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The Effects of Phases I, II, and III on Wages, Prices, and Profit Margins in the Manufacturing Sector of the United States

Dissatisfaction with our ability to achieve reasonable compromises between competing national objectives has reached crisis proportion in recent years as, in country after country, a high rate of inflation has continued to exist side by side with below-potential economic growth and an unacceptably high rate of unemployment. In such a climate, the clamor for direct government intervention to influence wage and price decisions tends to be strong. The United States, England, France, Australia have found it necessary or convenient to resort to some kind of incomes policy or wage and price controls to alleviate inflationary pressures.

The U.S. experimentation with wage and price policy in peacetime goes back to the Kennedy-Johnson guideposts of 1962–1966, although formal wage and price restraint was implemented only with the inauguration of the Economic Stabilization Program (ESP) by the Nixon administration in August 1971. The forces that brought about the new program were varied and complex, including primarily the deterioration in the U.S. balance of trade and payments, the repeated runs on the U.S. dollar in foreign money markets, and the failure of prices and wages to respond quickly and adequately to the anti-inflationary demand-management policies of the 1969–1971 period.

A cursory look at the record during the controls period shows moderate price increases in 1972 but sharply rising prices in 1973. Do these diverse price trends reflect the relative success or failure of the various phases of the ESP, or are they largely the result of external market forces that overwhelm any impact emanating from wage and price controls? What are the theoretical considerations in assessing the effectiveness of the regulations on the pricing practices of different types of firms? Given these theoretical considerations, how can we estimate the effects on prices and wages of the various phases of the control program, and what degree of disaggregation is required to provide meaningful results? In cases where wages and prices were found to have been significantly affected by the control program, was this achieved at considerable costs in terms of market distortions?

Our purpose in this paper is to provide answers to some of these questions, using phases I, II, and III of ESP as a frame of reference. The focus is on the manufacturing sector of the economy, on which the program was supposed to have had its heaviest impact. The paper contains two main parts, one theoretical and the other empirical. In the theoretical section we explore the possible effectiveness of the regulations on firms with different pricing practices. In the empirical section we present the results of an integrated wage-price model focused on the manufacturing sector. The model contains wage, price, and profit margin equations for seventeen manufacturing industries. These are aggregated on a fixed weight basis to create aggregate equations for manufacturing. Dummy variables are used to capture specific structural shifts that may have occurred during the various phases of controls. One dummy variable, covering the eight-quarter period, is used for the wage equations, and two dummy variables are used in the price equation to capture the separate impacts of phases II and III. Dynamic simulations are then used to compare the aggregate performance of the manufacturing sector with what would have occurred without price controls.

I. THE THEORETICAL EFFECTIVENESS OF PRICE AND WAGE CONTROLS

Our purpose in this section is to explore the implications of the price, wage, and profit regulations of phases I, II, and III. We examine the price regulations of the three phases for manufacturing firms from the partial equilibrium viewpoint of the theory of the firm. While this is far from a complete picture of the effect of the price regulations, it is a natural first step. In order for there to be any aggregate effects in a dynamic general equilibrium context, there must be some effect at the microeconomic or firm level. Further, the theoretical development offers a number of suggestions that can be combined with econometric analysis of past price changes and with data gathered by the price control agencies to produce tentative conclusions.

Prices

To facilitate the theoretical analysis of the effect of the price regulations on the determination of prices, assume that the firm faces a stable, downward-sloping demand curve[1] and makes a decision at the beginning of each phase of controls that determines the quantity of all inputs hired, the prices of all outputs, and the quantity that will be produced over the period. In other words, at the beginning of each phase the firm chooses inputs, outputs, and prices, and these remain fixed over the period of the regulations. Further, the plan for prices, inputs, and outputs is independent of future periods. The firm bases its decision on certainty expectations about input prices and demand (i.e., the variance of expected input prices and quantities sold at various output prices is zero).

Phase I

On August 15, 1971, President Nixon announced a New Economic Policy commencing with a freeze on most wages and prices for a period of not more than ninety days.[2] Many firms had either announced price increases or planned price increases that were delayed by the freeze.[3] To the extent that these price increases were in response to cost increases already incurred, the profitability of the firm would have been adversely affected during Phase I. The effect on production decisions would, however, depend upon the relation between demand and marginal costs. If some unit costs had risen before the freeze, but had not been recouped by higher prices, then clearly average costs would be higher. However, the effect on marginal costs, in both the short and long run, is ambiguous: marginal costs could either rise or fall for specific levels of output (see Truett and Roberts 1973). It seems likely, however, that marginal costs would be higher. With prices frozen at prefreeze levels, the firm would face a kinked demand schedule, with the kink at the frozen price level. Thus, marginal costs could increase without the firm changing its output. The degree to which marginal costs could change without having an effect on output would depend upon the elasticity of the firm's demand curve and, hence, the extent of discontinuity in the marginal revenue function. Thus, there is some theoretical support for the hypothesis that the freeze caused no change in output or prices relative to prefreeze levels, that price increases should have been near zero, and that profit margins should have been somewhat below what they would have been without the freeze.

Phase II

Phase II price regulations classified firms into three tiers: Tier I—firms with over $100 million in annual sales; Tier II—firms with between $50 million and $100 million in annual sales; and Tier III—firms with less than $50 million in annual sales. Tier I firms were required to "prenotify" the Price Commission of price increases unless they had a term limit pricing agreement (TLP).[4] The prenotification requirement meant, in effect, a delay of thirty days.[5] Tier II firms were required only to postnotify the Price Commission. Tier III firms were required merely to keep appropriate records for auditing and monitoring purposes.

The basic regulations that applied to manufacturing firms stated simply:

> A manufacturing firm may charge a price in excess of the base price only to reflect increases in allowable costs that it incurred since the last price increase in the item concerned, or that it incurred after January 1, 1971, whichever was later, and that it was continuing to incur, reduced to reflect productivity gains, and only to the extent that increased price does not result in an increase in its profit margin over that which prevailed during the base period.[6]

From the beginning of Phase II, one major stumbling block in this regulation was the meaning and measurement of productivity. At first, the forecasted productivity rise used to offset the rise in wage rates was calculated by each firm. The situation was entirely unsatisfactory from the standpoint of the Price Commission because no uniform productivity measurement was used by Tier I firms (some used output per man-hour as a measure of productivity, while others used total factor productivity) and because many firms showed zero or unacceptably low productivity figures, either because of oversight, ignorance, or a deliberate policy of justifying higher price increases. To remedy the situation the Price Commission, beginning in April 1972, required that instead of using their own estimates, firms should apply a set of productivity factors developed by the staff of the commission for most four-digit Standard Industrial Classification (SIC) industries. The commission's productivity factors were based on the Bureau of Labor Statistics (BLS) trends in output per man-hour for 1958–1969. In addition to using these productivity estimates as offsets to allowable labor cost increases, firms were also required to subtract from cost increases an appropriate amount of reduced fixed costs due to increased volume of output. However, the projected volume was solely up to the firm, rarely challenged by the operations staff of the Price Commission, and generally quite low.

Other steps were taken by the Price Commission to limit "allowable" cost increases. Allowable labor cost increases resulting from contracts signed after August 15, 1971, were limited to the Pay Board standard of 5.5 percent plus 0.7 percent for fringe benefits. Other limits were placed on discretionary cost increases (overhead and advertising) incurred to avoid the intent of the regulations. For several reasons, the impact of the limitation on labor cost increases was not very significant for manufacturing firms. First, workers under expiring contracts accounted for no more than one-fourth of the total labor force of major unions (those representing 1,000 workers or more) during 1972; since unionization accounted for about two-thirds of production workers on manufacturing payrolls and about two-fifths of all production workers on private nonagricultural payrolls, the relative importance of expiring contracts was much reduced. Second, during Phase II the Pay Board approvals averaged 5.5 percent for new wage agreements, 5.3 percent for deferred agreements in durable manufacturing, and 5.3 percent for deferred agreements in nondurable manufacturing (Mitchell 1974).

Firms were constrained by two control policies, one on allowable costs and one on the base-period profit margin (generally referred to as the second line of defense). If the firm had only *one* product, granted "allowable" wage increases, and based its decision on an assumed gain in total productivity roughly equivalent to the productivity and volume offsets required under Phase II, the two control policies were reduced to one basic restriction—a constant profit margin limit: either the profit margin in effect just prior to cost increases occurring after January 1, 1971, or the profit margin in the base period,[7] whichever was lower.

The effect of such a regulation under the foregoing assumptions will depend on the pricing practices of the firm. Accordingly, we shall consider three types of firm: the profit-maximizing firm, the sales-maximizing firm, and the target-return-pricing firm. In each case, the firm is assumed to produce only a single product.

The Profit-maximizing Firm A single-product firm that is constrained by a constant profit margin rule has a profit margin curve that is parabolic to the average cost curve, reaching a minimum and being closest, in absolute terms, to the average cost curve at its minimum. The profit-maximizing firm would not necessarily be constrained by the Price Commission rules. Specifically, it would not be affected if the marginal revenue curve cut the marginal cost curve at the point at which the desired price was less than the allowable cost curve.[8]

During Phase II it was often argued that the allowable cost rules provided an incentive for firms to incur higher costs. Generally, the argument ran as follows: since an x percent increase in unit costs (assuming such cost increases were not detectable by the Price Commission as discretionary) entitled the firm to an equivalent x percent increase in price, margins would remain constant, but absolute profits would rise. There is clearly some merit to this argument, especially when such cost increases can be shown on the books to be current but actually are productive expenditures to be recouped later. However, the argument is only valid under a limited set of circumstances.

First, suppose the firm considers cost expenditures that are purely wasteful. The firm will have an incentive to incur such costs if the allowable price under the constraints of a given profit margin is at a point on the firm's demand curve that is inelastic.[9] In such cases, the profit-maximizing firm will allow costs to increase until the allowable price is such that marginal revenue is zero. By letting average unit costs rise by x percent, the firm is entitled to an x percent increase in price. If demand is inelastic, the quantity demanded will fall by less than x percent, providing the percent increase in profit is precisely equal to the percent increase in revenue. However, the regulations always cause the profit-maximizing firm to produce as much or more than it otherwise would have and at a price equal to or less than the uncontrolled price, even when the firm expends monies on nonproductive but allowable costs.

The firm will, however, have no incentive to engage in purely wasteful expenditures when the allowable price is in an elastic portion of the firm's demand schedule. In this case, there will be no distortion of the optimal capital-labor relation, in contrast to typical public utility regulation based upon rate of return on capital. As is well known, rate-of-return regulation causes an excessive investment in capital (see Averch and Johnson 1962, Baumol and Klevorick 1970, and Stein and Borts 1972).

If the unnecessary cost increases are allowable cost increases but do generate some present-valued revenue, it then follows that the constrained profit-maximizing firm will let cost rise more than if such expenditures generated no revenue.[10] Under such conditions, the firm will reach an equilibrium in maximizing profits at some point between unconstrained output and the point where marginal revenue is zero, depending upon how much additional revenue is generated per dollar of unnecessary cost increases.

The Sales-maximizing Firm The implied effectiveness of the control program is much different for a firm that maximizes sales (revenues) than for one that maximizes profits. A sales-maximizing firm earns no pure economic profits, that is, revenue is maximized subject to the condition that total revenue must be greater than or equal to total costs. Of course, accounting profits would be positive, since they are, in part, returns to factors of production that are not measured in the accounting process. If all unmeasured costs in the accounting sense are fixed, then the allowable price curve may lie everywhere above the average total cost curve, intersect it once, or intersect the average total cost curve twice. For the sales-maximizing firm, the price control strategy must either be ineffective or the firm must be forced to operate at a loss, since by definition the firm just covers average total cost.

The Firm That Pursues Target Rate-of-Return Pricing Since the work of Kaplan, Dirlam, and Lanzillotti (1958), pricing to achieve a target rate of return on investment has become widely regarded as the most prevalent short-run business pricing practice. Usually target rate-of-return pricing is construed to mean that the price is set so that if the firm produces at "normal" output (generally defined by management as 70–80 percent of capacity), it will earn its target rate of return on investment (net worth plus long-term debt). If net worth and long-term debt are constant, then repricing in response to increased unit costs of production is equivalent to maintaining a constant dollar profit per unit of output when the firm is operating at its "normal" rate. Price adjustments that maintain a constant dollar profit at normal output are referred to as "dollar-for-dollar pass-throughs" of cost increases, a rule in effect under Phase IV of the ESP. Phase II regulations allowed an equal percent increase in unit profits to be tacked onto cost increases.

If capital investment is unchanged, the same dollar profits would achieve the target rate of return. It follows, therefore, that if the firm had no volume offset for fixed costs (either because all accounting costs were variable or because the firm projected no change in volume), then the allowable price increase permitted by the Price Commission would be greater than the price increase desired by the firm using target rate-of-return pricing. If the firm did experience an increase in volume and had a volume deduction for allowable increases in variable costs, then the permitted price increase may be greater than, equal to, or less than the desired price increase, depending upon the magnitude of the volume offset, the increase in allowable costs, and the profit margin of the firm.[11] Since the volume offset was entirely up to the firm, it would seem likely that the requested price increase was "greater than or equal to" rather than "less than" for the firm using target rate-of-return pricing. The firm would have no incentive to incur unnecessary costs unless its projected volume increase was too high. In that case, if it did incur additional costs, the percent increase in profits would be commensurate with both. Thus, if the volume projection was too high (which is unlikely), unnecessary costs could be incurred to raise profits at the normal level of output to achieve the target rate of return. This analysis does not consider current demand conditions but, in general, the target rate-of-return rule is not a profit-maximizing rule of thumb.

To summarize the import of the foregoing analysis, the effect of Phase II controls depended upon the specific conditions of the market. It seems likely that in several industries there was no change in historical relationships among prices, output, and costs. Furthermore, in cases where structural shifts can be identified empirically, the analysis should offer an explanation.

Phase III

Guided by its avowed policy of ridding the economy of the fetters of wage and price controls, the Nixon administration took advantage of the observed improvement on the inflationary front in late 1972. Phase III, which lasted for nearly half a year, abolished both the Price Commission and the Pay Board, dropped the prenotification requirements in most sectors of the economy, maintained the report-filing requirements for only the largest economic units, exempted the rent sector from control, made the profit margin rule much less stringent, and allowed considerable flexibility in the standards.[12] These steps gave Phase III the appearance of "a dash back to the market" despite repeated references by various government spokesmen to the ultimate use of the "stick in the closet" to restrain undue wage and price increases. Assuming the management of the firm interpreted the new steps as the death knell of controls, then the firm would resume historical pricing practices. Thus, if any structural shift was identified for Phase II, it should disappear for Phase III.

Wages

The first freeze, in August 1971, applied to virtually all wages and salaries, including those with increases scheduled by contract to take effect during the freeze. Initially the Cost of Living Council ruled that wage increases scheduled to go into effect during the freeze could not be paid retroactively after the freeze was over. This was later overturned by the courts, and many wage increases were paid retroactively after Phase II began. This fact has two principal effects on the data. First, because of the bunching of these increases, the data should show a bulge for the beginning of Phase II. Second, the increase in the wage indexes will lag behind the actual increase in labor costs in those cases where wage payments were made retroactive to the freeze.

Phase II

Phase II regulations were comprehensive, although some exceptions were later made in the program for small units (those employing fewer than 60 workers) and for low-wage earners. Employee units were classified into three categories: Category I firms, those with 5,000 workers or more, were required to prenotify the Pay Board of all wage increases regardless of whether they were above or below the pay standard; Category II firms, employing 1,000 to 5,000 workers, were only required to submit quarterly reports to the Pay Board about pay increases, the same as for Category I units; and

Category III firms, those with under 1,000 workers, were subjected to little or no control. A pay standard of 5.5 percent per year for contracts negotiated or determined after November 14, 1971, was set by the Pay Board. This standard was, however, allowed to go higher (up to 7 percent) in those special cases where higher wage increases were deemed necessary to promote faster productivity growth, to correct a gross inequity in the relation between the pay of one group of workers and another group with which the first group had a well-established parity, to allow for legitimate fringe benefits, or to honor contracts written prior to Phase II and scheduled to go into effect during the phase.

Phase III

The Phase III regulations generally de-emphasized wage regulations apart from food, health care, and construction. Officially, the regulations published on January 12, 1973, still contained the 5.5 percent standard, but latitude for exceptions was greatly increased. With the primary emphasis on a self-administered control program, the prenotification requirement of wage increases by large units was removed.

Relevant to this paper is the potential effect of the Pay Board regulations on wage determination. This effort is somewhat unclear, for the regulations may tend to decrease or increase the rate of change in wages in specific industries depending upon prevailing economic conditions. One of the consequences of the establishment of an incomes policy is to add bargaining strength to those contracts with pay provisions closest to the control program's pay standard. For example, in an industry where, without a Pay Board, the increase in wage rates may have been held to 4 percent by management, the increase in wage rates, under a 5.5 percent pay standard, would be higher with controls than without them. However, in industries where management would have offered, say, 8 percent without a standard, the rate of increase in wage rates would probably be constrained by the existence of a wage control program with a 5.5 percent standard. Thus, the institution of a standard tends to shift the bargaining on the distribution of income from the industry to the national level. With an incomes policy that is "in the national interest," the role of the labor union is to follow the "national interest" with respect to the overall goals of reducing inflation, although the brunt of the anti-inflationary strategy should fall on tougher price regulations, particularly as they apply to those industries most able to absorb cost increases.

Wage increases granted during Phase II were not significantly different from the 5.5 pay standard (see Mitchell 1974 for a discussion of this point). While this is revealing, it does not answer the pertinent question of whether wage increases would have been different without wage controls. Although no definitive answer can be provided, wage equations with dummy variables can be employed roughly to assess the relative impacts of the wage regulations on different industries.

II. FORMS OF THE VARIOUS AGGREGATIVE EQUATIONS

In the preceding section, microanalysis at the firm level was used to suggest the various effects a control program might have. However, because of aggregation and data gaps, it is difficult to derive aggregative equations for major economic sectors or a specific industry from the theory of the firm. At the more aggregative level, it is necessary to resort to less rigorously derived theoretical models if one is to make any attempt at quantifying determinants of wages and prices and the effect that controls may have had.

Prices, profit margins, and wage rates are not only interrelated but they depend on similar economic forces. For example, an increase in the overall price index for goods and services usually provokes an upward pressure on wages in various industries. In addition, the relative rates of increase in prices and wages, together with changes in demand and nonlabor unit cost, will largely determine whether the profit margins of specific industries will increase or decrease. Moreover, both prices and profit margins are heavily affected by such things as the scale of production, the intensity of demand, and the efficiency with which inputs are used in the production processes. These interrelationships should be kept in mind in setting the analytical framework and in interpreting and estimating equations relevant to the three variables.

The Price Equations

In theory, price changes are a function of changes in demand and supply forces. Demand changes are caused by shifts in consumers' incomes, consumers' tastes, and relative prices. Changes in supply, on the other hand, largely reflect changes in technology and input prices, both of which affect productivity and unit costs. The manner by which these demand and supply forces affect price adjustment depends heavily on the relative sizes of supply and demand elasticities. The latter, in turn, are a function of the degree of competition in commodity and labor markets, the degree of substitution among inputs, the length of the production process, the reliability and speed of information, and the institutional arrangements governing the production and distribution of goods and services.

A priori, one would expect large differences among manufacturing industries in the way in which supply and demand forces affect their prices. Whether or not the responses of industry prices to these forces can be adequately measured by use of regression equations is an open question. For one thing, most of the factors with a bearing on member firms' pricing decisions lack available quantitative measures. And since these factors are continuously interacting, no neat hypothesis exists that can be tested with available data.

While theory and available data are so far apart in the case of price adjustments that no meaningful tests can be performed, it is still possible to use the correlation-regression approach to identify stable relations among the prices of key manufacturing industries (the object of the price restraint program) and other explanatory variables which, at least to a degree, run the gamut of supply-demand factors. The objective of such an approach is not so much to test a theory of market behavior but to predict price changes. The basic form used here is

$$\frac{dp}{p} = a_0 + a_1\frac{dy}{y} + a_2\frac{dy^d}{y^d} + a_3\frac{dw}{w} + a_4\frac{dv}{v} + a_5\frac{dr}{r} + a_6\frac{di}{i} \tag{1}$$

where p is an index of the price of output, y is an output variable, y^d is an excess demand variable, w is a wage rate variable, v is an index of materials prices, r is a rate of return variable, and i is an interest rate variable.

The Profit Margin Equations

Profit margins are, by definition, a function of output price, level of output, and unit (or average) costs of production. Hence, equations that explain changes in profit margins do not suffer from the same theoretical morass of confluent unmeasurables as optimal price adjustment. They do, however, suffer from inadequate profit data. Therefore, the parametric values we obtain in estimating an equation of the form given in (2) do tell us something about the industry.

Furthermore, where the standard error is sufficiently small, such equations should also be useful in assessing the potential impact of a system of price controls that relies, in part, upon profit margin limitations.

The equation for profit margins is

$$\frac{dm}{m} = a_0 + a_1\frac{dy}{y} + a_2\frac{dp}{p} + a_3\frac{dw}{w} + a_4\frac{dv}{v} + a_5\frac{di}{i} + a_6\frac{dk}{k} \quad (2)$$

where m is the ratio of pretax profits to sales, and k is a depreciation rate variable. Other variables are defined in equation 1.

The Wage Equations

The basic Phillips-curve hypothesis (which serves as an initial point of departure for the specification of our wage equations) states that when the supply of and demand for labor in terms of money wages is not in equilibrium, the rate of change of wages is proportional to the excess demand for labor. The relationship between money wage change and the unemployment rate is convex. This is but one of several possible nonlinearities in the determination of the rate of change in money wages (for a discussion of nonlinearities in wage equations, see de Menil 1969). This convex relationship between the unemployment rate and the rate of change in money wages is approximated by the inverse of the unemployment rate. Labor market tightness is characterized by extremely large wage changes at low unemployment rates. The opposite is true for a fluid labor market.[13]

The relationship between prices and wage change can be established in two ways. First, wage bargaining is more in terms of real wages than money wages, and thus money wages are influenced by prices. Second, money wage determination is based on money wage expectations as measured by future price expectations. In the absence of a money illusion, individuals should fully anticipate price changes and translate them into wage gains. This would imply a vertical long-run Phillips curve and a coefficient of unity on the expectations variable. In most empirical tests of the expectations hypothesis the coefficient has been statistically less than unity.[14] The real wage associated with any increase in money wages varies inversely with the rate of change in the prices workers pay as consumers, and thus workers adjust their wage demands according to the size of the price inflation they expect. A coefficient of less than unity would imply that workers are either unwilling or unable to translate the price increases into wage demands.

The effect of the wage regulations on econometric wage equations over the various phases of controls depends to some extent upon how such equations are specified. In recent years, a number of alternative hypotheses of wage determinations have been advanced, all of which apparently have approximately the same explanatory ability.[15] However, the type of specification does affect the significance of dummy variables included in an equation. This is evident by comparing some recent studies of wage determination at the aggregate level. Perry (1970) used a modified Phillips-curve approach for wage determination by emphasizing labor market variables that differ from the conventional aggregate rate of civilian unemployment. Using a weighted unemployment rate and an unemployment dispersion index, Perry was able to track movements in wages during the late 1960s that were above the rates predicted by previous conventional models. Perry's approach yields a significant guidepost dummy variable. Eckstein and Brinner (1972) explain the apparent outward shift in the Phillips curve by using an inflation severity variable with the usual aggregate rate of unemployment. This approach also yields a significant dummy variable for the period of the guideposts. Gordon (1971, 1972) uses three labor market variables along the lines of Perry's and rejects the significance of a guidepost dummy variable. Wachter (1974) takes into account the change in the relative structure of wages over the business cycle, uses the conventional rate of unemployment, and rejects the significance of a dummy variable.

Often profits or the profit rate are included in the wage equation on the presumption that profits influence the bargaining power of unions and management in the determination of wages. Kuh (1967), however, argues that profits are actually a proxy for productivity, and that workers bargain for higher wages on the basis of increased productivity and its associated reduction in unit labor costs.

In summary, we hypothesize that the rate of change in money wage rates is a function of labor market tightness, price expectations, and labor productivity. The general form of the equation estimated for each industry is as follows:

$$\frac{dw}{w} = a_0 + a_1 \frac{dp}{p} + a_2 \frac{dE}{E} + a_3 \frac{dQ}{Q} + a_4 \frac{1}{U} + a_5 Z + a_6 L + a_7 GPD$$

where w is the industry wage rate, p is the consumer price index, E is the industry employment, Q is the productivity index for all manufacturing, U is the aggregate rate of unemployment, Z is the level of industry profits, L is the layoff rate for all manufacturing, and GPD is a guidepost dummy variable; its value for 1962I is 0.25; for 1962II, 0.50; 1962III, 0.75; 1962IV–1966IV, 1.0; 1967I, 0.75; 1967II, 0.50; 1967III, 0.25; and zero for all other quarters.

III. DATA TECHNIQUES AND METHOD OF ESTIMATION

Form of the Variables and the Data

For several reasons, we elected to use the four-quarter percent change in each variable, which we then corrected for autocorrelation. All the rate variables were expressed in decimal as opposed to percent form. All lags were introduced as either fixed weighted averages of past variables (rather than being estimated freely) or as lag adjustments. For the weighted average, weights of 0.4, 0.3, 0.2, and 0.1 were used for periods t through $t - 3$.[16]

The data used to estimate the price equations are at the two-digit Standard Industrial Classification (SIC) level of compilation. The variables are largely self-explanatory except for the indexes of output and input prices. All are defined in the appendix below. The variables were constructed in a manner similar to that employed by Eckstein and Wyss (1972).[17] However, the final series were constructed with slightly different groupings and thus are not comparable with theirs.

Estimation Procedures

The wage, price, and profit margin equations were estimated for the time interval from 1959III to 1971II. The initial date was chosen primarily because of data limitations, and the closing one was selected so as to avoid the influence of the Economic Stabilization Program.

The use of four-quarter rates of change reduces the multicollinearity among variables in a statistical sense, although it does not eliminate the problem. In using four-quarter rates, we do not assume that a constant fraction of the dependent variable changes every quarter with the same parametric response to the same variables (or the equivalent) as postulated, for example, by Perry (1964). For a discussion of the problems generated by the Perry-type assumption, see Black and Kelegian (1972) or Rowley and Wilton (1974).[18]

The estimated wage, price, and profit margin equations were corrected for autocorrelation, using nonlinear least squares estimation and the Hildreth-Lu technique.[19] The latter was used to search a grid of values to insure a global minimum rather than only a local minimum for the residual sum of squares. The wage equations were corrected for first-order autocorrelation; and the price and profit margin equations, for second-order autocorrelation.

IV. EMPIRICAL RESULTS FOR 1959III–1971II

A summary of the results for the estimated price, profit margin, and wage equations for the seventeen industries is presented in tables 1, 2, and 3. Initially, each equation was estimated with all the hypothesized variables included. Variables were then retained in an equation on the basis of two considerations: one, that the variable was significant prior to the correction for serial correlation; two, that the variable also proved to be significant in other periods of estimation and the estimated coefficients appeared to be robust both prior to and after the correction for serial correlation. Variables were retained in the estimated equations on this basis even if their estimated coefficient was not significantly different from zero; variables that did not satisfy conditions one and two were dropped from the estimated equations. Within any general category of variables, such as output or demand, the specific forms of the variables may differ, as indicated in the tables.

The Price Results

As would be expected, price changes are positively and significantly affected by wage and materials cost pass-throughs in most of the sample manufacturing industries. However, the results do not provide clues to the market structures of specific industries. They are capable of supporting either a competitive pricing model or the other widely held hypothesis: target-rate full-cost pricing. At least in part, this is because of the broad level of industry aggregation with which we are working (two-digit SIC) and because of the variables chosen for making the analysis. Most of these variables enter into the pricing decisions of both competitive and noncompetitive firms. Variables such as capital costs that would be useful in discriminating between competing theories are either not available in accurate form or are rendered ineffective by the presence of more powerful cost factors with which there may be strong multicollinearity.

The output variable has an impact on the dependent variable in textiles (SIC 22), lumber (SIC 24), paper (SIC 26), and electrical machinery (SIC 36). For textiles and lumber, the positive output coefficient taken in conjunction with the positive association between the price variable and the profit margin (Table 2), implies that price increases in those two industries tend to exceed average cost increases when output is rising, with the result that consumers do not always share in the fruits of cyclical increases in productivity. Or put another way, prices in those industries are responsive to the market cyclical changes associated with those industries. For paper and electrical machinery, the negative correlation between changes in output and variations in price would suggest that those industries pass on cost declines during periods of increasing productivity. This phenomenon seemed to have characterized the 1959–1966 period when, because of increased capacity utilization, the electrical machinery industry was able to maintain relative price stability.

As an explanatory variable, excess demand seems to be important in only four industries. In three of them (food processing, lumber, and nonferrous metals), the regression coefficient has the correct sign, i.e., there is a negative association between the inventory-to-sales ratio (a proxy for excess demand) and the four-quarter rate of change in output price. In chemicals and fabricated metals, prices tend to fall when demand becomes excessive.

In only one instance is there a negative relation between changes in wages and changes in prices. Adjusted average hourly earnings were not available for nonferrous metals (SIC 33). For this industry, both unadjusted wage rates and wage rates adjusted for overtime and interindustry shifts were tried. The latter gave a superior fit. A 1 percent increase in average hourly earnings, excluding overtime, results in a decline of 0.77 percent in output prices, but in a lagged manner over sixteen quarters. The negative coefficient is difficult to explain.

Materials prices are significant in eight industries. The negative coefficients on input prices in textiles and rubber are extremely small—0.01 and 0.04 percent, respectively.

A decline in cash flow in tobacco is associated with price increases. The four-quarter rate of change in Moody's Aaa bond rate

TABLE 1 Industry Price (PQF) Equations,[a] 1959III–1971II (figures in parentheses are t statistics)

SIC No.	Industry	Constant	Output (*QF*)	Demand (*DINSF*)	Wages (*WF*)	Materials Prices (*PIQF*)	Bond Rate (*BAAF*)	ρ_1 [ρ_2]	$\bar{R}^2$ [*DW*] {*SEE*}
20	Food processing	.0160 (2.57)		−.1040 (−1.76)		.4812 (8.25)		0.77	0.91 [1.78] {0.0008}
21	Tobacco	.0028 (0.27)			.3050[b] (2.29)		.1086 (3.21)	0.76	0.79 [1.74] {0.0104}
22	Textiles	−.0679 (−2.09)	.1356 (1.36)		1.5158[c] (2.42)	−.0118 (−0.29)		0.79	0.54 [1.97] {0.0204}
23	Apparel	.0084 (2.11)				.2708 (2.22)		1.37 [−0.70]	0.82 [2.03] {0.0090}
24	Lumber	−.0385 (−1.07)	.2086 (0.95)	−.3001 (−2.48)	1.3611[d] (1.96)			1.18 [−0.51]	0.80 [2.28] {0.0381}
25	Furniture	−.0066 (1.90)			.6998[d] (8.18)	.0782[c] (1.75)		1.09 [−0.45]	0.94 [2.26] {0.0038}
26	Paper	−.0095 (−0.85)	−.0101 (−0.14)		.3532 (1.56)	.1898[b] (2.11)		1.03 [−0.44]	0.75 [2.19] {0.0088}
28	Chemicals	−.0061 (−0.67)		.0533 (3.43)	.1853[b] (1.26)			0.90	0.87 [2.19] {0.0035}
30	Rubber	−.0149 (−0.84)			.7214[c] (1.58)	−.0441[d] (−0.32)		1.11 [−0.40]	0.72 [1.92] {0.0181}

32	Stone, clay, and glass	−.0265 (−5.32)			1.1129[c] (9.87)		1.17 [−0.48]	0.95 [2.08] {0.0044}
331	Ferrous metals	−.2709 (−0.49)				.0791 (1.48)	1.25 [−0.25]	0.96 [1.79] {0.0049}
333	Nonferrous metals	.5081 (2.31)		−.0415 (−3.67)	−.7745[b] (−1.313)		1.53 [−0.77]	0.86 [1.98] {0.0224}
34	Fabricated metals	.0060 (1.84)		.0175 (1.29)	.1082 (1.15)	.6730 (2.72)	1.08 [−0.46]	0.96 [1.90] {0.0039}
35	Nonelectrical machinery	−.0004 (−0.04)			.4897[c] (2.93)	.2310 (3.06)	0.88	0.96 [1.74] {0.0030}
36	Electrical machinery	.0022 (0.37)	−.1293 (−2.67)				1.43 [−0.62]	0.90 [2.15] {0.0078}
371	Motor vehicles	−.0053 (−1.15)				.9351 (4.83)	0.94 [−0.31]	0.82 [2.18] {0.0084}
38	Instruments	.0049 (0.93)				.3193 (2.40)	0.82	0.73 [1.72] {0.0059}

ρ_1 = first-order autocorrelation coefficient.
ρ_2 = second-order autocorrelation coefficient.
DW = Durbin-Watson statistic.
$\bar{R}^2$ = coefficient of multiple determination, adjusted for degrees of freedom.
SEE = standard error of estimate.
[a] For identification of variables and sources of data, see appendix.
[b] For wages, signifies use of *WF*, lagged one period; for materials prices, signifies *PIQF*, lagged one period.
[c] For wages, signifies use of *WFWA*; for materials prices, *PIQF*, lagged two periods.
[d] For wages, signifies use of *WFWA*, lagged one period; for materials prices, *PIQF*, lagged four periods.

TABLE 2 Industry Profit Margin (PMF) Equations,[a] 1959III–1971III (figures in parentheses are t statistics)

SIC No.	Industry	Constant	Output (*QF*)	Output Prices (*PQF*)	Wages (*WF*)	Input Prices (*PIQF*)	Interest Costs (*BAAF*)	ρ_1 [ρ_2]	$\bar{R}^2$ [*DW*] {*SEE*}
20	Food processing	.0087 (0.66)		−.4297[b] (−0.62)				0.60	0.45 [1.71] {0.0311}
21	Tobacco	−.0359 (−1.84)	.4349 (2.59)	1.572[b] (3.13)				0.60	0.42 [2.00] {0.1442}
22	Textiles	−.0558 (−2.32)	2.524 (7.89)	2.265 (3.36)			−.5889 (−2.11)	0.23	0.82 [1.91] {0.0963}
23	Apparel	−.1731 (−2.63)	4.236 (5.04)	1.545[b] (1.04)	3.263[b] (2.34)				0.34 [1.40] {0.2071}
24	Lumber	−.3166 (−2.23)	6.689 (5.26)	.8463 (0.99)	4.018 (1.49)			0.43	0.66 [1.88] {0.3116}
25	Furniture	−.0782 (−2.19)	3.974 (6.87)			−.7323[b] (−1.74)			0.50 [1.73] {0.2197}
26	Paper	.0345 (0.39)	1.974 (5.32)	1.741 (2.20)	−4.669 (−2.59)		.0050[b] (0.02)	0.73	0.86 [1.63] {0.0528}
28	Chemicals	−.1862 (−4.01)	1.333 (5.94)	−2.762 (−2.40)	1.265 (1.46)			0.60	0.76 [1.92] {0.0352}

30	Rubber	−.2502	1.715		2.142[b]	−5.623	0.25	0.66
		(−4.96)	(6.77)		(1.74)	(−3.83)		[1.42]
								{0.1086}
32	Stone, clay, and glass	−.1025	2.285				0.30	0.44
		(−3.18)	(4.74)					[1.99]
								{0.1442}
331	Ferrous metals	.0740	1.500		−4.460[c]		0.39	0.59
		(0.75)	(4.67)		(−1.94)			[1.49]
								{0.2300}
333	Nonferrous metals	−.0670	1.578	1.369	−1.809[d]		0.30	0.73
		(−1.60)	(7.99)	(4.10)	(−1.50)			[1.95]
								{0.1059}
34	Fabricated metals	−.0882	2.522				0.60	0.68
		(−2.15)	(6.18)					[1.99]
								{0.1076}
35	Nonelectrical machinery	−.0573	1.007				0.89	0.72
		(−1.97)	(3.13)				[0.29]	[2.05]
								{0.0745}
36	Electrical machinery	−.1076	1.471				0.70	0.62
		(−2.37)	(4.31)					[1.83]
								{0.0872}
371	Motor vehicles	no statistical relationship						
38	Instruments	−.0608	1.070				0.68	0.71
		(−1.80)	(3.77)					[1.65]
								{0.0654}

[a] Summary statistics are identified in notes to Table 1. For identification of variables and sources of data, see appendix.
[b] For output prices, signifies use of *PQF*, lagged one period; for wages, *WF*, lagged one period; for input prices, *PIQF*, lagged one period; for interest costs, *SPD*.
[c] *WF*, lagged four periods, was used.
[d] *WFWA* was used.

TABLE 3 Industry Wage (WF) Equations,[a] 1959III–1971II (figures in parentheses are t statistics)

SIC No.	Industry	Constant	Consumer Prices (*PRF*)	Employment (*EMF*)	Productivity (*QMF*)	Unemployment (1/*u*)	Guideposts (*GPD*)	ρ_1	$\bar{R}^2$ [*DW*] {*SEE*}
20	Food processing	.0271 (6.08)	.7347[b] (6.86)	−.2426 (−3.60)			−.0105 (−2.63)	0.70	0.94 [1.90] {0.0040}
21	Tobacco	.0100 (0.86)	1.0870[b] (3.55)	−.3667 (−0.88)	.2261[b] (1.85)			0.53	0.65 [1.72] {0.0178}
22	Textiles	.0048 (0.35)	.6487[b] (14.51)	.2061[b] (2.05)		.0939[b] (1.31)		0.44	0.82 [1.85] {0.0077}
23	Apparel	.0840 (3.85)	−.3914[c] (−0.92)			−.0071[c] (−0.96)	−.0385 (−3.08)	0.96	0.83 [1.53] {0.0096}
24	Lumber	.0299 (2.75)	1.0057[b] (3.82)	.1988 (2.45)			−.0220 (2.19)	0.64	0.82 [1.74] {0.0114}
25	Furniture	−.0214 (−2.84)	.5545[b] (5.22)	−.1307 (−3.82)		.2216[b] (5.29)		0.55	0.94 [1.82] {0.0047}
26	Paper	.3020 (6.75)	.6794[b] (15.07)	−.0773 (−2.57)			−.0085 (−5.17)	0.31	0.96 [1.65] {0.0032}
28	Chemicals	.0151 (0.36)	.0974[b] (0.76)				−.0040 (−0.88)	1.02	0.96 [1.72] {0.0032}

30	Rubber	.0252 (2.48)	.5513[b] (2.35)	.1512 (5.10)			−.0250 (−2.85)	0.74	0.80 [1.82] {0.0083}
32	Stone, clay, and glass	.0251 (6.19)	.4726[b] (2.28) .3686[b] (2.14)	.0607 (2.00)			−.0055 (−1.46)	0.41	0.91 [1.92] {0.0054}
331	Ferrous metals	−.0304 (−1.66)	.4225[c] (0.21)	−.0518[b] (−1.45)	.6408 (5.56)	.1697[b] (1.82)	−.0179 (−1.88)	0.49	0.71 [1.45] {0.0135}
333	Nonferrous metals	.0472 (2.89)	.4715[c] (0.21)	.0472 (1.19)	.4275 (5.95)	−.0102[c] (−2.77)	−.0157 (−2.02)	0.61	0.80 [1.77] {0.0082}
34	Fabricated metals	.0196 (4.50)	.8494[b] (7.91)	.0782 (2.89)			−.0113 (−2.66)	0.33	0.93 [1.68] {0.0046}
35	Nonelectrical machinery	.0217 (6.88)	.8386[d] (9.97)	.0248 (0.28)			−.0085 (−2.65)	0.48	0.93 [1.99] {0.0043}
36	Electrical machinery	.0250 (3.47)	.6269[d] (3.05)	−.1050 (−3.69)				0.80	0.91 [1.64] {0.0057}
371	Motor vehicles	.0121 (0.51)	.8632 (2.93)	.1452 (4.03)	.5614 (2.88)	−.0091[c] (−0.81)	−.0167 (−2.09)	0.24	0.69 [1.94] {0.0164}
38	Instruments	.0201 (3.58)	.7049 (4.63)	−.0980 (−4.14)				0.85	0.96 [1.32] {0.0034}

[a] Summary statistics are identified in notes to Table 1. For identification of variables and sources of data, see appendix.
[b] For consumer prices, signifies use of *PRF*, lagged one period: for employment, *EMFWA*; for productivity, *QMF*, lagged one period; for unemployment, $1/u$, lagged one period.
[c] For consumer prices, signifies use of *PRFWA*; for unemployment, *L*.
[d] *PRFWA*, lagged one period, was used.

in tobacco is positively related to price movements as well as cash flow. For other variables there is no significant relationship with price changes in all the other industries.

The Profit Margin Results

The demand and cost variables are much weaker in explaining the variations in the profit margins of food processing (SIC 20), apparel (SIC 23), furniture (SIC 25), and stone-clay-glass (SIC 32) than those of ferrous metals (SIC 331), fabricated metals (SIC 34), nonelectrical machinery (SIC 35), and instruments (SIC 38). The explanation may lie in the degree of market power exercised by different industries and in the ability and willingness of those industries to absorb cost increases. By and large, the first group of industries is relatively competitive, operates with narrow margins, and is often forced to absorb some cost increases when demand is weak. The other group of industries, on the other hand, tends to pass on to consumers the bulk of cost increases, irrespective of the state of the business cycle.

Increased output raises profit margins in every industry except food processing, where it is not significant, and transportation (371), where we could not obtain a fit. And except for those industries, the estimated elasticity of profit margins with respect to output is greater than 1.00. For example, at a profit margin of 0.07, a 1 percent increase in output in textiles would increase margins 2.5 percent, to 0.0718.

Price increases in food processing and chemicals are associated with falling margins. This indicates that price increases do not fully compensate for rising average costs. For example, it is well known that when farm food prices are rising, processors do not mark up and pass through all the increases. In the chemical industry, price reductions are associated with increased margins, indicating that while productivity gains do lower prices, the price reductions do not match unit cost declines, with the result that margins increase.

The constant term is relatively large and negative for the majority of industries covered in this report. This is probably because we have not estimated the precise profit margin identity: $\Pi/px = 1 - (WL/px) - (rk/px)$. Instead we have abstracted from the identity the main economic variables that influence profit margins.

The Wage Results

For all industries except apparel, chemicals, and nonferrous metals, a form of the rate of change in the consumer price index (CPI) is significant at the 10 percent level. In tobacco and lumber, a 1 percent increase in price induces an increase of more than 1 percent in wages. The CPI is particularly important during periods of rapid inflation when, in their desire to catch up, union leaders usually have strong support among workers to push for higher wages. The role of the CPI in wage determination has become much more important of late as labor contracts increasingly contain cost-of-living escalator clauses, and as nonunion wages tend to follow union wage patterns, though often with some lags.[20]

Profits do not seem to be significant in explaining wage changes, perhaps because of their high collinearity with consumer price changes and with productivity. The role of productivity in wage settlement seems to be unimportant, except in such industries as tobacco, primary metals, and motor vehicles. In these industries, there is some information on productivity trends that can be considered along with other variables in determining hourly wage rate increases, even though labor and management do not always agree on the size and measurement of productivity growth. Moreover, the fact that there has been a significant application of labor-saving technology in these relatively highly unionized and concentrated industries makes consideration of the productivity variable highly relevant in any meaningful wage negotiations.

Changes in production worker employment is another variable that may have an impact on variations in the hourly wage rate. During periods when the labor market is relatively tight, an industry that must expand its labor force in order to perform efficiently may have to pay higher wages in order to attract workers from other industries or discourage its existent workers from leaving in search of more attractive pay. For several of the industries covered in this paper, the coefficient on the employment variable has the expected positive sign. However, the coefficient is negative for several other industries—food, tobacco, ferrous metals, and electrical machinery. In these industry groups, the trend of production worker employment has been downward, largely because of automation. The negative sign can be explained by the existence of strong union pressure for higher wages as a partial compensation for reduced employment. This is true in electrical machinery, where a 1 percent decrease in employment would increase average hourly earnings by 0.10 percent.

In most cases, the measures of labor market tightness were ineffective in explaining movements in wages. The aggregate unemployment variable had the expected positive sign in textiles, furniture, and ferrous metals, while layoffs had the expected negative sign in apparel, nonferrous metals, and transportation. It would appear that national indicators of labor market tightness have minimal impact in explaining the movement of wages on the disaggregated two-digit manufacturing industries.[21]

The guidepost dummy variable is significant and negative in eleven industries, its impact ranging from 0.4 to 3.85 percentage points.[22]

V. DIRECT IMPACT OF PHASES I, II, AND III ON PRICES, PROFIT MARGINS, AND WAGES IN SEVENTEEN MANUFACTURING INDUSTRIES

In this section of the paper we attempt to measure the *direct* impact of the Economic Stabilization Program on the determination of prices and wages in specific manufacturing industries. The direct impact is to be distinguished from the *total* impact, which includes feedbacks between prices and wages. The mechanism for measuring the total impact will be discussed in section VI.

Obtaining the direct impact of controls is possible by re-estimating industry equations for 1959III–1973II so as to include the eight quarters of the ESP. The dummy variable *ESP*1 was added to all the wage equations and has the value of 1.0 in the eight quarters from 1971III to 1973II, and zero in all other quarters. The price and profit margin equations have two dummy variables: *ESP*2, which equals 1.0 in the period 1971III–1972IV, and zero otherwise; and *ESP*3, which equals 1.0 in 1973I and 1973II. The approach is analogous to the one used for the guidepost dummy *GPD*.[23]

Using the estimated coefficient for a dummy variable in an equation for prices, wages, and profit margins leaves a great deal unanswered about the program. First, it assumes that the program was totally responsible for any change that occurred. Second, to determine the total impact, a model should be constructed that would compare simulated values without controls to simulated values with controls or with actual data where there exist interactions between wages and prices.[24] This exercise was far too complicated and required too many questionable assumptions to be undertaken here. However, an aggregate model for the manufacturing economy is presented in section VI.

The results of the re-estimated equations are shown in tables 4, 5, and 6. In general, there was very little change in the value of the coefficients for the independent variables or the general statistical properties of the equations. The control dummies, *ESP*1, *ESP*2, and *ESP*3, were retained regardless of their significance.

The listing in Table 7 highlights the cases in which the dummy variables in the price, profit margin, and wage equations were significant at the 5 or 10 percent level. A negative coefficient suggests that controls may have been effective in restraining prices and wages, and a positive coefficient would imply at least the absence of restraint. Several inferences can be drawn from this table and from tables 4 through 6.

The control program seemed to be totally ineffective in constraining price inflation in those industries that experienced demand-pull inflation during phases II and III, namely, lumber (SIC 24), ferrous metals (SIC 331), and nonferrous metals (SIC 333). The explanation lies, perhaps, in the nature of capacity utilization in these industries and in the manner in which wage and price controls work during various phases of the business cycle. It is generally recognized that controls tend to be much more effective in restraining prices when there are significant amounts of unused capacity in various industries than during periods of capacity constraints. The experience of the lumber industry from the second half of 1972 through most of 1973 reflected the influence of the housing boom and the resulting pressure on lumber prices. Similarly, the acceleration in general economic activity in this period put undue pressure on productive capacity and prices within the metals industry and made evasion of price controls by some Tier I firms much easier.

Despite its attractiveness as a resource-saving device for the Price Commission staff, term limit pricing (explained in note 4) was a factor in the lack of any significant impact of the control program on the pricing decisions of such key industries as chemicals (SIC 28) and electrical machinery (SIC 36). Many of the companies that elected the TLP arrangement were in these two industries, and their productivity growth during the 1971–1972 business recovery was above average. This productivity improvement, coupled with the significantly high rate of profits, should have resulted in more moderate price performance by the chemical and electrical machinery industries than what actually occurred. It is conceivable that the TLP arrangement (which gave

TABLE 4 Industry Price (PQF) Equations,[a] 1959III–1973II (figures in parentheses are t statistics)

SIC No.	Industry	Constant	Output (QF)	Demand (DINS)	Wages (WF)	Materials Prices (PIQF)	Rate of Return (BAAF)	Phases I and II (ESP2)	Phase III (ESP3)	[ρ_2]	$\bar{R}^2$ [DW] {SEE}
20	Food processing	.0143 (2.10)		−.1194 (−1.35)		.4393 (8.47)		−.0068 (−0.64)	.0270 (1.68)	0.76	0.93 [1.74] {0.0111}
21	Tobacco	.0040 (4.26)			.2449[b] (3.34)	−.0034 (−1.29)	.1086 (3.40)	−.0205 (−2.22)	−.0030 (−0.24)	0.75	0.78 [1.84] {0.0101}
22	Textiles	−.0703 (−2.03)	.1275 (1.43)		1.7818[c] (2.94)	−.0069 (−0.17)		.0227 (1.04)	.0049 (0.16)	0.81	0.72 [1.96] {0.0231}
23	Apparel	.0086 (2.08)				.3511 (3.95)		−.0113 (−1.37)	−.0230 (−2.03)	1.34 [−0.67]	0.81 [2.17] {0.0096}
24	Lumber	−.0026 (−1.57)	.5367 (3.03)		1.7669[d] (2.24)			.0965 (2.63)	.0884 (1.70)	1.21 [−0.51]	0.83 [2.07] {0.0417}
25	Furniture	−.0086 (−2.81)			.7557[d] (8.00)	.3641[c] (1.39)		−.00001 (−0.00)	−.0066 (−1.29)	1.27 [−0.65]	0.92 [2.14] {0.0043}
26	Paper	−.0111 (−1.10)	−.0044 (−0.06)		.3817 (1.89)	.1843[b] (2.25)		.0084 (1.11)	.0165 (1.57)	1.05 [−0.45]	0.81 [2.10] {0.0085}
28	Chemicals	−.0030 (−0.34)		0628 (4.60)	.1251[b] (0.95)			.0014 (0.35)	.0136 (2.46)	0.70 [−0.21]	0.84 [1.74] {0.0043}

30	Rubber	−.0155			.7520[c]	.0196[d]	−.0098	−.0080	1.06	0.70
		(−0.95)			(1.81)	(0.17)	(−0.59)	(−0.36)	[−0.36]	[1.91]
										{0.0174}
32	Stone, clay,	−.0250			1.0161[c]		−.00001	.0081	1.20	0.89
	and glass	(−2.84)			(5.24)		(−0.02)	(0.89)	[−0.50]	[1.75]
										{0.0078}
331	Ferrous	.0134				.1298	.0319	.0325	1.41	0.93
	metals	(1.31)				(1.52)	(4.25)	(3.12)	[−0.52]	[1.77]
										{0.0079}
333	Nonferrous	.0502		−.0404	−.5598[b]		.0292	.0408	1.52	0.85
	metals	(2.05)		(−3.50)	(−0.11)		(1.43)	(1.43)	[−0.76]	[1.83]
										{0.0225}
34	Fabricated	.0044		.0190	.1854	.5984	.0009	−.0033	1.01	0.96
	metals	(1.43)		(1.50)	(2.30)	(8.79)	(0.26)	(−0.69)	[−0.42]	[1.94]
										{0.0039}
35	Nonelectrical	−.0008			.4636[c]	.2474	−.0034	−.0071	0.83	0.94
	machinery	(−0.11)			(2.84)	(3.31)	(−0.95)	(−1.46)		[1.78]
										{0.0035}
36	Electrical	.0051	−.0543				.0016	.0201	1.47	0.89
	machinery	(0.83)	(−1.71)				(0.24)	(2.03)	[−0.61]	[1.93]
										{0.0078}
371	Motor	−.0056				.8449	.0025	−.0086	0.81	0.79
	vehicles	(−1.10)				(4.88)	(0.31)	(−0.33)	[−0.24]	[2.16]
										{0.0095}
38	Instruments	.0056				.3689	−.0074	.0029	0.96	0.73
		(1.26)				(2.84)	(−1.34)	(0.40)	[−0.16]	[2.07]
										{0.0057}

[a] Summary statistics are identified in notes to Table 1. For identification of variables and sources of data, see appendix.
[b] For wages, signifies use of *WF*, lagged one period; for materials prices, *PIQF*, lagged one period.
[c] For wages, signifies use of *WFWA*; for materials prices, *PIQF*, lagged two periods.
[d] For wages, signifies use of *WFWA*, lagged one period; for materials prices, *PIQF*, lagged four periods.

TABLE 5 Industry Profit Margin (PMF) Equations,[a] 1959III–1973II (figures in parentheses are t statistics)

SIC No.	Industry	Constant	Output (*QF*)	Output Price (*PQF*)	Wages (*WF*)	Input Prices (*PIQF*)	Interest Costs (*BAAF*)	Phases I and II (*ESP2*)	Phase III (*ESP3*)	ρ_1	$\bar{R}^2$ [*DW*] {*SEE*}
20	Food processing	.0070 (0.58)		−.3878[b] (−1.61)				−.0220 (−0.80)	.0363 (0.92)	0.54	0.40 [1.85] {0.030}
21	Tobacco	−.0076 (−0.46)	.0621 (0.47)	.2951[b] (0.71)				−.0301 (−1.01)	.0142 (0.38)	0.59	0.37 [1.84] {0.037}
22	Textiles	−.0684 (−2.02)	2.699 (6.91)	1.157 (1.56)			−.5474 (−1.77)	−.1566 (−1.68)	.0524 (0.43)	0.38	0.71 [1.90] {0.118}
23	Apparel	−.1276 (−1.72)	3.287 (3.62)	−.9202[b] (−0.58)	3.197 (2.01)			−.0491 (−0.43)	−.2550 (−1.12)		0.15 [1.34] {0.237}
24	Lumber	−.3148 (−2.31)	6.729 (5.73)	.8108 (1.04)	3.893 (1.51)			−.1256 (−0.57)	.0183 (0.06)	0.44	0.67 [1.82] {0.295}
25	Furniture	−.5065 (−1.51)	3.666 (6.86)			−1.892[b] (−1.59)		.1136 (0.92)	−.3524 (−1.96)		0.47 [1.68] {0.218}
26	Paper	−.0672 (−0.28)	2.754 (2.82)	4.271 (1.93)	−2.771[b] (−0.59)		.1362[b] (0.91)	.3400 (1.83)	−.3255 (−1.42)	0.76	0.66 [2.05] {0.156}
28	Chemicals	−.1732 (−3.83)	1.265 (5.48)	−2.170 (−1.87)	1.079 (1.30)			.0441 (1.32)	.0524 (4.83)	0.56	0.73 [1.85] {0.038}

30	Rubber	−.1892 (−3.46)	1.299 (4.57)		1.963[b] (1.57)	−2.480 (−3.56)	.1276 (1.59)	−.1154 (−1.03)	0.16	0.55 [1.86] {0.131}
32	Stone, clay, and glass	−.1003 (−2.94)	2.179 (4.42)				.0451 (0.46)	−.1085 (−0.76)	0.33	0.41 [2.02] {0.147}
331	Ferrous metals	.0045 (0.08)	1.638 (7.35)		−2.988[c] (−2.18)		.4022 (3.36)	.6603 (2.68)	0.09	0.60 [1.98] {0.253}
333	Nonferrous metals	−.1479 (−1.21)	2.242 (4.82)	1.501 (1.98)	−.4902[d] (−0.15)		.1518 (0.84)	−.2134 (−0.89)	0.24	0.45 [2.00] {0.252}
34	Fabricated metals	−.0896 (−2.23)	2.499 (4.82)				.0886 (1.10)	−.2591 (−2.41)	0.60	0.69 [1.98] {0.101}
35	Nonelectrical machinery	−.0567 (−1.67)	.9191 (2.98)				−.0015 (−0.02)	.0472 (0.55)	0.64	0.67 [1.58] {0.079}
36	Electrical machinery	−.110 (−2.51)	1.384 (4.24)				.0804 (1.08)	−.0501 (−0.58)	0.70	0.63 [1.89] {0.085}
371	Motor vehicles	no statistical relationship								
38	Instruments	−.0604 (−1.93)	1.053 (3.76)				.0293 (0.51)	−.0812 (−1.11)	0.61	0.64 [1.89] {0.070}

[a]Summary statistics are identified in notes to Table 1. For identification of variables and sources of data, see appendix.
[b]For output price, signifies use of *PQF*, lagged one period; for wages, *WF*, lagged one period; for input prices, *PIQF*, lagged one period; for interest costs, *SPD*.
[c]*WF*, lagged four periods, used.
[d]*WFWA* used.

TABLE 6 Industry Wage (WF) Equations,[a] 1959III–1973II (figures in parentheses are t statistics)

SIC No.	Industry	Constant	Consumer prices (*PRF*)	Employment (*EMF*)	Productivity (*QMF*)	Unemployment (1/*u*)	Guideposts (*GPD*)	Phases I, II, III (*ESP*1)	ρ_1	$\bar{R}^2$ [*DW*] {*SEE*}
20	Food processing	.0307 (6.88)	.6500[b] (6.12)	−.2054 (−3.60)			−.0123 (−3.05)	.0060 (0.16)	0.70	0.94 [1.93] {0.0042}
21	Tobacco	.0121 (1.02)	1.0852[b] (3.49)	−.2718 (−3.33)	.2997[b] (2.04)			.0021 (0.15)	0.51	0.64 [1.88] {0.0189}
22	Textiles	.0056 (0.44)	.6213[b] (4.55)	.2408[b] (2.65)		.0938 (1.39)		.0026 (0.14)	0.37	0.79 [1.90] {0.0082}
23	Apparel	.0829 (4.39)	−.2529[c] (−0.64)			−.0087[c] (−1.30)	−.3813 (−3.24)	−.0070 (−0.77)	0.85	0.82 [1.59] {0.0093}
24	Lumber	.0324 (2.74)	.9852[b] (3.48)	.1877 (2.37)			−.0246 (−2.27)	−.0198 (−1.81)	0.68	0.80 [1.72] {0.0114}
25	Furniture	−.0161 (−1.68)	.6211[b] (4.90)	−.0891 (−2.32)		.1897 (3.72)		.0110 (2.20)	0.61	0.91 [1.88] {0.0055}
26	Paper	.0307 (14.35)	.6639[b] (12.50)	−.0476 (−1.47)			−.0093 (−4.79)	.0089 (4.08)	0.32	0.94 [1.76] {0.0038}
28	Chemicals	.0586 (1.96)	.0598[b] (0.41)				−.0052 (−0.87)	−.0033 (−0.79)	0.97	0.94 [2.24] {0.0040}

30	Rubber	.0255 (2.87)	.4838[b] (2.33)	.1360 (4.76)			−.0234 (−2.99)	−.0049 (−0.64)	0.69	0.81 [1.93] {0.0083}
32	Stone, clay, and glass	.0247 (6.57)	.5420[b] (2.81) .2893[b] (1.87)	.0617 (2.10)			−.0065 (−2.01)	.0099 (2.72)	0.31	0.90 [1.90] {0.0065}
331	Ferrous metals	−.0148 (−0.68)	.5158[c] (1.51)	−.0740[b] (−1.81)	.4550 (3.98)	.1130 (1.05)	−.0154 (−1.39)	.0473 (4.04)	0.75	0.78 [1.41] {0.0171}
333	Nonferrous metals	.0664 (4.30)	.3712[c] (1.79)	.0641 (1.73)	.3119 (5.43)	−.0242[c] (−3.86)	−.0202 (−2.85)	.0083 (1.24)	0.57	0.87 [1.69] {0.0086}
34	Fabricated metals	.0211 (5.06)	.8087[b] (7.86)	.0752 (2.95)			−.0120 (−2.91)	.0013 (0.30)	0.61	0.93 [1.74] {0.0048}
35	Nonelectrical machinery	.0219 (7.75)	.8294[d] (10.95)	.0196 (1.21)			−.0083 (−3.00)	.0014 (0.49)	0.40	0.93 [1.99] {0.0045}
36	Electrical machinery	.0271 (3.57)	.6072[d] (2.85)	−.0940 (−3.57)				−.0032 (−0.59)	0.81	0.90 [1.62] {0.0058}
371	Motor vehicles	.0305 (1.30)	.8276 (3.12)	.1474 (5.76)	.4440 (3.23)	−.0194[b] (−0.20)		.0067 (0.67)	0.25	0.74 [1.90] {0.0165}
38	Instruments	.0231 (4.01)	.6260 (3.74)	−.0973 (−3.31)				−.0033 (−0.70)	0.78	0.91 [1.71] {0.0049}

[a] Summary statistics are identified in notes to Table 1. For identification of variables and sources of data, see appendix.
[b] For consumer prices, signifies use of *PRF*, lagged one period; for employment, *EMFWA*; for productivity, *QMF*, lagged one period; for unemployment, 1/*u*, lagged one period.
[c] For consumer prices, signifies use of *PRFWA*; for unemployment, *L*.
[d] *PRFWA*, lagged one period, used.

TABLE 7 Two-Digit SIC Manufacturing Industries in Which Dummy Variables Were Significant

$ESP1_t$		$ESP2_t$		$ESP3_t$	
Positive	Negative	Positive	Negative	Positive	Negative
		Price Equation			
		SIC 24†	SIC 21*	SIC 24†	SIC 23*
		SIC 331*	SIC 23†	SIC 26†	SIC 35†
		SIC 333†		SIC 28*	SIC 38†
				SIC 331*	
				SIC 333†	
				SIC 36*	
		Profit Margin Equation			
		SIC 26*	SIC 22*	SIC 28*	SIC 25*
		SIC 30†		SIC 331*	SIC 26†
		SIC 331*			SIC 34*
		Wage Equation			
SIC 25*	SIC 24*				
SIC 32*					
SIC 331*					

*Significant at 5 percent level.
†Significant at 10 percent level.

companies much flexibility in raising individual prices so long as their weighted average price increases were within the prescribed limit of 1.8 percent) could have resulted in the circumvention of a significant downward impact on prices that otherwise would have been obtained because of the control program. Moreover, with the relaxation of the control program under Phase III, and with the significant reduction in the level of unused capacity experienced during the first half of 1973, demand pressures asserted themselves, thereby rendering unlikely any effective price restraint in these and several other industries. Small wonder then that the coefficients on the dummy variables turned out to be positive in the price equations for several industries. Output prices in the tobacco industry (SIC 21) and in apparel (SIC 23) were somewhat lower under Phase II than would have been the case without controls.

The dummy variables for the wage equations, if significant, are generally capturing shifts arising from other causes. Most of the major contracts in manufacturing were not negotiated during phases I and II, having been signed prior to mid-1971. The only industries in which the Pay Board played a major role during the control period were lumber and glass. The Pay Board's action is reflected in the negative coefficient on the wage dummy variable for SIC 24 (Table 7). The Pay Board's action is not reflected in a similar wage constraint for SIC 32, which incorporates the glass industry subgroup. This is because the wage behavior of the other subgroups of SIC 32 (namely, stone and clay) was subject to little or no control due to the preponderance of small firms in these two.

The positive coefficient for ferrous metals in the wage equation is perhaps more indicative of the distortion hypothesis than the effects of the control program. The wage settlement in this industry was negotiated prior to the August 1971 freeze. It is interesting that average hourly earnings in ferrous metals were "out of line" by about 4.7 percent. However, an examination of the profit margin equation seems to suggest that the advances in the wage variable may have been more than compensated by price increases, since the profit margin dummy variable is positive and significant for the ferrous metals industry.

Finally, according to the equations, wages were held down in lumber, while prices were pushed above their normal relation with the independent variables, though without any impact upon the profit margins. This can perhaps be explained by the proposition that large lumber firms used wage increases as a trigger to raise prices, and that such wage increases are correlated positively with margins. In other words, if wages are held down, this will tend to reduce profit margins.

VI. AGGREGATE WAGE-PRICE EQUATIONS AND THE TOTAL IMPACT OF CONTROLS

Microanalytic data and disaggregated industry equations are indispensable to any meaningful understanding of the wage-price control experiment. However, in most of the literature, the impact of controls is assessed through the use of aggregate wage-price relations for the manufacturing or private nonfarm sector of the economy. Following this practice, the seventeen industry variables were aggregated into macroeconomic wage and price variables for total manufacturing. The purpose of this exercise was twofold: to determine if the aggregate results were consistent with the industry results and to ascertain the results of the program in terms of the movement of macroeconomic variables.

The manufacturing wage and price equations were estimated for the period 1959III–1971II to determine the aggregate historical relation, and simulated from 1971III through 1973II to provide a basis for assessing the movement of wages and prices in the absence of controls. The equations were then re-estimated with dummy variables from 1959III through 1973III to determine the direct impact of controls on manufacturing input prices in phases II and III. The model was then simulated over the control period to allow for feedbacks between wages and prices, so that we could measure the total impact of controls. The method of aggregation entails weighting average hourly earnings, output prices, and input prices for each of the seventeen manufacturing industries by the appropriate relative value of shipments in 1958. The other variables in the estimated wage and price equations were taken from data relevant to the manufacturing sector.

Variables shown as four-quarter rates of change are marked by an *F* suffix. Variables with the suffix *FWA* are defined as four-quarter rates of change with an imposed weighted average of that variable for periods t through $t - 3$ (see appendix). The wage and price equations are estimated with the identical autocorrelation correction procedure that was used to estimate the industry wage and price equations of section V.

Estimated Equations

The results for the estimated wage and price equations appear in Table 8. The estimated coefficients all have the correct signs and the correct magnitudes. In the wage equation, the coefficient on the price expectations variable (*PFWA*) is significantly different from zero but not significantly different from unity, indicating that workers attempt to recover loss of real income in the form of higher money wages. The other two variables in the wage equation that are significant at the 5 percent level are the wage guidepost dummy variable (*GP*) and changes in output per man-hour in manufacturing (*QFWA*). The aggregate unemployment[25] rate (u) has the correct sign but is insignificant at the 5 percent level. Changes in prices are explained by changes in labor and nonlabor input costs. In particular, standard unit labor costs ($WFWA_{t-1} - 0.03$) and input prices ($IPFWA_t$) explain 94 percent of the movement of prices. A 1 percent change in standard unit labor costs induces a change of 0.36 percent in prices.

For manufacturing wage and price equations to capture the feedbacks of inflation, it is necessary to treat wages and prices as endogenous variables. While wages (WF_t) and output prices (PQF_t) are endogenous to the model, consumer prices are exogenous. To close the model, consumer prices (PF_t) are made a function of output prices (PQF_t). The equation linking output prices and consumer prices (PF_t) is estimated for the period 1959III–1971II by using an Almon lag. The estimated equation implies that the partial adjustment mechanism will translate 95 percent of output prices into input prices in eight quarters. The estimated linking equation is[26]

$$PF_t = \underset{(14.62)}{0.01161} + \underset{(21.21)}{0.95212} \sum_{i=D}^{7} PQF(-i)_t$$

$$\bar{R}^2 = 0.91; DW = 0.412; SEE = 0.00410$$

The simulations are based on the four-quarter price and wage equations, fitted to the period 1959III–1971II (equations 1 and 3 of Table 8). Over the entire period, the full model has a tendency to underpredict wages by 0.061 percentage points. The error measures provide the first warning that the model will not perform with complete accuracy. While the estimated wage and price equations have significant coefficients and strong explanatory power, the structural equations when combined into a model fail to perform with any real consistency. First, the model tends to slightly underpredict wages. This problem is compounded by the failure of the model to track the wage increases of the late 1960s.[27] Second, the root-mean-square errors for the wage and price simulations are larger than the standard errors for the estimated wage and price equations. This implies that the variances of the residuals of the simulations are larger than the variances of the residuals of the estimated equations. The interpretation of the mean absolute errors is that at each discrete simulation the average error, irrespective of sign, is 0.5352 percentage points for wages and 0.3978 for prices.

The Wage-Price Control Program

The actual movement of wages and prices during the control period can be compared with the performance of the model in simulations from 1971III to 1973II under the influence of identical exogenous factors. Comparisons are made on the basis of average performance of controls for 1971III–1973II, which corresponds

TABLE 8 Estimated Wage and Price Equations for Total Manufacturing, 1959III–1971II and 1959III–1973II (figures in parentheses are t statistics)

Wage Equations (WF_t)	Constant	$PFWA_t$	$1/u_t$	GPD_t	$QFWA_t$	$ESP2$	$ESP3$	ρ_1	$\bar{R}^2$ [DW] {SEE}	ME[a] [$RMSE$] {MAE}
1. 1959III–1971II	0.0046 (0.755)	0.987 (8.54)	0.0349 (1.23)	−0.0109 (−3.69)	0.3220 (5.16)			0.4271 (2.77)	0.921 [2.14] {0.0045}	.000613 [.007256] {.005352}
2. 1959III–1973II	0.0061 (0.958)	0.8874 (7.17)	0.0436 (1.46)	−0.0133 (−4.11)	0.3313 (5.13)	0.0056 (1.41)	−.01169 (−2.47)	0.450 (2.78)	0.926 [2.00] {0.0049}	

Price Equations (PQF_t)	Constant	$WFWA_{t-1}$ −0.03	WF_t −$WFWA_t$	$IPFWA_t$	$ESP2$	$ESP3$	ρ_1	ρ_2	$\bar{R}^2$ [DW] {SEE}	ME[a] [$RMSE$] {MAE}
3. 1959III–1971II	0.0059 (2.22)	0.3636 (2.65)	0.09175 (1.31)	0.5858 (7.28)			0.9481 (6.21)	−.1604 (−1.02)	0.963 [1.93] {0.0030}	−.000097 [.005377] {.003978}
4. 1959III–1973II	0.0054 (1.67)	0.2185 (1.10)	0.0252 (0.279)	0.5966 (7.08)	0.0011 (0.301)	−0.0007 (−1.80)	1.1612 (8.07)	−.3595 (−2.21)	0.958 [2.04] {0.0037}	

$\bar{R}^2$ = coefficient of multiple determination adjusted for degrees of freedom.
DW = Durbin-Watson statistic.
SEE = standard error of estimate.
NOTE: Variables used in the equations are identified in the accompanying text, and the data sources are given in the appendix.
[a] ME = mean error; $RMSE$ = root-mean-square error; MAE = mean absolute error. The mean of WF_t is 0.03978, and the mean of PQF_t is 0.01331. The error measures are calculated as follows, where A_t defines the actual value, S_t the simulated value, and N the number of observations in the interval of the simulation:

$$ME = \frac{1}{N} \sum_{t=1}^{N} (A_t - S_t)$$

$$RMSE = \sqrt{\frac{1}{N} \sum_{t=1}^{N} (A_t - S_t)^2}$$

$$MAE = \frac{1}{N} \sum_{t=1}^{N} \left| A_t - S_t \right|$$

roughly to the period of the initial wage-price freeze, the controls of Phase II, and the more flexible controls of Phase III. The exogenous variables retain their actual values (historical values) for this period, while the endogenous wage and price variables assume the values of 1971II as their initial values and the simulated values thereafter. By beginning the dynamic simulation in 1971III, we avoid the cumulative underpredictions exhibited by the 1959III–1971II simulation.

If wages and prices were determined in the same manner after controls as in the period prior to 1971III, then our model would accurately predict the movement of wages and prices during the control period. If the mechanisms that generated wages and prices prior to controls were operating in an unrestrained fashion during the control period, then the errors generated in the latter period should be of approximately the same magnitude as those before.

Table 9 contains the simulated wage and price changes predicted for 1971III–1973II. These results are characteristic of an economy without controls, while the actual wages and prices are for an economy with controls. The average difference between the simulated and actual values could serve as a crude approximation for the total impact of controls.[28]

Since this approach is unable to distinguish between simulation error and error due to controls, the alternative—to estimate the direct impact of controls by including dummy variables in the wage and price equations—has also been used. The dummy variables measure the influences on the residuals of an estimated equation. We have associated these structural influences with the efforts of the Economic Stabilization Program by defining ESP to coincide with the establishment of wage and price controls.

Equations 2 and 4 of Table 8 were estimated for 1959III–1973II. They include the ESP dummy variables, which reflect the partial derivative of the change in wages and prices with respect to the actions of the Economic Stabilization Program. The coefficients are only a measure of the direct impact of controls, since the equations are not allowed to interact. Controls resulted in a significant 1.17 percentage point annual reduction in wages in the manufacturing sector of Phase III. The impact on manufacturing prices also was negative (an annual percentage point decrease of 0.074), but not significantly different from zero. Phase II and Freeze I exerted a positive pressure on wages and prices, which is consistent with the industry results. On the other hand, the significant downward impact on wages in Phase III contradicts our previous results for the disaggregated industries. However, the disaggregated equation did not include a Phase III wage dummy, and this could account for the inconsistency.

Because they do not include the interaction of wages and prices, the dummy variable coefficients fail to measure the total impact of controls. The total impact can be measured by simulating the reestimated wage and price equations (2 and 4). It has been indicated that the model used to simulate an economy without controls produced a bias in the predicted value of wages and prices because of the errors generated in each of the discrete simulations. To measure the total impact of controls by comparing the simulated values for an economy without controls against the actual values for an economy with controls would result in an error because of the presence of bias in the simulated series. A more consistent measure of the total impact of controls is to compare two simulated series of wages and prices. It may then be assumed that simulation bias is present in both models and, hence, that the total impact would be net of any simulation bias. Therefore, the total impact is measured by comparing the simulated values for an economy without controls against the simulated values for an economy with controls. These simulated values appear in Table 9.

If the mechanism generating wages and prices had operated as it did prior to the establishment of the control program, then the equations for an economy without controls would provide predictions of wages and prices. However, if the control program had any influence on the determination of wages and prices, then the equa-

TABLE 9 Comparison of Simulated Values of Wage (WF_t) and Price (PQF_t) Equations for an Economy with Controls and for an Economy without Controls[a]

	Simulated without Controls		Simulated with Controls	
	WF_t	PQF_t	WF_t	PQF_t
1971III	7.48	3.85	8.02	3.87
IV	7.55	4.61	8.06	4.54
1972I	7.35	5.48	7.81	5.32
II	7.39	5.91	7.91	5.67
III	7.84	6.22	8.16	5.87
IV	8.51	6.36	8.74	5.89
1973I	9.04	7.08	7.96	5.74
II	9.48	8.73	8.19	7.21

[a]Simulations begin in 1971III.

tions with the control-program dummy variables would yield the appropriate predictions for an economy with controls. The differences in these two simulations would reflect the total impact of the control program. It appears that the control program raised manufacturing wages by 0.03 percentage points on an annual basis and lowered prices by 0.52 percentage points on an annual average, above what would have occurred in the absence of controls.

On the whole, it can generally be concluded that the aggregate wage and price relations fail to agree with the results presented for the disaggregated two-digit industries. The poor performance of the model in the historical period and the inability of the wage equation to track the wage inflation of the mid-1960s result in an underprediction of wage change. The lower-than-normal wage values then interact in the price equations and result in an underprediction of prices. Thus, the aggregate equations probably yield erroneous estimates of the impact of controls. Second, the apparent contradiction between the industry and aggregate models leaves us somewhat apprehensive about the worth of any macroeconomic relation. The method of data aggregation and poor selection of a model could be causes of some of the disagreement, but a problem of equal importance may be in the inappropriateness of aggregate wage and price equations for the manufacturing sector.[29] This suggests that relationships should not be estimated at such a high level of aggregation.

VII. SUMMARY AND CONCLUSIONS

Our tentative conclusion is that the industry equations are more meaningful than the aggregate ones. Hence, the Economic Stabilization Program had little impact on the manufacturing sector of the economy. The conclusion is labeled tentative because there are several shortcomings in the analytical system and in the two-digit manufacturing data that underlie the simulation results. The models used are somewhat imprecise and limited by the choice of variables in testing various hypotheses relating to price and wage determinations. Simultaneous models for individual manufacturing industries were not constructed, and consequently the total impact of controls could not be ascertained. An attempt was made to estimate the total impact at the aggregate manufacturing level, but the experiment was less than satisfactory. Finally, like most researchers in the field, we were limited in our ability to measure structural shifts in the economy due to controls because there are many shortcomings in the use of dummy variables.

APPENDIX: SOURCES OF DATA

All monthly series were transformed into quarterly ones by averaging their values for the three months of each quarter, except shipments, S_t, for which the sum of the monthly values was used.

In tables 1 through 6, the F suffix on a variable indicates that the figures used for the series are for the change between the current quarter and the same quarter a year ago as a percentage of the current quarter: for any series X, the variable XF_t is equal to $(X_t - X_{t-4})/X_{t-4}$. Unless stated otherwise each data source is industry-specific. The suffix *FWA* indicates that the variable is defined as a four-quarter weighted average of the F series just described: for any series X, the variable $XFWA_t$ is defined as $0.4\ XF_t + 0.3\ XF_{t-1} + 0.2\ XF_{t-2} + 0.1\ XF_{t-3}$, where XF_t is defined as above.

BLS = U.S. Department of Labor, Bureau of Labor Statistics;

BEA = U.S. Department of Commerce, Bureau of Economic Analysis;

NIPA = national income and product accounts of the United States;

Census = U.S. Department of Commerce, Bureau of the Census;

FRB = Board of Governors of the Federal Reserve System;

SIC = Standard Industrial Classification.

PQ_t = index of nonseasonally adjusted output prices for two-digit SIC. The correspondence between the monthly elements of the BLS nonseasonally adjusted wholesale price index (WPI) and the three- and four-digit SICs was established at the four-digit level. These WPIs were then aggregated to the input-output classifications of the 1958 input-output table published in *Survey of Current Business*, weighting by shipments of the corresponding SIC category in 1958. The quarterly series was constructed as a simple average of the monthly series.

Q_t = FRB quarterly series for industrial production for two-digit SIC.

$DINS_t$ = inventory-to-sales ratio for two-digit SIC. Inventories are the BEA adjusted inventory valuation in billions of current dollars. Sales for two-digit SIC are the BEA seasonally adjusted monthly series on sales in billions of current dollars.

W_t = BLS seasonally adjusted monthly index of average hourly earnings of production workers, adjusted to exclude overtime for two-digit SIC.

PIQ_t = index of nonseasonally adjusted input prices for two-digit SIC. Input prices are constructed from the output price indexes by using input-output coefficients as weights. The input price for an industry is the weighted average of output prices, where the weights are the direct input requirements as given in the 1958 input-output table. Allowances are made for intraindustry purchases of inputs and for the purchase of important materials from outside manufacturing.

BAA_t = Moody's yield on Aaa corporate bonds.

SPD_t = special dummy variable equal to 1.0 in 1970 and 2.0 in 1971, to account for unusual profits in 1970 and 1971.

PR_t = BLS nonseasonally adjusted monthly index of consumer prices for all items, with base of 1.0 in 1967.

EM_t = BLS nonseasonally adjusted employment of production workers for two-digit SIC.

QM_t = BLS seasonally adjusted quarterly index of output per man-hour for two-digit SIC with base of 1.0 in 1967.

u_t = BLS seasonally adjusted unemployment rate for all civilian workers.

L_t = BLS seasonally adjusted layoff rate for all manufacturing, per 100 employees.

GPD_t = mid-1960s wage-price guidepost dummy variable constructed to equal 0.25 in 1962I and 1967II, 0.50 in 1962II and 1967II, 0.75 in 1962III and 1967I, 1.0 from 1962IV through 1966IV, and zero in all other quarters.

$ESP1_t$ = ninety-day wage-price freeze, Phase II, and Phase III dummy variable.

$ESP2_t$ = ninety-day wage-price freeze and Phase II dummy variable.

$ESP3_t$ = Phase III dummy variable.

PM_t = quarterly series on profit margins for two-digit SIC. Ratio of NIPA pretax profits to BEA sales for two-digit SIC.

NOTES

1. Whether a firm is a near-perfect competitor, a monopolistic competitor, an oligopolist, or a pure monopolist, the output-price decisions of the firm depend upon the demand schedule as pictured by the firm after any and all allowances for the actions of others. Thus, we are assuming, for purposes of

determining the effect on the planning function of the firm, that the regulations of the various phases did not affect the demand schedule for the firm.

2. The major exemptions from the freeze were raw, unprocessed products and imports. For further details see *Economic Report of the President* (1972) and Weber (1973).
3. Among the more notable were the ones announced by the major steel firms. Following the signing of a new labor contract effective August 8, 1971, which contained average first-year wage increases of about 15 percent, prices were raised on some product lines and announced for the others. These scheduled price increases averaged 8 percent.
4. Under the term limit pricing (TLP) arrangement enacted by the Price Commission in late 1971, Tier I firms were given the option of applying for a weighted average price increase covering all or most product lines for a period of one year without specific commission approval of changes in individual product prices. The weighted average price increase was initially set at 2 percent, but was reduced to 1.8 percent in the spring of 1972. TLP was designed to give flexibility to the price control program and to relieve the limited staff of the commission from processing and approving thousands of individual price requests by large firms with complex product lines. In order to make certain that firms taking advantage of the TLP arrangement would not commit flagrant violations of the rules, they were required to keep records and file quarterly reports. They were also supposed to establish a monitoring procedure that would assure reasonable compliance with the allowable weighted average price increase.
5. From November 15, 1971, to December 31, 1971, the waiting period was only seventy-two hours. Details are presented in Lanzillotti, Hamilton, and Roberts (1975).
6. "Base *price*" is the price that existed during the freeze. The "base *period*" is the best two out of the last three fiscal years. "Profit margin" is pretax profits, before extraordinary income, as a percent of sales. See *Economic Stabilization* (1972).
7. If prices are allowed to increase by the amount of the increase in unit production costs, then profit margins are identical before and after the price increase. This is only true for a single-product firm.
8. For the profit-maximizing firm, either marginal cost (MC) equals marginal revenue (MR) and the constraint is unbinding, or the profit margin (M) is binding and $MC = MR$. In the following proof, P = price, Y = output, PY = value of output, and $C(Y)$ = costs, where costs are a function of output:

   Max: $PY - C(Y)$

   subject to $M = \dfrac{PY - C(Y)}{PY} \leq$ a constant

   implies that for the Lagrangian:

   $$L = PY - C(Y) + \lambda\,[MPY - PY + C(Y)]$$

   $$\frac{\partial L}{\partial Y} = \frac{\partial(PY)}{\partial Y} - \frac{\partial C}{\partial Y} + \lambda\left[(M-1)\frac{\partial(PY)}{\partial Y} + \frac{\partial C}{\partial Y}\right] \leq 0;\ \frac{\partial L}{\partial Y}\,Y = 0$$

   $$\frac{\partial L}{\partial \lambda} = (M-1)\,PY + C(Y) \geq 0;\ \frac{\partial L}{\partial \lambda}\,\lambda = 0$$

Thus, if $\lambda > 0$; $[PY - C(Y)]/PY = M$. If $Y > 0$, $\lambda = 0$; then $\partial(PY)/\partial(Y) = \partial C/\partial Y$.

9. To show this, let $C = C(Y, \alpha)$, where $\alpha \geqslant 0$ and $\partial C/\partial\alpha = 1$. If expenditures are purely wasteful the $\partial(PY)/\partial\alpha = 0$. Thus the Lagrangian is

$$L = PY - C(Y, \alpha) + \lambda[MPY - PY + C(Y, \alpha)]$$

and the first-order conditions are:

$$\frac{\partial L}{\partial Y} = \frac{\partial(PY)}{\partial Y} - \frac{\partial C}{\partial Y} + \lambda\left[(M-1)\frac{\partial(PY)}{\partial Y} + \frac{\partial C}{\partial Y}\right] \leqslant 0; \frac{\partial L}{\partial Y}Y = 0$$

$$\frac{\partial L}{\partial \alpha} = -\frac{\partial C}{\partial \alpha} + \lambda\frac{\partial C}{\partial \alpha} \leqslant 0; \frac{\partial L}{\partial \alpha}\alpha = 0$$

$$\frac{\partial L}{\partial \lambda} = (M-1)\,PY + C(Y, \alpha) \geqslant 0; \frac{\partial L}{\partial \lambda}\lambda = 0$$

Therefore, if $Y > 0$ and $\lambda = 0$, it must be that $\alpha = 0$ and $\partial(PY)/\partial Y = \partial C/\partial Y$. However, $y > 0$, and $\alpha > 0$; then $\lambda = 1$ or $(P\dot{Y} - C)/PY = M$ and $\partial(PY)/\partial Y = 0$.

10. Formally, add $R(\alpha)$ to the constrained optimization problem in note 9, where $1 > (\partial R/\partial\alpha) > 0$ and $\partial C/\partial\alpha = 1$. The Lagrangian and first-order conditions are:

$$L = PY + R(\alpha) - C(Y, \alpha) + \lambda\,(MPY - PY + C)$$

(a) $$\frac{\partial L}{\partial Y} = \frac{\partial(PY)}{\partial Y} - \frac{\partial C}{\partial Y} + \lambda(M-1)\frac{\partial(PY)}{\partial Y} + \lambda\frac{\partial C}{\partial Y} \geqslant 0; \frac{\partial L}{\partial Y}Y = 0$$

(b) $$\frac{\partial L}{\partial \alpha} = \frac{\partial R}{\partial \alpha} - \frac{\partial C}{\partial \alpha} + \lambda\frac{\partial C}{\partial \alpha} \leqslant 0; \frac{\partial L}{\partial \alpha}\alpha = 0$$

(c) $$\frac{\partial L}{\partial \lambda} = MPY - PY + C \geqslant 0; \frac{\partial L}{\partial \lambda}\lambda = 0$$

Thus, if $Y > 0$ and $\lambda = 0$, then $\partial(PY)/\partial Y = \partial C/\partial Y$ and $\alpha = 0$, since $\partial R/\partial\alpha < \partial C/\partial\alpha$. If $Y > 0$ and $\alpha > 0$, then from (b), $\lambda > 1 - \partial R/\partial\alpha > 0$. From (a), if $\partial C/\partial Y > \partial(PY)/\partial Y$, then $\lambda > 1$; thus $\partial C/\partial Y > \partial(PY)/\partial Y > 0$ at the optimum.

11. Letting $\hat{P}$ be the desired price for target rate-of-return pricing; P, the allowable price under the regulations; $\hat{\Pi}$, profits at $\hat{P}$; and $\hat{M}$, the profit margin at normal output with price $\hat{P}$; then $dP/P \gtreqless d\hat{P}/\hat{P}$ as

$$\Sigma f_i\left(\frac{dv_i}{v_i} + \frac{dv_i}{v_i} - \frac{dY}{Y}\right) \gtrless \frac{f_f}{\hat{M}}\frac{dY}{Y}$$

where v_i is the price of the ith factor of x_i, $f_i = v_i x_i/C$, and f_f = the fraction that fixed costs (K) are to total costs. The proof is as follows: at $\hat{Y}$, $\hat{P}\hat{Y} = \Sigma v_i\hat{x}_i + \hat{\Pi}$, and $\hat{r} = \hat{\Pi}/K$, where $\hat{r}$ is the normal rate of return. Thus $d\hat{r} = 0$ implies $d\hat{\Pi} = 0$

$$\frac{d\hat{P}}{\hat{P}} = \frac{\Sigma f_i\left(\frac{dv_i}{v_i} + \frac{d\hat{x}_i}{x_i} - \frac{dY}{Y}\right)}{\frac{\Sigma v_i\hat{x}_i}{\hat{Y}}}$$

The allowable percentage increase in price is

$$\frac{dP}{P} = \Sigma f_i\left(\frac{dv_i}{v_i} + \frac{dx_i}{x_i} - \frac{dY}{Y}\right) - f_f\frac{dY}{Y}$$

Thus, $dP/P \gtreqless d\hat{P}/\hat{P}$ implies that

$$\Sigma f_i\left(\frac{dv_i}{v_i} + \frac{dx_i}{x_i} - \frac{dY}{Y}\right) \gtrless \frac{f_f}{M}\frac{dY}{Y}$$

12. The relaxation in the profit margin limitation raised from three to five the number of fiscal years from which firms could select the two years they would consider most advantageous in calculating their profit margin base. Moreover, a firm would no longer be constrained by the profit margin rule if its weighted average price increase was not in excess of 1.5 percent a year.
13. Other alternative proxies for labor market tightness are quit rates, layoff rates, unemployment dispersion, or excess labor reserves.
14. The expectation hypothesis can consist of a distributed lag of past price changes (Turnovsky 1972a), actual expectations price data (Turnovsky 1972b), or a nonlinear inflation severity variable (Eckstein and Brinner 1972).
15. Recent analysis of wage determination stems from the work of A. W. Phillips (1958), who related wage changes to the unemployment rate, a proxy for labor market tightness. Modifications have taken several directions. For example, Eckstein and Wilson (1962), Hammermesh (1972), Ashenfelter, Johnson, and Pencavel (1972), Wachter (1970a, 1974), and Okun (1973) have included effects of unions on the relative wage structure, termed "the spillover thesis" or the "relative wage distortion thesis." Kaldor has long considered profits as a causal variable in wage rate determination, based on his theories of economic growth. Thus, Kaldor (1959) argued that Phillips's results probably arose from a correlation between unemployment rates and profits. Among those who have tested the high profits-wages thesis are Levinson (1960), Bhatia (1962), Eckstein and Wilson (1962), Perry (1966), and Perry et al. (1969). Kuh (1967) argued that profits in econometric wage equations were only a surrogate for a more fundamental determinant of wages: productivity. While this may be true at the aggregate level, it need not be so at the industry level. At the aggregate level, if we divide national income into profits and labor income, then by definition the percent change in wages is equal to the percent change in prices plus the percent change in output per man-hour plus the percent change in the output-capital ratio multiplied by the ratio of profits to labor income. Consequently, if the output-capital ratio is constant or changing at a constant rate, K, then $\%\Delta w = K + \%\Delta p + \%\Delta(Y/L)$, where w = wages, p = prices, and Y/L = output per man-hour.
16. This particular weighting of the lag variables is adopted from Eckstein and Brinner (1972). Also, the imposed weighted lags tend to smooth out impacts which produce a dampening of large fluctuations in predicted wages and prices.
17. We are grateful to David Wyss for providing us with the original work sheets, which were helpful in constructing the output and input series. Because of adjustments these are different from those of Eckstein and Wyss (1972).
18. In previous wage and price studies in which simultaneous-equation techniques were used, it was found that the bias associated with reliance on ordinary least squares is quite small in wage and price equations. See Dicks-Mireaux (1961), Eckstein and Brinner (1972), Goldstein (1972), and Rappoport and Kniesner (1974).
19. However, the Durbin-Watson statistics imply autocorrelation due to the presence of an omitted explanatory variable. For a discussion of this in terms of consistency of the estimated coefficients, see McCallum (1973).
20. For a discussion of the impact of cost-of-living adjustments in the periods prior to and during controls, see Stallard and Solnick (1974).
21. There have been various conceptual objections to using the aggregate unem-

ployment rate as a proxy for labor market tightness. Both Gordon (1971) and Perry (1970) have developed alternative measures of labor market tightness. Both measures were tested in the wage equations, and they performed less well than the aggregate measures. It is doubtful that industry-specific measures would perform any better, except in industries with high unemployment and weak labor unions.

22. This particular weighting of the dummy variable is adopted from Eckstein and Brinner (1972) and reflects the relative strength of the guidepost policies over the period of estimation.
23. For the use of ESP1 to determine the direct impact of controls, see Gordon (1972). Explanations of the wage and price impacts of the freeze and Phase II are discussed in Askin (n.d.), Bosworth (1972), and Poole (1973). For a discussion of the adequacy of guidepost dummies, see Perry (1967) and Perry et al. (1969). For a more general discussion of the dummy variable technique see Askin and Kraft (1973) and Rees (1971).
24. Methods of computing the total impact of wage and price controls are elaborated in Askin and Kraft (1973) and Gordon (1972).
25. The four-quarter percent change in the unemployment rate, the manufacturing layoff rate, and the unemployment rate for manufacturing were also tried separately and in combination, but all were inferior proxies for labor market tightness.
26. We use a second-degree polynomial lag with the coefficient constrained to zero in the last period. The linking equation presents the sum of the lag coefficients on PQF_t, where the t statistic is computed from the standard error of the sum.
27. The model trackings for 1959III–1971II are available on application to the authors.
28. The approximation is crude, since we would be comparing a simulated value with a fixed actual value. Under this comparison, the difference could reflect both controls and any simulated error and thus could be an overstatement, depending on whether the simulations underpredict or overpredict wages and prices.
29. While we presented only one macromodel in the paper, we tested and simulated several others. In all of them there were even greater underpredictions of wage changes.

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COMMENTS

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The general purpose of this study is appealing—to estimate the effects of the price and wage controls from disaggregated industry data. Equations are fitted to the precontrols period and then applied to the controls period to determine their residual effect. We can thus estimate the effect on the rate of change of prices and wages during the controls period and the cumulative effect. The cumulative effect is especially pertinent when controls begin with a freeze, because of postfreeze catching up. It might also be desirable to measure the cumulative effect beginning a little before and ending a little after, to catch precontrol anticipatory increases and postcontrol catching up, though this was not done (since not all the data were yet available for the catch-up period). The total effect is important, since controls are likely to redistribute price increases over time but have little lasting effect on the price level.

The authors take aggregate demand as given, of course, and do not go into the important policy issue of whether the imposition of controls changed policy, perhaps leading policymakers to be overly expansionary, as I think did happen in 1972. The price and wage equations cannot answer that question, and we cannot expect them to. I mention this only to remind us that in discussing the technical problems of these equations, we are not answering all the questions raised by controls.

While we are busily engaged in estimating the effect of controls, I keep wondering what effect we are testing for. For a given set of aggregate demand policies, there is a path of prices and wages which the economy tends to follow. What can controls do? They might suppress increases by holding real wages and profit margins down, in which case there will be large catching-up increases afterward, but no lasting departure from the equilibrium path. Economists understand this, even if no one else does. To be sure, the way in which controls are enforced can affect the degree of suppression, as the authors discuss in the first part of their paper, but such effects are fluctuations around the equilibrium path, not changes in the path itself. The important question is, Can the equilibrium path be changed?

For a given aggregate-demand policy, the answer has to be no, but the hope is that suppression will make the imposition of greater monetary and fiscal restraint easier to bear by allowing higher output and lower prices than would otherwise occur. I see little possibility of achieving this by holding down profit margins through suppression of price increases; the effect on output and employment is likely to be adverse. The argument in the paper that a freeze puts a kink in the demand curve of oligopolies, with the result that changes in marginal cost are *un*likely to cause a change in output, may be correct for the short run, but it overlooks the effect on incentives to invest in greater capacity, which can create supply limitations later on.

A lasting benefit from controls depends upon a suppression of wage increases by preventing either anticipatory increases to future inflation or a catching up to past inflation. This probably works because labor supply does not appear to be reduced, at least in the short run, by a reduction in real wages that comes about through a failure of money wages to rise as fast as the cost of living; at the same time, on the demand side the reduction in real wages stimulates hiring. The crux of the control program lies in the wage effects; the price controls are a smoke screen. Therefore, I do not understand the authors' concluding remarks, which are addressed to improving the enforcement of *price* controls. They are silent on the benefits to be achieved. I can only surmise that they see controls as preventing cost-push price increases. However, I did not think anyone thought that inflation in recent years was a genuine cost-push. Perhaps I am wrong about prevailing opinion; in any event, it seems to me that the evidence is all against the cost-push interpretation.

The three phases of controls do not appear to have produced any lasting benefit because most of the effect is estimated to have been on prices, with little on wages. That is the indication of casual observation of wages and profit margins and of Gordon's econometric analysis.[1] The results of this study, though mixed, do not contradict that conclusion. These are the same as Nadiri's results presented at this conference for phases I and II, though he inexplicably obtains a strong effect for Phase III, which from all appearances was weak.

Looking more closely at the details of the estimates in the paper, we note that the individual equations of price changes are for seventeen industries. The explanatory variables tested were the change in the indexes for wages and for materials price, the change in deficient demand as measured by an inventory-sales ratio (rather than measuring the change in the ratio, deficient demand should be measured as deviations from a normal or average level, though perhaps the change approximates such deviations), the change in output to catch changes in productivity as firms move along their average cost curve, the change in a rate of return to the firm to catch the effect of target-return pricing, and the change in a bond yield to reflect the cost of capital. Variables were dropped if, before correction for serial correlation, they were statistically insignificant. However, those which became insignificant after correction for serial correlation were retained. In the results, the rate-of-return variable was dropped from all the equations; and the bond rate, from all but one. None of the equations has the same set of variables, though most have wages and input prices, and about half have either the variable for output or for deficient demand or both. Still, deficient demand, which should be important in the more competitive industries (though it is strangely important for certain industries in some studies and not in others), is significant and negative only for the competitive lumber industry and the fairly concentrated nonferrous metals industry. The problem of not having significant demand variables in the equations is brought out by imagining that controls operated perfectly to reduce the rate of change of all prices and wages in the economy. Theoretically, the reduction in price change would be matched in the equations by the reduction in wage and input price changes. Then, without any demand variable, the residuals of the equation would not indicate that controls had any effect!

Most aggregate studies take explicit account of labor productivity by including unit labor cost, not just wages, in the price equation. In this and the Eckstein-Wyss study,[2] productivity is assumed to grow at a constant rate and to be incorporated in the constant term. I am perturbed over this difference between the aggregate and disaggregate studies. I am not sure which is correct. However, it is inadequate to assume that productivity and wage changes are correlated in the short run and that the wage coefficient can represent their combined effect, as the authors seem to imply in their statement at the end of section IV, on wage results, in their effort to make sense of a negative wage coefficient.

Aside from a quarrel here and there over details, I have no objection to the general design of their equations, but I am uneasy with the results here and elsewhere based on time series. My main concern is with the fixed lags implicit in these regression equations. My casual inspection of the time series indicates that lags vary from one episode to the next as well as among industries. I am not sure the short time periods of this study avoid the problem. The use of four-quarter weighted changes in the variables probably does not smooth out very much of the differences in lag times. At the moment, traditional techniques use fixed lags, and I have no alternative to recommend, but they can be a source of major difficulty.

Even aside from lags, the dangers of spurious results are high because of common cyclical movements in these variables. The regressions cover the long upward movement in rates of change over the 1960s and contain four or five explanatory variables; they are ripe for spurious correlation. My uneasiness is heightened by the lack of robustness of the results, which differ greatly between the aggregate and disaggregate studies and between small changes in the period of coverage and in specification. If we compare the same sixteen industries covered in the Eckstein-Wyss study for a slightly earlier period, and look just at the common wage and input price variables, the large differences in significance and magnitude of estimates are alarming. Ignoring the size of the coefficients and looking merely at how many of the coefficients agree only in sign and significance, we find five out of sixteen for wages, though a more favorable twelve out of sixteen for input prices (however, even in the latter case, eleven of the industries do not have a significant coefficient for materials prices). To be sure, other variables included in the equations of these two studies are different, but why should their inclusion make so much difference for basic variables like wages and materials cost? Eckstein and Wyss made much of their equations as showing price behavior consistent with a classification of industries by concentration, based on the coefficients of the utilization and rate-of-return variables. Insofar as the present study offers comparison, I see little agreement in classification.

Let me turn now to Nadiri's results presented at this conference. He regresses the variables in level form, not rate of change, but allows for lagged adjustments and, in principle, estimates some of the same parameters. Here again the differences are major. Nadiri generally obtains more significant results, presumably because the level form of his variables is likely to reflect longer-run total effects than the first-difference form used here. In his price equation Nadiri finds a significant wage variable in eight of his twelve industries, but there is less than 50 percent agreement between his study and this one on significance for the eleven industries covered in common, and the same is true for materials cost. For the wage equations, there is the same problem. By comparison with Nadiri, the significance and sign of unemployment agree in only seven of eleven industries and the significance and sign of lagged prices in six of eleven.

So we are hardly yet in a position to say that we have reached a consensus on the specification and general results of these industry equations. I wish that these studies would duplicate the specifications of previous ones, so that we could distinguish among the differences due to the periods covered, the data used, and the specification, and so narrow down the glaring inconsistencies.

Aside from the lack of robustness, the coefficients often flop around from positive to negative from one industry to another. The authors try to cope with this by arguing that the variables are proxies for different effects, which are relatively strong for some industries and weak for others. For example, changes in output, if positive, indicate changes in capacity utilization and reflect excess demand pressures, but if they are negative, they are a proxy for movements along a falling average cost curve. There may be no simple solution to flip-flopping coefficients, but such multiproxy variables are hardly ideal.

In addition, the size of the coefficients is extremely wide-ranging, much more so than is the theoretical effect of the wage and input price variables, which in percentages should have a long-run effect on prices equal to their respective shares in total costs in each industry. Moreover, those for materials cost are generally too low, suggesting that a good part of the lagged effects is not being caught. Materials costs range from 40 to 70 percent of total costs,[3] but the positive regression coefficients range from 8 to 67 percent. The wage coefficients, on the other hand, tend to be much too high.

For the purpose at hand—estimating the effect of controls—all these deficiencies may not matter too much. The equations, even if misspecified, may be adequate to show the residual effect of controls. The results for the dummy variables inserted in the equations to register the effect of controls indicate that only for tobacco did phases I and II have downward effects on price changes that were statistically significant at the 5 percent level. For Phase III, there is a significant result for apparel only. A few other results were statistically significant at the 10 percent level. In several industries the dummies used had significantly positive effects; however this is explained, it gives no support to the effectiveness of controls. Furthermore, a completely different set of industries showed significant effects of controls on profit margins. If controls suppressed prices, it is hard to see why they would not also reduce profit margins in the *same* industries.

What about wages, which I argued above are the crux of the control program? The wage equations, which do show a significant effect of the mild guideposts in the early 1960s in nine industries, do not show a significantly negative effect during phases I–III in *any* of the seventeen industries, and show significantly *positive* effects in four industries! The aggregate effect, using BLS weights for wholesale prices in December 1972 and excluding instruments (SIC 38), is +0.6 percent. This result is hard to swallow, even for someone unsympathetic to the usefulness of controls like me. I'd bet my hat that the control dummies are reflecting catching-up wage increases here, and the problem lies in the use of concurrent values (or, at most, values lagged one quarter) of the cost of living, which imposes too fast an adjustment on its effect.

Rightly skeptical regarding these results, the authors have presented other tests based on aggregate equations. Theirs are much simpler than Gordon's or Nadiri's, for they use only wages and input prices in the price equation and prices, unemployment, and output per man-hour in the wage equation. The control dummies are generally not significant; the only significant one is for wages in Phase III. The interaction effect of combining the price and wage equations, presented in the final table of the paper, shows a zero overall effect on wages, though a positive effect in phases I and II and a negative one in Phase III. I think the sequence is wrong (Phase II was tougher than III), but the overall zero effect seems to me about right. Nadiri's results for aggregate equations in his Table 9 for total manufacturing are not dissimilar for wages, being generally positive in phases I and II and negative only in III.[4] As I argued before, if the effect of controls was all on prices and not on wages, as suggested by these results, it was not lasting.

Let me end with the obvious point we all know but usually leave unsaid: that the data for two-digit industries are probably not accurate enough to reveal the small effects we are looking for. There is considerable mismatching of prices with other variables at the two-digit level, and we may have to disaggregate further. Certainly no one can say that a reason for not doing so is that the results with more aggregate data have been so satisfactory.

NOTES

1. R. J. Gordon, "Inflation in Recession and Recovery," *Brookings Papers on Economic Activity*, no. 1 (1971):105–166; and "Wage-Price Controls and the Shifting Phillips Curve," *ibid.*, no. 2 (1972):385–430.
2. O. Eckstein and D. Wyss, "Industry Price Equations," in O. Eckstein, ed., *The Econometrics of Price Determination* (Washington, D.C.: Board of Governors of the Federal Reserve System, 1972).

3. *Ibid.*, p. 143.
4. These results suffer also, I believe, from a concurrent price variable.

   Nadiri has an inexplicable positive effect for manufacturing prices, which turns into the correct negative effect for the equation pertaining to the total economy. But what sectors outside of manufacturing were strongly affected by controls?