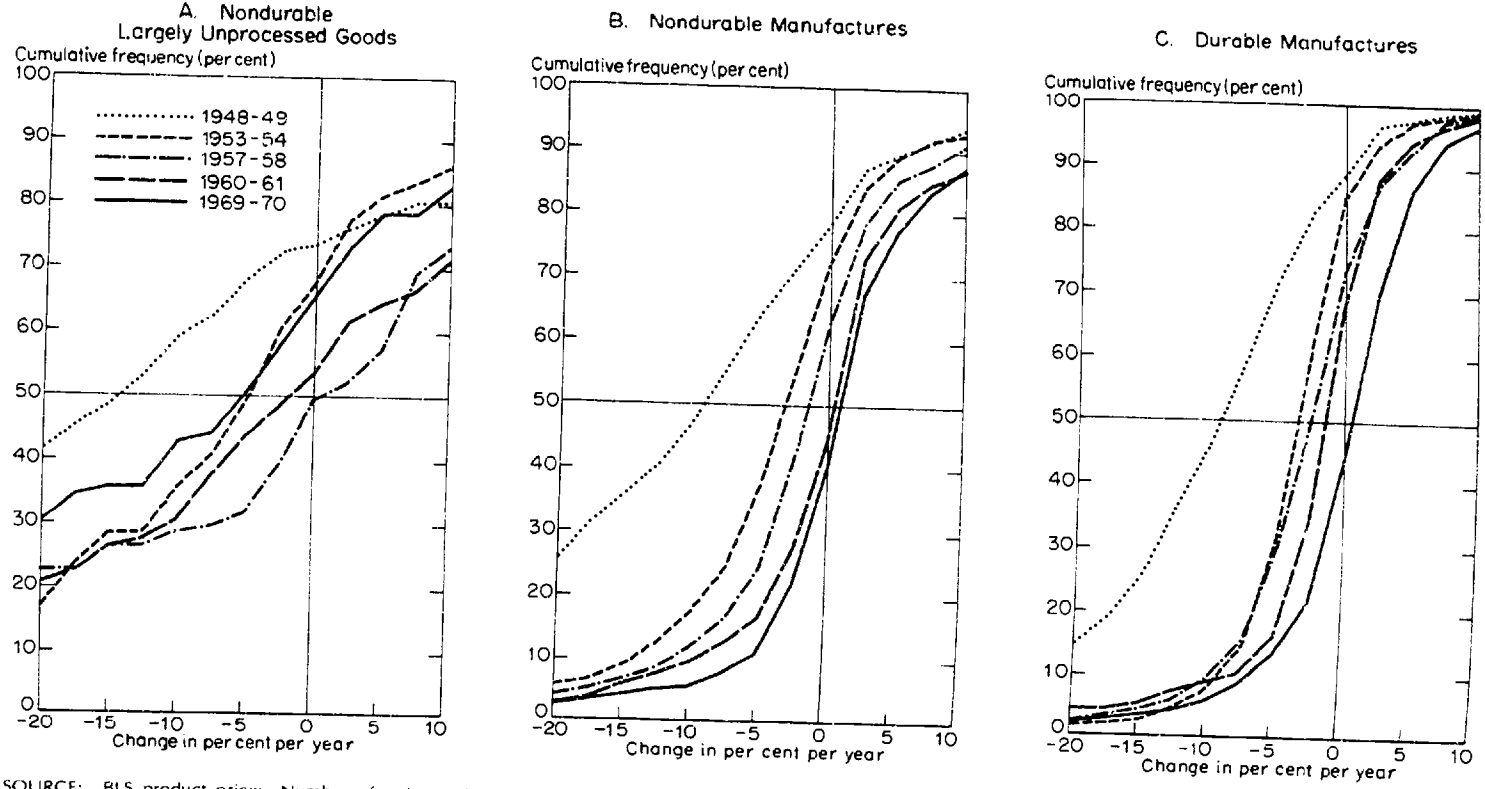
Charts 9, 10, and 11 present cumulative frequency distributions for all the previous 1,100-odd product prices except those omitted from these classifications for the reasons noted.

Prices Classified by Degree of Processing and Durability of Product

The group of largely unprocessed goods isolates the raw materials, which characteristically undergo large price fluctuations. The raw materials aside, the durability of manufactured goods affects their price behavior because of differences between the rate of use and of purchase. Most durable finished goods have variable use lives, and replacement can be postponed. (The converse is not invariably true, of course, since users of some nonessential nondurables can also do without for temporary periods.) This classification also corresponds to degree of perishability, which determines the feasibility of sizable inventories. Inventories absorb short-run changes in demand and also dampen price fluctuations. Unfortunately, Chart 9 corresponds to this classification only roughly. The durable manufactures are not all finished goods, and the demand for some of them may remain steady to maintain production schedules of nondurable products for which they are inputs. Furthermore, apart from perishable basic foods, the nondurable group includes textiles, leather, paper, petroleum, chemicals, and other such products classified as nondurable but regularly held in inventory. No attempt was made to alter the BLS classification for present purposes. Nevertheless, the classification helps to show whether the durability of products is related to the changes in cyclical behavior of prices.

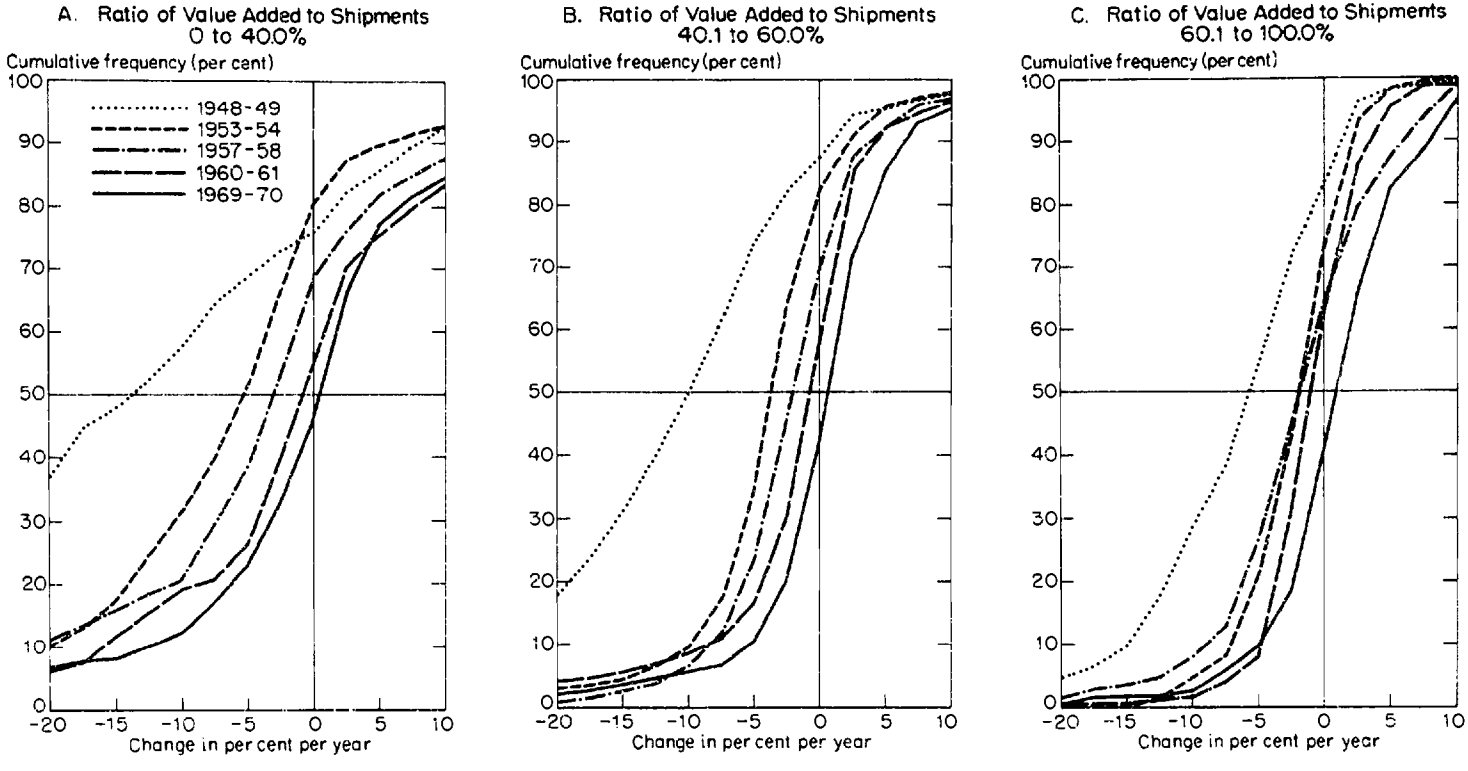
Chart 9 reveals a sharp difference between the largely unprocessed nondurable goods and the two manufacturing groups. As expected, the distributions of the former are much flatter, indicating considerable dispersion of price responses to the recessions. The smaller number of series covered by this group (about one-fifth of the other two) makes these distributions more jagged but would not ordinarily affect their slope or median. The strong dependence of these prices on short-run market conditions apparently is the reason why these distributions do not shift progressively rightward for each recession, as do those for the two manufacturing groups and for the combined distributions in Chart 5. Indeed, the distribution for 1970 in Chart 9A is further to the left than that for 1958. In the 1970 recession basic commodity prices declined as usual, while in 1956–57 they weakened during the final stages of the business expansion and began to recover in the 1958 recession before it ended.

CHART 9 **Cumulative Frequency Distributions of Rates of Change of Wholesale Prices Grouped by Durability of Product and Stage of Processing in Post-World War II Recessions (recession rates minus preceding expansion rates)**



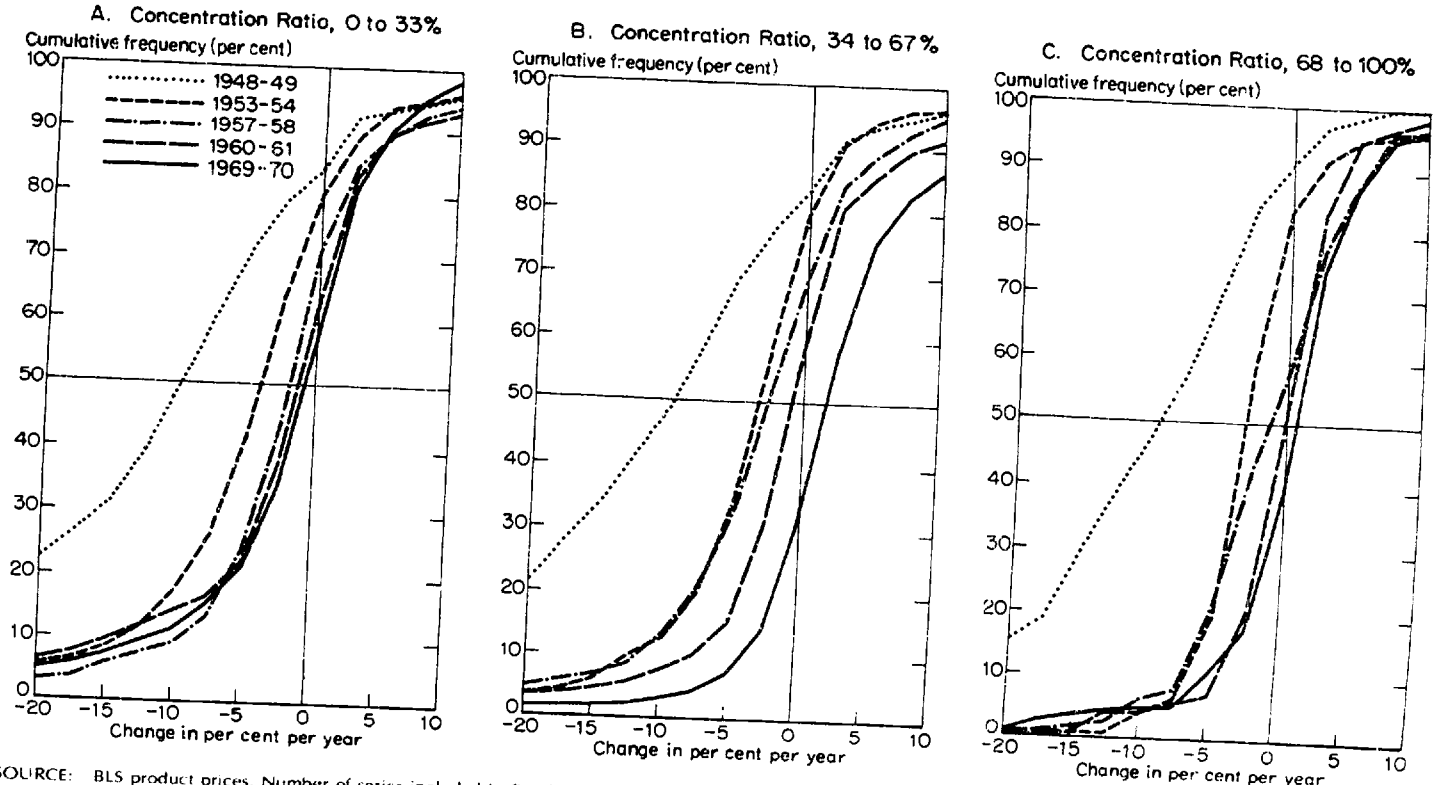
SOURCE: BLS product prices. Number of series included in first four and last cycles is, respectively, in A, 101 and 93; in B, 495 and 485; and in C, 535 and 524.

CHART 10 Cumulative Frequency Distributions of Rates of Change of Wholesale Manufacturing Prices Grouped by Ratio of Value Added to Shipments, Post-World War II Recessions (recession rates minus preceding expansion rates)



SOURCE: BLS product prices. Number of series included in first four and last cycles, respectively, is in A, 208 and 200; in B, 552 and 540, and in C, 174 and 173.

CHART 11 **Cumulative Frequency Distributions of Rates of Change of Wholesale Manufacturing Prices Grouped by Concentration Ratio of Producers, Post-World War II Recessions (recession rates minus preceding expansion rates)**



SOURCE: BLS product prices. Number of series included in first four and last cycles, respectively, is in A, 376 and 366; in B, 482 and 474; and in C, 126 and 123

The distributions for the two manufacturing groups (Charts 9B and 9C) are surprisingly similar, though as expected the durables exhibit somewhat less price dispersion. Both sets show successive rightward shifts from one recession to the next, but less for the durables than the nondurables except in 1970. Apart from the raw materials, therefore, the rightward shifts in successive recessions do not differ by durability and by inference are not related to inventories.

Prices Classified by Ratio of Value Added to Shipments

A higher value-added ratio means that materials and fuels are less important in the cost of production, and wages and salaries, which are less responsive to short-run shifts in demand, play the main role. Of course, labor costs are a component of materials too, but the proportion is generally lower than for manufactures. A higher ratio gives less importance to volatile prices of raw materials, and this explains why price dispersion declines as the ratio increases. The average ratios in the three groups are 28, 50, and 66 per cent, respectively, and the dispersion roughly declines commensurately between the first two groups, though by less between the second two (see Table 7).

For each recession the medians of the distributions for each higher group of ratios tend to move rightward, though much less so for the later than the earlier recessions. Also, the distributions for the higher ratios cluster more around zero and exhibit a response to recession which is smaller over-all and changes less over the postwar period.

Taken all together, these results support the view that the inflexibility of wage rates (due to custom as well as union bargaining) contributes to the lack of responsiveness of prices to recessions, whereas a high dependence in production on raw materials adds to price dispersion. Yet the tendency in successive recessions for the rate of change of prices to decline less or rise more in relation to expansion rates cannot be attributed directly to labor costs. These rightward shifts are largest for those prices having the greatest dispersion and least dependence on wages. In the 1949 and 1954 recessions at the beginning of the postwar period, the high value-added group displayed the least price response, but the subsequent rightward shifts in the distributions for this group were also the smallest. The rightward shifts in the total distributions of Chart 5 reflect larger shifts by the lower value-added products. Therefore, while the well-known inflexibility of wage costs contributes to the stability of prices, wage costs do not appear to explain the general reduction in price responsiveness to recessions.

TABLE 7 Measures of the Distribution of Rates of Change of Wholesale Manufacturing Prices Grouped by Durability, Value Added, and Concentration, Post-World War II Recessions (recession rates minus preceding expansion rates in per cent per year)

Classification		Mean					Absolute Deviation from Mean				
		1948 –49	1953 –54	1957 –58	1960 –61	1969 –70	1948 –49	1953 –54	1957 –58	1960 –61	1969 –70
Durability[a]											
Nondurable Manufactures		−12.1	−3.1	−1.1	1.2	2.1	13.6	7.7	8.0	7.5	6.8
Durable Manufactures		−11.1	−4.0	−3.1	−2.8	−0.3	7.9	3.5	4.5	4.6	4.5
Ratio of Value Added to Shipments											
Interval	Average[b]										
0 –.400	.284	−16.5	−6.8	−3.3	−0.4	1.6	17.3	9.2	10.8	9.6	9.3
.401–.600	.496	−9.5	−3.8	−1.9	−2.0	0.2	9.1	4.4	4.3	5.3	4.4
.601–1.00	.661	−6.6	−2.4	−1.9	−1.0	0.7	5.5	3.0	4.8	2.7	4.0
Concentration Ratio											
0–.33	.218	−11.8	−4.2	−1.5	−2.2	−2.5	10.7	6.4	5.8	7.4	5.6
.34–.67	.484	−13.0	−4.2	−3.1	−0.5	3.3	11.9	5.3	6.3	5.7	6.0
.68–1.00	.789	−11.2	−2.7	−1.0	−0.2	0.6	7.6	3.2	4.6	3.4	3.9

[a]Not computed for nondurable unprocessed goods (Chart 9A).
[b]For 1948–61. Averages for 1970 differ slightly because of a smaller number of series.

Prices Classified by Concentration Ratio

Concentrated industries have long been linked to short-run price inflexibility, supposedly because they engage in oligopolistic price fixing or, even without overt collusion, set prices independently of short-run market conditions.[20] Quite apart from pricing by oligopolies, various arguments can be devised why firms might prefer to avoid frequent price changes, and concentration may help them to exercise that preference. Market concentration ratios, however, may be a poor measure of the control exercised over market prices. The available industry data often exclude important substitutes and so do not follow the most relevant market boundary. Furthermore, the number of dominant firms in an industry is by no means always a good index of the degree of competition. Although profits are supposed to benefit from such control over prices, various studies have found concentration to be a poor indicator of profit rates among industries.[21] Despite these doubts and limitations, however, the concentration ratio is used here to approximate the degree to which firms can set prices independently of immediate market conditions. This use follows the common notion of "administered pricing," though that concept is sometimes used differently to signify a specific strategy of pricing, such as target-return or markup pricing. As originally used by Gardner Means, administered pricing was defined by the frequency with which firms changed their prices.[22] For present purposes, however, this is not a satisfactory classification because it is not independent of the price series.

In Chart 11 the distributions for the more concentrated industries generally show less price response—they have smaller dispersion and lie closer to zero, though this observation makes no allowance for the interrelation between concentration, durability, and high value added, all of which work in the same direction. To the extent that it is justified, this observation supports the contention that in concentrated industries price adjustments to a change in sales are weaker; this presumably reflects a greater ability to set prices independently of short-run market conditions. (As indicated in Section IV, underreporting of market price shading does not appear to be important for these distributions of changes in rates of change.)

Among the three groups, the smallest rightward shifts of the distributions in successive recessions occur in the lowest concentration group. The price response of these industries, which is sharp, has not changed much over the postwar period. Yet the rightward shifts are generally no smaller in the middle than in the high concentration group, and are somewhat larger in the middle group for the 1970 recession. It is hard to see here an important role for concentration in the postwar changes in price behavior, contrary to the attention often paid to concentration. The tendency of prices to

respond less in successive recessions does not reflect the special behavior of highly concentrated industries, despite their weaker price response overall, but is a more general phenomenon.

Summary of Grouped Distributions

Certain groups of products reveal differences in the responsiveness of their prices to recessions. Table 7 provides summary measures of the distributions for durability, value added, and concentration. Larger declines in rates of price change are characteristic of low market concentration and high materials costs, and these prices exhibit greater dispersion. Such differences are borne out by product groups (see Appendix Table C), in which the farm, lumber, and leather industries with low concentration and value added exhibit these characteristics the most. Nondurable products display greater price dispersion but not in general larger declines in rates of price change.

Apart from basic commodity markets where prices closely follow short-run demand and supply conditions, wholesale prices exhibit a pervasive tendency to respond to recessions less and less over the postwar period. This tendency does not appear to be dominated by the behavior of any particular group, though it is strongest for manufactures with low value added and medium concentration.

[VI] SUMMARY AND INTERPRETATION OF FINDINGS

The failure of the aggregate index of wholesale prices to decline in the recessions of 1954 and 1958 and then again in 1961, which contrasted with the sharp declines of previous recessions, was a new phenomenon. The change in behavior was attributed at the time to the emergence of downward rigidity in prices and a tendency of producers to "administer" their prices with less regard for short-run shifts in market demand. Why did this phenomenon emerge following the 1949 recession? One explanation given was the growth of market power of firms over prices and of labor unions over wages, but it is not clear that the changes in the structure of labor and product markets implied by this explanation have been sufficient to account for the change in price behavior. Another explanation was that price setting is strongly influenced by aggregate-demand policies. The Employment Act of 1946, which had committed the government to pursue high-employment policies, was followed in the postwar years by an upward trend of prices, and the two together reinforced a belief that any deflationary pressures would be brief. Presumably that gradually dissuaded

firms from reducing prices in recessions. Given periodic cyclical expansions which increase prices, the failure of prices to undergo offsetting declines during the ensuing recessions seemed sufficient at that time to explain the upward trend of prices.[23]

The findings of this study of wholesale product prices partly modify these views. First of all, the distributions of rates of price change in recessions display a high dispersion, less than in the 1920's but still considerable and little changed in the past four recessions. The wide range of changes has long been noted.[24] It indicates the diversity of price behavior, reflecting both random variations and persistent differences in volatility between certain groups of prices. The dispersion of price changes was less in the recessions following 1949 in part because of greater bunching at zero, which was widely interpreted to imply a downward rigidity of prices. But such bunching results largely from a bias toward zero change in reported prices; the Stigler-Kindahl data for transaction prices in 1958 and 1961 shown in Section IV do decline moderately.

The emphasis on downward rigidity was not sufficient, in any event, to explain the continuing *rise* of most prices in 1970 when the recession had eliminated most excess demand pressures. Half of the prices in 1970 did not even rise less rapidly than in the preceding expansion. While lags in the system could be invoked to argue that prices continued rising to catch up with previous cost increases, such lags had not been equally significant in previous recessions. The new behavior required a revision of the theories.

An important revision brought in the anticipated rate of inflation as a basic determinant of price changes to which the effects of market demand and supply conditions are then added.[25] The anticipated rate supposedly depends upon anticipated trends in unit costs at standard levels of capacity utilization. Declines in demand reduce the rate of price change in relation to the anticipated rate. A high anticipated rate makes the actual rate high and, if demand subsequently declines, prices continue rising, albeit less rapidly. Rising prices in 1970 could thus be explained by anticipated rates of inflation higher than those in earlier recessions. (A theoretical formulation of such price behavior is presented in the first section of the Appendix.)

From this point of view the response of prices to recessions should be measured by a decline in rates of change below the anticipated rates. In the absence of an acceptable measure of anticipated rates, the preceding expansion rates served here as rough proxies, though admittedly they are far from perfect. The frequency distributions of changes in rates of price change from expansions to ensuing recessions indicate how prices respond to cyclical downturns. They also allow for differences in the trends of prices and are equivalent to measures of overall cyclical amplitude.

There is no doubt that this amplitude has diminished since the 1920's and has continued to diminish in successive recessions. Expansion and recession rates have both helped to reduce the cyclical amplitude, but the attenuation of recession rates has been greater. A decrease of the severity of recessions in business activity has contributed, but it does not provide a full explanation, because the severity of the five postwar recessions in real terms has not decreased chronologically. The 1966–67 minirecession was examined as an additional test case, and the size of its response to prices fell chronologically between that of the recessions of 1961 and 1970 even though in terms of business activity it was less severe than those two.

Furthermore, although the dispersion of recession price changes among products has decreased sharply between the 1920's and 1949, it has remained the same since 1949. Developments in market structure and mix which could stabilize price fluctuations would show up in the dispersion of price changes. Since dispersion has not decreased since 1949, we may conclude that the continued decline in response to recessions has occurred along the entire distribution of price changes and does not reflect any alteration in market structure which also affects dispersion (or, for that matter, skewness and kurtosis as well, which also show no trends).

Why have declines from expansions to recessions in the rates of price change progressively diminished over the postwar period? The answer cannot be that anticipated rates of inflation rose. Although that was probably true, rising anticipated rates would not account for diminishing declines in the rates of change. Part of the answer may be that a reduction has occurred in the magnitude of price responses to excess capacity because of a growing general belief that inflationary movements will not be reversed. If declines in demand growth have been brief, the price response to the next one will be less. Certainly the postwar history of government failures to curb inflation must have affected price responses significantly. In addition, a decline in demand is likely to reduce the rate of price change mainly to the extent that the rate has risen above the anticipated rate during the business expansion. Thus price increases would presumably be reversed faster in a subsequent recession if they had recently accelerated than if they had been rising at a fairly constant rate for some time, though an offset to this faster reversal is the persistence of accelerated inflation while its lagged effects on costs work through the economy. The anticipated rate of inflation at the beginning of the 1970 recession may have been closer to the actual rate than had been true at previous cyclical peaks because the rate of inflation at the end of 1969 had been about the same for a year or two. This would help explain why the average price response was so slight in 1970.

Have structural changes occurred in product markets to account for the decline in price responses? There has, for example, been a steady growth in the relative importance of highly specialized and fabricated products,

which characteristically fluctuate less in price than do raw materials. But this cannot account for the rightward shifts of the distributions, which are composed of the same set of prices. In a related classification of the prices into durable and nondurable manufactures, the latter exhibited somewhat larger rightward shifts than the former. The exception to successive shifts of the distributions is shown by prices of raw materials, which continue to exhibit their characteristic sharp and variable responses to market developments. Other classifications of prices which might be thought to reveal structural changes are the concentration of markets and the ratio of value added to shipments of producers. It is true that dispersion of price changes is lower in more concentrated markets and for firms with high value-added ratios. And the more concentrated markets exhibit fewer and smaller price declines in the recessions. But these differences between groups of prices have remained the same over the postwar period. The price response to recessions of the high value-added and concentration groups has declined the same or perhaps less than the others have. Therefore, even if they had increased in relative importance, which is not generally true, they cannot account for the general decline in price response.

The decisive influence on price response appears to have been a general adaptation of economic units to inflationary prospects rather than structural developments, in which prices respond less to short-run fluctuations in demand. Thus the change in price behavior appears to be long range and therefore not likely to change much either way within a few years. The attenuation of price responses appears to have moderated cyclical accelerations as well as decelerations of price changes about equally across industries. The problem for aggregate-demand management is that the upside moderation encourages the prolongation of expansive policies with the attendant build-up of inflationary pressures which surface later, and the downside moderation causes impatience with policy restraints. Both of these tilt the resulting trend of prices upward.

APPENDIX

THE EFFECT OF PRICE ANTICIPATIONS ON THE DISTRIBUTION OF PRICE CHANGES—A THEORETICAL ANALYSIS

This appendix develops a theoretical relationship between the kurtosis of the distribution of price changes and the uniformity of price anticipations. A smaller variability of anticipated rates of inflation will reduce the variability of the actual rates and will also, in combination with demand

influences on prices, increase the kurtosis of the distribution, though by very little. We begin by formulating the effect of excess demand and anticipations on price changes.

A Model of Price Changes

For each product we may postulate demand and supply schedules which are continually shifting upward because of inflation (and rightward because of growth in real terms). The anticipated rate of increase in the price at their intersection point is $\dot{p}^e$, which represents the anticipated rate of equilibrium price increase. The anticipated level of the demand and supply schedules is not at any time necessarily equal to the actual levels D and S. The excess quantity demanded implied by these actual schedules at the market price P is, for some point in time, D-S, and we may suppose that this helps determine $\dot{p}$, ($\equiv dP/Pdt$), given an adjustment fraction α and distributed lag function L as follows:

$$(1) \quad \dot{p} = \alpha L[D(P) - S(P)] + \dot{p}^e.$$

The lag function L accounts for the time it takes for changes in the prices of factor inputs to work through the price system. Since many manufacturing firms appear to respond to an increase in demand initially by depleting inventories or by lengthening delivery schedules or by taking steps to expand output and only later by raising prices as the upward pressure on factor prices pushes up costs, a discrepancy between demand and supply can exist for some time before selling prices are affected.

Actual prices rise along the anticipated path $\dot{p}^e$ with deviations which depend with a lag upon D-S. The anticipated path changes slowly over time, so that D-S does not remain always positive or negative but moves cyclically above and below the anticipated path.

A change in aggregate demand is reflected in the rate of change of demand $\dot{D}$ and affects excess demand D-S. $\dot{p}^e$ depends upon past rates of price change as well as information about future developments. It is unrelated to *current* excess demand D-S. A special case is for $\dot{p}^e$ to equal the anticipated rise in unit costs at a "standard" level of capacity utilization. It is possible for P to be rising even though D-S is negative. Thus a slowing of aggregate demand makes D-S negative, so that $\dot{p}$ is less than $\dot{p}^e$, and D equals S at a price lower than the current P.

Equation 1 implies corresponding adjustments in quantities to the discrepancy between D and S. Assuming there are inventories, one possibility is that dollar sales are D(P) and the value of production is S(P), so that the bracketed expression is the unplanned change in the value of inventories (ignoring planned changes and revaluations of inventory stocks due to price changes). But the actual amounts sold and produced might not be on

either schedule, though sales would be less than D. Thus D(P) is the maximum demand and S(P) the desired production, hypothetical amounts which the firm estimates through its experience in the market.

It is difficult to imagine equation 1 without the price anticipations term, for that would imply that price changes always moved according to (a lagged function of) excess demand. A moving equilibrium of rising prices would then not be possible. Yet it seems plausible that a fully anticipated inflation could occur in which excess demand at each moment was zero. In general, however, $\dot{p}$ could be above or below $\dot{p}^e$.

If the anticipated rate of inflation were below the actual rate, prices would be rising in part to reflect current, as well as to catch up to past, excess demand, the first term of equation 1. It is certainly conceivable for lagged excess demand to raise prices even though $\dot{p}$ were above $\dot{p}^e$ and there was a deficient current demand, that is, a negative D-S. Such a rise in prices greater than $\dot{p}^e$ could be described as due to the push of past cost increases not previously adjusted to.

When a higher $\dot{p}$ has persisted for a long time due to continuing excess demand, $\dot{p}^e$ becomes higher. Eventually the faster growth of demand is fully anticipated and is no longer excessive. If then the rate of growth of demand were to decline, D-S would turn negative and begin to reduce $\dot{p}$. But $\dot{p}$ does not immediately fall to a lower rate commensurate with the lower rate of growth of demand, because $\dot{p}^e$ will continue to reflect the preceding higher rate of growth and will decline slowly, as it had previously risen slowly. This is the analytical counterpart of the statement in the Summary section that an inflation rate which comes to be anticipated will resist a period of deficient demand longer than a rate which is not anticipated.

The Distribution of $\dot{p}$ Across Products

The distribution of $\dot{p}$ depends upon the distribution of excess demand and of $\dot{p}^e$. It is plausible that deviations of individual price changes from the economy-wide mean rate of change reflect myriad small influences and therefore are normally distributed. The variance of the probability distributions which generate individual price changes differs among products, however, because of characteristic differences in the volatility of prices. For a given point in time we have, for each product i,

$$(2) \quad \dot{p}_i = \alpha_i L[D_i(P_i) - S_i(P_i)] + \dot{p}^e_i.$$

By the previous assumptions the first term follows a normal distribution with some mean and a variance $\sigma_{1,i}^2$ which are different for each product, and the second term is normally distributed with some mean and a variance σ_2^2 which are the same for all products. The assumption that the

mean and variance of $\dot{p}_i^e$ are the same across products is crucial to the following argument, but it seems reasonable as a first approximation: The anticipated rate of price change for a product will depend mainly upon prospects for inflation in the economy at large and ordinarily much less upon developments in the individual sectors. Individual firms will assess these prospects differently, of course, but most of the relevent influences are the same and therefore the distribution of perceived possibilities would generally be the same.

Then $\dot{p}_i$ has a distribution subordinate to a normal probability function in which the variance of the normal function is determined by a "directing process" with mean

$$(3) \quad m = \frac{1}{n}\sum_{i}^{n}(\sigma_{1,i}^2 + \sigma_2^2) = \overline{\sigma_1^2} + \sigma_2^2,$$

and variance

$$(4) \quad s = \frac{1}{n}\sum_{i}^{n}[(\sigma_{1,i}^2 + \sigma_2^2) - m]^2 = \frac{1}{n}\sum_{i}^{n}(\sigma_{1,i}^2 - \overline{\sigma_1^2})^2.$$

The kurtosis of the subordinated normal distribution is[A1]

$$(5) \quad k = 3\left(1 + \frac{s}{m^2}\right).$$

If the uniformity across products of the anticipated rate of inflation changes, this is reflected in a smaller σ_2^2, which reduces the variability of $\dot{p}_i$ by the same amount. What happens to its kurtosis? We have $\partial m/\partial\sigma_2^2 = 1$ and $\partial s/\partial\sigma_2^2 = 0$. Therefore, from (5), the change in kurtosis with respect to a change in σ_2^2 (in percentage terms in order to abstract from the arbitrary time unit of measurement of $\dot{p}$), is

$$(6) \quad \frac{\partial k}{\partial\sigma_2^2}\left(\frac{\sigma_2^2}{k}\right) = -\frac{6s}{m^3}\frac{\sigma_2^2}{k} = \frac{-2(k-3)\sigma_2^2}{k\,m}.$$

Since these parameters are all necessarily positive, the effect on k is negative. In words, the kurtosis depends upon the variance of the "directing process" as a *percentage* of its mean squared as in (5). The variance may be high absolutely, but, if the mean is also very high, the percentage variation in the "directing process" is small. Since a reduction in σ_2^2 reduces the mean and therefore increases the variance of the "directing process" relative to the mean, the reduction increases the kurtosis.

As a rough indication of magnitude, m was 11.9^2 in 1970 and k was 16.4 (see Table 6). We do not know σ_2^2, the variance of $\dot{p}_i^e$, but it seems likely that it was much smaller than m, say at most 2^2. If so, then (5) shows k to be on the order of 4 per cent. Thus, if σ_2^2 fell by 50 per cent, k would rise only 2 per cent.

TABLE A Rate of Change of Wholesale Prices over Business Cycles By Stage of Processing, 1913–70 (per cent per year)

Reference Cycles			Basic Materials			Intermediate Goods			Finished Goods		
Trough	Peak	Trough	Expansions	Recessions	Rec. minus Exp.	Expansions	Recessions	Rec. minus Exp.	Expansions	Recessions	Rec. minus Exp.
	Jan. 1913	Dec. 1914		−0.9			−6.5			−1.3	
Dec. 1914	Aug. 1918	Mar. 1919	30.2	2.1	−28.1	34.2	−20.1	−54.2	51.2	−3.5	−54.7
Mar. 1919	Jan. 1920	July 1921	12.4	−31.6	−44.0	83.5	−38.3	−121.8	21.2	−21.5	−42.7
July 1921	May 1923	July 1924	11.6	−3.3	−15.0	20.4	−13.6	−34.0	0.8	−5.5	−6.3
July 1924	Oct. 1926	Nov. 1927	1.0	0.5	−0.6	−2.4	−4.8	−2.4	2.2	−3.6	−5.8
Nov. 1927	Aug. 1929	Mar. 1933	−0.5	−13.7	−13.2	0.1	−10.9	−11.0	−0.1	−8.7	−8.6
Mar. 1933	May 1937	June 1938	18.5	−16.9	−35.4	13.0	−13.7	−26.7	8.0	−5.6	−13.6
June 1938	Feb. 1945	Oct. 1945	9.1	1.3	−7.8	3.8	4.1	0.3	3.5	0.6	−2.9
Oct. 1945	Nov. 1948	Oct. 1949	16.0	−8.8	−24.9	21.0	−9.4	−30.4	18.0	−6.7	−24.7
				−12.7			−7.9			−4.8	
Oct. 1949	July 1953	Aug. 1954	2.1	−2.0	−4.1	5.2	−0.5	−5.7	2.7	0.3	−2.4
Aug. 1954	July 1957	Apr. 1958	0.7	1.2	0.6	3.3	0.0	−3.3	2.2	3.1	1.0
Apr. 1958	May 1960	Feb. 1961	−0.2	−1.3	−1.1	0.9	−1.5	−2.3	0.1	1.1	1.0
Feb. 1961	Nov. 1969	Nov. 1970	1.3	−0.1	−1.4	1.3	3.5	2.2	1.6	2.5	0.9
					Averages						
By Period											
6 cycles 1921–49			9.3	−8.9	−16.2	9.3	−8.1	−17.4	5.4	−4.9	−10.3
4 cycles 1949–70			0.8	−0.6	−1.5	2.7	0.4	−2.3	1.6	1.8	0.1

TABLE A (concluded)

Reference Cycles			Basic Materials			Intermediate Goods			Finished Goods		
Trough	Peak	Trough	Expansions	Recessions	Rec. minus Exp.	Expansions	Recessions	Rec. minus Exp.	Expansions	Recessions	Rec. minus Exp.
					Averages						
By Period and Similar Severity											
2 cycles 1921–27			6.3	−1.4	−7.8	9.0	−9.2	−18.2	1.5	−4.6	−6.0
2 cycles 1954–61			0.2	−0.0	−0.2	2.1	−0.8	−2.8	1.2	2.1	1.0

SOURCE: Bureau of Labor Statistics, "Wholesale Prices and Price Indexes" (issued monthly).
"Raw materials" to 1948–49 overlap and "crude materials" thereafter; "semi-manufactured goods" to overlap and "intermediate goods" thereafter; "finished products" to overlap and "finished goods" thereafter; all seasonally adjusted except finished goods since 1949.

NOTE: Method of Computation and severity of business recessions are the same as for Table 1.

TABLE B Forty-eight Subindexes Used in Charts 1 and 2

BLS Code	Subindex	1926 Weight	1970 Weight
011	Fresh and dried fruits and vegetables	2.30	1.176
012	Grains	3.62	1.198
013	Livestock	6.71	2.851
014	Poultry	.51	.255
015	Plant and animal fibers	3.88	.437
016	Fluid milk	2.87	2.081
017	Eggs	.99	.510
018	Hay, hayseeds, and oilseeds	1.13	.694
019	Other farm products (coffee, beans, tea, tobacco, and nuts)	1.17	.835
021	Cereal and bakery products	4.27	2.017
022	Processed meats, poultry, and fish	9.59	4.153
023	Dairy products	2.53	2.300
024	Processed fruits and vegetables	.63	.866
025	Sugar and confectionary products	2.44	1.268
0272	Crude vegetable oils	.45	.165
0291	Cattle feed	.43	.186
031	Cotton products	3.44	1.086
032	Wool products	2.50	.346
037	Miscellaneous textiles (jute, rope & twine)	.97	.132
041	Hides and skins	.77	.077
042	Leather	.84	.179
043	Footwear	1.77	.694
051	Coal	6.87	.700
052	Coke	.93	.092
056	Crude petroleum	3.06	.628
057	Refined petroleum products	4.48	3.459
0622	Paint materials	.65	.212
0651	Mixed fertilizers	.28	.181
0652	Fertilizer materials	.32	.211
0711	Crude rubber	.81	.201
0712	Tires and tubes	1.73	.611
081	Lumber	2.61	1.259
0911	Woodpulp	.29	.274
0913	Paper	1.08	1.314
0914	Paperboard	.34	.426
1010	Iron and steel	4.80	4.797
1020	Nonferrous metals	2.11	3.376
1050*	Plumbing fixtures and brass	0.00	.181
1110	Agricultural machinery and equipment	.21	.705
1210	Household furniture	1.21	.925
1230	Floor coverings	.46	.336
1320	Concrete ingredients	.96	.630

TABLE B (concluded)

BLS Code	Subindex	1926 Weight	1970 Weight
1360*	Asphalt roofing	0.00	.120
1391	Building lime	.04	.006
141101	Passenger cars	5.40	5.265
141102*	Motor trucks	0.00	.915
1522*	Cigars	0.00	.091
1523	Other tobacco products	.69	.063
	TOTAL WEIGHT OUT OF 100	93.14	50.484

SOURCE: 1926 weights: *Wholesale Prices 1913 to 1927*, Bureau of Labor Statistics Bulletin No. 473 (Jan. 1929), Appendix B, pp. 251–62. 1970 weights: December 1970 relative importance of "former" index (based on 1963 shipments), Bureau of Labor Statistics, *Wholesale Prices & Price Indexes for Jan. 1971* (July 1971), Table 16.

NOTE: Coding is based on 1967 revision.

*Omitted for 1924 recession in Chart 1 and also 1927 in Chart 2.

TABLE C Measures of the Frequency Distribution of Wholesale Prices by Industry in Post-World War II Recessions (recession rates minus preceding expansion rates in per cent per year)

BLS Code	Industry	No. of Series 1948–1961	No. of Series 1969–1970	Mean 1948–1949	Mean 1953–1954	Mean 1957–1958	Mean 1960–1961	Mean 1969–1970	Per Cent Declining 1948–1949	Per Cent Declining 1953–1954	Per Cent Declining 1957–1958	Per Cent Declining 1960–1961	Per Cent Declining 1969–1970	Standard Deviation 1948–1949	Standard Deviation 1953–1954	Standard Deviation 1957–1958	Standard Deviation 1960–1961	Standard Deviation 1969–1970
1	Farm prod.	70	62	−16.3	−5.3	3.6	3.1	−8.3	78.6	58.6	41.4	51.4	62.9	24.7	18.7	28.6	19.6	22.3
2	Proc. foods	110	100	−12.7	−2.2	6.6	7.7	1.9	70.0	60.0	40.0	30.0	36.0	20.0	15.3	15.2	18.5	12.8
3	Textiles	114	114	−9.2	−3.7	−2.6	−3.1	−0.7	79.8	74.6	71.1	59.6	50.9	14.3	5.0	6.0	8.7	4.6
4	Leather	36	35	−2.2	−12.1	−6.9	−12.8	−6.3	63.9	88.9	72.2	91.7	85.7	13.8	18.7	13.5	14.1	14.4
5	Fuels	33	33	−41.1	−11.7	−18.3	6.8	13.1	100.0	93.9	93.9	33.3	18.2	25.3	15.1	20.0	9.1	22.7
6	Chemicals	150	149	−9.3	−0.3	−1.6	2.0	1.8	74.0	65.3	61.3	30.0	36.2	23.6	17.6	17.9	12.9	14.8
7	Rubber	30	30	−6.4	−5.0	−7.2	−11.4	0.8	83.3	80.0	70.0	60.0	33.3	8.3	5.2	14.5	27.1	14.9
8	Lumber	57	55	−20.4	−7.2	−3.5	−11.4	−11.0	93.0	91.2	82.5	91.2	94.5	15.0	6.7	7.4	12.8	10.4
9	Paper	43	43	−13.6	−5.6	−1.1	−3.8	1.2	90.7	93.0	74.4	58.1	39.5	17.8	5.1	7.9	6.7	6.1
10	Metals	131	124	−15.6	−5.4	−6.8	−3.2	1.2	90.0	86.3	89.3	77.1	37.1	15.1	9.1	11.2	7.8	7.8
11	Machinery	242	239	−8.9	−3.2	−2.1	−1.8	1.3	90.5	83.9	64.9	66.9	32.6	8.5	4.0	5.6	6.0	4.8
12	Furniture	46	46	−8.0	−3.3	−1.4	−1.0	−0.7	84.8	84.8	73.9	65.2	60.9	5.3	2.9	4.5	2.3	3.8
13	Minerals	30	30	−7.8	−2.5	−3.2	−0.4	0.8	96.7	86.7	63.3	60.0	30.0	5.5	2.4	9.5	4.7	3.9
15	Miscellan.	46	46	−3.9	−2.4	−1.4	0.8	1.2	63.0	82.6	67.4	32.6	43.5	7.0	4.3	6.4	4.4	3.9
	All items	1138	1106	−11.7	−4.0	−2.2	−1.1	0.1	82.7	78.0	66.9	56.9	43.7	17.5	11.4	13.9	12.9	11.9

NOTES AND REFERENCES

1. The BLS index begins in 1890. The Warren-Pearson index of wholesale prices covering 1854 to 1890 (not shown) rose in the final two (1887 and 1890) of the seven recessions in that period.

   For an analysis of specific cycles in the rates of change of wholesale prices, see Geoffrey H. Moore, *The Cyclical Behavior of Prices*, Bureau of Labor Statistics Report 384 (1971).
2. Milton Friedman and Anna J. Schwartz, *A Monetary History of the United States 1867–1960* (New York: National Bureau of Economic Research, 1963). Table 25, p. 594.
3. Harry B. McAllister, "Statistical Factors Affecting the Stability of the Wholesale and Consumers' Price Indexes," *The Price Statistics of the Federal Government*, Report of the Price Statistics Review Committee (New York: National Bureau of Economic Research, 1961), pp. 373–418.

   McAllister also examined the number of reporters per individual price series, which has generally increased. The use of more reports for each series increases the probability of catching and recording small changes in market prices, but averaging the reports tends to smooth the movements in individual price quotations. The effect on cyclical amplitude, however, is probably minor.
4. Allan D. Searle, "Weight Revisions in the Wholesale Price Index, 1890–1960," *Monthly Labor Review* (February 1962): 175–82.
5. This can be shown as follows. Suppose an index Z is composed of n prices (x_i), all with the same weight and variance $\bar{\sigma}^2$ and a correlation coefficient $\bar{R}$ with each other. (This example abstracts from changes in the weighting and variance of new items and concentrates on changes in number of items only.)

   $$Z = \sum_{1}^{n} x_i/n$$

   and $\sigma_{x_i} = \bar{\sigma}$ and $R_{x_i x_j} = \bar{R}$ for all $i \neq j$.

   Then

   $$\sigma_Z^2 = \frac{n\bar{\sigma}^2}{n^2} + n(n-1)\frac{\bar{R}}{n^2}\bar{\sigma}^2.$$

   $$\frac{\sigma_Z^2}{\bar{\sigma}^2} = \bar{R} + \frac{1-\bar{R}}{n}.$$

   For large n, this approaches $\bar{R}$ from above. Hence the variance of the index will not under these assumptions decline much for increases in n beyond a moderate size.
6. The rate of change gives different rankings than the total change would, since the durations of the recessions vary from 9 to 14 months, but for the post-World War II recessions, which vary only from 9 to 12 months, the variation is less.
7. The 1924 distribution, which in Table 2 has the largest mean rate of decline except for 1949, appears to be representative of earlier recessions back to the early 1890's in both the mean and dispersion of the rates of change. This observation is based on the distribution of specific cycles in over 100 wholesale price series. See Frederick C. Mills, *The Behavior of Prices* (New York: National Bureau of Economic Research, 1927), Table 139, p. 421.
8. Rankings of severity based solely on GNP in constant dollars are somewhat different but also out of chronological order. However, aggregate-dollar measures follow a chronological order more closely. For dollar GNP, only 1953–54 and 1957–58 are out of chronological order of declining severity. And dollar personal income follows the

chronological order exactly. Of course, dollar measures misrepresent the pressures of excess capacity on prices. Nevertheless, the rankings of severity in Chart 7 based on general business activity should be viewed as a crude ordering of the cyclical pressures on prices.

9. The number of prices included here is 1,104, 34 less than in Chart 5 (the 32 series not covering the 1970 recession were excluded here from all the distributions, as well as two other series omitted inadvertently). These minor differences in total number of series are of no consequence.
10. In Table 3 the means were computed from the individual rates of change, but the average deviations in Table 4 are based on midpoints *multiplied by* frequencies of the closed class intervals and on sums of the individual rates of the open-end intervals. Because of bunching at zero, the midpoint of the 0 to 2½ interval overstates the actual mean of this class and biases the average deviation upward except when the mean is above the midpoint of that class as in 1970. However, this bias is bound to be small, and a correction was not made.
11. See the exchange in the *American Economic Review* between Gardner C. Means (June 1972), pp. 292–306, and George Stigler and James Kindahl (Sept. 1973), pp. 717–21.
12. George Stigler and James Kindahl, *The Behavior of Industrial Prices* (New York: National Bureau of Economic Research, 1970), p. 23.
13. For price changes in the interval −2½ to 2½ per cent per year, the percentage declining in 1958 is 45.45 per cent by the NBER data and 5.26 per cent by the BLS data, and in 1961, 67.87 and 15.15 per cent, respectively. This implies that 40.19 and 52.71 per cent of the BLS series in 1958 and 1961, respectively, should be shifted from the interval between 0 and 2½ to less than zero. These percentages were applied to manufactures with concentration ratios above 33 per cent only and not to all series in that interval on the view that the nonmanufacturing and lowest concentration industries are less likely to display bunching at zero. This also reduces the size of the adjustment. (The elimination of low concentration industries is consistent with the analysis of Section V and with numerous studies in the literature on pricing in concentrated industries.) For 1958, there are 212 series shifted in this way and for 1961, 295 series, which results in the percentages reported in the text.
14. See Mills, *Behavior of Prices*, especially Figure 45, p. 343, and Wesley C. Mitchell, *The Making and Using of Index Numbers*, Bureau of Labor Statistics Bulletin No. 656 (March 1938), reprinted from Bulletin No. 284 (1921), especially pp. 14–21.
15. On the kurtosis of the sequence of individual price changes over time, see Benoit Mandelbrot, "The Variation of Certain Speculative Prices," *Journal of Business* (October 1963): 394–419, and Peter K. Clark, "A Subordinated Stochastic Process Model with Finite Variance for Speculative Prices," *Econometrica* (Jan. 1973): 135–55.
16. See Clark, "Subordinated Stochastic Process Model." I have benefited from discussions with Clark on the application of subordinate normal distributions to the present data.
17. These data cover total shipments of establishments in the industry and therefore cover all products, not just the main one on which classification of the establishment is based. This produces some error in our classification of prices.
18. The fraction of total industry shipments by the four largest firms was used. In a few cases where the four-firm ratio for 1963 was not available, the concentration ratio for 1958 was used if the eight-firm ratio suggested that the concentration of the industry had not changed much between 1958 and 1963.
19. The dividing lines were, for the value-added ratio, 0–.400, .401–.600, and .601–1.000 and, for concentration, 0–.33, .34–.67, and .68–1.00. These boundaries were chosen to provide wide intervals each of which would contain a fairly large number of price series.

20. See Gardner C. Means, *Industrial Prices and Their Relative Inflexibility,* Senate Doc. 13, 74th Cong., 1st sess., 1935. See also *Hearings on Administered Prices,* Part 9, Sen. Subcommittee on Antitrust and Monopoly, 1959, pp. 4745–60 and National Resources Committee, *The Structure of the American Economy,* Part II, June 1939, p. 143.
21. For a recent survey of these studies, see Harold Demsetz, *The Market Concentration Doctrine,* AEI-Hoover Policy Study 7 (Washington, D.C.: American Enterprise Institute, 1973).
22. Means, *Industrial Prices.*
23. For a survey of inflation theories discussed in the 1950's, see Martin Bronfenbrenner and Franklyn D. Holzman, "Survey of Inflation Theory," *American Economic Review* (Sept. 1963): 593–661.
24. Mills, *Behavior of Prices,* and Mitchell, *Making and Using of Index Numbers.* See also Rufus S. Tucker, "Reasons for Price Rigidity," *American Economic Review* (March 1938): 41–54.
25. See Milton Friedman, "Comment" in G. P. Shultz and R. Z. Aliber, eds., *Guidelines, Informal Controls, and the Market Place* (Chicago: University of Chicago Press, 1966), and Edmund S. Phelps, "Phillips Curves, Expectations of Inflation and Optimal Unemployment over Time," *Economica* (Aug. 1967): 254–81.

A1. This is shown by Clark, "Subordinated Stochastic Process Model." I am indebted to Clark for the following proof and interpretation of the kurtosis.