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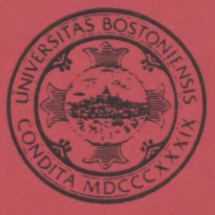

PRICE ADJUSTMENTS TO DEMAND SHOCKS IN A MONOPOLISTIC ECONOMY

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1. INTRODUCTION

This note deals with the question of slow price responses to contractionary demand policies. The focus is on an economy where firms enjoy some degree of monopoly power which enables them to set the prices for their products.

The Neokeynesian literature mostly explains sluggish price adjustments by linking prices in the products markets to the situation in other markets. Such is the case, for instance, of the models dealing with labor contracts negotiations (Tobin, 1972; Taylor, 1979). In these, product prices react to wages through the existence of a mark-up rule over a constant unitary costs function. Thus, slow wage adjustments determined by workers' expectations and/or indexation rules are translated into slow adjustments in goods prices. This line of argument can be applied as well to analyze the impact of changes in imported input costs, heavily affected by an exchange rate fixed by the government, and also the effects of changes in interest rates, affecting prices via changes in the cost of working capital (Bruno, 1978,; Cavallo, 1977).

This paper, however, focuses instead on the behavior of product markets, allowing some variable such as demand and expectations to play a more direct role in the determination of prices.1/ We will show that, in an economy characterized by the existence of monopolists in the goods markets, perceptions on demand elasticities and future inflation will play an important role in the speed of price adjustments to demand shocks, even when maximization of profits and increasing marginal cost curves are assumed.

The model, to be presented in sections 2 and 3, deals with profit maximizing monopolistic firms, which set their prices based on perceived demands for their products. A market disequilibrium can be created only when there is an unexpected shock in the economy affecting their demands.

Possible reactions to this kind of disequilibrium are analized in section 4. The Walrasian type of response, which predicts that inflation will go down rapidly when there is an excess supply, is contrasted with another type of conjectural equilibrium, in which inflation is sticky downwards for reasons other than cost push pressures.

2. MAIN ASSUMPTIONS

1) The typical firm has some degree of monopoly power on one

good or sector "i", with which it will be identified.2/

2) Firms maximize profits, i.e. they aim at producing where thier marginal revenues equal their marginal costs.

3) Firms set prices and possible production targets at the beginning of a "marketing period" during which transactions will actually take place. They sell in that period as much as they can and produce as much as they sell, at the given price.3/

4) It follows from 3) that, at the time prices are set, firms have to rely on their perceptions about what will happen during the marketing period. Thus, prices are determined on the basis of an expected or perceived demand for that period, so that the marginal revenues involved in the maximizing process are expected rather than actual.

5) Marginal cost elasticities and the behavior of cost variables are assumed known by the firm. 4/

6) After each marketing period, firms reestimate their perceived demands, taking into account what actually happened, and set their prices again. The way in which they react to previous mistaken expectations (i.e. market disequilibrium) will be important in determining the speed of the adjustment process

towards equilibrum.

3. BASIC EQUATIONS

3.1. MARGINAL COST GROWTH

It is possible to arrive at a marginal cost growth equation for the firm by starting from a well behaved separable production function on capital, labor, and imported inputs, homogeneous of degree one for labor and inputs. This equation would look as follows:5/

$$c = c_0 \cdot q + c_1 \cdot w + c_2 \cdot p_n \qquad (1)$$

In this equation, where subscripts for the firm "i" have been omitted for simplicity, c stands for grwoth in marginal costs and q, w and p_n for the growth in production, wages and prices of imported inputs, respectively. The values of c_0, c_1 and c_2 are assumed to be positive.6/

3.2. PERCEIVED DEMAND GROWTH

The adjustment process to be studied here will depend very importantly on suppliers' perceptions with respect to the quantities to be demanded during the next marketing period. We will consider two cases, to be identified with the Walrasian and Neokeynesian adjustment assumptions.

The expected demand function includes an income/wealth and a relative price effect, assuming them unknown to the firms at the moment in which prices are to be set. The basic difference in the two hypotheses to be confronted lies in the firms' perceptions regarding price elasticities of demand for their products. The Walrasian approach is to be identified with the perception of a demand curve with a high price elasticity, while the Neokeynesian approach is linked to a perceived inelasticity in demand for prices relatively lower than the current ones.

3.2.1 Elastic Perceived Demand (Walrasian adjustment)

The perception of the quantity to be demanded during the marketing period can be formulated in the following way:

$$Q^*_i = T^*_i \cdot \left(\frac{p_i}{p^*}\right)^{b_i} \qquad (2)$$

The subscript i means that we are referring to a particular firm, for which:

p_i = Price to be determined by the firm,

p^* = Expected price level of the economy or some substitute products,

T^*_i = Position parameter for the expected demand curve, related either to the income/wealth effect or previous market disequilibria,7/ and

b_i = Price elasticity, assumed to be negative and lower than -1.

This equation can be solved for P and, after transformation into growth terms -to be represented by lower case letters-, would look as follows:

$$p_i = \frac{1}{b_i} (q^*_i - t^*_i) + p^* \qquad (3)$$

If marginal revenue is calculated and then translated into growth terms, it will be the same as equation (3).8/

One way to find the profit maximizing equilibrium point is by equating equations (1) and (3), i.e. the perceived marginal revenues growth and the marginal cost grwoth. From there, we obtain an equilibrium expected quantity growth to be inserted back in equation (3) in order to solve for p, arriving at:

$$P_i = [c_1 \cdot w + c_2 \cdot p_n + c_0 \cdot t^*_i - b_i \cdot c_0 \cdot p^*] \cdot \left(\frac{1}{1 - C_0 \cdot b_i}\right) \qquad (4)$$

Bearing in mind that the parameter b is negative, while all the others are positive, we see that all the signs in (4) are expected to be positive. An increase in the growth of costs as well as an upwards shift in the demand growth curve and/or an increase in expected inflation, will bring about an icnrease in the inflation rate.

3.2.2. Demand Inelasticity (Neokeynesian adjustment)

An alternative approach regarding demand price elasticities assumes that firms perceive an inelastic demand for relative

prices lower than the current ones. This brings about a "kinked demand", for which several (not necessarily exclusive) explanations can be found in the economic literature.

The most traditional hypothesis of a kinked demand is that of Sweezy's (1939), by which price setters perceive other firms following their lead when reducing prices, but not when increasing them. This is, in other words, an oligopolistic implicit agreement aimed at keeping relative prices from falling, so that equilibrium is not upset by a price war in which all producers may loose.

Leibeinstein (1981) adds to the argument of fear of retaliation the uncertainty of long run elasticities and the concept of "inert" areas surrounding purchasing behavior, by which households continue to buy the same bundle of goods from the same suppliers as price increases, up to a certain point. In other words, demand is inelastic to prices up to that point, above which firms will not be able to retain customers when increasing their prices.

Okun (1981) provided a more detailed explanation of this behavior when analyzing the existence of customers' markets. According to this view, firms offer continuity in their price setting behavior in order to keep their customers. A price

increase above their shared expectations will motivate customers to search for other suppliers where they expect prices to be growing at lower rates. On the other hand, a price reduction below these shared expectations will not necessarily attract new customers from other suppliers, unless the others have increased their prices above them.9/

This approach seems particularly relevant when inflation is running very high and the period in which prices remain unchanged becomes shorter and shorter. When this is the case, there is no time to compare prices efficiently, since they are changing all the time. Therefore, demand will be correctly perceived as more inelastic the higher the expected inflation is for everyone and the shorter marketing periods are.

Assuming expected inflation linked to past inflation (corresponding to the implicit "oligopolistic" or buyers-sellers' price agreements), we arrive at a new price growth equation in which the previous solution (4) will be relevant only for equilibrium solutions above that of the expected inflation, i.e. coming from either higher costs or aggregate demand effects.

Thus, inflation will be linked in this case to the expected inflation in an attempt to maintain relative prices constant, since the inelastic portion of the demand is not relevant for the

monopolist who maximizes profits at the elastic points of the demand curve. For relative prices higher than the ones in the "kinked" part of the demand curve, equation (4) would be applicable. In general:

$$p_i = \text{Max}\left[\frac{1}{1-C_0 b_i}\left(C_1 \cdot w + C_2 \cdot p_n + C_0 \cdot b_i \cdot p^*\right); p^* = p_{t-1}\right] \qquad (5)$$

Notice that, expressed in terms of relative price changes, we obtain:

$$p_i - p^* = \left[\frac{1}{1-C_0 b_i}\left(C_1 \cdot w + C_2 \cdot p_n + C_0 \cdot t^*_i - p^*\right); 0\right] \qquad (5')$$

4. DEMAND SHOCKS AND PRICE ADJUSTMENTS

4.1 ADJUSTMENTS DURING THE MARKETING PERIOD

We start from a long term equilibrium situation, where all variables have been steadily growing at a constant rate, and expectations are equal to actual values. In this case, a typical firm would be at a point like E in Figure 1, in which the growth of its marginal costs curve (cc) is equal to that of its perceived marginal revenues (dd), with its prices growing at a rate pE and its production at a rate qE.

Assuming that firms do not expect any change from the previous pattern, an upwards shift in demand would bring the actual marginal revenues growth curve to d+d+, while the expected

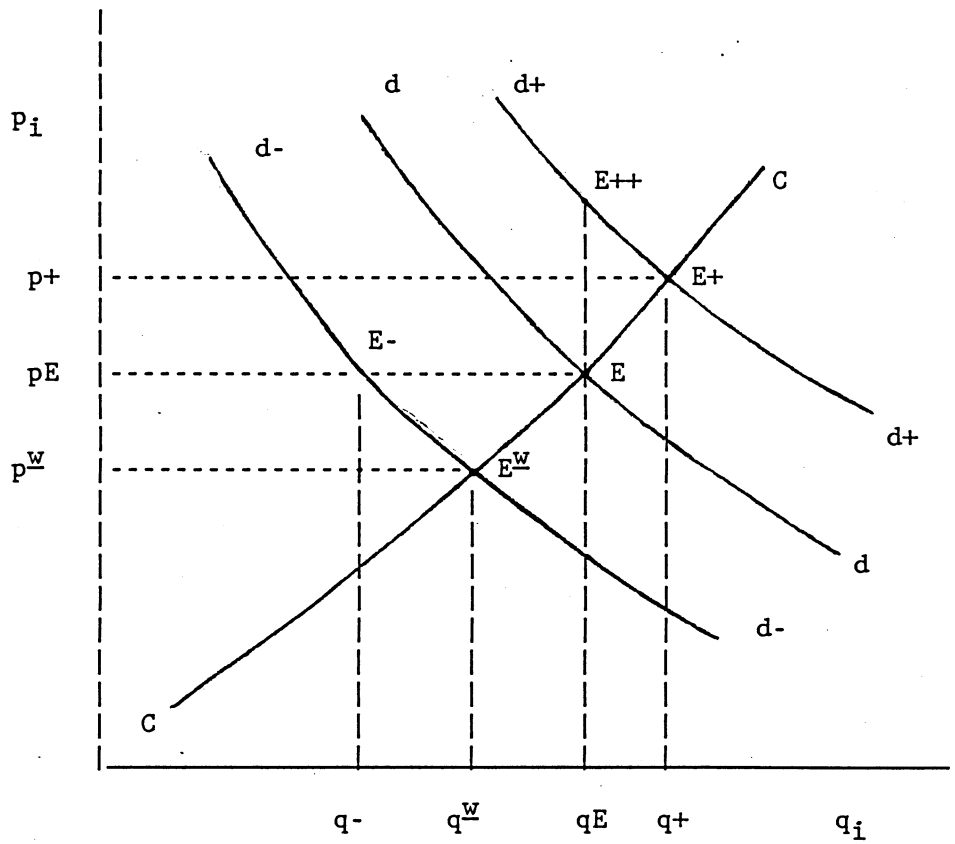
p_i
d
d+
d-
E++
C
p+
E+
E-
pE
E
d+
$p^{\underline{w}}$
$E^{\underline{w}}$
d
d-
C
q-
$q^{\underline{w}}$
qE
q+
q_i

Figure 1

one remains at dd. Given our assumption of increasing costs, there will be no increase in production growth, unless there is an increase in the growth rate of prices.

One possible reaction to the resulting excess demand, even during the marketing period, is that of having unsatisfied demand with some product rationing taking place. However, E+ would be rapidly acknowledged by the firms as their targetted price growth. They could even realize that E++ is a feasible target in the very short run, though it will also last only very briefly if they are profit maximizers, as we have assumed here. Thus, a point like E+ seems to be reached very soon for a profit maximizing firm, quite possibly even shortening the marketing period.10/

When there is an unexpected downwards shift in demand, bringing the actual marginal revenues curve down to d-d-, with the expected one remaining at dd, in the very short term, i.e. during the marketing period, production will grow at a lower rate q-, instead of the expected one of qE. This results in the existence of an excess supply disequilibrium. Notice that, according to our assumptions, the relevant "supply growth curve" during the marketing period could be drawn by linking those segments from points pE, E-, E, E+, and C,11/ or:

$$p_i^{"MP"} = \text{Max}\left[\frac{1}{1-C_0 b_i}\underbrace{(C_1 w + C_2 p_n + C_0 t^*_i - b_i C_0 p^*)}_{\hat{M_g}R^* = \hat{M_g}C};\right.$$

$$\left.\frac{1}{1-C_0 b_i}\underbrace{(C_1 w + C_2 p_n + C_0 t_i - b_i C_0 p)}_{\hat{M_g}R = \hat{M_g}C}\right] \qquad (6)$$

4.2 ADJUSTMENTS TOWARDS A LONGER TERM EQUILIBRIUM

Let us begin from the excess supply disequilibrium situation that we found between q- and qE, and try to find paths towards possible longer run equilibriae, where expectations will be equal to actual values and quantities will tend to be stable again.12/ The type of reaction from the firms will depend mainly on how they reestimate their expected values and what kind of elasticities they perceive in their respective markets.

Let us assume that the demand growth curve will remain at d-d- and that expectations are based on previous values:

$$t^*_i = t^i_{t-1}$$

$$p^* = p_{t-1}$$

This implies that the difference between expected and actual values will take place only in one marketing period, since the new actual growth rates will be incorporated into expectations

for the next one. This simplifying assumption will only speed up the adjustment mechanism, without affecting the direction of the changes to be assumed.

If no other constraints are perceived by the firms, for the next marketing period the expected demand growth curve will be at d-d-, and the new equilibrium point will be at E^{W}, with prices and quantities growing at a p^{W} and q^{W} rates, respectively. There was a quick Walrasian adjustment in prices.

Notice that the typical firm has gone from E- to E^{W}. If all firms behaved in a similar way, the inflation rate remains unchanged at first, and the demand shock is absorbed by a quantity adjustment. Once this new demand curve is perceived, firms are supposed to understand that by lowering their p's they will increase their q's.

However, if firms perceive an inelastic demand for a growth in their prices lower than the traditional one, i.e. a "kinked demand" with an inelastic (and thus irrelevant) portion at prices growing at a rate lower than pE, the conjectural equilibrium will have been reached at PE. Nobody will reduce p, expectations will be equal to actual values, firms will be maximizing their expected profits, and the demand reduction will translate into lower production growth for a longer period than the one predicted by the Walrasian type of analysis.

5. SOME CONCLUDING REMARKS

1. In a monopolistic economy, price responses to contractionary demand shocks will be greatly influenced by the firms' reaction to the "notional" excess supply disequilibrium generated by such a policy.

2. The initial situation will play a very important role in this reaction, particularly if price setters perceive an inelastic demand for relative prices lower than the current ones. In this case, they increase prices at the rate they expect others to do so, making inflation sticky downwards if these expectations are heavily influenced by the inflation rates previously observed.

3. When this is the case, the demand shock could be fully absorbed by a contraction in the economic activity, delaying the price response until common expectations for lower inflation rates are shared throughout the economy.

4. The demand inelasticity makes cost growth largely irrelevant as an explanatory variable for pricing, even when firms are profit maximizers. In this case, they are interested only in the elastic segment of the demand curve, in which marginal revenues are positive. If marginal costs intersect

marginal revenues at some point in their inelastic segment, they will play no role in the determination of prices (of course, if they shift as much as needed to change this situation, then they will become important). Econometric excercises for price formation equations including elements of costs, demand, and inflationary expectations will then show the latter as the significant variable, depending upon previously observed rates. However, other variables could be used to break the expectations spiral (e.g. the exchange rate).

FOOTNOTES

1/ In this sense, we could relate this work to ideas advanced by Okun (1981).

2/ Notice that this assumption is not restricted only to nontraded goods, since it can be applied as well to traded goods when there is some degree of monopoly power in the domestic marketing process.

3/ Unless, as we show below, they face costs constraints due to an unexpected increase in demand and are forced to increase prices (shortening the length of the marketing period). Notice that we are not assuming accumulation of stocks when expectations are not fulfilled; that problem is dealt with elsewhere in the literature (Cavallo, 1977), and its introduction would not significantly affect our analysis.

4/ The possibility of uncertainty in wages and input prices during the marketing period is not explored here, although it can be easily incorporated in the model without affecting our conclusions. The determination of these costs is related to the situation in other markets and, as stated above, what we are trying to highlight here is the behavior in the product market itself. In fact, marketing periods are defined for a lapse in

which factor prices are known. Non traded inputs will not be incorporated in our model, not only for the sake of simplicity, but also because their prices would be eliminated anyway from the final equation when solving for aggregate domestic inflation.

5/ We base these costs and demand equations in formulations previously proposed by Bruno (1978, 1979) and Maccini (1978).

6/ The assumption of a positive c_0 is made in order to allow for a positively sloped marginal cost curve, i.e. the relevant segment for a profit maximizing firm.

7/ For a more detailed explanation, see Bruno (1979).

8/ This property, together with a similar one with respect to the cost functions (marginal equals average cost growth) simplifies our algebra and graphs.

9/ We may consider the possibility of a price discriminating firm which selectively offers lower prices (special discounts) in order to attract new customers. But, if the firm's objective is to transform these random shoppers into future regular customers, it should keep offering them these lower rates. According to Okun (1981, p.149): "The firm can attract only the bargain hunters by cutting its price; and that may by a poor investment

if it expects to raise its price again and thus dissapoint the bargain hunter". In any case, the addition of random and repeat shoppers; demands will still result in a kinked aggregate demand for the firm, the kink given by the discontinuity observed in the regular customers' curves.

10/ This seems to be a reasonable explanation for the quick response of inflation to expansionary demand policies, in cosntrast with the slow reaction to opposite programs, which we wil study below.

11/ As we observe, prices will increase faster than planned when demand increases faster than expected during the marketing period, providing a reason for shortening these for higher inflation rates. These periods will be shorter as well as a response to more continuous changes in demand, usually observed when inflation is high. Equation (6) summarizes this by determining the price growth ($\hat{MC}$) and the higher demand (marginal revenue) growth curve, from either the expected ($\hat{MR}^*$) or the actually observed one ($\hat{MR}$). Initially, the expected one will help setting the prices, but if the actual demand increases faster than expected, then prices will be rapidly adjusted upwards.

12/ We are not assuming in our definition of longer run that

full employment must be achieved throughout the economy, and thus that all markets will be clearing in "notional" terms. That assumption would preclude a Neokeynesian solution from taking place in this time horizon.

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