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STAFF PAPER 8

STATISTICAL FACTORS AFFECTING THE STABILITY OF THE WHOLESALE AND CONSUMERS' PRICE INDEXES

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Three facets of the behavior of the Wholesale Price Index or its constituent prices are studied in the present paper. First is considered the effect that changes in coverage have upon the cyclical sensitivity of the index. The two following parts deal with the effects of changes in the number of price reporters and the source of price quotations upon the behavior of the individual price series.

I. The Effect of Changes in Coverage upon the Stability of the Wholesale Price Index and the Consumers' Price Index

This study examines the effect of coverage changes upon the movements of the Wholesale Price Index (WPI) and the Consumers' Price Index (CPI). While the techniques and analysis are general and apply to all price indexes, for purposes of clarity the presentation will deal with only these two indexes and for only one coverage change for each index. Some additional data will, however, be given for the Wholesale Price Index.

A. THE WHOLESALE PRICE INDEX

In 1931 the BLS increased the number of commodities included in the WPI from 550 to 784, and revised the index back to 1926 based on prices collected during the period but not used in the former index. Similarly in 1952 the WPI was revised back to 1947 based on about 1,900 items instead of the previous 900. As Tables 1.1 and 1.2 show for the overlapping periods, the new index in each case was more stable than the old in its cyclical swings. By putting the results of these two tables together, it can be inferred that the current 1,900-

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item index would show cyclical swings roughly a third smaller than the same swings shown by the old 550-item index.[1]

TABLE 1.1.—*The Effect on Amplitude of the Changed Sample for the All-Commodity Wholesale Price Index, 1926–31*

Date	Position of index	550-item index (1926=100)	784-item index (1926=100)	
January 1926	High	103.6	103.2	
June 1927	Low	93.8	94.1	
September 1928	High	100.1	98.6	
December 1931	Low	66.3	68.6	
		Change, 550-item index	Change, 784-item index	Ratio of col. 4 to col. 2 (percent)
		Index points (1)	Percent (2)	Index points (3)	Percent (4)	(5)
January 1926 to June 1927		−9.8	−9.5	−9.1	−8.8	93
June 1927 to September 1928		+6.3	+6.7	+4.5	+4.8	72
September 1928 to December 1931		−33.8	−33.8	−30.0	−30.4	90
Average, 3 swings						85

SOURCE.—550-item index: Bureau of Labor Statistics, *Wholesale Prices*, Bulletin 543; 784-item index: *Monthly Labor Review*, February 1932; *Wholesale Prices*, Bulletin 572.

TABLE 1.2.—*Amplitude Comparisons Between the Old and New All-Commodity Wholesale Price Indexes, 1947–51*

Date	Position of index	900-item index (1947–49=100)	1,900-item index (1947–49=100)	
January 1947	Low	90.2	92.3	
August 1948	High	107.9	106.2	
December 1949	Low	96.1	97.7	
March 1951	High	116.9	116.5	
September 1951	Low	112.8	113.4	
		Change, 900-item index	Change, 1,900-item index	Ratio of col. 4 to col 2 (percent)
		Index points (1)	Percent (2)	Index points (3)	Percent (4)	(5)
January 1947 to August 1948		17.7	19.6	13.9	15.1	77
August 1948 to December 1949		−11.8	−10.9	−8.5	−8.0	73
December 1949 to March 1951		20.8	21.6	18.8	19.2	89
March 1951 to September 1951		−4.1	−3.5	−3.1	−2.7	77
Average, 4 swings						79

SOURCE.—900-item index: *Survey of Current Business*, 1951 Supplement; *Monthly Labor Review*, April 1952. 1,900-item index: *Survey of Current Business*, March 1952.

Turning to the evidence for 1926–31 when the sample was expanded from 550 to 784, we find that of the 234 items added 1 was a raw material, 31 were semimanufactured goods, and 202 were finished products. National Bureau cyclical analysis shows that the average rise

[1] The shift from 550 to 784 items brought an average reduction in relative amplitude of 15 percent. The corresponding average reduction in the shift from 900 to 1,900 items was 21 percent. Excluding the effect of the shift from 784 to 900 items, the combined effect is (0.85) (0.79) = 0.67, or a reduction of one-third.

and fall of finished goods prices during four cycles, 1922–39, was only 0.5 percent per month, compared to 1.0 percent per month for semimanufactured goods and 0.9 percent for raw materials during approximately the same period. One would therefore expect the index to become more stable as the proportion of semimanufactured and finished goods included in the index increased. The question that now arises can be stated as follows: Was the increased stability due to the fact that the economy was actually producing more semimanufactured and finished goods or to the fact that the sample was enlarged, particularly in these two sectors.[2]

To test whether the behavior of the new sample reflected the changing importance of semimanufactured and finished goods only or whether additional influence could be attributed to the enlargement of the sample, the following test was made: The percentage change for raw materials, for semimanufactured goods, and for finished goods during the cyclical swings was noted for the 550-item sample. Each of these percentages was then weighted by the proportion that each category represented of the 784-item sample. In other words, the new structure of the economy as represented by the new weights was applied to the old sample to see if the increased stability could be attributed solely to the change in weights. Table 1.3 reports the basic data by stage of processing for the turning points of the 550-item All-Commodity Index and Table 1.4 shows the effect of applying the new weights to the stage-of-processing components of the old and new indexes.

TABLE 1.3.—*Magnitude and Change by Subperiods and Stage of Processing for Components of the WPI, 550-Item Index, 1926–31*

Date	Position of index	Raw material index	Semimanufactured goods index	Finished goods index
January 1926	High	105.9	104.0	102.1
June 1927	Low	94.1	95.6	93.4
September 1928	High	100.5	96.9	100.5
December 1931	Low	60.2	62.2	71.0

	Change, raw material index		Change, semimanuf. goods index		Change, finished goods index	
	Index points	Percent	Index points	Percent	Index points	Percent
January 1926 to June 1927	−11.8	−11.1	−8.4	−8.1	−8.7	−8.5
June 1927 to September 1928	6.4	6.8	1.3	1.4	7.1	7.6
September 1928 to December 1931	−40.3	−40.1	−34.7	−35.8	−29.5	−29.4

SOURCE.—Bureau of Labor Statistics, *Wholesale Prices*, Bulletin 543; *Survey of Current Business*, January 1932.

[2] Another closely related question but one with which this paper does not deal is how representative was the sample of the universe for this period of time.

TABLE 1.4.—*Effect of Weighting Stage-of-Processing Components of the Old and New Indexes by the Weights of the New Sample, 1926–31*

Stage of processing	(550 items) Old weight (per-cent)	(784 items) New weight (per-cent)	January 1926–June 1927		June 1927–September 1928		September 1928–December 1931	
			Per-centage change	Weighted change	Per-centage change	Weighted change	Per-centage change	Weighted change
A. Old Sample (550 items):								
Raw materials	36.11	29.23	−11.1	−3.2	6.8	2.0	−40.1	−11.7
Semimanufactured	7.74	8.86	−8.1	−0.7	1.4	0.1	−35.8	−3.2
Finished goods	56.15	61.91	−8.5	−5.3	7.6	4.7	−29.5	−18.2
Total	100.00	100.00		−9.2		6.8		−33.1
B. New Sample (784 items):								
Raw materials		29.23	−10.6	−3.1	6.8	2.0	−40.1	−11.7
Semimanufactured		8.86	−9.7	−0.9	1.0	0.1	−32.3	−2.9
Finished goods		61.91	−7.5	−4.6	4.4	2.7	−25.4	−15.7
Total		100.00		−8.6		4.8		−30.3

SOURCE.—*Wholesale Prices*, Bulletin 493 and 572, Bureau of Labor Statistics. Weights computed from these bulletins.

If the weighted change totals of the two samples are computed, it can be seen whether the changed structure of the economy accounts for the differences noted in table 1.1. For ease of comparison the summary figures of table 1.4 are put into the following table 1.5.

TABLE 1.5.—*Comparison of the Movements of the Old and New Sample Indexes of the WPI When Changes in Industry Structure Are Allowed for*

Period	Percentage change in all-commodity index			
	Old index with old weights	Old index with new weights	New index weighted by stage-of-processing components	New index weighted in regular way [1]
	(1)	(2)	(3)	(4)
January 1926–June 1927	−9.5	−9.2	−8.6	−8.8
June 1927–September 1928	6.7	6.8	4.8	4.8
September 1928–December 1931	−33.8	−33.1	−30.3	−30.4

[1] See table 1.1.

SOURCE: Tables 1.1 and 1.4.

In computing the new index in the regular way, individual items are weighted separately and the weighted components are summed. The percentage change figures that one would derive from this index are shown in column 4. Column 3 shows the percentage change figures for the various periods of Table 1.5 that one would get if one separated the new index into stage-of-processing components and weighted the percentage change for each stage by its percentage of the total weight in the overall index. Because of the different methods involved, it would be expected that the small differences between the two indexes that are observed in comparing columns 3 and 4 would exist.

More important to the analysis, however, are the differences found between columns 2 and 3 or 4. These differences show rather clearly that the effects of increased coverage are more important than the

change in economic structure [3] in accounting for the reduced fluctuations in the index. The changed industry structure as represented by the new weights when applied to the old index still leaves a relatively large discrepancy unaccounted for. This is evident from the relatively small differences between columns 1 and 2 as compared to the differences between columns 2 and 3 or 4. The change in the weighting of the old index altered it but little, whereas changes other than weighting apparently altered it a substantial amount. Factors other than the weighting which changed between the old and new index were the increased coverage and some increase in the number of reporters. The change in the number of reporters [4] was not large however; the predominant influence effecting change must be attributed to the different coverage. The nature of the extended coverage and its effects will be considered next.

As previously mentioned, the raw materials component of the index was changed by one item, the semimanufactured element was increased by 31 items (a 50-percent increase), and the finished goods part of the total was enlarged from 380 to 582 items (a 53 percent increase). What effect does this changed coverage have on the index and what is the effect of each stage-of-processing component? Table 1.6 shows the percentage amounts that each stage-of-processing com-

TABLE 1.6.—*Comparative Importance of the Stage-of-Processing Components in Stabilizing the New WPI Sample, 1926–31*

Stage of Processing and Sample Size	January 1926–June 1927 (percentage change)	June 1927–September 1928 (percentage change)	September 1928–December 1931 (percentage change)
Raw materials:			
550-item index	−3.2	2.0	−11.7
784-item index	−3.1	2.0	−11.7
Difference	−.1	0	0
Semimanufactured:			
550-item index	−.7	.1	−3.2
784-item index	−.9	.1	−2.9
Difference	.2	0	−.3
Finished goods:			
550-item index	−5.3	4.7	−18.2
784-item index	−4.6	2.7	−15.7
Difference	−.7	2.0	−2.5
Total difference	−.6	2.0	−2.8

RATIO OF PERCENTAGE CHANGE IN NEW INDEX TO PERCENTAGE CHANGE IN OLD INDEX

	January 1926–June 1927 (percent)	June 1927–September 1928 (percent)	September 1928–December 1931 (percent)
Raw materials	97	100	100
Semimanufactured	129	100	91
Finished goods	87	57	86

SOURCE.—Table 1.4.

[3] "Change in economic structure" as used here refers to the shifts in relative importance of the three major groups, and not to the shifts within groups.

[4] The effect of the changes in the number of reporters is analyzed in the second study.

ponent contributes to the total change between the old and new index and brings out rather forcibly the dominant influence of the finished goods category in damping the fluctuations of the WPI. In the swing from January 1926 to June 1927, it contributed to most of the difference; in fact it contributed more than the total because it had to overcome the opposite movement of the semimanufactured element which fluctuated more in the new sample than in the old. A similar influence upon the upward movement of June 1927 to September 1928 and the decline from September 1928 to December 1931 can be noted. The finished goods component accounts for all of the difference between the old and new indexes in the 1927–28 rise and for 89 percent of the difference in the 1928–31 decline.

In summary, it is clear that the increasing coverage of the wholesale price index has had the effect of making wholesale prices appear more stable than they are if one compares fluctuation between the old and new coverage. Increasing the size of sample and increasing the proportion of the more stable finished goods and semifinished goods prices both contributed to minimizing its fluctuations. While the BLS should continue its practice of revising the index to reflect structural change in the economy, analysts should recognize that problems in economic analysis are created by such revision.

B. THE CONSUMERS' PRICE INDEX

In accord with changing expenditure patterns of consumers, the Bureau of Labor Statistics periodically revises the Consumers' Price Index (CPI) so that it may reflect changed economic conditions. However, the revised index may reflect more than just the new expenditure pattern and it may, in fact, also reflect certain factors such as new coverage, new imputing, the correction of previous bias (such as new unit bias in the rent index), and new items included in the index.

Since the CPI is used as a measure of inflation and deflation in the consumer sector of the economy these influences should be investigated.

The New Index of 1935–39.—In 1939 the Consumers' Price Index was revised. The coverage, weighting, base period, imputing, and substitution of new items for old were factors that made the old index differ from the new. The index was revised back to 1935, hence there exist two indexes for 1935–39, one on the old basis and one on the new. The differences in coverage of the two indexes are shown in Table 1.7.

TABLE 1.7.—*Coverage of Old and New CPI Indexes, 1935–39*

Item	Number of items in 1939 coverage	
	Old index	New index
Food	84	54
Clothing	63	48
Fuel, electricity, and ice	6	10
House furnishings	16	26
Miscellaneous	33	60
Total	202	198

SOURCE.—*Changes in Cost of Living in Large Cities in the United States*, Bulletin 699, U.S. Department of Labor, Bureau of Labor Statistics, p. 15.

One effective difference between the new index and the old one is its increased sensitivity. Evidence of this difference is illustrated in table 1.8. The table shows the index numbers and their changes for two lows and a high over the period 1935–39 (based on quarterly observations). Column 5 in the lower part of the table shows that the percentage amplitude of the new index in the upswing from July 1935 to September 1937 was 21 percent above that for the old, while in the downswing from 1937 to 1939 the decline was 41 percent larger in the new index.

TABLE 1.8.—*The Effect on Amplitude of Changes in Construction of the Consumers' Price Index (All Items), 1935–39*

Date	Position of index	202-item index (1923–25=100)	198-item index (1935–39=100)
July 1935	Low	80.4	97.6
September 1937	High	85.0	104.3
June 1939	Low	81.7	98.6

	Change, 202-item index		Change, 198-item index		Ratio of col. 4 to col. 2 (percent)
	Index points	Percent	Index points	Percent	
	(1)	(2)	(3)	(4)	(5)
July 1935–September 1937	4.6	5.7	6.7	6.9	121
September 1937–June 1939	−3.3	−3.9	−5.7	−5.5	141

SOURCE.—202-item index: *Monthly Labor Review*, April 1940; 198-item index: *Survey of Current Business*, May 1941.

Tables 1.9 through 1.13 provide data for analyzing why the index increased in sensitivity, 1.9 and 1.10 providing the basic data on initial magnitude and change by commodity groups, and 1.11, 1.12, and 1.13 showing the effects of weighting the percentage changes of these commodity groups by the weights of the new sample.

TABLE 1.9.—*Magnitude and Changes by Subperiods for the Old Index by Commodity Components of the CPI, 1935–39*

[Date and position of index (1923–25=100)]

Commodity group	July 1935, low	September 1937, high	June 1939, low
Food	80.2	85.8	76.3
Clothing	77.8	84.0	80.9
Rent	62.7	68.1	69.5
Fuel and light	84.9	86.0	85.4
House furnishings	76.2	86.7	83.2
Miscellaneous	96.7	98.1	98.5

Commodity groups	July 1935–September 1937, change		September 1937–June 1939, change	
	Index points	Percent	Index points	Percent
Food	5.6	7.0	−9.5	−11.1
Clothing	6.2	8.0	−3.1	−3.7
Rent	5.4	8.6	1.4	2.1
Fuel and light	1.1	1.3	−.6	−.7
House furnishings	10.5	13.8	−3.5	−4.0
Miscellaneous	1.4	1.4	.4	.4

SOURCE.—*Monthly Labor Review*, April 1940.

TABLE 1.10.—*Magnitude and Change by Subperiods for the New Index by Commodity Components of the CPI, 1935–39*

[Date and position of index (1935–39=100)]

Commodity group	July 1935, low	Sept. 1937, high	June 1939, low
Food	99.4	107.9	93.6
Clothing	96.7	105.1	100.3
Rent	94.1	102.1	104.3
Fuel and light	99.0	100.0	97.5
House furnishings	94.5	106.7	100.6
Miscellaneous	98.2	101.7	100.4

Commodity group	July 1935–September 1937, change		September 1937–June 1939, change	
	Index points	Percent	Index points	Percent
Food	8.5	8.6	−14.3	−13.3
Clothing	8.4	8.7	−4.8	−4.6
Rent	8.0	8.5	2.2	2.2
Fuel and light	1.0	1.0	−2.5	−2.5
House furnishings	12.2	12.9	−6.1	−5.7
Miscellaneous	3.5	3.6	−1.3	−1.3

SOURCE.—*Survey of Current Business*, May 1941.

TABLE 1.11.—*Effect of Weighting Commodity Components of the Old and New Indexes by the Weights of the New Sample, 1935–39*

Commodity group	New weight (percent)	July 1935–September 1937		September 1937–June 1939	
		Percentage change	Weighted change	Percentage change	Weighted change
A. Old sample (202 items):					
Food	33.9	7.0	2.4	−11.1	−3.8
Clothing	10.5	8.0	.8	−3.7	−.4
Rent	18.1	8.6	1.6	2.1	.4
Fuel and light	6.4	1.3	.1	−.7	[1] −0
House furnishings	4.2	13.8	.6	−4.0	−.2
Miscellaneous	26.9	1.4	.4	.4	.1
Total	100.0		5.9		−3.9
B. New sample (198 items):					
Food	33.9	8.6	2.9	−13.3	−4.5
Clothing	10.5	8.7	.9	−4.6	−.5
Rent	18.1	8.5	1.5	2.2	.4
Fuel and light	6.4	1.0	.1	−2.5	−.2
House furnishings	4.2	12.9	.5	−5.7	−.2
Miscellaneous	26.9	3.6	1.0	−1.3	−.3
Total	100.0		6.9		−5.3

SOURCE.— Weights from *Changes in Cost of Living in Large Cities in the United States*, Bulletin 699 Bureau of Labor Statistics.

TABLE 1.12.—*Comparison of the Movements of the Old and New Sample Indexes When Changes in Weighting Are Allowed for, 1935–39*

Period	Old index with old weights (1)	Old index with new weights (2)	New index weighted by commodity groups (3)	New index weighted in regular way (See table 1.8) (4)
July 1935–September 1937	5.7	5.9	6.9	6.9
September 1937–June 1939	−3.9	−3.9	−5.3	−5.5

SOURCE.—Tables 1.8 and 1.11.

TABLE 1.13.—*Comparative Importance of the Commodity Group Components in Accenting the Fluctuations in the New CPI Sample, 1935–39*

Commodity group and sample size	Percentage change	
	July 1935–September 1937	September 1937–June 1939
Food:		
New index	2.9	−4.5
Old index	2.4	−3.8
Difference	.5	−.7
Clothing:		
New index	.9	−.5
Old index	.8	−.4
Difference	.1	−.1
Rent:		
New index	1.5	.4
Old index	1.6	.4
Difference	−.1	0
Fuel and light:		
New index	.1	−.2
Old index	.1	−.0
Difference	0	−.2
House furnishings:		
New index	.5	−.2
Old index	.6	−.2
Difference	−.1	.0
Miscellaneous:		
New index	1.0	−.3
Old index	.4	.1
Difference	.6	−.4
Total difference	1.0	−1.4

SOURCE.—Table 1.11.

In Table 1.11 the percentage changes for each commodity group of the index are multiplied by the respective weights of the new index for the 1935–37 upswing and for the 1937–39 downswing. The effects for the total old index as compared with the new index are noted in table 1.12 for ease of comparison. The comparison of columns 1 and 2 show that the new weighting had little effect for the 1935–37 period and none for the 1937–39 period. The discrepancy between the indexes as shown by comparison of columns 2 and 3 or 4 must rest largely on other causes.

Table 1.13 pinpoints the importance of the various components in effecting the percentage changes shown for the two all-commodity indexes. It is apparent upon examination of this table that the food and miscellaneous elements were dominant in making the new index more flexible than the old.

It appears reasonable to attribute this increased flexibility in the food component to the shift in weights away from cereals and baking products and to the increased emphasis upon fruits and vegetables as well as the effect of a smaller sample. In the miscellaneous element the greater sensitivity would appear to be caused by the fact that automobiles and their operation, a more sensitive subelement, constitute nearly one-fifth of the new miscellaneous category whereas previously they were not represented.

While it is clear that the new commodities and weighting give a more representative index and the new structure of consumer expenditures is better represented by the new index, there still remains an arbitrary element of change induced by the change in the size in the sample similar to that shown by the previous analysis of the WPI. The mathematical section that follows shows clearly why and how the change in sample size affects the variance of the new sample. While it is true that the overall sample changed but little (202 to 198), there were substantial changes in the samples taken from the various groupings. The decrease in the food component for example, from 84 to 54, undoubtedly contributed a great deal to the increased sensitivity noted in this element, an element which accounted for about half the change in the 1935–37 and 1937–39 cyclical swings.

General Effects of Increased Sample Size.[5]—A more exact analysis of the elements affecting the variance of an index when its coverage is increased can be noted if the elements are set up and analyzed as an equation.

Let z=the new index, x=the old index, y=the added items index, w=the weight of the old index, $(1\text{-}w)$=the weight of the added items index, and r=the correlation between the old and the added items index.

Then:

$$z=wx+(1\text{-}w)y, \text{ and} \tag{1}$$

$$\sigma_z^2=w^2\sigma_x^2+(1\text{-}w)^2\sigma_y^2+2w(1\text{-}w)r\sigma_x\sigma_y \tag{2}$$

Case I

$$\sigma_x^2=\sigma_y^2,\ r=1$$

$$\sigma_z^2=w^2\sigma_x^2+(1\text{-}w)^2\sigma_x^2+2w(1\text{-}w)\sigma_x^2$$

Then

$$=\sigma_x^2[w^2+(1\text{-}w)^2+2w(1\text{-}w)]=\sigma_x^2. \tag{3}$$

Thus, if we add to an index a group of items whose indexes are perfectly positively correlated with the old indexes, and if the variance of each subindex is identical, the new variance will be identical with the old.

Case II

Given: $\sigma_x^2=\sigma_y^2$, $r=-1$, then the new variance, $\sigma_z^2=\sigma_x^2[2w\text{-}1]^2$.

In this case where the old variance is weighted by a perfect square whose only variable is the weight of the old index w, symmetrical results are derived for each (w) and its consequent $(1\text{-}w)$. The more that (w) and $(1\text{-}w)$ diverge, the closer will be the new variance to the old.

If the added items had the same weight as the old items, the variance of the new sample would be zero.

Case III

Given:

$$\sigma_x^2=\sigma_y^2,\ 0<r<1.$$

[5] I am indebted to Zvi Griliches for suggesting this approach to the problem.

Then:

$$\sigma_z^2=\sigma_x^2[1+(2w^2-2w)+(2w-2w^2)r]. \quad (4)$$

Since $0<w<1$, the closer r is to 1, the closer will be the variances of the old and the new combined sample (with case I as a limit). Since $0<r<1$ and $0<w<1$, it follows that $-1<[2w^2-2w]<0$ and $0<[(2w-2w^2)r]<1$. Also $/2w^2-2w/>(2w-2w^2)r/$. The addition of the last two elements in the bracket of (4) will always result in some proportion p where $0<P<1$. Therefore, the given condition will always result in $\sigma_z^2<\sigma_x^2$.

Case IV

Given:

$$\sigma_x^2=\sigma_y^2,\ r=0.$$

Then:

$$\sigma_z^2=\sigma_x^2[2w^2-2w+1]. \text{ Since } 0<w<1, \quad (5)$$

$$0<[2w^2-2w+1]<1, \text{ and } \sigma_x^2<\sigma_z^2.$$

Case V

Given:

$$\sigma_y^2=k^2\sigma_x^2,\ k^2<0,\ r=1.$$

Then:

$$\sigma_z^2=\sigma_x^2[w+(1-w)k]^2 \quad (6)$$

Here the relationship between the old and new variance depends fundamentally upon the value for k. If $0<k<1$ the new variance will be less than the old; if $k>1$ the new variance will be greater than the old.

Given:

$$\sigma_y^2=k^2\sigma_x^2, k^2>0,\ 0<r<1.$$

$$\sigma_z^2=\sigma_x^2[w^2+(1-w)^2k^2+2w(1-w)rk] \quad (7)$$

Since

$$0<r<1 \text{ and } 0<w<1 \quad 0<[2w(1-w)]<1.$$

$\sigma_z^2>\sigma_x^2$ only when $k>1$ by some amount that can be determined for given values of r and w.

Stated verbally, the variance of the added items has to exceed the variance of the items already in the index in order for the variance of the new index to exceed that of the old. It is possible for the added items variance to exceed that of the old and have the new variance be less than the old. However, the ratio of the variances

$$\left(\frac{\sigma_y^2}{\sigma_x^2}\right)$$

would, with the usual relationships of r and w, probably be quite close to unity for this phenomenon to occur.

While cases other than the ones above can be examined, these furnish enough evidence to point up the effect that adding to the number of items in an index will have on the variance of that index. Only in the special case where there is perfect correlation between the old and the

new item indexes and where the variance of the added items index is equal to the variance of the old items index will the variance of the new index be the same as the old. The closer the correlation is to one and the closer the variances to each other, the closer the two index variances will compare. Any departure of the correlation from one tends to make the new index have a smaller variance than the old. If the added items index has less variance than the old index the effect is to decrease the variance of the new index as would be expected. Should the added items index have more variance, the variance of the new index will tend to be increased but will be counterbalanaced, the lower the correlation between the old and the new items index and the more than the values of (w) and $(1-w)$ diverge.

Some idea of the numerical amount by which the variance of the new sample will be changed relative to the old variance (σ_x^2) is shown in column 4 of Table 1.14. Each of the coefficients of σ_x^2 shows the proportion that the variance a new sample would be of that of an old sample with given values of w, r, and k^2 substituted into the case VI formula.

TABLE 1.14.—*Numerical Effects of Various Values for w, r, and k^2 on the Variance of the New Sample*

	w	r	k^2	Coefficient of σ_x^2		w	r	k^2	Coefficient of σ_x^2
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
(1)	0.2	1.0	1.0	1.00	(3)—Continued	0.2	0.5	0.8	0.69
	.5	1.0	1.0	1.00		.5	.5	.3	.47
	.2	0	1.0	.68		.5	.5	.8	.67
	.5	0	1.0	.50	(4)	.2	.9	1.5	1.35
(2)	.2	.5	1.0	.84		.2	.9	2.0	1.72
	.5	.5	1.0	.75		.5	.9	1.5	1.17
(3)	.2	.5	1.5	1.19		.5	.9	2.0	1.38
	.2	.5	2.0	1.54		.2	.9	.3	.39
	.5	.5	1.5	.93		.2	.9	.8	.81
	.5	.5	2.0	1.10		.5	.9	.3	.58
	.2	.5	.3	.32		.5	.9	.8	.85

Table 1.14 and the formulae discussed above show that there are "sample effects" when one changes the size of an index. These "sample effects" can have the effect of making an index more or less stable quite apart from the respective variances of the old and the new items. The magnitude of this effect can and should be investigated empirically so that incorrect inferences regarding the meaning of an index whose sample size is changed over time are not made.

II. EFFECT OF NUMBER OF REPORTERS ON THE NUMBER OF PRICE CHANGES

A great deal has been written in the past twenty years about the subject of price flexibility and "administered prices." One piece of information not heretofore available on the basic data and in these studies is the effect of the number of reporting firms (reporters) and the nature of the quotations which they report. These topics form the subject of this study.

It was pointed out in a 1959 price flexibility study by the Bureau of Labor Statistics [6] that the steady general increase in the number of reporters has had the effect on the average of increasing the number of price changes shown for the various items for which data were shown. This study confirms this statement and shows the effect of the number of reporters by various classifications of the data.

In order to put the data into a framework of comparison with the BLS price flexibility study, it was decided to take a sample from the same time period used in that study. Every third item in the Wholesale Price Index was taken from the list which was arranged in order by the 15 commodity groups used by the BLS.

Items were considered as part of the sample only if they continued to be reported throughout the entire period December 1953 through December 1956. Classifications were set up according to the number and type of reporters and whether they had been in the sample prior to the 1952 revision of the Wholesale Price Index. One difficulty in classifying the data by number of reporters was that for some items the number would shift back and forth. For example, an item might have two reporters one month, then shift to three the following month. A question then arose as to how this series should be classified. It was decided that it should be classified as a two-reporter item for the months it had two reporters and a three-reporter item for the months it had three reporters. To take account of the shift, all changes were computed as the number of changes per month.

RESULTS FROM TOTAL SAMPLE

Table 2.1 shows the results secured from the total sample on the changes per month by number of reporters, by type of reporting, and by stage of processing and pre- and post-1952.

TABLE 2.1.—*Number of Price Changes per Month by Stage of Processing and by Type of Reporter, 1953–56*

Type of reporter	Stage of processing		
	Crude	Intermediate	Finished
AVERAGE NUMBER OF PRICE CHANGES PER ITEM			
All classes of reporters	0.515	0.270	0.246
Company reporters	.490	.211	.176
Government reporters	.870	.847	.833
Publication reporters	.259	.294	.364
Pre-1952 items	.498	.345	.373
Items added 1952 or after	.536	.232	.202
NUMBER OF ITEMS PER CELL			
All classes of reporters	79	405	443
Company reporters	16	277	378
Government reporters	27	18	28
Publication reporters	36	110	37
Pre-1952 items	50	124	112
Items added 1952 or after	29	281	331

[6] *Frequency of Change in Wholesale Prices, A Study of Price Flexibility,* United States Department of Labor, Bureau of Labor Statistics, 1959, pp. 2 and 21.

Several facts become clear upon examination of the table. The well-known tendency for the prices of crude materials to vary more than intermediate goods and for the latter to vary more than finished goods is confirmed. In addition, the table makes clear some facts that are not generally obvious: that prices reported from government sources exhibit greater variability than those reported from technical publications (as say *Oil Paint* and *Drug Reporter*) and from companies. Also prices reported by publications show greater variability than those reported by companies. Lastly, the number of price changes has declined since the 1952 revision of the WPI as the prices of the items added have a substantially smaller variability. To a considerable extent this last effect comes about due to the fact that added items have largely come from companies rather than from government or publications (see Tables 2.2 and 2.3). In considering the above facts it becomes clear than an attempt to find the effect of a varying number of reporters upon price changes without cross classification by stage of processing and type of reporter runs the risk of falling into the statistical fallacy of incomplete classification. For example, a proportionately greater number of government reporters in the one-reporter series could make it appear more variable than a two- or three-reporter series even if in fact it were not. As a means of analyzing the effect of the number of reporters then, Table 2.4 is cross-classified by type of reporter and stage of processing.

TABLE 2.2.—*Reporter Sample Classified by Date of Entry into WPI, Type of Reporter, and Stage of Processing*

Type of reporter and stage of processing	Pre-1952		1952 and after		Entire sample	
	Nonrepeat	All [1]	Nonrepeat	All [1]	Nonrepeat	All [1]
1. Company:						
(a) Crude	10	10	6	6	16	16
(b) Intermediate	51	58	214	219	265	277
(c) Finished	56	79	200	299	256	378
Total	117	147	420	524	537	671
2. Government:						
(a) Crude	16	16	11	11	27	27
(b) Intermediate	8	9	7	9	15	18
(c) Finished	3	17	0	11	3	28
Total	27	42	18	31	45	73
3. Publication:						
(a) Crude	24	24	12	12	36	36
(b) Intermediate	39	57	47	53	86	110
(c) Finished	1	16	0	21	1	37
Total	64	97	59	86	123	183
4. All reporters:						
(a) Crude	50	50	29	29	79	79
(b) Intermediate	98	124	268	281	366	405
(c) Finished	60	112	200	331	260	443
Total	208	286	497	641	705	927

[1] Shows the number of observations under each designation even though they have been previously included. For example, some items appear in "finished" goods that appear also in "intermediate" goods.

TABLE 2.3.—*Reporter Sample Classified by Date of Entry into WPI, Type of Reporter, and Economic Classification*

Type of reporter and economic classification	Pre-1952		1952 and after		Entire sample	
	Nonrepeat	All [1]	Nonrepeat	All [1]	Nonrepeat	All [1]
1. Company:						
(a) Materials—food	5	5	4	4	9	9
(b) Materials—nonfood	56	56	216	216	272	272
(c) Finished goods—food	6	10	8	12	14	22
(d) Consumer finished goods other than food	44	65	111	167	155	232
(e) Producer finished goods	6	39	81	165	87	204
Total	117	175	420	564	537	739
2. Government:						
(a) Materials—food	22	22	15	15	37	37
(b) Materials—nonfood	2	2	3	3	5	5
(c) Finished goods—food	3	17	0	11	3	28
(d) Consumer finished goods other than food						
(e) Producer finished goods						
Total	27	41	18	29	45	70
3. Publication:						
(a) Materials—food	8	8	3	3	11	11
(b) Materials—nonfood	55	55	56	56	111	111
(c) Finished goods—food		6		1		7
(d) Consumer finished goods other than food	1	10	0	20	1	30
(e) Producer finished goods						
Total	64	79	59	80	123	159
4. All reporters:						
(a) Materials—food	35	35	22	22	57	57
(b) Materials—nonfood	113	113	275	275	388	388
(c) Finished goods—food	9	33	8	24	17	57
(d) Consumer finished goods other than food	45	75	111	187	156	262
(e) Producer finished goods	6	39	81	175	87	214
Total	208	295	497	683	705	978

[1] Shows the number of observations under each designation even though they have been previously included. For example, some items appear in "finished goods—food" that appear also in "materials—food."

Due to the small number of cases in the cells, one would have to say that the number of price changes in crude materials for company reporters do not appear to differ significantly from one another for the five classifications established in the table. However, if one compares the one-reporter average with that for two or more, a significant difference does appear in the direction of showing greater variability the greater the number of reporters. For companies reporting goods that fall within the intermediate and finished goods category, the case is clear: the series with the greatest number of price reporters show the greatest variability in price changes.

Evidence to show that an increased number of reporters increases the number of price changes is also available for government reporters in the intermediate and finished goods categories (by comparing one with the two and over case). Not enough observations are available to establish the case for crude materials under the government classification of publications. An examination of the reporters, however, shows that each reporter, for government and for publication, is in effect a composite of several reporters. Hence, it appears that the greater number of price movements for government and publication

TABLE 2.4.—*Number of Price Changes per Month by Stage of Processing and by Number and Type of Reporter*

Type of reporter and stage of processing	Number of reporters					
	1	2	3	4	5 and over	2 and over
AVERAGE NUMBER OF PRICE CHANGES PER ITEM						
Company:						
Crude	0.474	0.470	0.526	0.500	0.480	0.499
Intermediate	.096	.143	.212	.207	.392	.229
Finished	.106	.112	.196	.215	.276	.189
Government:						
Crude	.862	.972	----	----	----	.972
Intermediate	.806	.972	.991	----	----	.986
Finished	.806	.972	.991	----	----	.986
Publication:						
Crude	.254	----	----	----	.444	.444
Intermediate	.294	----	----	----	----	----
Finished	.361	----	----	----	.444	.444
NUMBER OF ITEMS PER CELL						
Company:						
Crude	5	2	4	2	3	11
Intermediate	48	47	89	52	41	229
Finished	70	82	125	56	45	308
Government:						
Crude	26	1	----	----	----	1
Intermediate	14	1	3	----	----	4
Finished	24	1	3	----	----	4
Publication:						
Crude	35	----	----	----	1	1
Intermediate	110	----	----	----	----	----
Finished	36	----	----	----	1	1

reporters is at least in part due to the fact that these represent several actual reporters for each one shown.

For some types of price analysis, an economic classification other than "crude," "intermediate," and "finished" is desirable. One such classification breaks the WPI into two major groupings rather than three: materials and finished goods, with the first group being further subdivided into food and nonfood, while the latter is subdivided into consumer—food, consumer—other than food, and producer.[7] Table 2.5 gives a summary of the results for this five-way classification.

It becomes clear upon analyzing Table 2.5 and comparing it with Table 2.1 that some sharply divergent price series are combined in the three-way classification. Food items for example are put into both the crude materials and the finished goods categories. It is immediately apparent that food items, either material or finished goods, are higher and more like each other in price movements than like the major classification under which they fall. Although some of this correspondence is illusory because many items are the same under the two classifications, nevertheless when all duplicating items are excluded, the correspondence still holds. It is also useful to observe that the nonfood materials, producer finished goods, and consumer finished goods follow in descending order of variability with significant differences between each classification. While this ordering and signifi-

[7] For arguments in favor of this classification, see "Observations on Economic Groupings of the Wholesale Price Index," Clayton Gehman and Murray Altmann, mimeographed.

TABLE 2.5.—*Number of Price Changes per Month by Economic Classification and by Type of Reporter*

Type of reporter	Economic classification				
	Materials, food	Materials, nonfood	Finished goods, food	Consumer finished goods, other than food	Producer finished goods
AVERAGE NUMBER OF PRICE CHANGES PER ITEM					
1. All classes of reporters	0.820	0.232	0.637	0.170	0.186
2. Company reporters	.350	.212	.276	.157	.186
3. Government reporters	.901	.488	.833	----------	----------
4. Publication reporters	.909	.260	.862	.246	----------
5. Pre-1952 reporters	.847	.281	.667	.219	.268
6. Added 1952 or after reporters	.775	.210	.599	.150	.169
NUMBER OF ITEMS PER CELL					
1. All classes of reporters	57	388	57	262	204
2. Company reporters	9	272	22	232	204
3. Government reporters	37	5	28	----------	----------
4. Publication reporters	11	111	7	30	----------
5. Pre-1952 reporters	35	113	33	75	39
6. Added 1952 or after reporters	22	275	24	187	175

cance is not unexpected, the exclusion of food gives a better evaluation of the differences of variability between the series.

The data in table 2.6 provide an opportunity to test further the effect of increasing the number of reporters for a price series. Again the evidence is solidly in favor of series with greater numbers of reporters mechanically showing greater variability apart from the true variability of the series.

It could be argued that certain types of industry tended to have certain numbers of reporters and that differences shown in the number of price changes stemmed directly from the type of industry rather than the number of reporters, since the type of industry determined the number of reporters. To a limited extent the argument is true, that is, the reporting on food tends to be largely by government reporters, which fall largely into the one-reporter class; and the reporting on nonfood materials items tends to fall largely into the one-reporter classification of publications.

In order to test the previous findings that showed the number of price changes increasing as the number of reporters increased, the basic data for companies were analyzed again on a somewhat different basis.

One company was selected by use of a table of random numbers from the companies reporting for each individual item. Items with but one reporter were excluded. Each item then had a one-reporter case as well as an n-reporter case. The number of reporters was then shown from 1 to 5 and over as before for four of the five classifications shown previously. Classification I, "materials—food," was excluded because there were too few items for reliability.

TABLE 2.6.—*Number of Price Changes per Month by Economic Classification and by Number and Type of Reporter*

Type of reporter and economic classification	Number of reporters					
	1	2	3	4	5 and over	2 and over
AVERAGE NUMBER OF PRICE CHANGES PER ITEM						
Company:						
Materials, food	0.250	0.725	0.610			0.668
Materials, nonfood	.103	.143	.206	0.207	0.392	.227
Finished goods, food	.225	.167	.469	.342	.472	.362
Consumer finished goods other than food	.056	.101	.170	.200	.287	.177
Finished goods, producer	.088	.129	.208	.230	.288	.202
Government:						
Materials, food	.885	.971	.990			.982
Materials, nonfood	.488					
Finished goods, food	.806	.971	.990			.985
Consumer finished goods other than food						
Finished goods, producer						
Publication:						
Materials, food	.909					
Materials, nonfood	.258				.444	.444
Finished goods, food	.862					
Consumer finished goods other than food	.239				.444	.444
Finished goods, producer						
NUMBER OF ITEMS PER CELL						
Company:						
Materials, food	7	1	1			2
Materials, nonfood	44	47	88	52	41	228
Finished goods, food	14	2	3	2	1	8
Consumer finished goods other than food	43	51	74	30	34	189
Finished goods, producer	34	41	78	33	18	170
Government:						
Materials, food	32	2	3			5
Materials, nonfood	5					
Finished goods, food	24	1	3			4
Consumer finished goods other than food						
Finished goods, producer						
Publication:						
Materials, food	11					
Materials, nonfood	110				1	1
Finished goods, food	7					
Consumer finished goods other than food	29				1	1
Finished goods, producer						

A summary of findings using the above procedure is shown in Table 2.7. The previous findings that show increased price movement for an individual commodity in the Wholesale Price Index as the number of companies reporting prices on this item is increased are confirmed.

TABLE 2.7.—*Number of Price Changes per Month for Commodities Reported by Companies, by Economic Classification and Number of Reporters, with Allowance for Effect of Type of Industry*

Economic classification	Number of reporters					
	1	2	3	4	5 and over	2 and over
AVERAGE NUMBER OF PRICE CHANGES PER ITEM						
Materials—nonfood	0.111	0.150	0.209	0.213	0.424	0.251
Consumer finished goods—food	.197	.236	.458	.333	.472	.379
Consumer finished goods—nonfood	.068	.098	.177	.187	.322	.195
Producer finished goods	.076	.128	.201	.233	.342	.214
All above classifications	.089	.126	.200	.214	.371	.224
NUMBER OF ITEMS PER CELL						
Materials—nonfood	185	38	86	46	53	223
Consumer finished goods—food	6	2	3	1	1	7
Consumer finished goods—nonfood	144	42	70	26	44	182
Producer finished goods	131	32	75	32	25	164
All above classifications	466	114	234	105	123	576

Table 2.8 contains a comparison of the basic data of the two preceding tables. Little difference is noted between the findings of the two different methods. Clearly, the number of price changes varies directly with the number of reporters regardless of industry structure.

TABLE 2.8.—*Comparison of Number of Price Changes per Month for Commodities Reported by Companies, by Economic Classification and Number of Reporters, With (Table 2.7) and Without (Table 2.6) Allowance for Type of Industry*

Number of reporters	Materials, nonfood		Consumer finished goods, food		Consumer finished goods, nonfood		Producer finished goods	
	Table 2.6	Table 2.7	Table 2.6	Table 2.7	Table 2.6	Table 2.7	Table 2.6	Table 2.7
	Average number of price changes per item							
1	0.103	0.111	0.225	0.197	0.056	0.068	0.088	0.076
2	.143	.150	.167	.236	.101	.098	.129	.128
3	.206	.209	.469	.458	.170	.177	.208	.201
4	.207	.213	.342	.333	.200	.187	.230	.233
5 and over	.392	.424	.472	.472	.287	.322	.288	.342
2 and over	.227	.251	.362	.379	.177	.195	.202	.214

SOURCE.—Tables 2.6 and 2.7.

The average percentages of price change from December 1953 to December 1956 for the four classifications shown in Table 2.7 were also computed. The deviations from 100 for each item were then arrayed and the medians chosen for each economic classification. The results are shown in Table 2.9.

Of the four classifications, producer finished goods showed the greatest fluctuation over the period. Following in order of magnitude were nonfood materials, nonfood consumer finished goods, and food consumer finished goods.

It is of importance to note that the pattern for the magnitude of price fluctuation did not correspond to the pattern shown in the previous analysis of the average number of price changes per month. Food finished goods, for example, showed the greatest average number of price changes per month but the lowest average price fluctuation of any of the four economic classifications examined. Producer finished goods, which, on the other hand, showed one of the smallest average number of price changes, showed the greatest average amount of price fluctuation.

The data in Table 2.9 also offer comparisons between the fluctuation for the one-reporter case and that of the two and over case. Little significant difference exists between the medians both by economic classes and overall. It would be expected, however, that the two or more reporters would tend to average out their movements more and give a generally smaller average fluctuation. The operation of two types of upward bias on the two and over series probably prevents the expected from occurring.

TABLE 2.9.—*Amplitude of Price Change and Its Dispersion and Skewness, December 1953 to December 1956, by Economic Classification*

Economic classification	Absolute percentage change, December 1953 to December 1956, median		
	Number of items	1 reporter	2 or more reporters
II. Materials, nonfood	177	10.9	11.0
III. Consumer finished goods, food	6	3.9	2.2
IV. Consumer finished goods, nonfood	132	7.9	8.0
V. Producer finished goods	121	17.3	16.4
All four classifications	[1] 329	10.9	11.3

	Dispersion [2]		Skewness [3]	
	1 reporter	2 or more reporters	1 reporter	2 or more reporters
II. Materials, nonfood	63.4	62.2	0.114	0.112
III. Consumer finished goods, food	62.4	72.6	.365	.739
IV. Consumer finished goods, nonfood	75.9	70.0	.274	.111
V. Producer finished goods	51.5	40.5	.195	.147
All four classifications	67.5	63.8	.129	.077

[1] Not including items repeated in two or more groups. These total as follows: II–0, III–0, IV–40, V–67.

[2] Coeff. dispersion $= \left(\frac{Q_3 - Q_1}{Q_3 + Q_1}\right) 100$

[3] $Sk_Q = \frac{(Q_3 - Q_2) - (Q_2 - Q_1)}{Q_3 - Q_1}$

The first type of upward bias enters in because of full price changes appearing in the data at the time of linking. These price changes would appear in every average but would not appear in every single item. In the second type of bias, the two or more case gives *average* behavior while the one-company case reflects the behavior of that company only. To be on a comparable basis, the one-company case should be averaged for all companies to compare with the two and over average.

In summary, in studying the price movements of commodities one must take into account the source of reporting, the number of reporters, and changes in composition of the sample as well as economic classification. Some care must be employed with the type of economic classification as well.

III. The Validity of Using WPI Data for Measuring Short-Term Fluctuations in Prices

An increasing interest in the study of the behavior of prices in the short run has focused attention upon the evidence provided about this phenomenon by the data of the Wholesale Price Index. At the same time the validity of these prices for this type of analysis is coming under closer examination.

It is our purpose here to examine the validity of the WPI quotations as suitable data for the study of these movements. The topic will be divided into two sections: the first will set forth a comparison of the indexes of prices of individual commodities reported by primary market sellers (to the Bureau of Labor Statistics) with those of primary market buyers; the second will deal with a comparison of WPI prices with Census unit values.

That so-called list prices are not likely to reflect properly short-term changes in prices is clear. Constant evidence of this fact is provided in trade journals and other current periodicals. A few examples from the *Wall Street Journal* follow:

In a story on plumbing fixtures of September 20, 1957, it was stated that price lists had not changed but prices had dropped 10 to 20 percent under quoted list for big orders. In the December 12, 1957 issue, a story discussed the selling of acetate rayon under list. Again in June 20, 1958, it was said of sales in chemicals that salesmen find their competition underselling them "by almost 20 percent, although the publicly posted price remains untouched." A recent issue (June 16, 1960) noted that in the area of building equipment, although published prices were 3 percent higher than a year ago, the actual selling prices were about the same. It was stated that there were price cuts to about 6 percent below list.

While it appears that list prices are not likely to be good indications of short-term changes, it is not clear that the BLS index is dominated by such prices. The agency, on the contrary, asks reporting companies to give actual prices along with discounts and allowances. Should the prices actually gathered tend toward list, this phenomenon would most likely be due to the difficulties of voluntary reporting plus the complications involved for companies computing their true average prices.

A. Comparative Fluctuations in WPI and Company "Prices Paid" Indexes

The BLS describes the prices in the WPI as representing items sold in "primary markets" in "quantities" and relating to "the first commercial transaction in the United States." [8]

In an effort to test the short-term movements of these prices, data were collected by the author from large companies which regularly

[8] *Wholesale Prices and Price Indexes, 1958*, Bulletin 1257, U.S. Department of Labor, Bureau of Labor Statistics, pp. 4–5.

bought items in large quantities that met the same or substantially the same specifications as those forming part of the Wholesale Price Index data.[9] Personal interviews were conducted with buyers in the purchasing department of the various companies. In each instance company records were examined by company personnel for buying prices which were given directly to the author in terms of prices or as indexes with January 1957=100. Data were collected for the 36-month period from January 1957 through December 1959.

Comparison of the indexes of prices paid with those of the BLS offers difficulties in interpretation. An individual company might, for example, represent such a small part of the total market that even if its price did differ from that of the WPI item, it could be argued that such a price could exist and the WPI figure could still be correct. On the other hand, it might be argued that a company buying a very small percentage of the total volume offered in the market might buy "at the market" and reflect quite well the price movements of that item with a possible lag for price cuts and a possible lead for price increases.

In Appendix Table A.1, 43 items were considered that showed price stability for the BLS series for six consecutive months or more during the 1957–59 period. For 12 of these 43 products, the company experience was identical with that for the BLS—no price changes were observed. The others did, however, show differences in their movements with the company series exhibiting on the average about twice as many price changes and an amplitude about 40 percent greater (Table 3.1).[10]

A further computation based on these same items reveals that the company series fluctuated on the average about 5.7 percent during the periods when the BLS series were completely rigid (Table 3.2), with an average period of BLS rigidity of 13.7 months. For this average period there were approximately 2.4 price changes for the company or companies compared to no movement in the BLS series.

A classification of the above 43 items into BLS commodity groups reveals that nine different groups were represented, with dominant representation being found in the Chemicals and Allied Products Classification.

[9] As stated, the analysis to follow was performed using price information for commodities that met BLS specifications. However, purchasing agents bargain on packaging and transportation costs as well as the cost of the commodity itself in the buying of items. A change in any one of these three elements of cost is considered by the puchasing agent to be a price change. It would therefore be an improvement in the measurement of price change if some practical way could be found for the "price data" to reflect those packaging and transportation differences that were a part of the true changes in prices.

[10] A more severe test of the BLS data than that of this table would make comparisons on the basis of price changes relative to the number of price quotations.

TABLE 3.1.—*Comparative Fluctuations of Company and BLS Prices, 1957–59 (series selected on basis of BLS data constant for six months or more but not over entire three-year period)*

Commodity, BLS Code and name		Direction and number of price changes						Amplitude H to L, or L to H (percent)	
		Plus		Minus		Total			
		Co.	BLS	Co.	BLS	Co.	BLS	Company	BLS
*052003	Coke, Milwaukee	3	1	1	0	4	1	9.1	4.9
052004	Coke, Indianapolis	5	1	4	1	9	2	−5.7	−.8
								8.1	5.0
055401	Fuel oil, N.Y.	1	1	8	8	9	9	0	8.2
								−35.5	−28.2
*061109	Sulphuric acid	5	0	2	0	7	0	−1.7	0
061111	Aluminum sulphate	0	1	1	0	1	1	−10.0	[1] 8.1
*061126	Calcium chloride	1	1	0	0	1	1	3.2	6.9
*061133	Carbon dioxide	1	0	0	0	1	0	25.0	0
*061157	Salt	2	2	1	0	3	2	.8	3.7
061161	Silver nitrate	6	4	6	1	12	5	−3.0	−.8
								3.1	8.7
*061169	Sodium hydroxide	1	1	1	0	2	1	11.6	11.7
*061214	Ethyl alcohol	1	1	1	0	2	1	9.0	7.7
*061231	Carbon disulfide	1	0	0	0	1	0	1.4	0
061233	Carbon tetrachloride	9	1	1	0	10	1	5.2	4.5
*061263	Furfural	1	0	1	0	2	0	5.5	0
								−2.7	0
061265	Glycerine, natural	2	1	1	0	3	1	−8.1	0
								13.7	5.3
*061289	Styrene	9	3	1	3	10	6	−25.0	−33.0
061291	Toluene	0	0	2	2	2	2	−26.5	−7.8
*063135	Glycerine	2	1	2	0	4	1	−1.1	0
								5.5	5.3
*063173	Vitamin C	0	0	2	1	2	1	−33.3	−16.7
067311	Phenolics	3	2	3	1	6	3	.3	12.0
								−4.2	−9.3
*072101	Passenger car tires	4	2	5	3	9	5	8.2	3.1
								−12.7	−20.4
*072131	Tractor and implement tires	3	3	1	1	4	4	3.0	6.0
*072201	Tubes, passenger cars	4	2	5	2	9	4	4.3	2.7
								−7.4	−1.3
081412	Gum, No. 2, common	2	2	2	1	4	3	10.4	4.0
								−2.8	−1.8
102230	Platinum	6	3	9	5	15	8	−38.6	−32.5
								55.9	48.1
*103011	Steel barrel	4	3	0	1	4	4	5.8	6.4
*117314	Electric motor	0	1	3	5	3	6	−18.9	−9.6
*117633	Welding electrode	2	1	0	0	2	1	16.0	3.4
*117801	Storage battery	8	7	15	2	23	9	3.8	3.7
								−16.0	−.8
								7.6	5.6
*132230	Portland cement	5	4	6	3	11	7	2.0	.9
								−2.9	[1] +2.4
All items:									
Total		91	49	84	40	175	89	461.7	330.8
Average		3.0	1.6	2.8	1.3	5.8	3.0	11.0	7.9
Starred items:									
Total		57	33	47	21	104	54	240.6	153.8
Average		2.8	1.6	2.4	1.0	5.2	2.7	9.3	5.9

[1] If the company and BLS indexes move in opposite directions the amplitude figures are omitted in the totals and averages.

*Identical specifications for company and BLS.

Source: Appendix Table A.1.

For these items of Table A.1 it is clear that the prices paid diverge from the BLS reported prices. Whether they diverge enough to affect the individual item index and not be "rounded off" is not clear for most of the items.[11]

TABLE 3.2.—*Fluctuation of Company Prices Paid During Periods That Prices Reported to the Bureau of Labor Statistics Remained Constant*

Commodity, BLS Code and name	Number of months BLS price was constant	Company price changes			Amplitude of company change *H* to *L* or *L* to *H* (percent)
		Increases	Decreases	Total	
*052003 Coke, Milwaukee	19	2	1	3	4.5
052014 Coke, Indianapolis	22	3	3	6	6.6
	8	2	1	3	10.0
055401 Fuel oil, New York	8	1	1	2	6.1
*061109 Sulphuric acid	36	5	2	7	2.0
061111 Aluminum sulphate	25	0	1	1	10.0
*061126 Calcium chloride	29	1	0	1	3.2
*061133 Carbon dioxide	21	1	0	1	25.0
*061157 Salt	10	1	0	1	.5
	10	1	1	2	.6
061161 Silver nitrate	6	1	3	4	1.9
*061231 Carbon disulfide	26	1	0	1	1.4
061233 Carbon tetrachloride	32	8	1	9	4.6
061263 Furfural	13	1	0	1	5.5
	12	0	1	1	2.7
061265 Glycerine, natural	12	1	0	1	8.1
*061289 Styrene	6	2	0	2	1.0
	8	3	0	3	1.0
061291 Toluene	7	0	1	1	19.4
*063135 Glycerine	32	1	2	3	1.1
*063173 Vitamin C	20	0	1	1	20.0
067311 Phenolics	9	2	1	3	3.6
*072101 Passenger car tires	6	0	1	1	1.4
	11	0	3	3	10.2
*072131 Tractor and implement tires	14	2	0	2	2.0
*072201 Tubes, passenger cars	6	1	0	1	2.6
	9	2	1	3	3.5
081412 Gum, No. 2, common	6	0	1	1	1.2
	11	1	0	1	9.7
102230 Platinum	9	4	1	5	9.1
*103011 Steel barrel	7	2	0	2	2.0
*117314 Electric motor	16	0	3	3	18.9
*117633 Welding electrode	9	2	0	2	16.0
*117801 Storage battery	10	1	5	6	10.1
	6	0	3	3	2.5
	6	0	4	4	5.2
*132230 Portland cement	6	0	1	1	.4
	6	0	2	2	1.1
All items:					
Total	509	52	45	97	234.7
Average per fluctuation	13.4	1.4	1.2	2.6	6.2
Starred items:					
Total	329	28	30	58	136.2
Average per fluctuation	13.7	1.2	1.2	2.4	5.7

*Identical specifications for company and BLS.

SOURCE: Appendix Table A.1.

[11] For example, suppose that an individual prices-paid item shows a 10 percent increase while its counterpart in the BLS index shows no change. Suppose also that the buying firm for the prices paid item buys 0.6 percent of the total amount marketed. Then we have the following:

	Beginning index	Weight	Ending index	Weighted ending index
Individual company	100.0	0.006	110.0	0.660
Rest of industry	100.0	.994	100.0	99.400
Weighted index at end of the period				100.060

When rounded to one decimal place, this would give 100.1. Following the supposition of this example, any one firm whose buying price moved up 10 percent while the rest of the firms had a constant buying price would have to buy 0.6 percent or more of the total in order not to be "rounded off" in the industry average.

Of the 31 items showing a divergence from the BLS indexes, the market share bought was determined for six of them. In every case the market share was large enough so that this company's or these companies' experience should have moved the index.

It cannot be said categorically from the evidence provided by the above data that the overall Wholesale Price Index or that even its broader segments are unsuitable for the study of short-term price change. The whole question of the effect of weighting by components has, for example, not been mentioned. Dozens of items of small weight might move in a way substantially different from the BLS data and still be too unimportant to affect the overall index.

Neither can it be said that a random sample was taken and that its results provided evidence of inadequacy of the WPI for the study of short-term movements.

However, the evidence is clear that in the particular industrial areas in which data were gathered important divergencies of prices paid from BLS data do appear and that weighting or other procedural steps do not explain these divergencies.

B. COMPARATIVE FLUCTUATIONS IN WPI PRICES AND CENSUS UNIT VALUES FOR SELECTED COMMODITIES

Another method of testing the allegation that WPI prices are too sluggish for the proper study of short-term price changes is to take indexes from WPI data and compare them with unit value indexes made from the imputed prices secured by dividing the value of shipments by volume of shipments for individual products from data of the Bureau of the Census. The unit values should include divergences from list prices and therefore should be more flexible than the WPI prices if the WPI figures are slow in noting price changes as alleged.

It is almost impossible for price series to adequately reflect all the short-term changes that it would be useful to know in analyzing economic change and relationships. The difficulty of proper allowance for changes in quality is one such change that is discussed in other studies of the Price Statistics Review Committee Report. In addition, there are for some items almost as many prices as there are buyers. No less important are the various terms of sale and concessions that are not reflected in the transactions price at all, but in effect represent real price changes. Changes in credit terms, quality guarantees, and various special services provide examples. It should be emphasized in the comparisons that follow that neither series will reflect these changes.

Despite the difficulties of getting all the economic change reflected in given price series, it is still possible to test the validity of other price changes of the WPI prices by comparing them with the Census unit value series.

The Census data are taken from figures published currently under the title of *Current Industrial Reports* and previously under the title *Facts for Industry*. The data as published represent the total value of shipments including interplant transfers as well as the aggregate volume of these shipments by types of product. While data were available on an annual basis, these were not deemed a fair test of short-term fluctuations, and were excluded from examination with the

exception of steel products. With this exception, only monthly series were used.

To get the basic data, the entire list of commodities reported in the monthly Census reports for which value and the number of units shipped monthly were available was checked to see if commodities could be matched with similar items from the WPI (6-digit WPI items were matched with 7-digit Census items). Only nine monthly series in the entire list were deemed close enough in specifications to warrant close comparison. Data for a tenth item, however, was gathered for use on a somewhat different basis than for the other nine.

Despite the careful matching, a comparison of the Census unit values with the WPI series is not exact for several reasons. One distortion is caused by the fact that interplant transfers are not excluded from the unit value data.[12] Presumably, some portion of these transfers do not enter the market at all since they are used within a company. However, the amount of distortion from this source should be small as the Census instructs that for these interplant transfers the "nearest approximation to commercial values" be reported. Also the WPI series represent a small sample of particular items while the Census data represent either a large sample or all the items. In addition, the specifications for an individual product are likely to be somewhat broader in the Census figures. Both sets of figures are given as f.o.b. plant.

1. *Steel Mill Products.*—As previously mentioned, one comparison of WPI and Census data was made using annual data. This comparison for steel mill products follows.

A composite index of 49 steel mill products was made for each of the two types of data shown in Table 3.3. Individual product prices were matched for the two series so that product mix and specifications were as close as possible. The same 1954 weights were used for each series. Differences remaining in the two sets of prices would be due to the following factors: changes by customers from one specification to another, freight absorption, and price concessions. Neither series had cash discounts deducted. The following are some effects of these factors that would be likely to obscure comparisons: omitting cash discount would omit a factor which would bring greater fluctuation to the unit value series; changes by customers from one specification to another would be in the direction of minimizing costs and would bias the unit value (UV) series downward in relation to the WPI series, especially in a period of slackening demand.

To some extent an upswing would reverse the process with the Census series reflecting "trading up." However, industrial users would not likely fully reverse their position unless supply pressures were severe.

From Table 3.3 it is evident that there is an upward trend in both series, a factor which probably obscures to some extent their cyclical differences. Despite this factor for "togetherness," substantial differences in prices due to the WPI method of pricing would still obtain if there are true differences. Due to the use of annual data, the short-term differences would have to be substantial, however, in order to show distinction in the series.

[12] This bias from inclusion of interplant transfers is almost entirely absent from the steel mill products data.

TABLE 3.3.—*Test Indexes for 49 Steel Mill Products Based on WPI Prices and Census Unit Values with 1954 Weights, 1947, 1949–58*

Year	WPI index 1947=100 [1] (1)	Unit value index 1947=100 [1] (2)	Steel industry (percent of capacity) [2] (3)	Percentage of previous year			(4) ÷ (5) (7)
				WPI (4)	UV (5)	Capacity (6)	
1947	100.0	100.0	93.0			128.3	
1949	122.9	122.9	81.1	[3] 122.9	[3] 122.9	[3] 87.2	100.0
1950	129.9	128.7	96.9	105.7	104.7	119.5	101.0
1951	139.3	139.4	100.9	107.2	108.3	104.1	99.0
1952	142.5	142.7	85.8	102.2	102.4	85.0	99.8
1953	153.1	150.0	94.9	107.4	105.1	110.6	102.2
1954	159.4	152.9	71.0	104.1	101.9	74.8	102.2
1955	166.7	158.7	93.0	104.6	103.8	131.0	100.8
1956	180.5	172.3	89.8	108.3	108.6	96.6	99.7
1957	197.5	186.5	84.5	109.4	108.2	94.1	101.1
1958	204.8	192.4	60.6	103.4	103.2	71.7	100.2

[1] Indexes prepared by Division of Prices and Cost of Living, Bureau of Labor Statistics. The second of these indexes was a specially computed index.
[2] *Statistical Abstract*, 1959, p. 820.
[3] Percent 1949 is of 1947.

Columns 1 and 2 of the table show indexes computed for WPI prices and census unit values respectively for the same products with the same 1954 weights for both series. Column 3 shows the percentage of capacity at which the steel industry was operating in a given year. Columns 4 and 5 show the percentage that each index was of the previous year and column 6 the percentage that capacity was of its previous year figure. Column 7 shows the ratio that percentages of previous year changes for the WPI index are of comparable changes of the unit value index.

Unless there are influences other than those previously mentioned, one would expect (in the face of a rising trend in both series) that the UV series would accelerate more when the demand for steel increased and accelerate less when it decreased. Hence, a ratio (R) of the percentage changes from the previous year for the two series expressed as WPI/UV should be less than one as conditions of demand improve and be greater than one as conditions of demand worsen. If the capacity data are taken to represent the conditions of demand, the ratio (R), as it should be and was, is as follows:

	Should be—	Was—	Agree with theory?	
			Directly	Qualified
1947–49	$R>1$	$R=1$	No	
1949–50	$R<1$	$R>1$	No	
1950–51	$R<1$	$R<1$	Yes	
1951–52	$R>1$	$R<1$	No	Yes.
1952–53	$R<1$	$R>1$	No	
1953–54	$R>1$	$R>1$	Yes	
1954–55	$R<1$	$R>1$	No	
1955–56	$R>1$	$R<1$	No	Yes.
1956–57	$R>1$	$R>1$	Yes	
1957–58	$R>1$	$R>1$	Yes	

According to the above preliminary analysis, the movements of the two indexes behaved according to the hypothesis four times and contrary to it six times. However, there were three times during this period when capacity probably did not indicate the state of demand.

These occasions were during the strike years of 1949, 1952, and 1956. One would expect that the effect of the strike would make conditions of demand more favorable to the seller except as prices were held down by contracts in existence. Following this assumption, the change in capacity from 1951 to 1952 reflected the strike of 1952 and not demand, and conditions of demand should have caused the column 7 ratio to be less than one, which it was. The 1949–47 ratio should have been greater than one but was exactly one and *R* for 1955–56 should have been less than one and was. If the true nature of demand has been properly reflected in the above analysis, the evidence shifts slightly in favor of the UV series being more sensitive than the WPI series though the results are far from being conclusive. In any event further investigation appears warranted at the single product level.

An analysis of 25 different individual steel products, matched as closely as possible for WPI and Census data, gives the average agreement per product (with the hypothesis just formulated above) of 5.2 times out of a possible 10 times. Clearly, the data as analyzed in the above fashion do not substantiate the hypothesis that the unit values are more flexible on an annual basis than the WPI prices. It is not clear from the data available for steel products whether there is no significant difference between the WPI and the UV series or whether putting the data on an annual basis obscures the difference. Unfortunately, monthly data are not available for the UV series.

2. *Standard Typewriter (Nonelectric).*—In the comparisons to follow, the census data represent indexes of derived prices that are secured by dividing dollar sales volume by the number of items shipped. For standard typewriters a different type of comparison is available. In each case, that is for the BLS and for the Census, their respective series are derived by using prices stated by manufacturers. The comparison 1956–59 is shown in Chart 3.1. While the specification appears to be the same for both series, the broader sample used by the census generally results not only in a greater number of reporters but also in a widening to some degree of the specifications. Since, as shown previously, increasing the number of reporters tends to increase the number of price changes, it would be expected that the Census series would be more variable than that of the BLS.

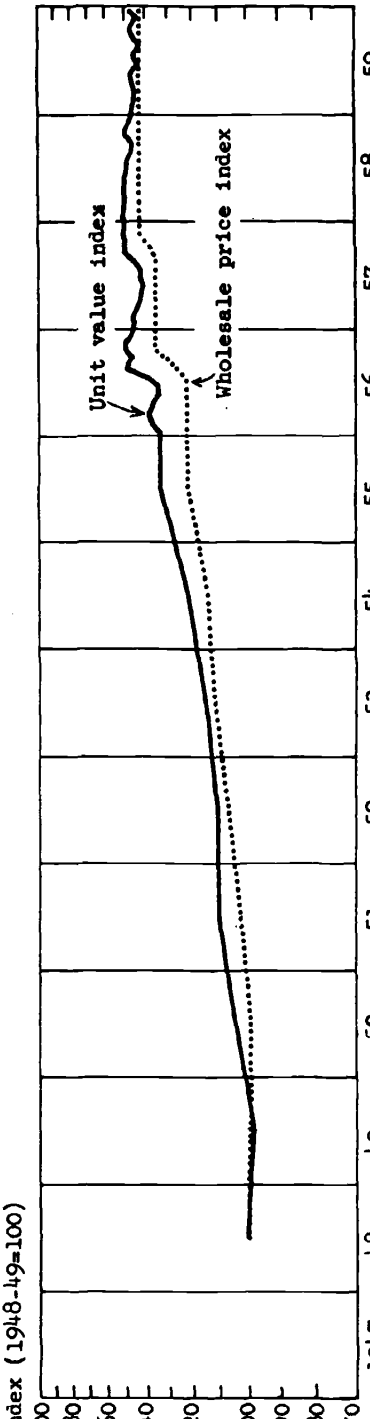
The difference in level on a 1947 base at the beginning of the period and the gradual convergence of the two series is puzzling.

Based on the data for this item where the data are collected by each agency on as nearly a comparable basis as is consistent with their collection procedures, it appears that a greater consistent variability of the Census series can be expected, due to the fact that it represents a larger number of reporters and also with a greater number of reporters there is some tendency for slight specification differences between reporting manufacturers to arise. However, with the close matching of items, the differences in fluctuation should not be extreme. Also the general movements for a given year or over a period of several years should be approximately the same.

3. *Clay Building Brick.*—Comparative movements in monthly indexes for the WPI and unit value (UV) data for clay building brick are shown in Chart 3.2 for 1947–49. Both series show a generally rising trend in prices over the period, the WPI rising by 56 percent and

CHART 3.1

Standard Typewriter (Non-electric)



Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

the UV series by 61 percent. The UV series is a more flexible one in its movements, rising higher and falling lower during the ups and downs of the business cycle. For example, it started down a month before the cyclical peak of November 1948, while the WPI continued its upward climb. During the depression year 1949, it went lower and averaged lower in its index. The impact of the Korean War in 1950–51 saw it rise more rapidly at first and then fluctuate moderately while the WPI remained nearly constant. Again in 1953 the UV index reflected the peak reached in business that year while the WPI changed very little. In 1954 it again declined while the WPI did not. Also it reflected the peak activity of 1957 and the 1958 trough while the WPI remained relatively stable. In addition, the UV data exhibit for part of the period a definite seasonal pattern, rising during the summer months and falling toward the end of the year. Clearly, the UV index is more sensitive than its comparative WPI series.

4. *Structural Clay Facing Tile.*—The unit value and WPI series for this commodity show a generally upward trend as was noted for clay building brick (see Chart 3.3). However, in this case the two indexes diverged more in their movements, with the WPI index rising 34 percent over the 1947 to 1959 period compared to 65 percent for the unit value index.

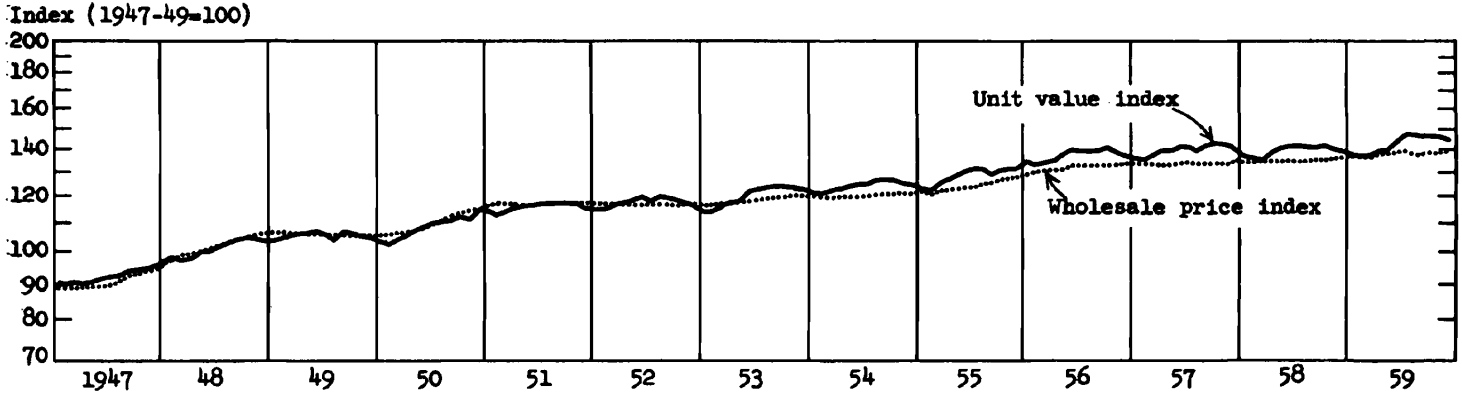
Again, as noted for the previous series, the UV series is more sensitive cyclically although the presence of some seasonal influence tends to obscure these movements. During the upward swing of 1951–53 this tendency is particularly in evidence; the UV series fluctuates seasonally while evidencing a sharp upward trend, while the WPI index remains constant over the entire period. Again in the 1948–49 and the 1957–58 recessions the UV index declines while the WPI data remain nearly constant in the first downturn and entirely so in the second. In fact, it is generally characteristic of the WPI series that it tends to remain constant over fairly long periods. As was the case for clay building brick, the differences in the variation of the two series appears greater than would be warranted according to their composition.

5. *Clay Drain Tile.*—As in the previous cases, the UV series for this item shows greater variability than that of the WPI (Chart 3.4). There appears to be seasonal movement in the UV that is not found in the other series but it tends to be obscured somewhat by the rising trend of the series. Also the seasonal pattern does not appear to be definite from month to month, it appears only as a general tendency to rise during the summer and fall in the late months of the year.

Neither series shows much of a tendency to conform to the NBER reference dates of the business cycle. There is an overall tendency for the WPI series to show periods of rigidity not found in the other series.

CHART 3.2

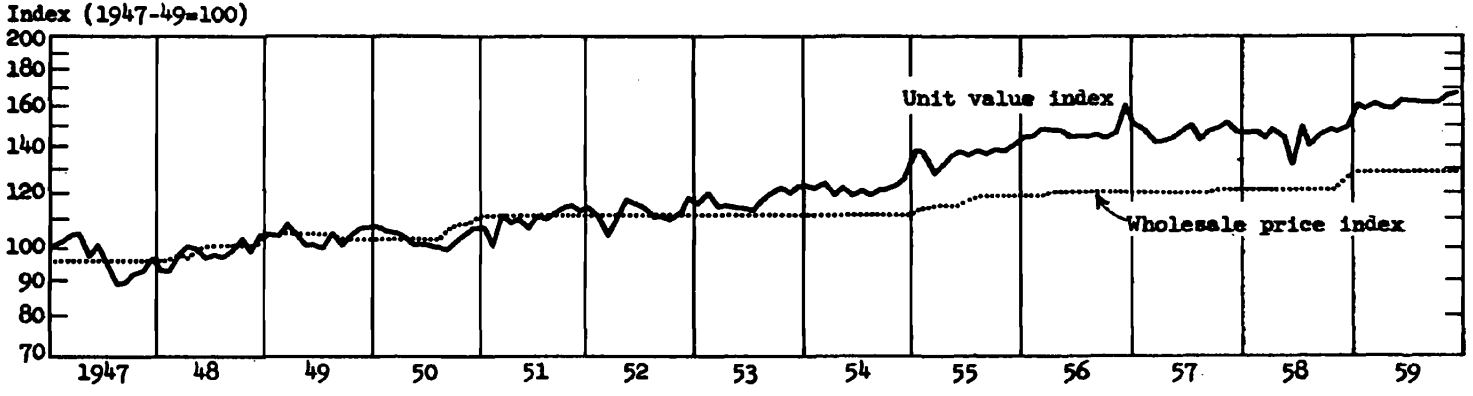
Clay Building Brick



Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

CHART 8.8

Structural Clay Facing Tile (Hollow), Ceramic Glazed*

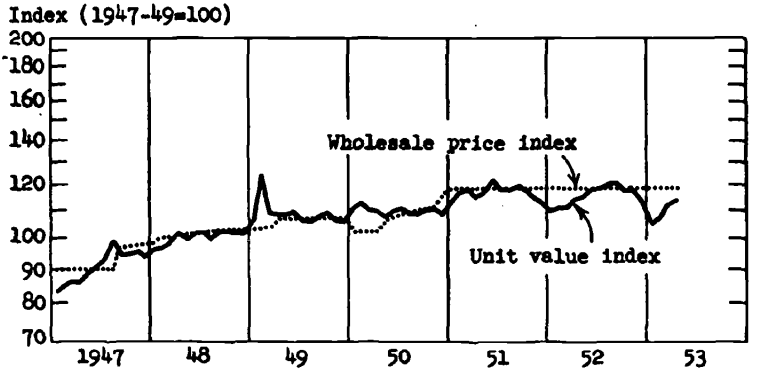


*Data July 1947 through 1954 include unglazed tile which represents about 5 per cent of total quantity and 10 per cent of total value in 1954.

Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

CHART 3.4

Clay Drain Tile



Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

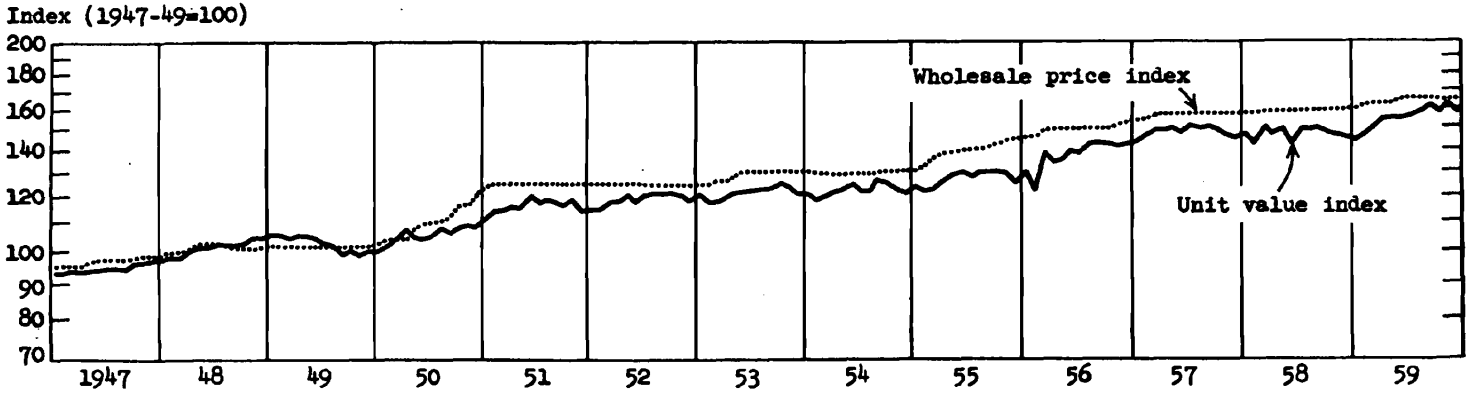
6. *Vitrified Clay Sewer Pipe.*—The Census series for this item showed considerably more conformity to general cyclical movements than the BLS series (Chart 3.5). The general level of the two series was nearly the same from 1947 through 1949 but diverged rather sharply in 1950, with the WPI being at a higher level through 1959. In this year the two series did come closer together toward the end of the year, however.

Again, a comparison of the series shows some seasonal for the UV and none for the WPI. Also the WPI shows long periods of stability in price where the UV series is fluctuating.

7. *Domestic Gas Cooking Range.*—While the BLS series for this commodity shows more variation than similar series for other items, again the census data shows substantially more (Chart 3.6). Generally, greater cyclical flexibility is shown for the Census UV series, with the WPI data remaining relatively rigid. The 1949 and 1954 declines of general business were followed much more by the UV than the WPI data. In fact, while the WPI data did decline to a small degree in 1949 (compared to a more substantial fall in the UV data), it actually showed an overall rise for the year 1954 instead of a decline. Also to be noted is the divergence of level in the two indexes. Since about 1950 they have tended to diverge, with the WPI pulling away to a higher and higher level.

CHART 3.5

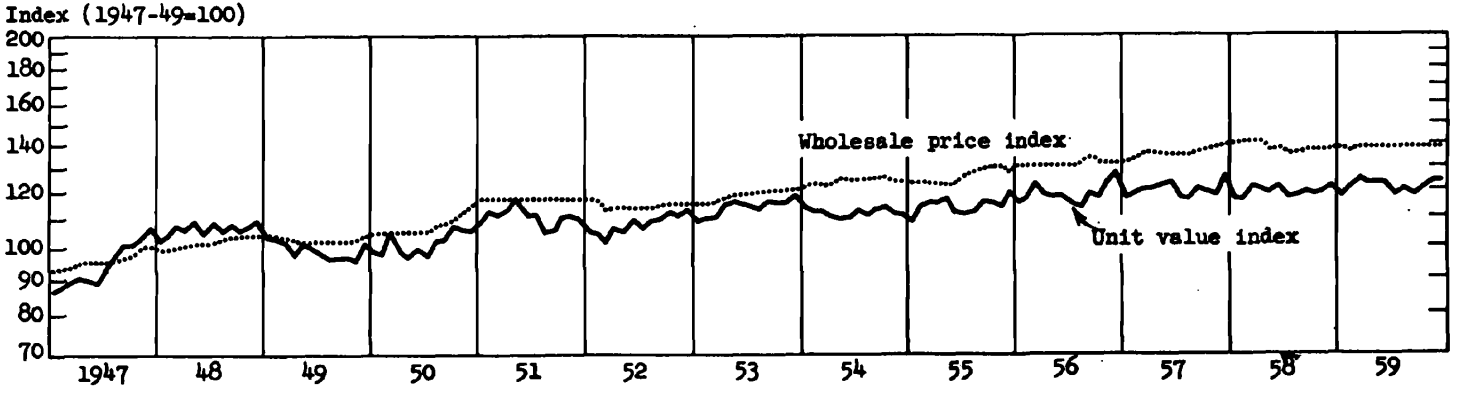
Vitrified Clay Sewer Pipe



Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

CHART 3.6

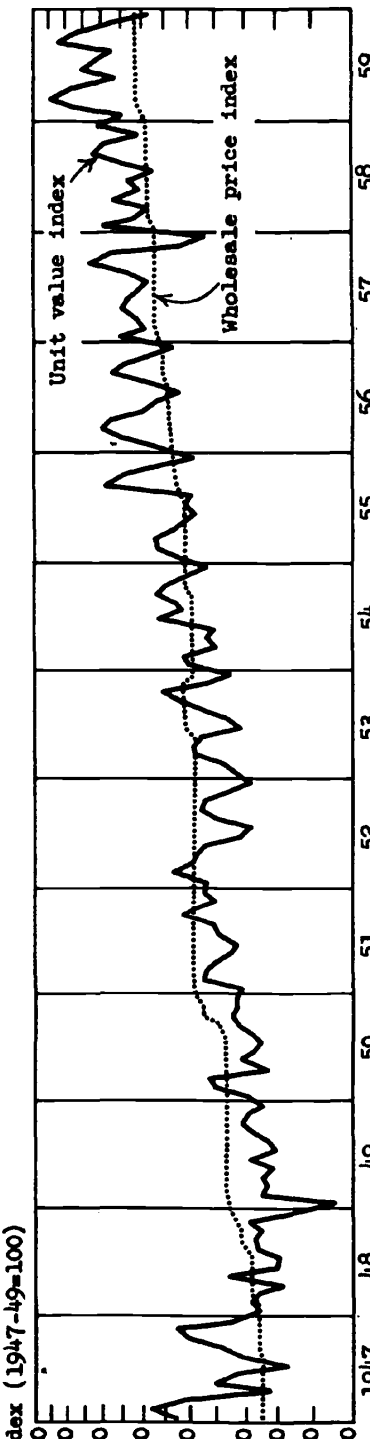
Domestic Gas Cooking Range, Standard Size



Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

CHART 8.7

Domestic Gas Heated Stove (Vented)



Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

8. *Domestic Gas Heating Stove (Vented).*—The number of plants reporting to the Census is considerably smaller for this item than for the previous products discussed (see Table 3.4). Consequently, the UV series fluctuates much more sharply than it would with a large number of items included (Chart 3.7). Under these circumstances the relative stability of the WPI series is even more striking than for the other commodities discussed. A great deal of the difference, however, is due to the fact that seasonal changes appear in the UV series where they do not in the BLS data. Adjustment of the Census series for these changes would still leave a pattern of cyclical change of greater magnitude than for the BLS statistics. In addition, a divergency in trend with the UV series rising more rapidly has appeared since 1956.

TABLE 3.4.—*Average Number of Plants Reporting Facts for Industry*

[Data for Given Year]

Commodity	1947	1948	1949	1950	1951	1952	1953
Clay building brick	630	619	639	633	612	595	578
Structural clay facing tile	*29-66	56	66	64	64	63	58
Clay drain tile	164	163	197	189	178	177	180
Vitrified clay sewer pipe	76	76	77	73	72	71	72
Domestic gas cooking range	55	56	N.A.	N.A.	N.A.	N.A.	N.A.
Domestic gas heating stove (vented)	27	29	N.A.	N.A.	N.A.	N.A.	N.A.
Domestic gas heating stove (unvented)	25	26	N.A.	N.A.	N.A.	N.A.	N.A.

*Number for glazed tile only is 29; 66 for glazed and unglazed.

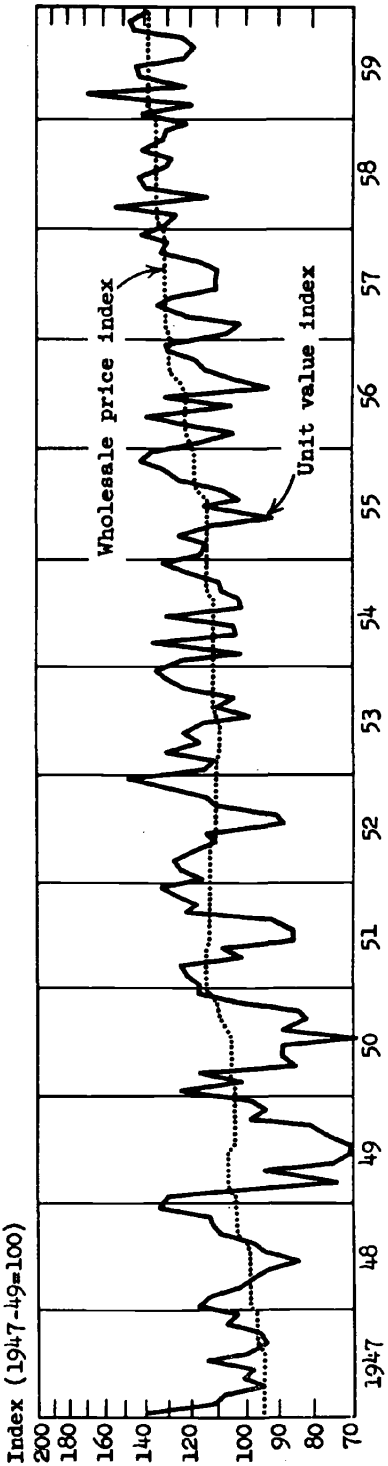
SOURCE.—*Facts for Industry*, U.S. Bureau of the Census.

9. *Domestic Gas Heating Stove (Unvented).*—For this commodity a relatively small number of items (see Table 3.4) for the Census data tends to give this series relatively wider swings than most of the other series (except for the one in the immediately preceding discussion which has about the same number of items).

Again, as with the previous commodity, a seasonal pattern is exhibited that tends to somewhat obscure the cyclical movements of the data (Chart 3.8). However, cyclical variation is much more apparent in the Census than in the BLS data. The WPI series moved largely upward or downward in small steps and stays constant over long periods of time, while the UV series shows more conformity to change as during the downswing of 1948–49.

CHART 3.8

Domestic Gas Heating Stove (Unvented)

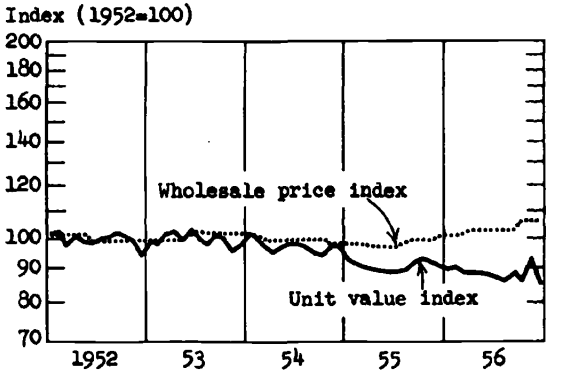


Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

10. *Water System, Deep Well, Jet Type, ½ H.P.*—Data were available on a comparative basis for only the five years 1952–56. The general pattern of greater stability for the WPI series is again evident, though in this case the fluctuations in the UV series are not as wide as those noted for other commodities (Chart 3.9). In addition to the difference in relative fluctuations, however, there is a disturbing difference in the trend of the two series, the WPI data exhibiting an upward and the UV data showing a downward trend.

CHART 3.9

Water System, Deep Well,
Jet Type, 1/2 h.p.



Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

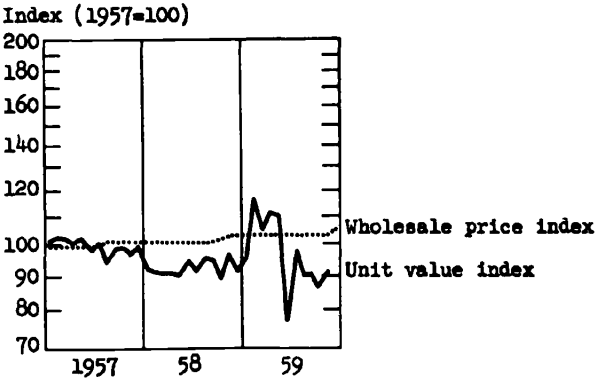
11. *Bed Springs (Coil Type).*—Only three years of monthly data were available for this comparison. The comparison is similar to the general pattern of all the items: general stability of the WPI, wider fluctuation of UV (Chart 3.10). As in the case of the deep-well water system, the UV shows an overall downward movement compared to a small upward one for the WPI item.

Again, as was evident in the prices-paid comparison, the compared series showed greater short-term flexibility than their BLS counterparts. Part of this greater flexibility is attributable to the greater number of reporters that the Census has. However, with a greater number of reporters the magnitude of the flucuation should be less for the Census data and it is not. Also, the probably slightly wider classification of the Census data should have these same effects—that is more changes but with lessened fluctuations.

Despite all these factors operating in the direction of a smaller magnitude of fluctuation for the unit value data of the Census, it clearly varies more than the BLS series. It is difficult to find any logical explanation for this phenomenon that does not include more accurate short-term pricing in the sales data of the Census. Possibly, manufacturers' greater concern with the accuracy of the sales figures than the BLS reporters' concern with the accurate reporting of specified items may account for this difference.

CHART 3.10

Bed Springs (Coil Type)



Source: WPI - Wholesale Prices and Price Indexes, BLS
U.V. - Facts for Industry, Census Bureau

In conclusion, the two sources of information used to compare with the BLS prices indicate that these prices are likely too rigid in the short-term and hence are not suitable for an examination of short-term economic change.

APPENDIX

TABLE A.1.—*Comparison of Monthly Indexes of Company Prices Paid with Indexes of Prices Reported to the BLS, 1957–59*

[January 1957=100.0]

A. THE FOLLOWING ITEMS WERE STABLE[1] OVER THE 1957-59 PERIOD BOTH FOR THE COMPANIES' SERIES AND THOSE OF THE BLS

BLS code	Name	BLS code	Name
1. 028411	Flavoring syrup.	7. 061257	Ethylene glycol.
2. 061103	Hydrochloric acid.	8. 061277	B-Napthol.
3. 061135	Chlorine.	9. 095611	Typewriter ribbon.
4. 061165	Sodium carbonate.	10. 095641	Adding machine rolls.
5. 061167	Sodium bichromite.	11. 102251	Magnesium, pig ingot.
6. 061173	Sodium silicate.	12. 114131	Rotary pump.[2]

[1] Some of these items such as typewriter ribbons and adding machine rolls, were probably not bought in large enough quantities to be a good test of their WPI counterparts.
[2] This item changed to 100.2 in the BLS series October 1957. There were no other changes.

TABLE A.1.—*Comparison of Monthly Indexes of Company Prices Paid with Indexes of Prices Reported to the BLS, 1957–59*—Continued

B. THE FOLLOWING ITEMS WERE NOT STABLE OVER THE ENTIRE 3-YEAR PERIOD BUT DID EXHIBIT STABILITY FOR 6 MONTHS OR MORE CONSECUTIVELY IN THE BLS DATA

BLS code	Name and specification difference, if any	Date of price change	Price index	
			Company	BLS
13. *052003	Coke, Milwaukee	February 1957	104.1	100.0
		May 1957	104.5	100.0
		September 1958	103.5	100.0
		February 1959	109.1	104.9
14. 052004	Coke, Indianapolis. (Different delivery point about 20 miles distant.)	March 1957	100.9	99.2
		October 1957	98.2	99.2
		January 1958	94.2	99.2
		March 1958	95.8	99.2
		July 1958	98.2	99.2
		January 1959	96.4	99.2
		February 1959	96.4	104.2
		April 1959	98.2	104.2
		July 1959	101.8	104.2
		Oct. 1959	91.6	104.2
15. 055401	Fuel oil, New York. (Different delivery point about 30 miles distant.)	February 1957	100.0	108.2
		April 1957	96.3	108.2
		May 1957	96.3	104.9
		June 1957	96.3	101.6
		July 1957	90.2	101.6
		August 1957	90.2	100.0
		September 1957	90.2	96.8
		October 1957	85.4	96.8
		January 1958	79.9	96.8
		February 1958	79.9	90.2
		March 1958	79.9	86.9
		April 1958	77.0	86.9
		May 1958	77.0	84.3
		July 1958	74.6	84.3
		October 1958	68.8	77.7
		January 1959	64.5	77.7
		June 1959	64.6	77.7
16. *061109	Sulphuric acid	January 1957	100.0	100.0
		June 1957	100.2	100.0
		September 1957	98.0	100.0
		October 1957	98.4	100.0
		August 1958	98.3	100.0
		December 1958	98.6	100.0
		October 1959	98.8	100.0
		November 1959	99.2	100.0
17. 061111	Aluminum sulfate (carload, bags, freight not equalized.)	June 1957	100.0	108.1
		July 1959	90.0	108.1
18. *061126	Calcium chloride	March 1957	100.0	106.9
		August 1959	103.2	106.9
19. *061133	Carbon dioxide	January 1957	100.0	100.0
		September 1958	125.0	100.0
20. *061157	Salt	April 1957	100.0	102.0
		February 1958	100.5	102.0
		March 1958	100.5	103.7
		August 1958	100.2	103.7
		January 1959	100.8	103.7
21. 061161	Silver nitrate, slightly better grade	June 1957	97.0	99.2
		August 1957	99.0	99.8
		November 1957	98.8	99.8
		December 1957	98.0	99.8
		January 1958	98.2	99.8
		February 1958	97.1	99.8
		March 1958	97.1	101.4
		October 1958	98.9	106.2
		November 1958	98.7	106.2
		December 1958	98.5	106.2
		January 1959	98.7	106.2
		February 1959	98.9	106.2
		March 1959	100.0	107.8
22. 061169	Sodium hydroxide:			
	1st company*	January 1957	100.0	100.0
		April 1958	100.0	111.7
		April 1959	111.6	111.7
	2d company*	January 1957	100.0	100.0
		April 1958	111.7	111.7
	3d company, solution	January 1957	100.0	100.0
		February 1957	98.2	100.0
		July 1957	96.4	100.0
		April 1958	96.4	111.7
		January 1959	95.5	111.7

*Starred items have the same specifications for the company as for the BLS; other items differ as noted.

TABLE A.1.—*Comparison of Monthly Indexes of Company Prices Paid with Indexes of Prices Reported to the BLS, 1957–59*—Continued

B. THE FOLLOWING ITEMS WERE NOT STABLE OVER THE ENTIRE 3-YEAR PERIOD BUT DID EXHIBIT STABILITY FOR 6 MONTHS OR MORE CONSECUTIVELY IN THE BLS DATA—Continued

BLS code	Name and specification difference, if any	Date of price change	Price index	
			Company	BLS
23. *061214	Ethyl alcohol:			
	1st company*	January 1957	100.0	100.0
		February 1957	99.0	100.0
		October 1958	109.0	107.7
	2d company, tank car	January 1957	100.0	100.0
		June 1957	101.5	100.0
		November 1957	102.1	100.0
		October 1958	102.1	107.7
		March 1959	102.8	107.7
		July 1959	103.1	107.7
24. *061231	Carbon disulfide	February 1959	101.4	100.0
25. 061233	Carbon tetrachloride, tank car	April 1957	100.6	104.5
		July 1957	101.1	104.5
		October 1957	101.9	104.5
		January 1958	103.0	104.5
		April 1958	103.5	104.5
		July 1958	103.6	104.5
		October 1958	104.2	104.5
		January 1959	104.6	104.5
		April 1959	105.2	104.5
		October 1959	104.2	104.5
26. *061263	Furfural	January 1958	105.5	100.0
		January 1959	102.7	100.0
27. 061265	Glycerine, natural:			
	1st company, tank car	January 1957	100.0	100.0
		January 1958	99.1	100.0
		October 1959	104.4	105.3
	2d company, tank wagon	January 1957	100.0	100.0
		January 1958	91.9	100.0
		January 1959	99.1	100.0
		October 1959	104.5	105.3
28. *061289	Styrene	January 1957	100.0	100.0
		July 1957	77.5	78.0
		October 1957	77.9	78.0
		January 1958	78.5	78.0
		February 1958	78.5	70.7
		April 1958	78.8	70.7
		July 1958	78.9	70.7
		October 1958	79.2	70.7
		January 1959	79.4	70.9
		February 1959	75.0	70.9
		March 1959	75.0	67.0
		July 1959	75.2	67.2
		October 1959	75.5	67.5
29. 061291	Toluene. (Some freight equalization to April 1958, thereafter, delivered.)	August 1957	91.2	96.9
		September 1957	91.2	92.2
		April 1958	73.5	92.2
30. *063135	Glycerine	January 1957	100.0	100.0
		February 1958	99.4	100.0
		September 1958	98.9	100.0
		August 1959	99.4	100.0
		October 1959	104.3	105.3
31. *063173	Vitamin C	October 1957	83.3	83.3
		June 1959	66.7	83.3
32. 067311	Phenolics, general purpose. (Different delivery point about 20 miles distant; delivered price)	February 1957	100.0	105.2
		April 1957	99.7	105.2
		November 1957	99.7	112.0
		January 1958	100.3	112.0
		April 1958	96.5	112.0
		July 1958	96.5	101.6
		October 1958	99.7	101.6
		January 1959	98.1	101.6
		April 1959	96.5	101.6

*Starred items have the same specifications for the company as for the BLS; other items differ as noted.

TABLE A.1.—*Comparison of Monthly Indexes of Company Prices Paid with Indexes of Prices Reported to the BLS, 1957–59*—Continued

B. THE FOLLOWING ITEMS WERE NOT STABLE OVER THE ENTIRE 3-YEAR PERIOD BUT DID EXHIBIT STABILITY FOR 6 MONTHS OR MORE CONSECUTIVELY IN THE BLS DATA—Continued

BLS code	Name and specification difference, if any	Date of price change	Price index	
			Company	BLS
33. *072101	Passenger car tires	February 1957	100.0	100.1
		April 1957	101.4	100.1
		July 1957	108.2	100.1
		August 1957	108.2	103.1
		October 1957	106.5	103.1
		January 1958	106.7	102.7
		July 1958	105.2	102.7
		August 1958	105.2	101.4
		January 1959	103.2	101.4
		March 1959	97.7	101.4
		July 1959	94.5	101.4
		August 1959	94.5	82.1
		October 1959	98.6	82.1
34. *072131	Tractor and implement tires	February 1957	100.0	100.1
		August 1957	100.0	103.1
		October 1957	102.0	103.1
		January 1958	101.0	102.9
		August 1958	101.0	106.0
		January 1959	102.0	106.0
		October 1959	103.0	106.0
35. *072201	Tubes, passenger cars	February 1957	100.0	100.1
		April 1957	97.4	100.1
		July 1957	104.3	100.1
		August 1957	104.3	102.7
		October 1957	103.4	102.7
		January 1958	101.7	102.5
		July 1958	104.3	102.5
		January 1959	99.1	101.4
		April 1959	96.6	101.4
		July 1959	97.4	101.4
		October 1959	100.0	101.4
36. 081412	Gum, No. 2, common. (1" rather than 4" by 4")	March 1957	101.8	100.0
		September 1957	100.6	100.0
		November 1957	100.6	102.1
		April 1958	100.6	104.0
		March 59	110.4	104.0
		December 1959	107.3	102.1
37. 102230	Platinum (January 1958=100). (Better quality)	February 1958	89.6	100.0
		March 1958	88.3	93.5
		May 1958	82.2	87.0
		July 1958	76.1	77.9
		August 1958	76.1	79.2
		September 1958	69.9	79.2
		October 1958	69.9	74.0
		November 1958	66.3	74.0
		December 1958	63.2	67.5
		January 1959	61.4	67.5
		February 1959	63.8	74.0
		March 1959	87.7	100.0
		April 1959	92.0	100.0
		May 1959	94.5	100.0
		September 1959	93.9	100.0
		November 1959	94.5	100.0
		December 1959	95.7	100.0
38. *103011	Steel barrel	March 1957	101.6	103.2
		January 1958	101.6	101.6
		September 1958	101.6	104.4
		October 1958	103.7	106.4
		November 1958	105.7	106.4
		May 1959	105.8	106.4
39. 108131	Cap screws. (9/16" by 1¼" instead of ⅜" by 2")	March 1957	100.0	101.9
		April 1957	100.0	105.7
		May 1957	104.6	105.7
		July 1957	104.6	108.2
		August 1957	111.6	113.2
		June 1958	94.8	113.2
		September 1958	94.8	119.5
		November 1958	97.7	122.7
		October 1959	97.7	128.7
		December 1959	97.7	114.9

*Starred items have the same specifications for the company as for the BLS; other items differ as noted.

TABLE A.1.—*Comparison of Monthly Indexes of Company Prices Paid with Indexes of Prices Reported to the BLS, 1957–59*—Continued

B. THE FOLLOWING ITEMS WERE NOT STABLE OVER THE ENTIRE 3-YEAR PERIOD BUT DID EXHIBIT STABILITY FOR 6 MONTHS OR MORE CONSECUTIVELY IN THE BLS DATA—Continued

BLS code	Name and specification difference, if any	Date of price change	Price index	
			Company	BLS
40. *117314	Electric motor, ½ hp	April 1957	100.0	100.3
		June 1957	100.0	98.6
		July 1957	100.0	94.9
		September 1957	100.0	93.2
		November 1957	96.2	93.2
		January 1958	88.7	93.2
		January 1959	81.1	93.2
		June 1959	81.1	91.2
		August 1959	81.1	90.4
41. *117633	Welding electrode	January 1958	100.0	103.4
		March 1958	112.0	103.4
		October 1958	116.0	103.4

BLS code	Name and specification, difference, if any	1957		1958		1959	
		Company	BLS	Company	BLS	Company	BLS
42. 117801	Storage battery:						
	1st company:						
	January	100.0	100.0	97.4	103.7	92.9	104.9
	February	103.8	102.6	93.3	103.7	92.9	104.9
	March	103.8	102.6	93.3	103.7	92.0	104.9
	April	103.8	102.6	93.0	102.9	89.1	104.9
	May	103.8	102.6	92.9	102.9	88.6	104.9
	June	103.8	103.7	89.4	103.8	88.1	104.9
	July	98.4	103.7	89.4	103.8	89.9	102.6
	August	99.5	103.7	88.2	103.8	91.1	102.6
	September	98.7	103.7	87.6	103.8	91.1	106.9
	October	98.7	103.7	87.2	103.8	91.8	106.9
	November	98.7	103.7	87.2	103.8	93.8	108.7
	December	97.9	103.7	91.8	104.2	93.8	108.7
	2d company (Plastic separators):						
	January	100.0	-------	100.0	-------	100.0	-------
	February	100.7	-------	99.3	-------	100.0	-------
	March	102.4	-------	99.3	-------	99.1	-------
	April	102.0	-------	99.1	-------	96.6	-------
	May	102.0	-------	98.8	-------	96.3	-------
	June	100.5	-------	96.3	-------	95.7	-------
	July	98.0	-------	94.4	-------	97.4	-------
	August	97.2	-------	93.7	-------	97.6	-------
	September	97.2	-------	92.5	-------	102.3	-------
	October	97.2	-------	92.3	-------	101.6	-------
	November	96.4	-------	92.3	-------	104.1	-------
	December	96.4	-------	96.5	-------	104.1	-------

BLS code	Name and specification difference if any	Date of price change	Price index	
			Company	BLS
43. *132230	Cement, portland	April 1957	102.0	100.9
		October 1957	101.6	100.9
		January 1958	101.9	103.1
		April 1958	101.6	103.4
		June 1958	101.6	103.3
		August 1958	99.2	103.3
		October 1958	99.0	103.3
		November 1958	99.9	103.2
		January 1959	100.5	104.3
		April 1959	99.7	104.3
		July 1959	99.4	104.3
		September 1959	99.4	104.2
		October 1959	99.5	104.2

*Starred items have the same specifications for the company as for the BLS; other items differ as noted.

TABLE A.1.—*Comparison of Monthly Indexes of Company Prices Paid with Indexes of Prices Reported to the BLS, 1957–59*—Continued

C. THE FOLLOWING ITEMS WERE ADDED AFTER THE TEXT WAS WRITTEN

BLS code	Name and specification difference, if any	Date of price change	Price index	
			Company	BLS
*061185	Sulfur	September 1957	100.0	88.6
		October 1957	88.9	88.6
		June 1958	86.1	88.6
		October 1958	84.2	88.6
		August 1959	69.9	88.6
*061281	Pentaerythritol	September 1957	98.7	100.0
		February 1958	91.0	92.2
		April 1959	95.6	96.9
092031	Wastepaper, No. 1, mixed. (Delivered about 20 miles from New York).	February 1957	100.0	92.9
		March 1957	100.0	85.7
		April 1957	83.3	50.0
		May 1957	83.3	35.7
		July 1957	81.5	50.0
		October 1957	85.2	50.0
		January 1958	90.7	50.0
		March 1958	90.7	42.9
		April 1958	85.2	42.9
		July 1958	74.1	64.3
		August 1958	74.1	71.4
		September 1958	74.1	142.8
		October 1958	138.9	142.8
		December 1958	138.9	114.3
		January 1959	118.5	114.3
		June 1959	118.5	157.1
		July 1959	146.3	157.1
102211	Pig lead. (Each company index weighted by number of days a given price was in effect.)	May 1957	96.2	96.8
		June 1957	89.6	87.5
		July 1957	87.6	87.5
		October 1957	85.7	84.4
		November 1957	84.5	84.4
		December 1957	81.4	81.2
		April 1958	75.2	75.0
		May 1958	73.4	75.0
		June 1958	70.3	68.8
		July 1958	68.9	68.8
		August 1958	68.0	68.8
		September 1958	68.3	67.2
		October 1958	79.3	81.2
		November 1958	81.4	81.2
		January 1959	78.9	81.2
		February 1959	72.6	71.9
		March 1959	71.6	71.9
		April 1959	70.2	68.8
		May 1959	74.6	75.0
		June 1959	75.2	75.0
		August 1959	76.9	75.0
		September 1959	81.4	81.2
		December 1959	78.4	78.1
102246	Mercury, 76-lb. flask. (Prices kept monthly but item bought quarterly; delivered 20 miles from New York.)	February 1957	100.4	100.0
		April 1957	102.0	100.0
		August 1957	99.8	98.1
		September 1957	97.2	96.3
		November 1957	90.1	89.3
		December 1957	87.9	88.5
		January 1958	86.1	87.3
		February 1958	87.7	85.6
		March 1958	87.7	91.2
		April 1958	90.4	91.0
		May 1958	90.4	89.5
		June 1958	92.9	89.5
		August 1958	93.7	94.6
		September 1958	93.8	94.2
		October 1958	92.9	91.6
		November 1958	90.3	89.7
		December 1958	90.3	86.9
		January 1959	90.3	85.8
		February 1959	87.6	85.8
		March 1959	88.9	87.5
		April 1959	95.6	94.8
		May 1959	97.2	96.5
		June 1959	97.2	94.2
		July 1959	97.2	91.8
		August 1959	97.2	90.3
		September 1959	88.8	87.5
		October 1959	88.4	87.9
		November 1959	88.3	84.4
		December 1959	85.0	84.0

***Starred items have the same specifications for the company as for the BLS; other items differ as noted.**

TABLE A.2.—*Possible Effects of Different Specifications on the Items of Appendix Table A.1*

052004 Delivery point about 20 miles apart. There is a possibility that different freight quotations might have caused the company index to move differently apart from price changes.

055401 Different delivery points about 30 miles apart. A possibility of different freight quotations affecting the company index.

061161 The company buys a better grade than the BLS prices. Company buyer stated that the two grades showed the same movements.

061214 One company bought this by the tank car rather than by drum. Comparative variation of the two company prices shows the tank car price to be substantially more variable while the company price for the same item, as specified by the BLS, moved very similarly to the BLS item index.

061233 The index used here represents a tank car price rather than a drum price. In the opinion of the buyer, there existed a constant differential between the two prices over the 1957–59 period.

061265 Again tank wagon prices were used instead of drums. In the opinion of the buyer of one company, there was a constant differential between the two types of prices.

061291 In the company index "there was some freight equalization from January 1, 1957, through April 14, 1958. Thereafter, a delivered price was quoted." Additional variation beyond that found in the BLS index would be expected here.

067311 The company price is a delivered price. Additional variation in the company index beyond that shown for the BLS index would be possible but not necessary.

081412 Company was buying 1" items rather than 4 x 4". Uncertain of likely price effect.

102230 Company bought a better quality item. Price variations should have been similar.

108131 $\frac{9}{16}$" x $1\frac{3}{4}$" instead of $\frac{3}{8}$" x 2" on these cap screws. Price variations should have been similar.

117801 There were plastic separators in the batteries bought by the company as compared to wood separators for the BLS. Price variations were similar for two reporting companies, one reporting data for wood and one for plastic separators.