should be recognized. Table 8 presents the results of some regressions of ΔP on ΔU and on the change in average hourly earnings, ΔW. It shows that the inclusion of ΔW, while important in all cases, does not eliminate the influence of ΔU. In fact, price changes in paper and textiles are apparently more strongly affected by "demand pressures" as measured by ΔU than by the direct "cost push" (ΔW). The influence of wage changes is relatively stronger in the regressions for the other industries. But it may be questioned whether the factors ΔU and ΔW should really be treated on a par as potential determinants of price change.[45] Moreover, there are good reasons to expect list prices to be more sensitive to cost than to demand changes, and the wholesale price indexes used in our regressions reflect to a large extent sellers' list quotations (see fn. 25 above).

TABLE 8. — RELATIONS BETWEEN PRICE CHANGES AND CHANGES IN BACKLOGS AND IN WAGES, FIVE MAJOR INDUSTRIES, 1948–58

Industry	Partial Correlation Coefficients $r_{12.3}$	Partial Correlation Coefficients $r_{13.2}$	Multiple Correlation Coefficient $R_{1.23}$
Paper and allied products	.737	.518	.801
Textile-mill products	.697	.525	.781
Primary metals	.348	.613	.696
Nonelectrical machinery	.271	.505	.648
Fabricated metal products	.360	.510	.640

NOTE: Variable "1" is ΔP_t; variable "2" is ΔU_{t-3} for paper and fabricated metals, ΔU_t for other industries; variable "3" is ΔW_{t-3} for paper, ΔW_t for other industries. Quarterly series used throughout: t denotes current quarter, $(t-3)$ previous quarter. The timing of ΔU and ΔW relative to ΔP is that which maximizes the multiple correlation coefficients. The regressions cover forty-three quarters for textiles and fabricated metals, forty-four quarters for each of the other industries (in Table 5 the use of ΔU variables made it necessary to work with forty-two and forty-three quarters).

For the source of the ΔP and ΔU data, see Table 4. The ΔW series are derived from monthly statistics of the U.S. Department of Labor, Bureau of Labor Statistics.

Lower concentration ratios prevail among the component industries in paper, textiles, and other durables than in metal products, machinery, and transportation equipment. This being the case, the results of our analysis (Tables 5 and 8) give some support to the idea that departures from competition contribute to the importance of backlog adjustments.[46]

IV. Summary

In the period since World War II, unfilled orders held by manufacturers in most major durable-goods and some nondurable-goods industries have been several times as large as monthly shipments and have fluctuated widely relative to them. Many products of these industries face extremely unstable, sporadic, or individualized customer demand. They are manufactured to order at all times because the expected costs of carrying unsold stocks of such items are high. Variations in order backlogs permit some stability in production rates in these industries, just as variations in finished-goods inventories permit output stability in industries that produce largely to stock. Indeed, it appears that backlog changes have a strong stabilizing effect in many industries, while changes in finished stocks have relatively weak effects.

Fluctuations in the ratio of unfilled orders to shipments reflect, at least roughly, fluctuations in average delivery periods. Earlier delivery will often cause costs to the producer; delayed delivery, costs to the buyer. Hence, other things equal, an inverse relation between price and delivery period would be expected. However, if demand increases and is such as to give rise to pressures upon the industry's capacity to produce, the typical result is an increase in price as well as a lengthening of the average delivery period (backlog accumulation). The second effect only partially offsets the first: if a larger part of the rise in demand is absorbed by additions to the volume of unfilled orders, less of it will go into price increases.

[45] Since labor costs are an important part of price, it is only natural for the simultaneous changes in the two to be positively correlated. While it is easier to think of ΔW influencing ΔP in the short run than vice versa, some elements of a "feedback" are presumably present. Thus, when prices rise and profit margins do also, owing to a strong and increasing demand for the product, wage increases may be demanded and, under the circumstances, promptly gained, too. Moreover, such demand pressures will cause overtime work, and our wage-cost variable is computed from average hourly earnings data which include overtime as well as straight-time earnings. To avoid the feedback difficulty, one could take ΔW with a quarterly lead, but (except for paper) the effect of this would be to reduce drastically the importance of the wage variable as a determinant of ΔP. On the other hand, if any feedback effect of ΔP_t upon ΔU_t exists at all, it is probably very small.

[46] The evidence is suggestive but, of course, far from conclusive because of its limitation to a few highly aggregative series. In our analysis, backlog accumulation is traced to the working of several factors and no reason is found to link it to noncompetitive behavior alone. (Cf. Galbraith in this REVIEW, XXXIX (May 1957), where backlog accumulation has been attributed squarely to oligopolistic pricing during a boom.)

Price change and backlog change are indeed positively correlated in each of the major manufacturing industries examined. However, significant interindustry differences exist in the relative importance of price versus backlog reactions. In the paper and textile-mill products industries, for example, changes in prices are large relative to changes in backlogs. In the machinery and equipment industries, backlog changes are large relative to price changes. There is a strong presumption and some evidence that unpredictable fluctuation in demand is a central phenomenon behind the large volume and wide swings of unfilled orders, although noncompetitive behavior can be a reinforcing factor.

APPENDIX

NOTES ON SOME THEORETICAL ASPECTS OF VARIABLE DELIVERY PERIODS

Joint Optimization of Delivery Period and Price. Consider a firm that sets the delivery period (k) as well as the price (p) in its offer to customers for an optimal (profit-maximizing) combination of p and k. *Ceteris paribus,* let prompter delivery indicate improved quality of the product, that is, let it increase demand (the quantity of the product ordered per unit of time, q^o) but also costs (the average production costs, c, of the quantity supplied per unit of time, q^s).[47] This gives the following demand (D) and cost (C) functions of the firm, of the simple static type, assumed to be continuous and differentiable:

$$q^o = D(p,k), \text{ where } D_p = \frac{\partial D}{\partial P} < 0 \text{ and } D_k = \frac{\partial D}{\partial K} < 0; \tag{6}$$

$$c = C(q^s,k), \text{ where } C_k = \frac{\partial c}{\partial k} < 0. \tag{7}$$

Suppose p and k are changed by small amounts and in such a way as to have equal and opposite effects upon the rate of ordering and sales. If the rates of quantities ordered and supplied are thus kept constant, we get

$$\frac{dp}{dk} = -\frac{D_k}{D_p} \text{ and} \tag{8}$$

$$dc = C_k dk.^{48} \tag{9}$$

The economic meaning of (8) is the marginal rate of substitution of price for delivery period, given a certain quantity ordered, q^o = constant. A system of downward sloping[49] indifference curves is thus conceived, each of which is a locus of all combinations of p and k that are associated with a given value of q^o.

The net effect on profit of small changes in price and delivery period, which leave unchanged the quantity the firm sells ($q = q^o = q^s$), is the difference between the effect on the gross revenue of the change in price ($= qdp$) and the effect on total costs of the change in delivery period ($= qdc$). By substitution from (8) and (9), this net effect on profit equals

$$qdp - qdc = -q\left(\frac{D_k}{D_p} - C_k\right)dk. \tag{10}$$

The condition for the "joint optimum" (profit-maximizing combination) of p and k is that this whole expression be zero. This will be so necessarily if, and only if, the expression in parentheses in (10) equals zero, for otherwise one could always choose dk (with the compensating dp) so that $dp > dc$, that is, profit could still be increased. Hence, it is required that

$$C_k = -\frac{D_k}{D_p}.^{50} \tag{11}$$

In Figure 1 this condition is satisfied, for example, at $k = OA$, $p = OB$, and $c = OC$. The "indifference curve" MM represents all the combinations of values of p and k at which the quantity ordered equals a given amount, say, q_1. The curve JJ shows the costs per unit (c) of supplying this

[47] This view of k as an aspect of product quality permits application in the present context of a simple and effective technique used in Robert Dorfman and Peter O. Steiner, "Optimal Advertising and Optimal Quality," *The American Economic Review,* XLIV (December 1954), 826–836.

[48] Equation (8) is obtained by differentiating (6) totally to get $dq^o = D_p dp + D_k dk$ and setting $dq^o = 0$. Equation (9) is the form to which the differential of (7) reduces when $dq^s = 0$.

[49] Since $D_p < 0$ and $D_k < 0$, dp/dk must, according to (8), be negative.

[50] This is the necessary condition for a maximum profit (if π is net revenue or profit taken as a function of p and k, then $d\pi = O$, that is, $\partial\pi/\partial p = \partial\pi/\partial k = 0$). To this the sufficient condition should be added, that is the second-order partial derivatives of the profit function must be assumed to be negative at the point where $\partial\pi = 0$.