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By GEORGE A. HAY*

In a major study recently completed, George Stigler and James Kindahl (S-K) constructed price indexes for various commodity groups based on prices reported by purchasers of the commodity in question. This is in contrast to the Bureau of Labor Statistics (*BLS*) approach in which prices are collected from sellers. The S-K hypothesis is that sellers frequently have an incentive to maintain the stated list price for substantial periods, while at the same time the actual prices at which transactions take place may differ from the list in response to market conditions. The incentives to maintain list price may involve the firm's relations with its competitors, for example, a kinked demand curve notion or the industry's relation with the general public; i.e., if list prices are reduced in periods of insufficient demand, it may be politically difficult to get them back up when conditions change. On the other hand, it is felt that buyers have no such incentive to disguise the purchase price, and prices collected from them should therefore provide a truer picture.

The proper criterion on which to judge a price index good or bad is somewhat ambiguous, since there is no "true" price against which to compare the index. S-K use basically three types of test. The first is a comparison of the trends for the two series. A second test is to plot the two indexes against some measure of general market conditions. S-K use National Bureau reference cycles. If one believes that the true price is correlated with general business conditions, then a comparison of the correlation of each of the indexes with the National Bureau measures may provide some basis for choosing between the two. A third test is to compare amplitude and frequency of short-run changes in the two indexes.

In addition to being of interest in themselves, however, price indexes are also used as inputs into various econometric models. A relevant criterion for choosing among alternative indexes, therefore, is whether one index significantly improves the explanatory power of a particular regression model.

One such model was developed by the present author in the September 1970 issue of this *Review*. The firm's profit maximizing decisions lead to a set of decision rules for production, price, and finished goods inventory:

$$\begin{aligned} X_t = {} & A_{11}X_{t-1} + A_{12}P_{t-1} + A_{13}H_{t-1} \\ & + A_{14}U_{t-1} + A_{15}Q_t + A_{16}Q_{t+1} \\ & + A_{17}Q_{t+2} + A_{18}W_{t-1} + A_{19}W_t + k_1 \\ P_t = {} & A_{21}X_{t-1} + A_{22}P_{t-1} + A_{23}H_{t-1} \\ & + A_{24}U_{t-1} + A_{25}Q_t + A_{26}Q_{t+1} \\ & + A_{27}Q_{t+2} + A_{28}W_{t-1} + A_{29}W_t + k_2 \\ H_t = {} & A_{31}X_{t-1} + A_{32}P_{t-1} + A_{33}H_{t-1} \\ & + A_{34}U_{t-1} + A_{35}Q_t + A_{36}Q_{t+1} \\ & + A_{37}Q_{t+2} + A_{38}W_{t-1} + A_{39}W_t + k_3 \end{aligned}$$

where

X = production
P = price
H = finished goods inventory

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TABLE 1—REGRESSION COEFFICIENTS
(t-values in parentheses)

		X_{t-1}	P_{t-1}	H_{t-1}	U_{t-1}	Q_t	Q_{t+1}	Q_{t+2}	W_{t-1}	W_t
PAPER										
A. S-K Index	1.375	−.016	−.071	−.428	.376	.873	−.056	−.051	7.630	−5.350
X_t		(0.52)	(2.17)	(3.90)	(5.95)	(27.06)	(1.79)	(1.79)	(3.80)	(2.56)
	15.454	.165	.877	−.281	.116	−.032	.024	.070	−1.734	−.508
P_t		(3.66)	(18.54)	(1.78)	(1.27)	(0.69)	(0 53)	(1.70)	(0.61)	(0.17)
	0.122	.032	−.021	.959	−.050	−.004	.035	.015	4.091	−4.574
H_t		(1.61)	(1.00)	(13.67)	(1.23)	(0.20)	(1.72)	(0.85)	(3.26)	(3.44)
B. *BLS* Index	1.683	−.009	−.078	−.434	.361	.871	−.047	−.063	7.545	−5.086
X_t		(0.28)	(3.72)	(3.86)	(5.72)	(26.00)	(1.45)	(2.20)	(3.66)	(2.29)
	16.264	.009	.809	−.082	.277	.058	−.059	.099	−.209	1.799
P_t		(0.12)	(15.69)	(2.96)	(1.78)	(0.70)	(0.74)	(1.40)	(0.04)	(0.33)
	−2.166	.032	.024	1.066	−.083	−.012	.044	.002	4.468	−4.931
H_t		(1.54)	(1.79)	(14.60)	(2.03)	(0.55)	(2.07)	(0.12)	(3.34)	(3.42)
LUMBER										
A. S-K Index	−1.482	.225	−.034	−.100	.197	.677	.031	.010	.583	.046
X_t		(3.82)	(2.22)	(1.01)	(2.86)	(10.04)	(0.45)	(0.18)	(0.35)	(0.03)
	19.910	−.180	.853	−.751	.100	.275	.282	.092	−2.871	−1.118
P_t		(1.07)	(19.64)	(2.43)	(0.51)	(1.43)	(1.48)	(0.59)	(0.61)	(0.22)
	−1.000	−.035	.004	.963	.004	−.056	.047	.032	1.919	−1.517
H_t		(1.11)	(0.47)	(16.86)	(0.11)	(1.57)	(1.32)	(1.13)	(2.21)	(1.61)
B. *BLS* Index	−4.618	.159	−.005	−.025	.164	.660	.042	−.029	.835	.318
X_t		(2.53)	(0.29)	(0.27)	(2.53)	(9.80)	(0.63)	(0.54)	(0.49)	(0.17)
	10.712	−.139	.883	−.583	.190	.161	.097	.442	−5.428	3.177
P_t		(1.05)	(24.36)	(2.94)	(1.39)	(1.13)	(0.68)	(3.86)	(1.52)	(0.81)
	−1.182	−.062	.116	.990	−.008	−.060	.057	.001	2.263	−1.748
H_t		(1.88)	(1.75)	(20.04)	(0.22)	(1.68)	(1.61)	(0.05)	(2.53)	(1.79)

U = backlog of unfilled orders
W = average hourly wages[1]

Q_t is intended to represent the expected value of the quantity intercept of a linear demand curve

$$\text{New Orders} \equiv O_t = Q_t - bP_t$$

where b is the slope which is assumed to remain constant over time. If perfect forecasting is assumed, then Q is obtained by the inverse relation

$$Q_t = O_t + bP_t$$

For the particular study referred to, b, which is not observable, was chosen to make the elasticity of demand equal to .5. However, alternative values of b did not significantly affect the results.

In this model, the *BLS* index is used in

[1] The theoretical specification in the original model contained a term (denoted as V_t) which includes raw materials prices and capital rental as well as labor costs, but for the industries treated here the only series for which there are usable data is the latter.

TABLE 2—COMPARISON OF ALTERNATIVE MEASURES OF GOODNESS OF FIT

Measures	$\bar{R}^2$ [a]	F-Ratio	Std. Error of Estimate σ	$\sigma \div$ Mean of Dependent Variable
I. PAPER				
A. S-K Index				
1. Production	.991	1388.	.019	.0149
2. Price	.985	819.	.276	.0027
3. Inventory	.986	874.	.012	.0226
B. *BLS* Index				
1. Production	.988	1048.	.020	.0153
2. Price	.830	60.	.500	.0050
3. Inventory	.982	665.	.013	.0238
II. LUMBER				
A. S-K Index				
1. Production	.955	258.	.033	.0445
2. Price	.947	212.	.940	.0091
3. Inventory	.936	177.	.017	.0290
B. *BLS* Index				
1. Production	.936	180.	.034	.0446
2. Price	.947	219.	.716	.0092
3. Inventory	.910	108.	.018	.0297

[a] 100 degrees of freedom

three ways: 1) as one of the dependent variables; 2) in lagged form as one of the explanatory variables; 3) to deflate the physical variables which are reported by the Census in value terms.

Regressions were performed using both the *BLS* and the S-K indexes at the two-digit Standard Industrial Classification (*SIC*) level for the Lumber industry and the Paper industry.[2] These industries are particularly convenient since the commodities covered in the relevant *BLS* group correspond very closely to the *SIC* classification used by Census from which the physical data were obtained.[3] The monthly observations are for the period January 1957–August 1966.

[2] While the S-K Price index for paper covers two-thirds of the two-digit Paper Industry weights, their Lumber index covers only 9 percent of the two-digit Lumber Industry weights. Unfortunately the physical data are not available at a lower level of aggregation.

[3] For most industries this is not the case, thereby making it difficult to include price in econometric studies involving production and inventories.

The results of the regression are reported in Table 1. Table 2 attempts to present the various statistics which are commonly used as measures of goodness of fit. It should be noted here that the S-K index is more flexible with standard deviations of 2.277 (mean value 102.95) and 4.018 (mean value 103.12) for Paper and Lumber, respectively, compared with those for the *BLS* series of 1.209 (mean value 99.96) and 3.112 (mean value 99.42).

No attempt will be made to interpret the individual coefficients (see Hay). The main result worth noting here is that there are no significant sign differences between the two sets and almost all the coefficients display the same order of magnitude with both price variables.

The interesting results are in Table 2. There it is clear that the S-K index improves the fit of the model. Except for the price equation in Lumber in which the *BLS* index does slightly better, the S-K index comes out ahead under every measure for every equation: $\bar{R}^2$ values and F-ratios are higher, standard errors and standard errors divided by the mean of the corresponding dependent variable are lower. In general, the improvements are not large, however, and the evidence can certainly not be considered conclusive.

It would be desirable to repeat the experiment for a greater number of industries (however, see footnote 2) and to make comparisons over other time periods. However, the results do suggest that the S-K index may be an improvement not only as an index per se, but also as an input into econometric models which require a price variable either as a deflator or as one of the variables.

REFERENCES

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