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RECENT DEVELOPMENTS IN THE THEORY OF INDUSTRIAL ORGANIZATION: SOME MACROECONOMIC IMPLICATIONS

Price Rigidities and Market Structure

By JOSEPH E. STIGLITZ*

Conventional wisdom has it that a large part of the explanation of Keynesian unemployment is the observed rigidities of wages and prices. What has been lacking, however, is a satisfactory theory (or conjunction of theories) which explains how wages and prices can be at non-market-clearing levels.

The objective of this paper is to sketch out several alternative theoretical explanations of this phenomenon. Each (in contrast with Keynesian theory) is consistent with the observation that as the economy goes into a recession, real product wages do not increase, and may, in fact, decrease. All of the theories assume rational, profit-maximizing firms, and all entail some important departure from the standard competitive paradigm. The first three explanations represent minor adaptations of standard models.

I. Some Simple Explanations of Price Stickiness

A. Long-Term Contracts

The first explanation denies, in effect, the relevance of the observation. Firms have long-term relationships with their customers that entail (implicit or explicit) insurance; the firm charges less than the marginal cost of production in good states and more in bad. The buyer is assumed to be (in effect) less risk averse than the seller. Though it is undoubtedly important to take into account long-term contracts in the analysis of short-

run movements in observed prices, I doubt whether these can fully account for the phenomenon I am attempting to explain. Why should buyers, on the whole, be willing to supply this insurance to sellers? Because workers, too, are on long-term contracts, spot wages and long-term wages differ; the theory predicts that spot real product wages increase during the recession. If long-term contracts are relatively more important in labor markets than in product markets, then the anomaly which is to be explained is even larger than suggested by data that fail to distinguish between spot and contract wages and prices.

B. Learning by Doing: Declining Marginal Cost Curves

The second explanation denies the hypothesis of diminishing marginal returns. I have identified one (and only one) important instance in which the *marginal* cost is reduced as the level of production increases, and that occurs when there is learning by doing.

This explanation may be important in a few sectors, but the phenomenon that is to be explained, the failure of real product wages to rise by very much, is hardly limited to sectors where learning is important.

C. Increasing the Elasticity of Demand

If there is diminishing marginal returns and the economy is competitive, the real product wage should rise as the economy goes into a recession. The same is true if the economy is dominated by monopolies (or monopolistically competitive firms), who set marginal revenue equal to marginal cost; so long as the elasticity of demand remains unchanged, price will remain a given markup

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over marginal cost. If, however, the elasticity of demand were to decrease, then the markup might increase; and thus, even if marginal costs of production fell, prices would not fall proportionately, and might even rise. The question is, is there any reason to believe that in a recession the elasticity of demand is decreased? Though there is no general presumption for a decrease in the elasticity of demand, two cases warrant mentioning. First, consider a monopolistically competitive market, say, characterized by n firms distributed around a circle. Assume that initially, demand is sufficiently strong that all market areas are served, and the equilibrium price thus is affected both by the intensive margin (the response of current customers to changes in price) and the extensive margin (the additional customers who purchase at the given store as a result of a price reduction). If the demand curves of each individual shifts enough, equilibrium may be characterized by some areas not being served by any store (i.e., the price, including transportation costs, is sufficiently high that their demand, with the new demand curves, is zero). Since there is then only an intensive margin, the equilibrium markup over marginal costs will now be higher.

Assume now that search is costly. Consider the product variety interpretation of the standard circular monopolistically competitive model. Individuals have a preferred point (product variety) on the circle; the utility they get from a product decreases the greater the distance of the product from the preferred point. Assume individuals randomly arrive at points along the circle, and there is a fixed cost for each additional search. As usual, they will have a simple reservation-quality-price rule: if $v(p, q)$ gives their level of utility as a function of price and quality, then they purchase at a store if $v(p, q) \geq \hat{v}$, for some critical \hat{v} . The critical value of \hat{v} depends on a number of factors, including the market rate of interest and the cost of search. If the real rate of interest rises in a recession, v will decrease; each individual will find a wider range of products acceptable. This will *reduce* the elasticity of demand, since there will then be fewer individuals who are just at the margin between

buying at one store and continuing to search; and this will increase the price (relative to marginal cost) charged at each store.

The discussion of the preceding three sections has shown that modifications of the standard theory may provide some insights into wage stickiness, but hardly provide a convincing general explanation. In the next sections, I turn to some alternative explanations based on more fundamental departures from the standard paradigm. The first two are based on imperfect information in a competitive environment, the second two on strategic behavior in a noncompetitive environment.

II. Imperfect Information and Price Stickiness

A. Judging Quality by Price

The first of the imperfect information theories is based on the premise that customers are imperfectly informed about the characteristics of the products which they purchase, at the time they purchase them. There is a widespread belief that higher priced commodities are of higher quality. This may be either because of selection effects (for example, potential sellers of good used cars will not sell them unless they are offered a high enough price), or incentive effects (if price exceeds marginal cost by enough, it pays to maintain one's reputation by producing high quality commodities). Lowering one's price may be interpreted as a lowering of quality, and thus demand may actually *decrease* rather than increase. In that case, firms may not respond to situations where the value of the marginal product of labor exceeds the wage by lowering price, as traditional theory would have predicted: it *appears* as if the firm is off its supply curve.

A simple example of a reputation model may help illustrate this point. A firm sells a product at a price p ; the marginal cost for producing the high quality product is c_h for the low quality c_l . Individuals cannot assess the quality of the product until after they have purchased it; they continue to purchase from the given firm unless he cheats on them, and sells them a low quality commodity. Once they have been cheated upon, they

refuse to purchase from the given firm again. The present discounted value of profits of the firm, if it remains honest, is $p - c_h/r$, where r is the rate of interest; the (present discounted value of) profits of the firm if it cheats is $p - c_l$, it gets its sales this period, but nothing thereafter. For the firm not to cheat,

$$(1) \quad (p - c_h)/r \geq p - c_l$$

$$\text{or} \quad p \geq (c_h - rc_l)/(1 - r).$$

Thus, even in a competitive economy, price will exceed the marginal cost of production. If the *real* interest rate increases as the economy goes into a recession, then the markup over marginal costs will increase.

Two modifications of this argument strengthen the presumption that prices may not fall (relative to wages) in a recession. First, assume that firms die exponentially, at the rate μ . Second, assume that the firm treats all customers the same (it cheats one, it cheats them all; this would be optimal if reputations spread quickly across customers). Let $Q = F(L)$ be the firm's output. Then the condition for producing high quality commodities becomes

$$(2) \quad p \geq (LW/Q)/(1 - (\mu + r)),$$

where W is the wage. Since death rates among firms are higher in a recession, it is reasonable that consumers will perceive μ as higher in such a situation, and thus price must increase to ensure that the firm produces a high quality commodity. Second, (2) makes it clear that what is relevant is the markup over average (variable) costs; if there are fixed costs to a firm, it is possible that there will be diminishing marginal products and increasing average products (this is consistent, for instance, with Okun's Law); in that case since the average productivity has decreased, the equilibrium price (relative to the wage) will need to increase to maintain the firms' incentives to produce high quality commodities.¹

¹This paragraph is intended to present a simple heuristic explanation of why reputation models can generate observed patterns of movements in real product wages.

The phenomenon I have just described is much more general than the specific reputational model I have discussed. A similar result obtains if current prices affect not only present but future demand. Firms trade off lower prices today for higher future sales; an increase in the cost of capital associated with a recession implies that the increased future profits will be less valuable, and hence firms will increase their current markup over marginal costs. (See my paper with Bruce Greenwald and Andrew Weiss, 1984).

B. *Asymmetric Responses with Costly Search*

It has long been recognized that if the demand curve facing a firm is kinked, then the firm may not respond to changes in the factor prices it faces. Thus, if it is hypothesized that the demand curve shifts to the left by z percent, with the kink remaining at the same price, then output will be decreased by z percent, but price will remain unchanged. If the kink occurs at a higher price, then price will increase; we would then observe the seemingly paradoxical result of increasing prices and falling output. Though some recent work in game theory has attempted to put the old oligopoly kinked demand curve on more solid footing, we are concerned here with kinked demand curves which arise in competitive markets because of costly search. Consider a market equilibrium in which all firms charge the same price. If a firm raises its price, all of its customers know that it has raised its price, and those with low search costs may proceed to search for one of the lower priced stores. If a firm lowers its price, it may sell more to its current customers; and more individuals who are searching who happen to stop at the store will decide to purchase there. But even if it became pub-

It is easy to show that the reputation equilibrium as described can arise as a perfect equilibrium in a repeated game. The formalization embodied in equations (1) and (2) assumes that current value variables will persist indefinitely; it is easy to extend the analysis to assume that there are, say, two states of nature ("good" and "bad") with stationary transition probabilities between the two. See Franklin Allen (1983). If consumers are imperfectly informed concerning current variable costs, and are risk averse, the critical price may be completely rigid.

licly known that *some* store had lowered its price, it might not become known which store had lowered its price; if there were many stores in the market, those at other stores, even with relatively low search costs, might thus not be induced to try to find the store. Thus, the store may gain fewer customers when it lowers its price than it loses when it raises its price, giving rise to a kink. The kink may well change as the environment changes; if, as the economy goes into a recession, all consumers believe that other stores have lowered their price by v percent, then the kink will occur at a price which is lower by a corresponding amount; for if the firm does not lower its price by that amount, the low search cost customers will be induced to search. At the same time, if they believe that all other firms have raised their price by z percent, the kink will occur at a price which is higher by z percent. Only if the firm increases its price by more than z percent will they be induced to search. There is a fundamental indeterminacy in the location of the kink (and hence in the equilibrium price); there are a multitude of rational expectations equilibria, including some which exhibit stickiness of money wages. (For a more extensive development of these ideas, see my 1983 paper.)

III. Oligopolistic Theories

Because of the plethora of possible patterns of interactions of firms in oligopolistic markets, economists have been loath to use oligopoly theory to provide insights into macroeconomic behavior. This seems to be excessively cautious; we do not need to claim that a particular oligopoly model describes behavior in all oligopolistic industries; only that it provides insights into the behavior of some. In this section, I wish to suggest how two recent developments in oligopoly theory can provide some insights into price rigidities.

A. Limit Pricing and Entry Deterrence

There is a long tradition that has held that monopolists kept lower prices than they otherwise would in order to deter entry. Potential competition may be (almost) as

effective as actual competition in keeping prices down. As the economy goes into a recession, the extent of excess capacity increases. Excess capacity is an effective deterrent. Because of the availability of excessive capacity, firms do not need to rely as much on limit pricing to deter entry.

This argument, though plausible, has two critical flaws: neither prices nor excess capacity may serve as an entry deterrent. For low prices to serve as an entry deterrent, or for high prices to encourage entry, implies that potential entrants believe that the incumbent firm(s) will leave their prices unchanged in response to entry (or at least that the price they charge after entry will be correlated with their pre-entry price). As stated, the analysis does not provide an explanation for why this should be so. Secondly, as Dixit has emphasized, for excess capacity to serve as an entry deterrent requires that entrants believe that it will be used after entry. This will not be the case if the post-entry equilibrium is a Nash-quantity equilibrium.

Still, one suspects, there is something to the argument that in a recession, the threat of entry is less important, and this allows firms to charge higher prices (relative to marginal costs). The following model (an adaptation of one due to Salop) provides one context in which this can be shown to be true.

Assume the potential entrants do not know what the marginal cost function of the incumbent firm is; they know that it may either be c_1 , or $c_2 > c_1$. The potential entrant believes it will be profitable to enter if his rivals costs are c_2 , but not otherwise. The incumbent, knowing this, attempts to convince the potential entrants that his costs are low. The potential entrants, of course, know this. We have a standard screening self-selection problem. The equilibrium may easily be characterized. If the incumbent has a high cost, he charges a price, p_2^* such that marginal revenue equals marginal cost. If the incumbent has a low cost, he charges a much lower price: sufficiently low that the high-cost firm does not try to imitate him. Let $\pi(p, c)$ denote profits as a function of price charged and marginal cost of production. We simplify the analysis by assuming only two periods with $\delta = 1/(1+r)$ being the discount

factor. Assume that the probability of entry the second period (if the potential entrants know that the incumbents costs are c_2) is λ , and that profits of the incumbent upon entry are (for simplicity) zero. Then the equilibrium prices charged by the low-cost store satisfies

$$(3) \quad \pi(p_2^*, c_2)(1 + \delta(1 - \lambda)) \\ = \pi(p_1, c_2)(1 + \delta).$$

It immediately follows that a reduction in the flow of entry (λ) or an increase in the rate of interest (a decrease in δ), will result in an increase in p_1 . (An increase in the threat of entry makes the high-cost firms more willing to sacrifice current profits, to imitate the low-cost firms.) Thus, once again, a recession may be associated with an increase in markup over marginal costs.

B. Coordinating Collusive Behavior

Recent developments in the theory of repeated games have shown how collusive behavior may be sustained (as perfect equilibrium) in noncooperative games. Individuals who are detected to deviated from cooperative behavior are punished.² It is often difficult, however, to detect deviations from cooperative behavior, particularly when demand curves are random and differ from firm to firm. Consider a cartel in which the price charged by each firm is observable,³ but that is all. One set of (perfect) equilibrium strategies entails each firm charging the cooperative price, p^* , so long as the rival charges p^* ; if any firm deviates, however, all firms revert to the Nash-equilibrium prices, p^N , for an extended period, after which prices again return to the cooperative level.⁴ The cooperative price p^* is chosen to maximize

the expected (present discounted value) of profits, given the demand variability (and given that the price cannot be changed in response to the change in demand). In this perfect equilibrium, firms do not respond to changes in the environment. Each firm cannot detect the changes in other firms' demand curves. They cannot discriminate between cases when rivals lower their price to cheat on the collusive arrangements, and when rivals lower their price in response to a reduction in their demand. The gains from being able to enforce collusive behavior outweigh the losses from failing to adapt the price to shifts in the demand curve.

IV. Concluding Remarks

This paper began by observing that the following statements are not consistent: (i) firms are competitive and on their supply curve; (ii) real product wages did not increase when employment decreased (technology and capital remaining constant); and (iii) there are diminishing returns to labor.

One of these hypotheses must be false. This paper is based on the premise that the empirical observations, the failure of real product wages to rise, is valid, at least for some important industries. I have provided one explanation for why the marginal product of labor might have decreased in the recession (learning by doing). If the sector is characterized by a technology exhibiting increasing returns, it will not be perfectly competitive. Thus, I have focused attention here on the first premise. If the market were non-competitive, then real product wages could fall as the economy went into a recession, if the elasticity of demand decreased; again, I have provided two models (based on costly search and monopolistic competition) that generate that result.

Most of the explanations of the seeming paradox which I have offered reflect a more fundamental alteration in traditional theory: (i) if prices convey information, firms may be reluctant to lower prices lest consumers believe that there is a reduction in the quality of the product; in these circumstances, I have shown that markups over marginal costs may well rise in a recession; (ii) when search is costly, demand curves may have a kink in

²Whether effective punishments can be designed depends, of course, on the rate of interest. It is possible that if as the economy goes into a recession, the real rate of interest increases, it may no longer be possible to enforce collusive behavior, in which case we would find such markets behaving more competitively.

³In many important cases, this may not be true: posted prices and traded prices may differ markedly.

⁴Provided the discount rate is low enough and demand variability small enough, there will exist a perfect equilibrium of this form.

them; (iii) in oligopolistic markets, the reduction of the threat of entry in a recession may lead to an increase in price; and (iv) maintenance of collusive arrangements by noncooperative equilibria may entail price rigidities.

I suspect that some of these theories may provide a better description of some markets, others of other markets; there is no compelling reason to believe a single theory provides the explanation of price rigidities in all markets.

In these theories, firms all behave “rationally”; an alternative “explanation” of seeming price rigidities is that firms’ managers act according to certain rules of thumb, for example, those that entail a markup over average costs. Though such “theories”—if they can be called that—fail to explain how or when the markups change, as they undoubtedly do, they may provide as good a description of the short-run behavior of the firm as our more sophisticated theories.⁵

⁵Other short-run dynamics may provide an explanation of the observed phenomena: firms do lower prices, but as quickly as they lower prices, wages fall, so that real product wages fail to rise. Observed movements on real product wages are thus attributable to assumptions concerning relative adjustment speeds; these explanations are unsatisfactory, since the assumptions concerning relative adjustment speeds are, to say the least, *ad hoc*.

Most of the theories I have presented have one thing in common: they are inconsistent with the competitive theory of supply which underlies the two strands of thought which have dominated research in macroeconomics in recent years (the rational expectations and fixed price models). Thus, whether predictions based on those models (for example, concerning consequences of policy changes) have any validity remains a moot question. What is needed is a macroeconomic theory based on theories of imperfect competition and imperfect information. This paper is intended as a contribution to the construction of that alternative paradigm.

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