Volume Title: The Behavior of Industrial Prices

Volume Author/Editor: George J. Stigler and James K. Kindahl

Volume Publisher: NBER

Volume ISBN: 0-87014-216-X

Volume URL: http://www.nber.org/books/stig70-1

Publication Date: 1970

Chapter Title: Comparison of Indexes for Individual Commodities

Chapter Author: George J. Stigler, James K. Kindahl

Chapter URL: http://www.nber.org/chapters/c3316

Chapter pages in book: (p. 56 - 70)

5

Comparison of Indexes for Individual Commodities

We come now to the formidable task of proofing the pudding of price indexes we have prepared. Price indexes are available for sixty-four more or less "specific" commodities, reproduced in Appendix C, and seven other commodities which we do not present for obligation of confidentiality. The present chapter compares the BLS and NB price indexes with respect to trend, cyclical fluctuations, and short-run movements. Chapter 6 extends the comparisons to price indexes of groups of commodities.

TREND

The varieties of distrust of quoted prices are numerous, but perhaps no one has suggested that there ought to be a secular bias in the quoted prices. Compounding is so formidable a process that eventually grotesque and surely purposeless discrepancies would arise between list and transaction prices. In very long periods this argument must be valid; list prices that have lost all relationship to transaction prices simply would not be published.[1]

It is truly a surprising finding of our study, therefore, that the BLS indexes have a strong upward tendency relative to our indexes. The

[1] Sometimes only the structure of prices, and not the level, is conveyed by list prices: for example, various sizes of glass sell in proportion to list prices but at discounts sometimes exceeding 80 per cent.

unweighted average monthly rate of change of our indexes for the decade is −.107 per cent whereas that of the BLS is −.068 per cent—a difference of .039, or 1 per cent every two years (Table 5-1). The difference in trend, it should be observed, was essentially zero in the first five years and almost twice as large (.73 per cent a year) in the second five-year period. If we consider two trends equal if they differ by less than .025 per month (or ⅓ per cent per year), in the latter five years there are fourteen prices which have equal trends, eighteen series in which the BLS index rose less rapidly than the NB index, and thirty-eight series in which the BLS index rose more or fell less rapidly. We shall postpone to the next chapter a discussion of the industrial areas in which marked differences in trends of prices occurred; here it will suffice to say that in the chemical products the excess of BLS over NB trends was especially large.

TABLE 5-1

Difference Between the Monthly Rates of Change, BLS and NB Indexes

BLS Change *Minus* NB Change (per cent)	Number of Commodities		
	1957–66 [a]	1957–61 [a]	1962–66
−.20 or less	1	5	3
−.20 to −.15	0	0	2
−.15 to −.10	2	4	3
−.10 to −.05	8	7	3
−.05 to −.025	3	6	7
−.025 to 0	6	9	3
0 to .025	13	5	11
.025 to .05	8	10	2
.05 to .10	10	9	11
.10 to .15	6	7	6
.15 to .20	7	3	8
.20 to .25	3	1	2
.25 or more	1	2	9
Total	68	68	70
Average	.037 [b]	.002	.061

[a] Excludes two products for which 1957–61 data are not available.

[b] An average difference of .039 is obtained if we include 1962–66 rates of change for the two products referred to in the preceding footnote.

The upward trend of BLS prices relative to NB prices is for the most part independent of questions of statistical coverage: it is equally evident for commodities for which we have few and many reporters.[2]

Perhaps the simplest explanation for the difference in trend of BLS and NB prices would be that there is inertia in quoted prices relative to transaction prices. The possibility at each moment that soon there will be a reversal of movement and the existence of costs of making changes in quoted prices, together imply that there should be a lag of quoted behind changed transaction prices. This argument is on its face symmetrical for both price increases and price decreases, but two factors tend to make the lags longer for price reductions.

The first factor is the general experience of all industrial prices. This has been an age of inflation, and therefore, on average, price reductions are reversed more often than price increases. The second factor is the growing intervention of the federal government in the fixing of quoted prices in conspicuous industries (for example, in the "guideline" policies). A reduction in quoted prices will be more difficult to reverse than a price increase, and a price freeze as of a recent date cannot be wholly impossible in this age of war. We encountered many businessmen who were acutely aware of the growing threat of public intervention in pricing.

A partial statistical test of this argument is provided by Table 5-2. We should expect that when transaction prices (measured by NB indexes) are rising, BLS prices will also rise—the rise in price should be registered rather promptly for both customers and the public price collecting agency. When transaction prices are falling, however, the quoted prices should lag because of the factors just discussed. This pattern is

[2] The effect of number of NB reporters may be summarized:

Number of NB Reporters	Number of Commodities	Number with Higher BLS Trend	Mean Difference in Trend per Month (BLS–NB) (per cent)	Standard Deviation of Difference in Trend (per cent)
Under 5	20	11	.025	.170
5 to 10	15	7	.045	.080
10 to 20	18	9	.043	.107
20 or more	17	9	.046	.084

TABLE 5-2

Comparison of Differences in Trends of Prices, BLS Minus NB, with Trend of NB Price Index

BLS Minus NB Average Monthly Trend	Average NB Monthly Rate of Change (per cent)		
	Falls More Than −.05	−.05 to +.05	Increases More Than .05
1957–66			
Positive	18	6	4
Negligible (±.05%)	13	8	9
Negative	7	1	4
Total	38	15	17
1962–66			
Positive	25	3	8
Negligible (±.05%)	4	7	12
Negative	4	2	5
Total	33	12	25

in fact found in the data: for the whole period, and particularly in the last five years, there is a vast preponderance of positive differences between BLS and NB monthly price trend slopes in the case of falling prices, and no systematic difference in slopes when transaction prices are rising.[3]

If this hypothesis on asymetrical lags is tentatively accepted, it raises an important question: does the lag in registering price reductions eventually stabilize? The main reason for delay in registering this year the fall in transaction prices over the previous year or two—uncertainty as to the persistence of the reduction—would lead one to reduce quoted prices after the lower level was reliably established. A *steady* fall in transaction prices should, on this line of argument, be registered more

[3] A X^2 test may be applied to the data underlying either panel of Table 5-2, with the null hypothesis that there will be an equal number of positive and negative differences in slope in periods of falling prices as in the periods of stable or rising prices. For 1962–66, for example, X^2 is 29.92 with two degrees of freedom, and the probability that the differences could arise by chance is much less than .01.

promptly than an irregular fall. The determination of the secular bias in quoted prices is a new problem of price behavior.

CYCLICAL BEHAVIOR

The aspect of price behavior upon which the literature of administered and rigid prices has placed emphasis is cyclical behavior: how do prices respond to the alternating periods of expansion and contraction of aggregate economic activity? We have already observed that the decade covered by our price indexes fortunately does not contain any severe and extended contractions, and this must be kept in mind in the following discussion. We examine first the changes in the price indexes during the cyclical phases, then briefly discuss what little additional evidence we have on price flexibility.

Cyclical Patterns of Price Behavior

Classical theory leads one to expect prices to fall in competitive industries during a business contraction, because both demand and marginal production costs fell, and that reverse movements will occur in expan-

TABLE 5-3

Monthly Percentage Rates of Price Change During Two Business Contractions, 1957–58 and 1960–61 Combined, Sixty-Eight Commodities

	Percentage Change in BLS Index							
Percentage Change in NB Index	−.5 or Less	−.5 to −.2	−.2 to −.1	−.1 to −.05	−.05 to +.05	.05 to .1	.1 to .2	.2 or More
−.5 or less	13	2			2	1		
−.5 to −.2	1	3	2		2	1	1	2
−.2 to −.1					2	1		1
−.1 to −.05		1	1		3			1
−.05 to +.05					7	3		
+.05 to .1					1	3	2	
.1 to .2					2	1	2	2
.2 or more								5

sions. This expectation was not subjected to elaborate analysis perhaps because a similar pattern was expected under monopoly. Here too, marginal costs would fall and there was no strong reason to expect marginal revenues to rise, although a price reduction was no longer a *necessary* result of a leftward shift in demand and cost functions.[4] The great impact of Means' writings on administered prices is attributable to the contradiction of this expectation by the price statistics.

What is the verdict of the present price data? We tabulate average monthly rates of price change during the two reference cycle contractions in Table 5-3. In summarizing the data we treat the class $-.05$ to $+.05$ per cent as showing no change and also show a tabulation excluding prices of steel products because they provide so large a share of all nonconforming price indexes:

	All Prices		Excluding Steel Products	
Price Changes	BLS	NB	BLS	NB
Decreases	23	40	23	40
No change	19	10	16	7
Increases	26	18	18	10

There are two NB price movements in the expected direction for each perverse change; in the BLS indexes the expected and perverse movements are virtually equal. Contrary to a widely held view, there is substantial cyclical conformity in the nonsteel prices. Neither the number of price reporters nor the level of concentration in the industry whose prices are reported has a clear effect upon cyclical conformity.[5]

The results are qualified, but not reversed, if we measure price changes during contractions from trend-corrected data, using the constant per-

[4] For an illustrative discussion of these expectations, see J. Niehans, "Kartelle und Preisflexibilität", *Schweizerische Zeitschrift für Volkswirtschaft und Statistik*, Vol. 94, 1958, pp. 315–28.

[5] The data on concentration and price behavior during contractions may be tabulated:

	Concentration Ratio			
NB Price	Under 25	25 to 50	50 to 75	75 and Over
Decreases	5	15	12	8
No change ($\pm.05\%$)	0	2	7	2
Increases	0	8	9	1

TABLE 5-4

Monthly Percentage Rates of Price Change During Two Business Expansions, 1958–60 and 1964–66 Combined, Seventy Commodities

Percentage Change in NB Index	Percentage Change in BLS Index								
	−.5 or Less	−.5 to −.2	−.2 to −.1	−.1 to −.05	−.05 to +.05	.05 to .1	.1 to .2	.2 to .5	.5 or More
−.5 or less	2								
−.5 to −.2	1	2	1		1				
−.2 to −.1		1	2	1	4	1			
−.1 to −.05		0	0		1	2			
−.05 to +.05		1	1		7	2	1	2	
+.05 to .1		1	1		2	1	3	1	
.1 to .2					3	3	4	0	
.2 to .5					2		2	5	
.5 or more								3	6

centage trends for the period 1957–61. The tabulation of trend-corrected changes is:

Price Changes	All Prices		Excluding Steel Products	
	BLS	NB	BLS	NB
Decreases	25	32	23	31
No change	19	24	12	17
Increases	24	12	22	9

The main impact of trend correction, it will be observed, is to change numerous NB price index increases and decreases to no change. One may of course question the accuracy of the estimates of trend based upon a short period and a single constant-percentage rate of change equation. However, when we segregate those price indexes for which the constant percentage trend fits well (judged by the correlation with time), the trend correction of the prices has the same effect upon the cyclical price patterns as that reported above.

A comparable analysis may be made of the reference expansion of 1958 to 1960 and of the brief, strong upsurge of 1964 to 1966 (see Table 5-4). The cyclical pattern may be summarized:

	Original Price Indexes		Trend-Corrected Indexes	
Price Changes	BLS	NB	BLS	NB
Increases	36	37	36	43
No change	20	14	23	23
Decreases	14	19	11	4

The BLS and NB price indexes, uncorrected for trend are essentially identical in their behavior. This time the trend correction increases the conformity to expectations for the National Bureau indexes.[6] Although we do not report the two expansions separately, it is worth reporting that cyclical conformity was only fair in the 1958 to 1960 expansion but very good in the 1964 to 1966 expansion. Again neither the number of reporters nor level of concentration influenced cyclical conformity.[7] The 1961–66 expansion could be analyzed similarly, but the period is so long that we expect cyclical effects to be swamped by secular effects of technical progress so there is no longer a definite "expected" price behavior.[8]

Our general conclusion, then, is that the behavior of industrial prices in business cycles is not perverse. In fact, on balance we found slightly

[6] The prices of steel products fall primarily in the "no change" class. The trend-corrected tabulation excluding steel prices is:

	BLS	NB
Increases	34	40
No change	14	15
Decreases	11	4

[7] The tabulation of price changes, not corrected for trend, as related to concentration ratios is:

	Concentration Ratio			
NB Price	Under 25	25 to 50	50 to 75	75 and Over
Increases	4	15	13	5
No change	1	4	7	2
Decreases	0	6	8	5

[8] For what it is worth, the tabulation for 1961–66 is:

	Original Data		Trend Corrected	
Price Changes	BLS	NB	BLS	NB
Increases	29	21	22	28
No change	18	15	38	35
Decreases	23	34	8	15

In order to preserve some pretense that trend and cycle phase are distinct in this long period, the trends are based upon the ten-year period.

better conformity of prices and business changes in contractions than in expansions prior to trend corrections. The widely held belief in the "ratchet" behavior of industrial prices is contradicted by our study.[9]

Frequency of Price Change

We have already summarized evidence which essentially destroys the significance of the reported frequency of price changes in the BLS data (see p. 18). The NB price data are not easily brought to bear upon the matter. Since half our individual price reports are based upon contract data, and many of the remainder upon quarterly or other averages (which may also be based upon contracts), we cannot attach a simple meaning to a direct count of price changes.[10] Certain inferences on frequency of price change may nevertheless be made from our contract data:

(1) Certain prices change—if at all—always in one particular month, say September, because a firm price is contracted for twelve months. Then a price change or nonchange may occur each September covered by the price series, but of course only in that month. A price has missed an opportunity to change if it does not change between August and September.

(2) Other prices change sporadically and irregularly because the contract may be renegotiated when market conditions change appreciably. A change or nonchange may then occur in every month, but realistically not repeatedly in closely adjacent months simply because

[9] The reference cycles mark off a class of fluctuation in general business conditions; specific cycles is the name given by the National Bureau to the corresponding fluctuations in individual industries and markets. (See A. F. Burns and W. C. Mitchell, *Measuring Business Cycles*, New York, NBER, 1946, Ch. 2.) A variant of the specific cycles was defined for our study. It measured substantial movements (20 per cent or more) in seasonally corrected output series, persisting eight to ten months. Such cycles occur mostly in the first four years of our period. The behavior of BLS and NB price indexes during such "specific cycles" was examined (and is described more fully in Appendix D). Our results are essentially negative, neither price index generally moved in agreement with output changes. In the absence of a method of identifying demand and supply induced changes in output, and of reasonably full information on inventories, it did not seem useful to present this inquiry in the text.

[10] In fact, since interpolation is used to incorporate incomplete data, see Appendix B, our price indexes also contain price changes which are irrelevant to the question of frequency of price change.

TABLE 5-5

Frequency of Changes in Price Indexes and Number of Reporters, December 1961 to December 1965

Number of Companies Reporting Prices	Average	Number of Products
Annual contracts with fixed terms: Actual price changes as percentage of possible changes		
1	58.3	12
2	67.7	7
3	50.2	5
4 or more	78.3	8
Annual contracts with variable term: Number of price changes		
1	3.7	15
2	5.0	9
3	8.8	6
4 or more	13.5	4
Monthly price series: Number of price changes		
1	6.2	27
2	12.9	15
3	15.7	9
4 or more	21.9	9

the purpose of the contract is to reduce negotiating costs. If the market price changes so frequently and substantially, either there will be no contracts or they will contain escalation factors.

In addition we have continuous monthly prices for some commodities. For each of these three classes of prices we may compare actual with possible changes in the index of prices.

We have then one class of price reporters, fixed contracts, from whose price indexes we calculate the ratio of actual to possible price changes, and two classes of price reporters, renegotiable contracts and monthly price series, where we present the actual number of changes in the price index. The averages of these measures by number of price reporters are given in Table 5-5.[11] We find that there is positive relationship between

[11] The indexes on which Table 5-5 were based were recomputed on the bases of the indicated types of price series. For example, the annual contract indexes

frequency of price change and number of price reporters, but one vastly weaker than McAllister found in the BLS data. Whereas the BLS pattern is baffling—how can one seller ignore changes in the price of the same commodity made by rivals?—our pattern is plausible. Irregular purchases and changes of supplier lead one to expect more price changes as the number of buyers rises.

SHORT-RUN MOVEMENTS

Amplitude of Short-Run Movements

We begin our comparison of short-run movements with a study of the magnitude of these fluctuations. The BLS indexes usually change less frequently than the NB indexes, in fact the *median* monthly change in the BLS indexes is often zero. But the movements of the BLS index are large and jerky, so the variance of these movements is usually larger than that of the NB. We may illustrate this sort of difference by the example of ammonia, our illustrative commodity in Chapter 4. We take the first differences in the logarithms of the price indexes as our measure of relative price change, and these differences are tabulated in Table 5-6. The NB distribution is intuitively much more plausible than the BLS distribution, which would reflect a world of alternating rigidity and fitful shifts in supply and demand conditions.

The variances of the first differences of the two price indexes of each commodity are compared in Table 5-7; the square roots of these variances are of course the standard deviations of the percentage changes in monthly indexes. In general the pattern of ammonia is reproduced:

BLS variance exceeds NB variance	38 commodities
Two variances are approximately equal (diagonal)	26 commodities
BLS variance less than NB variance	6 commodities

The main verdict of the comparison of variances is that the short-run movements of the BLS indexes are on average substantially more irregular, the respective means are 1.92 per cent for the NB index and 3.64 per cent for the BLS index.

---

are based only upon reporters giving annual contract prices for the four-year period.

TABLE 5-6

Distribution of First Differences in the Logarithms of the Monthly BLS and NB Indexes: Ammonia
(number of months)

Percentage Change [a]	BLS	NB
5.0 to 10.0	4	–
2.5 to 5.0	5	2
1.5 to 2.5	2	2
1.0 to 1.5	–	0
0.5 to 1.0	–	7
Over 0.0 to 0.5	–	16
Zero	101	45
Under −0.0 to −0.5	–	28
−0.5 to −1.0	–	12
−1.0 to −1.5	–	3
−1.5 to −2.5	–	2
−2.5 to −5.0	1	1
−5.0 to −10.0	6	1
Total	119	119
Mean	.040	−.103
σ	2.789	.898

[a] Relative difference ($\times 10^2$) = percentage change.

Timing of Short-Run Movements

A second characteristic of short-run movements is timing. Do the NB price indexes move parallel to BLS price indexes and, if not, does one index systematically lead or lag the other? We seek to answer these questions by correlating the movements of the indexes (or, more precisely, the first differences in the logarithms of the indexes over periods of one month and longer). We spare the reader the larger part of the computer's verbosity since the results are disappointing.

There is no close agreement in the monthly movements of the two indexes (see Table 5-8): the mean correlation coefficient is only .32 for the monthly comparisons and it is chiefly in the metals that there are any considerable number of coefficients greater than .7. The coefficients could arise because of small differences in the dating of price changes in the two indexes, but the facts are exactly the opposite. When the nonsimultaneous correlations are higher than simultaneous ones, both

TABLE 5-7

Variances ($\times 10^4$) of First Differences of Logarithms of Monthly Price Indexes

	BLS Variance							
NB Variance	Under .25	.25–1	1–2.25	2.25–4	4–6.25	6.25–9	9–16	16 and over
Under .25	7	9		3	1			
.25–1	1	11	3	2	1	2		1
1–2.25	1	1	3	3		1		
2.25–4		2		1	6	1		
4–6.25			1		3	1		
6.25–9						1	1	
9–16								3
16 and over								
$\sigma = \sqrt{\text{Variance}}$	Under .5%	.5–1	1–1.5	1.5–2	2 –2.5	2.5–3	3–4	4 and over

TABLE 5-8

Distribution of Coefficients of Correlation of First Differences in Logarithms of BLS and NB Price Indexes, Monthly, Quarterly, Semiannual, and Annual Changes

Correlation Coefficient	Monthly Changes	Quarterly Changes	Semiannual Changes	Annual Changes
Less than −.3	0	0	3	4
−.3 to −.2	0	1	0	1
−.2 to −.1	3	1	0	0
−.1 to 0	1	1	4	1
0 to .1	17	5	3	1
.1 to .2	10	8	1	0
.2 to .3	6	9	5	5
.3 to .4	8	9	5	4
.4 to .5	9	4	5	4
.5 to .6	4	5	9	11
.6 to .7	0	7	7	4
.7 to .8	5	9	6	7
.8 to .9	6	7	11	14
.9 to 1.0	1	4	11	14
Average	.32	.45	.54	.59

are usually small.[12] Conceivably, the poor agreement between the indexes is partly due to the existence of a considerable number of BLS price series in which there were very few price changes. We may separate out the BLS series in which the price changed at least thirty times, or once every four months, to obtain short-run movements of "active" BLS price indexes. The extent of agreement between the BLS and NB indexes is not changed by the exclusion of "inactive" BLS series: many of the largest and smallest correlation coefficients are eliminated.[13]

[12] We exclude nonsimultaneous correlation coefficients smaller than .18, which is approximately the 5 per cent significance level with $n = 119$.

[13] The distribution is as follows:

Correlation Coefficient	Number of Commodities	Correlation Coefficient	Number of Commodities
−.2 to −.1	2	.3 to .4	5
−.1 to 0	1	.4 to .5	4
0 to .1	3	.5 to .6	2
.1 to .2	3	.6 to .7	0
.2 to .3	1	.7 to .8	1

TABLE 5-9

Large Quarterly Price Changes (5 Per Cent or More) in BLS and NB Indexes

Changes in NB Indexes	Changes in BLS Indexes		
	Increases of 5 Per Cent or More	Changes of Less than 5 Per Cent	Decreases of 5 Per Cent or More
Increases of 5 per cent or more	26	23	0
Changes of less than 5 per cent	40	2,473	56
Decrease of 5 per cent or more	0	27	49

Large Price Changes

The difference between the BLS and NB price indexes with respect to large price changes has already been remarked. If we define a large price change as one of 5 per cent or more in a *quarter,* the BLS price indexes had 171 such changes and the NB price index, 125—out of a possible number of some 2,700 quarterly price changes in each case. These larger changes in the two sources agreed only moderately well. There were no instances in which large changes occurred in opposite directions but many where only one index showed a large change (see Table 5-9).

Conclusion

Price indexes based upon buyers' prices should, but don't, lag behind price indexes based upon sellers' prices. We infer that the quoted prices lag behind the changes in transaction prices by an unknown but appreciable time interval. The NB and BLS indexes are not very closely related in timing, and the BLS index usually has many smaller and a few larger price changes than the NB index. Accordingly, the BLS short-run price movements are suspect, and the NB short-run movements are subject to the lags of contractual pricing. At present there is little hope of accurately measuring the short-run changes in transaction prices other than those for contractual purchasers.