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Introduction

Inflationary movements since World War II have been sufficiently diverse to support a variety of theories of price behavior. Initially, the rising prices of World War II and the Korean War were classical inflations due to excess aggregate demand, and the rising prices of 1955-57 reflected a vigorous investment boom. Then, the general price level continued to rise during 1958 and 1959 in the face of slack demand, as did many individual prices in earlier years. **Similarly, prices declined in the business recession of 1954 and subsequent recessions far less than had been usual. The combination of price increases in cyclical expansions and of slight or no price declines in recessions produced a persistent upward trend in the price level.** The upward trend abated during the early 1960s but then attracted renewed attention during the 1970 recession though it which, ended the strong excess demands of the Vietnam War inflation, produced little immediate effect on the average rate of price increases. The phenomenon of strong inflation during a recession was startling in 1970, but it was only a further step in the weakening response of prices to postwar business recessions. The rates of change of prices have declined less and less on the average in each of the four recessions following 1919.[1]

[1] This is documented in my "Changes in the Recession Behavior of Wholesale Prices," NBER, forthcoming.

A variety of theories have been offered to explain why prices generally respond so little to declines in demand, and do so less now than formerly. Most of these center around a dependence of prices

*I am indebted to Susan Tebbetts for computational assistance.

on costs, or the anticipated trend of costs, and a greater disregard for short-run changes in demand. The disregard presumably reflects the costs of frequent changes in price--the difficulty of making them and their disruption to customers in planning ahead--combined with a conviction that periods of slack demand will be brief. Avoidance of these costs leads to a strategy of setting prices to cover anticipated costs at a standard level of plant utilization and adding a markup to provide a target return on capital.[2] Although

[2]For a survey of the theoretical and empirical literature, see Nordhaus [1972] and Eckstein [1964].

most firms might prefer to set prices in this way, not all are able to. They must as a precondition be capable of setting or administering prices, as the price takers of fully competitive markets cannot do. Such administered prices presumably occur in markets with a small number of firms who collude or engage in some form of price leadership. This view is now widely accepted, as is evidenced by the enforcement of the price controls instituted in 1971 against only the largest corporations. The limited enforcement was rationalized on the grounds that the giants could raise prices despite excess capacity while small firms operated in competitive markets and were effectively constrained by market conditions.

If prices are slow to respond to market conditions and are set largely with a view to covering standard unit costs, they would give the appearance of being independent of short-run changes in demand even though the costs fully incorporated demand influences over the long run. Lags of adjustment would at times produce rising prices in slack markets. Some special theories of cost-push inflation go further, however, to propose that administered prices originate in-

creases which produce a permanent inflationary trend in the economy. Such behavior is attributed to the price setting of large corporations which continually attempt to raise their profit margins or which are a conduit for excessive wage demands of organized labor. Moreover, even if these increases are confined to periods of strong product demand, the failure of these prices to decline in times of slack demand -- their downward rigidity -- results in an upward price trend over the long run.

The importance of such permanent cost-push pressures has not been empirically demonstrated. The attainment of high profit margins does not imply or require continually rising prices. A recurring increase in profit margins is not a profit-maximizing strategy even if attainable, and data on corporate profit margins indicate that few of them display upward trends during inflationary periods. Although some unions appear to be able to push up their relative wage, labor contracts just as often produce a lag in wages behind prices in the initial stages of inflationary movements. Downward rigidity of some prices may be a problem, but its prevalence in listed prices largely disappears when allowance is made for unreported market shading [Stigler and Kindahl 1970, and Cagan 1974].

The more appealing hypothesis is the simple one that price setters tend to adjust slowly to changes in market conditions; they transmit but do not originate inflation [Moore 1972]. This hypothesis is sufficient to explain the observed smaller volatility of prices in the highly concentrated industries. If their prices follow the anticipated rate of increase in costs and respond less to short-run changes in demand, they would fall behind in the initial stages of inflation and would catch up

in the later stages. In the slack markets of a subsiding inflation, they would appear to be moving against the tide.

To find that prices in the less competitive markets respond more slowly to changes in market conditions -- first lagging, then catching up -- would support the theory that firms try to avoid frequent changes in prices but vary in their ability to do so. Such a finding would suggest that anticipated levels of costs play an important role in price setting and would go far to explain the small response of many prices to recessions. It would not explain the diminishing response of prices in recessions since 1949, however, because fundamental changes in competition or market structure which would account for the new behavior have not been apparent. Moreover, downward rigidity or even cost push do not preclude short-run declines in the rate of change of prices. The diminishing response of prices would reflect, on the preceding theory, a change in the anticipated variability of the rate of inflation, such that firms increasingly acted on the belief that declines in demand have less effect on the trend of prices.

Anticipations of variability aside, are lags in price adjustments related to market structure? Previous empirical studies of the relation are inconclusive on this point. The most pertinent studies are cross sectional analyzes of a broad group of industries in which differences in market structure are represented by the concentration ratio. This ratio is not ideal for present purposes, because of the difficulties of specifying a self-contained product without close substitutes, but it is the best available index and is widely used. An earlier literature, largely theoretical, had suggested that concen-

trated industries tend to raise prices more rapidly, thereby exerting a permanent upward push on the price level.[3] Empirical studies have usually reported the opposite or no consistent relation, however.[4]

[3]For a discussion of this literature, see Bronfenbrenner and Holzman [1963].

[4]See de Podwin and Selden [1963], Yordon [1961], Phlips [1971], De Silva [1971], Weiss [1966], Eckstein and Wyss [1972], and Dalton [1973]. Of these, the last three show a positive effect of concentration on prices, and the others do not.

An important study by Weiss [1966] showed a positive response from 1953 to 1959 but little or no effect later from 1959 to 1963. Weiss interpreted this as evidence that concentrated industries do not continually raise prices faster, though they did in the earlier period in catching up to lagged increases during and after World War II. In a follow-up study of the years 1963 to 1969, Weiss[5] found a negative effect, which he took as confirmation of a lag in price setting by concentrated industries, though he did not verify that this was followed by catching-up increases.

[5]See Weiss [1971]. Dalton [1973] reported a positive effect for 1967-69, though the concentration coefficient was not statistically significant at the .05 level. My results for this period below agree with Weiss'. Apparently Dalton's opposite result reflects use of a different set of data. The disagreement raises a question about the general applicability of all these studies.

On the lag and catching-up theory, the concentrated industries should exhibit greater increases in the period of waning inflation after 1969. This study examines the data for such a pattern and finds striking evidence of it.

Framework of the Statistical Analysis

Weiss showed that price changes among industries were significantly related to concentration only after allowing for the effect of costs. He held labor and materials cost constant and found the partial effect of concentration on prices. The present analysis follows his approach with a modification due to Phlips [1971] and Dalton [1973] of weighting the costs in each industry by their relative importance in that industry. The price equation is

$$\begin{aligned} \text{price change} = {} & \alpha(\text{weighted change in unit labor cost}) \\ & +\beta(\text{weighted change in unit materials cost}) \\ & +\gamma(\text{concentration or firm-size ratio}). \end{aligned} \tag{1}$$

The changes are in percent per year. The weights are the respective shares of the value of shipments attributable to labor and materials purchases at the beginning of the period.[6] Of course, in the long run price equals total costs by double-entry bookkeeping, but in the short run profit margins absorb deviations from variable costs until prices and factor costs are adjusted to each other.

[6]Changes in output will not affect these measures of unit costs only if manufacturing cost curves are fairly flat. Changes in capital costs due to plant expansion or variations in interest rates are ignored as minor.

A rationale for an equation in which prices depend prices depend upon costs rather than vice versa is that pricing decisions in many industries are operationally based upon anticipated unit costs. Actual unit costs of labor and materials can be used in the equation because these are either correctly anticipated or are taken as largely irreversible and are passed through to prices within a short period. It is argued that price leaders prefer to relate price increases to factor costs, not only for administrative convenience and to avoid costly frequent changes, but also because such increases are accepted by customers and are less likely to lead to competitive undercutting or government intervention. The equations do not, of course, identify the particular reasons for a dependence of prices on costs.

Equation 1 takes no explicit account of shifts in demand, and later we shall use changes in quantity sold (the deflated value of shipments) as a direct proxy for shifts in demand. When this proxy is omitted, the concentration variable may be rationalized as representing a differential response among industries to demand shifts. This response by hypothesis would be lower for more concentrated industries. If in a given period the demand shifts are roughly the same across industries, the response may be measured as in (1) by the proportionate contribution of the concentration ratio to the price change. The concentration variable may also be interpreted as measuring an effect independent of differences in response to demand. This interpretation is discussed later.

Data

A major problem of fitting this equation is the differences in coverage between the data available on prices and on costs. The Census of Manufactures provides data on costs and shipments for four-digit SIC industries, while the BLS wholesale prices pertain to selected individual products. It is necessary to construct weighted price indexes of the product prices for four-digit industries, and this objective is hampered by the fact that many products are not covered by BLS price series. In recent years the BLS has attempted to rectify this problem, and it now publishes price indexes for 90-odd four-digit SIC industries for which the price data pertain to at least 50 percent of industry shipments in 90 percent (by value) of the five-digit components. [Moss 1965]. While these new indexes still entail problems of coverage, they avoid much of the mismatching in previous alternatives. For the period since 1967 the indexes cover 86 four-digit industries of which 20 are food processing and the remainder are scattered throughout the manufacturing sector. Among previous studies, the Dalton [1973] and second Weiss study [1971] utilized these new indexes.

The dollar value of shipments and labor and materials cost for four-digit SIC industries are given in the Census of Manufactures. Concentration is the four-firm industry ratios for 1967 modified by average regional ratios in 1963 for 13 selected local industries.[7]

[7]Bureau of Census, Concentration Ratios in Manufacturing Industry 1963, Part II, 1967, Tables 25 and 26. These regional ratios improve the fit, but not dramatically.

To determine the difference in price behavior between the concentration of sellers and the domination of large firms, we may also use an index of the fraction of output (approximated by employment) in the industry produced by divisions of parent corporations which have total annual sales of $100 million or more.[8] These are the Tier I

[8]Derived from National Bureau data for 1970 [Gort and Singamsetti 1974]. These data are subject to some double counting, and several of the ratios are erroneously well above unity. To avoid errors due to extreme double counting, an alternative index was constructed by setting the ratios above .90 (of which there are 22) equal to .95.

firms singled out in the Phase II price regulations.

Given the price index, quantity sold is derived as the value of shipments divided by the BLS price index. Then unit labor cost is the production worker payroll divided by quantity,[9] and unit

[9]Other employees are ignored. In the weighting, the ratio of production worker payrolls to shipments was used, but alternative weights using the ratio of total payrolls to shipments made little difference.

materials cost is cost of materials divided by quantity. These are annual data only, and the corresponding prices are annual averages of months. The variables are expressed as percentage changes per year for three periods: the two years of the Vietnam War expansion 1967-69, the 1970 recession, and the 1971 recovery. These three periods test the effect of market structure during different stages

of an inflationary episode. The inflation which began in 1965 reached a high point and began to moderate during 1970; it continued to subside albeit slowly until the end of 1972. Some results for 1972 and 1973 are also presented without the cost variables, which are not at the time of writing available for these years.

Multiple Regressions with Concentration and Firm-Size Variables

A test of market structure on the pattern of price changes is presented in Table 1. These regressions account for about half of the variation across industries in percentage price changes. Materials cost is the dominant variable; 80 to 100 percent of its change per unit is passed through to prices within the period. Labor cost is equally important in the period of expansion, but becomes increasingly less important under/excess conditions of capacity during the period of recession and recovery. Unit labor cost can be subdivided into productivity (quantity sold per manhour) and hourly wage rates (payroll per manhour). Prices are affected by wages positively and by productivity negatively. When these two variables are used instead of their combination (not shown), the coefficients reflect a larger (absolute) effect for wages than for productivity but a diminishing effect for both in consecutive periods, and virtually the same effects for the concentration index.

The market structure variables show a pattern indicative of a lag in response. The coefficients are initially negative in 1967-69 and still negative in the recession year of 1970, and then positive in the first year of recovery. Since these variables are measured as ratios and the dependent variable as percent per year, the coefficient of -2.5 in the first row means that an industry with concentration of .75 compared with one of .25, for example, had a

Table 1

Regression of Industry Price Changes on Changes in Costs and Index of Market Structure, 1967-71

Period	Regression Coefficients (and t values)					R^2
	Constant term	Wtd. Unit Labor Cost	Wtd. Unit Materials Cost	Index of Concentration	Index of Size of Firms[a]	
	(1)	(2)	(3)	(4)	(5)	(6)
1967-69	2.57	.93(3.6)	.81(9.3)	-2.5(2.4)	...	.60
1969-70	3.06	.32(1.2)	.86(8.5)	-1.8(1.1)	...	.48
1970-71	.58	.00(0.0)	1.07(10.5)	+3.6(2.3)	...	.63
1967-69	2.04	.83(3.1)	.85(9.9)	...	-1.1(2.4)	.60
1969-70	3.33	.43(1.7)	.91(9.3)	...	-2.0(3.0)	.52
1970-71	1.73	.03(0.1)	1.07(10.1)	...	+0.9(1.3)	.62
1967-69	2.59	.87(3.3)	.83(9.4)	-1.7(1.3)	-0.7(1.2)	.61
1969-70	2.97	.45(1.7)	.92(9.3)	+1.1(0.6)	-2.3(2.8)	.52
1970-71	.57	.00(0.0)	1.07(10.3)	+3.5(1.9)	+0.1(0.1)	.63

Note: Regression is equation 1 in text with constant term. Variables are expressed in percent per year except indexes, which are ratios. Hence units of coefficients are percent per year for cols. 1, 4, and 5, and pure numbers for cols. 2 and 3. Number of observations (industries) is 86.

[a]Because of double counting (see fn. 8), a revised index for size of firms was prepared in which the 22 ratios above .90 were set equal to .95. For the middle set of regressions, this gave the following coefficients for the index: 1967-69, -1.9(2.8); 1969-70, -2.4(2.3); 1970-71, +0.9(0.8).

rate of price change lower on average by 1.25 percent per year. Not all of the market structure coefficients are statistically significant at the .05 level ($t>1.9$), but their change of sign from negative in 1967-69 to positive in 1970-71 is highly significant by the F ratio (not shown). The changeover is shown by both concentrated industries and large firms, though the latter were slower to catch up. The concentration and firm-size ratios are not fully distinguishable (the two variables have a simple correlation coefficient of +.56). They were nonetheless included in the same regression in the bottom section of the table to help identify their separate effects. Most of the joint catching-up effect in 1971 is due to concentration, casting doubt on the market significance of size per se as a source of price increases, though measurement errors in the size index noted earlier may account for its poor showing in combination with the concentration ratio.

The concentration ratio, which can theoretically vary from zero to unity, does not necessarily measure the differences in market power accurately. To test the assumption of linearity in the relationship, the industries were divided into three concentration groups. The boundaries chosen were 0-.44, .45-.67, and .68-1.00, which gives a reasonable three-way grouping and at the same time puts the main cluster of industries in each group in the middle of the boundaries rather than at the edges. Dummy variables were used to represent the high and middle groups, and the constant term of the regression represented the low group.

Table 2 presents the results. The constant term of these regressions, which represents the low concentration group, varies among the three periods as in the Table 1 regressions. The variation reflects the fact that the regression does not capture all the

Table 2

Regression of Industry Price Changes on Changes in Costs and Concentration Groups, 1967-71

Period	Regression Coefficients (and t values)							R^2
	Wtd. Unit Labor Cost	Wtd. Unit Material Cost	Concentration Groups[a]			Differences:		
			Low	Mid-dle	High	Middle-Low	High-Low	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1967-69	.92(3.5)	.82(9.4)	1.85	1.04	.65	-0.8(1.7)	-1.2(1.9)	.60
1969-70	.31(1.2)	.86(8.4)	2.66	2.14	1.27	-0.5(0.8)	-1.4(1.5)	.48
1970-71	-.04(0.1)	1.08(10.8)	1.59	2.25	4.44	+0.7(1.0)	+2.9(3.2)	.65

Note: Regression equation is

price change = α(wtd. ULC) +β(wtd. UMC) + γ_H(dummy for high concen.)+γ_M(dummy for middle concen) +γ_L(dummy for low concen.) + constant term (=C), where units of measurement are the same as for Table 1. Columns 6 and 7 give γ_M and γ_H. As presented in cols. 3-5, the concentration dummies and constant can be equivalently written:

$(\gamma_H + C)$(dummy for high concen.) + $(\gamma_M + C)$(dummy for middle concen.)
+ C(dummy for low concen.)

Signs of t values have been dropped and, for concentration groups, computed for differences only.

[a]Range of concentration groups (and average ratio) is .0-.44(.30), .45-.67(.56), and .68-1.00(.82). Number of industries in three groups are 38, 34, and 14, respectively.

change in price behavior from one period to the next. So far as differences between the concentration groups are concerned, however, the dummy variables confirm the Table 1 results. Compared with the low concentration group, the middle and high groups lag at first and then catch up, and the high group has the larger swing from below to above the low group. This confirms a monotonic relationship between price change and degree of concentration.

Based on the average concentration ratio for each group, however, these results depart appreciably from a linear relationship. The lag in price change increases less than proportionately to the increase in the concentration ratio in the first period, but more than proportionately in the recession, and the catch-up price increase in the recovery is more than proportionate.[10] The use of higher-power terms to allow for this nonlinearity would increase the estimated total effect of the concentration variables, but such a cumbersome addition to the equation seemed unnecessary and was not pursued.

[10] Linearity would imply that the change in the concentration coefficient from the low to the middle and from the middle to the high group be proportional to the corresponding increase in the group average ratio. (The average ratio goes from .30 to .56 and from .56 to .82, which gives an increase of .26 for both.) These proportionalities from Table 2 are as follows:

	low to middle group (1)	middle to high group (2)	slope (2)÷(1)
1967-69	-0.8/0.26	-0.4/0.26	0.5
1969-70	-0.5/0.26	-0.9/0.26	1.8
1970-71	0.7/0.26	2.2/0.26	3.1

Market Structure and Lags in Price Adjustments

The significance of industry concentration in these regressions suggests that the response of firms to costs and demand shifts has an adjustment lag dependent upon the degree to which they are price setters rather than price takers. The specific implication is that more concentrated industries have smaller response coefficients. This implication is worth exploring, both to test the theory and to clarify the character and extent of price lags about which prevailing theories of price adjustments are unspecific and incomplete. A straight-forward method of measuring differences in response lags is to separate the variables in the price equation into three concentration groups as was done for Table 2. Each cost variable was subdivided into three parts by assigning its value to the one for the corresponding concentration group and a zero value to the other two for noncorresponding groups. The regression coefficients for the three parts then record the price response to costs in the three concentration groups individually.

The results are given in Table 3. Prices in the low concentration industries respond to materials cost almost fully (90 percent or more) within the time period, whereas the response is substantially less for the more concentrated industries. This is consistent with a differential lag in adjustment.

Yet such a pattern is not repeated for the labor cost coefficients, which are mixed and generally not statistically significant. Since unit labor cost is affected by changes in output and shifts in demand, which are often temporary, we expect differential lags. But unit labor cost also reflects contractual changes in wage rates, which are typically passed through to prices rapidly, and the differing speed of effect of these two components may be thought

to account for the mixed results. However, when we separate wage costs (payroll per manhour) and productivity (quantity sold per manhour), the results (not shown) still do not show a consistent difference between concentration groups. There is a suggestion that wage increases present the opportunity for incorporating accumulated cost increases of all kinds into prices but that low-concentration industries do not pass through such costs at all in periods of slack demand. (Table 3 also suggests this interpretation.) In any event, since many of these coefficients are not statistically significant, the effect of concentration on wage and productivity variables requires further exploration.

Table 3

Regression of Industry Price Changes on Changes in Costs Grouped by Industry Concentration, 1967-71

Period	Constant term	Regression Coefficients (and t values)						R^2
		Wtd. Unit Labor Cost by Industry Concen.			Wtd. Unit Materials Cost by Indus. Concen.			
		Low	Middle	High	Low	Middle	High	
1967-69	1.22	1.42	.61	1.45	.94	.70	.72	.61
	(4.6)	(2.7)	(1.8)	(2.6)	(8.3)	(5.1)	(2.1)	
1969-70	2.28	.57	.63	-.59	.90	.81	.23	.52
	(5.6)	(1.7)	(1.2)	(1.0)	(7.9)	(4.4)	(0.6)	
1970-71	2.31	-.09	-.12	1.06	1.05	1.07	.67	.62
	(6.6)	(0.2)	(0.3)	(1.3)	(7.3)	(6.8)	(1.6)	

Note: Regression equation is

$$\text{price change} = \text{constant} + \alpha_L(\text{wtd. ULC low concen.}) + \alpha_M(\text{wtd. ULC middle concen.}) + \alpha_H(\text{wtd. ULC high concen.}) + \beta_L(\text{wtd. UMC low concen.}) + \beta_M(\text{wtd. UMC middle concen.}) + \beta_H(\text{wtd. UMC high concen.})$$

where the first variable takes its value for low concentration industries and zero otherwise, and similarly for the other variables, all expressed as percent per year.

Signs of t values have been dropped.

Similar difficulties of interpretation occur in introducing a proxy for demand shifts (quantity sold) directly, as is done in Table 4.. Changes in quantity do not show the expected pattern of positive coefficients which diminish for higher concentration; actually, they do not differ significantly from zero.[11] A statistical difficulty with this variable, however, is that quantity (in this case deflated value of shipments) is an inaccurate proxy for demand shifts. First of all, this variable is deflated by the same price index used for the dependent variable, setting up an inverse covariation of measurement errors. When the change in manhours (which requires no deflation) is used as the quantity variable, the results (not shown) are similar, though to be sure manhours is a rough proxy even for output, much less quantity sold. A second problem is

[11] The insignificance of the quantity variables does not reflect a lack of variation across industries, which is fairly sizable for these periods. The following tabulation gives the standard deviations of annual percentage changes in quantity sold and, for comparison, weighted unit materials cost, for the 86 industries.

	Wtd. Unit Materials Cost			Quantity Sold		
Concentration group:	Low	Middle	High	Low	Middle	High
1967-69	2.0	1.6	0.6	4.2	4.8	2.7
1969-70	2.7	1.9	0.9	7.1	6.5	4.8
1970-71	2.3	2.3	1.3	5.3	6.4	3.9

that changes in quantity sold reflect much more than unanticipated shifts in demand, and in particular reflect anticipated growth of demand and exogenous shifts in supply factors and the slope of marginal cost schedules. Although an attempt to avoid large supply effects by excluding the 20 food processing industries gave the same results (not shown), this exclusion does not solve the problem, because many of the other low concentration industries are equally buf-

Table 4

Regression of Industry Price Changes on Changes in Materials Cost and Quantity Sold Grouped by Industry Concentration, 1967-71

Period	Regression Coefficients (and t values)							R^2
	Constant term	Quantity Sold by Industry Concen.			Wtd. Unit Materials Cost by Indus. Concen.			
		Low	Middle	High	Low	Middle	High	
1967-69	1.95	-.06	-.05	-.15	.98	.71	.71	.55
	(6.5)	(1.1)	(0.9)	(1.8)	(8.3)	(4.5)	(1.9)	
1969-70	2.63	.00	.01	.04	.88	.88	.11	.49
	(6.2)	(0.1)	(0.2)	(0.6)	(7.3)	(5.0)	(0.3)	
1970-71	2.48	-.03	-.10	-.16	1.01	1.02	.90	.64
	(7.3)	(0.5)	(0.5)	(0.1)	(7.3)	(7.5)	(3.6)	

Note: Price equation is the same as for Table 3 except for the substitution of quantity sold for ULC.

Signs of t values have been dropped.

feted by exogenous supply developments, which may explain why the low concentration group does not show a significant positive effect of quantity changes. Most studies using such price equations have also reported difficulty in measuring the effect of demand shifts satisfactorily.[12]

[12]This is true of Weiss [1966]. As judged by statistical significance and a positive sign for the quantity variable, Eckstein and Weiss [1972] and Dalton [1973] had partial success. A better measure would be unfilled orders [see Zarnowitz 1973], which unfortunately are not available for most four-digit industries.

We arrive at the tentative conclusion that only the materials cost variables show the expected pattern.[13] Their coefficients are about the same in Tables 3 and 4. The more concentrated industries started with

[13]In a study of 14 industries for the 1950s, Yordan [1961] found no difference in lag response to costs between concentrated and other industries. Whether his use of time series rather than cross section data or a difference in coverage and period account for the difference in results is not clear.

lower coefficients in 1967-69, and these rose to the unity level after the inflation peaked in 1970. This pattern is even more consistent if we disregard the 1969-70 recession in which cross currents in that transition period made the coefficient for the high concentration group statistically insignificant. Thus from 1967-69 to 1970-71 the concentrated industries increased their price response to changes in materials cost roughly from three-fourths to unity (in Table 4 only) while unconcentrated industries had the same price response to costs of about unity throughout. For concentrated industries the change in response per unit of time between the two periods was double that indicated by these coefficients, since the first period covers two years to the later one-year period. The difference in results between materials and labor cost, suggests that the principal adjustment lag in concentrated industries occurs in their response to

nonlabor costs.

Is the differential response to materials cost the only channel through which concentration affects prices? We may add the concentration index to the regressions which already differentiate the response to materials cost by concentration group. The expanded regression is presented in Table 5, which excludes the inbetween recession year. Unit labor cost is included as a single variable, since Table 3 revealed no consistent pattern between concentration groups. The results in Table 5 are largely the same for materials cost as in Table 4 for the low and middle concentration groups, showing a lag of the middle relative to the low group for the earlier period which is erased in the later period. But high concentration now shows no lag, and the concentration index is still negative in the earlier period (only slightly less so than in Table 1) and positive in the later period. The high concentration group contains only 14 industries, and its inexplicably high coefficient here may be influenced by a few extreme observations and should perhaps be overlooked. The continued importance of the concentration index in the earlier period should not be overlooked, however, since this implies that the response lag to materials cost is not the only channel by which concentration affects prices (the catch-up in 1970-71, of course, need not be related to cost increases). What other channels this effect takes is not clear, however, and further analysis of lag behavior is merited.

Table 5

Regression of Industry Price Changes on Changes in Costs Grouped by Industry Concentration and on Concentration Index, 1967-71

Period	Regression Coefficients (and t values)						R^2
	Constant term	Wtd. Unit Labor Cost	Wtd. Unit Materials Cost by Indus. Concen.			Concentration Index	
			Low	Middle	High		
1967-69	2.43	.94	.89	.68	.97	-2.27	.61
	(3.8)	(3.6)	(7.6)	(5.2)	(2.7)	(1.9)	
1970-71	.44	.05	1.13	1.02	1.00	+3.86	.64
	(0.5)	(0.2)	(7.9)	(7.1)	(3.8)	(2.4)	

Note: The materials cost variables are the same as for Table 3, the others as for Table 1.
Signs of t values have been dropped.

Market Structure and Price Controls

Although price increases in more concentrated industries began in 1971 to make up for previous shortfalls, the estimates suggest that the process was not completed during 1971. In Table 2 the middle and high concentration groups had price increases smaller than the low concentration group for three years from 1967 to 1970, and the amount of increases above the low group in 1971 made up only partly for the previous shortfall. In addition, the residuals from the price-cost equation do not show a negative relation between the earlier and later periods.[14] Apparently the catch-up does

[14]The residuals are those from the price equation excluding an index of market structure:

price change = constant + α(wtd. UCL) + β(wtd. UMC) + residual term,

for the three periods. The changes are in percent per year. Regressions of the later on the earlier residuals give the following results:

Dependent Variable, Residuals for:	Regression Coefficients (and t values)			
	Constant term	Concentration Groups		
		Low	Middle	High
		Residuals for 1967-69		
(1) 1969-70	.23(0.8)	-.23(0.8)	+.47(2.1)	+1.19(4.8)
		Residuals for 1969-70		
(2) 1970-71	-.04(0.1)	-.10(0.5)	-.24(1.3)	+.19(0.9)
		Residuals for 1969-70 plus two times residuals for 1967-69		
(3) 1970-71	.03(0.1)	-.04(0.3)	-.06(0.6)	+.07(0.7)

The positive coefficients for concentrated industries in (1), which indicates a tendency for the residuals to continue in the same direction throughout 1967 to 1970, was largely ended during 1970-71 but not reversed as shown in (2). Because of these cross currents, the 1970-71 residuals show no relation with the cumulative residuals representing 1967-70 in (3).

The absence of significant negative coefficients for the more concentrated industries may indicate that the residuals from the price equation do not measure the appropriate profit margin, though how the equation might be improved is unclear.

not occur dramatically in a year or two but is spread over many years. That is consistent with Weiss' interpretation of his findings for the 1950s.

If the catch-up was incomplete in 1971, it ordinarily would be continued until completed. But price controls, imposed in August 1971, were directed against large firms. What was the effect on the process of catching up? We cannot run the same price equations for these periods, because the Census data cover full calendar years (as well as not being available at this writing for the later years). A partial answer can be given, however, from simple correlations between market structure and price changes both before and after the controls. Table 6 presents the correlations. To pinpoint the time period of the price changes, they are based on three-month averages surrounding the months indicated.

From November 1969, a business cycle peak, to August 1971, the beginning of the Phase I freeze, the price change among industries is positively correlated with the concentration index, as was found in previous tables for year-over-year 1970-71. The regression coefficient is not significant here, however, and that for the size of firms is insignificantly negative. The absence of a significant positive effect, as was shown in Tables 1 and 2, reflects the inclusion here of 1970, when the effect was still negative, and the omission of the cost variables. Nevertheless, the simple correlations help to indicate the direction of the effect. In the twelve months following August 1971 during Phases I and II, the concentration effect turns negative, showing that the controls imposed greater restraint on concentrated industries.[15] A stronger

[15]The evidence suggests that Phases I and II had more effect on prices than on wages [Gordon 1973 and Cagan 1973].

Table 6

Regression of Industry Price Changes on Index of Market Structure, 1969-73

Period	Industry Coverage	Regression Coefficients (and t values) Constant term	Index of Concentration	Index of Size of Firms[a]	R^2
Nov.1969-Aug.1971	All	3.44	1.23(0.6)	...	.004
		4.22	...	-.31(0.3)	.001
Aug.1971-Aug.1972	All	4.54	-2.78(1.2)	...	.018
		4.44	...	-2.27(1.5)	.027
	Excl.Foods	3.87	-1.90(0.9)	...	.012
		4.13	...	-1.98(1.4)	.030
Aug.1972-Aug.1973	All	29.52	-32.36(2.4)	...	.065
		23.03	...	-16.78(1.9)	.041
	Excl.Foods	9.95	-8.70(2.1)	...	.006
		6.96	...	-2.26(0.8)	.010

Note: Dependent variable is percentage change per year in three-month average of prices between dates indicated.

Number of all industries is 86 and of excluded food industries is 20.

Signs of t values have been dropped.

[a]Revised index in which original ratios above .90 were assumed to entail double counting and were set equal to .95 (same as revised index cited in note a to Table 1).

negative effect also occurs for the large firms, which corresponds to the Tier I corporations singled out under Phase II. In the following year August 1972 to August 1973, the negative effect is greater for both indexes (even after excluding the food industries which were particularly affected by extraneous developments), reflecting a combination of controls and a resurgence of inflation in which the concentrated industries again exhibited their characteristic lag. Although these results disregard changes in costs, it is probably safe to conclude that the controls held down the profit margins of the more concentrated industries as intended by government policy. A justification for this policy based on the large price increases of these industries before August 1971 cannot be supported, however, since those increases appear to have been a belated and incomplete attempt to make up for earlier shortfalls.

Summary and Implications

One of the significant characteristics of inflationary movements is that residual price increases above costs tend to differ according to the degree of industry concentration. This has been the basis of one version of the familiar cost-push theory, whereby inflation originates in firms which have controls over prices and which continually increase rather than merely maintain profit levels. This version of cost push, however, has run aground of the finding that concentrated industries, which supposedly wield more such control than other sectors, sometimes raise prices less than the others. Another explanation of the relation between concentration and prices is that any firm, to the extent it has limited discretionary control over its prices, adjusts them to demand and cost changes with a lag. The implication is that prices in more concentrated indus-

tries tend to fall behind in periods of generally accelerating inflation and to catch up later as over-all inflationary pressures subside. This, too, is an old idea, and a few studies have presented some evidence of differential lags.

This study has built upon previous empirical work of pricing among industries to test the implication of a changing pattern of pricing in concentrated industries, which previous studies have not tested directly. Price changes of 86 four-digit industries for which the BLS publishes price series were regressed on changes in unit labor cost and unit materials cost from the Census of Manufactures and an index of market structure. Two indexes were used. The first was the 1967 Census fraction of shipments in each industry by the four largest firms. It is, despite deficiencies, the commonly used measure of market structure for these purposes. The second was an NBER ratio of industry shipments by divisions of parent corporations with total annual sales of $100 million or more (the Tier I firms of Phase II).

In these regressions the coefficient of the index of market structure was negative for 1967-69 and 1969-70 and positive for 1970-71. This gave striking confirmation of a change-over in pricing behavior of concentrated industries and large-size firms as the inflation reached a peak and began to subside (for a time) during 1970 and 1971. It is true that more concentrated industries have less price volatility in general [Cagan 1974], due perhaps to a greater underreporting of market discounting or to other special characteristics of those industries. But this would not account for their price changes falling short and then exceeding those in other industries.

In a comparison of concentration and large-size firms, the concentration index exhibited the stronger change-over pattern, though whether it is the more appropriate variable for these purposes is not certain. The assumption of linearity implicit in the use

of these indexes as single variables was tested and found to be weak, but dividing concentrated industries into three groups did not alter the basic findings.

The findings point to lags in the adjustment of prices by firms which in the traditional sense are price setters as distinct from price takers. The lagged behavior was traced to the response to materials cost, which implies that the speed of transmission of changes in basic commodity prices varies with the market structures through which the changes travel. No differential lag could be found in the response to labor costs, either to changes in wage rates or in labor productivity. More puzzling is the inability to find that shifts in demand have an effect which diminishes for more concentrated industries, as the theory seems to imply. Other studies report similar difficulties. The problem may be statistical, however, due to the deficiency of quantity variables as a proxy for demand shifts.

The differential response to materials cost does not account for all or even most of the concentration effect. This was shown by adding the concentration index to a regression which allowed separate coefficients for materials cost by concentration groups. The concentration index still exhibited its characteristic pattern over time -- being first negative and then positive. Since the concentration index was not zero here for the earlier period, apparently there is more to the effect of market structure than is captured by response lags in the cost variables.

The findings do not support the proposition that more concentrated industries originate inflationary movements as distinct from

passing them along, even though because of lags these industries can be observed to raise prices in the face of slack markets. Controls appear to be effective in holding back the process of catching up, but such a policy cannot be justified on the argument that concentrated industries spearhead inflationary movements. Indeed, these industries appear to delay inflationary impulses.

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