John
Charlie

SMALL MENU COSTS AND LARGE BUSINESS CYCLES: A MACROECONOMIC MODEL OF MONOPOLY

N. GREGORY MANKIW

Introduction In most Keynesian models, prices are sticky and do not necessarily put all markets in equilibrium at each moment in time. Mankiw shows that "sticky prices can be both privately efficient and socially inefficient." The suboptimal reaction of prices due to a demand shock creates the business cycle. Menu costs, are small but can cause large welfare losses.

Mankiw uses a static model of a monopoly's pricing decision where the firm sets price in advance and can change the price 'ex post' at a small menu cost. The main result is that the firm's price adjustment decisions are not socially optimal.

The Model Consider a monopoly firm with constant cost and in the inverse demand function

$$C = kqN \tag{1}$$

$$P = f(q)N, \tag{2}$$

where N denotes the exogenous level of aggregate demand. It can be the price level, the money stock, or the nominal GNP. Notice that both C and P increase proportionally to N.

Next, normalize with respect to N, and let $c = \frac{C}{N}$ and $p = \frac{P}{N}$. Thus, the firm's problem is independent of aggregate demand and becomes

$$c = kq \tag{3}$$

$$p = f(q) \tag{4}$$

The firm chooses p and q to maximize profits. The optimal p and q are denoted as p_m and q_m.

Price stickiness in the demand contraction case If aggregate demand is lower than expected, the observed price, p_o, is higher than p_m and the firm's profits are reduced by the area $B - A$ as in Figure 1. This must be positive since the firm was at its profit maximizing price.

The firm can now change its price, but at a menu cost of z. The firm, or the social planner will only change its price iff $B - A > z$.

Proposition 1 *Following a contraction in demand, if the firm cuts its price, then doing so is socially optimal.*

If the firm reduces its price, then $B - A > z$. This gives us, $B + C > z + A + C > z$. Therefore, the firm's decision to reduce price is socially optimal.

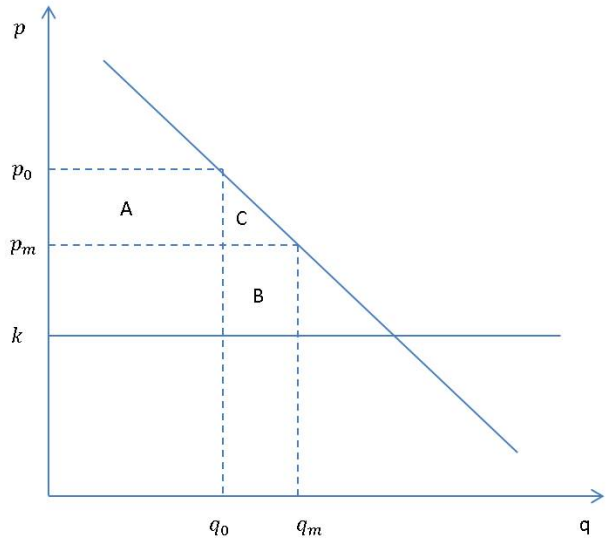

FIGURE 1.

Proposition 2 *Following a contraction in demand, if $B + C > z > B - A$, then the firm does not cut its price to p_m even though doing so would be socially optimal.*

The area $B + C$ is the social benefit and $B - A$ is the private benefit of a price adjustment. For a plausible demand function, the social gains from price are greater than the private gains, suggesting $B + C > B - A$. So, if $z > B - A$ then the firm will not cut its price to the socially optimal p_m, as shown in *Proposition 1*,

Proposition 3. *A contraction in aggregate demand unambiguously reduces the social welfare. If the firm cuts its price in response, then the contraction only has the menu cost z. If not, then the contraction has the possibly much larger cost $B + C$.*

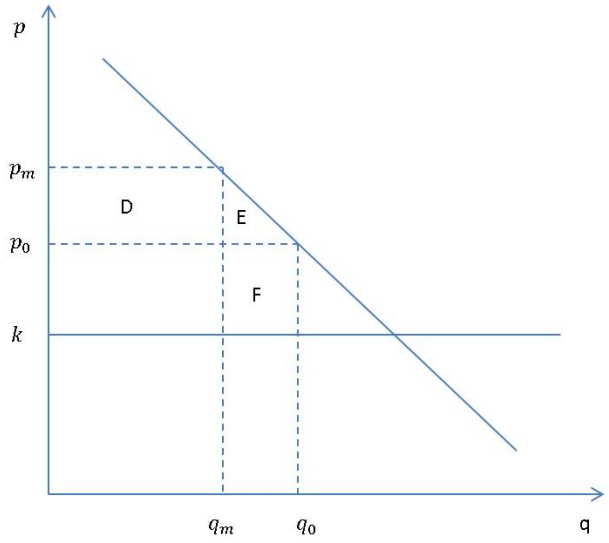

FIGURE 2.

Price stickiness in the demand expansion case If aggregate demand is higher than expected, then $p_0 < p_m$, the real price now is lower than the monopoly price. We have two subcases depending on whether the real price now is higher than marginal cost or lower than marginal cost.

Real price is higher than the marginal cost Here $p_0 > k$ as in Figure 2. Producer surplus is reduced by $D - F > 0$, since p_m is profit-maximizing price. Total surplus is increased by $E + F$. The firm raise its price back to p_m iff $D - F > z$.

Proposition 4. *If the firm resets its price, total surplus is decreased by the menu cost. If the firm does not reset its price, surplus will increase by* $E + F$.

Real price is below the marginal cost Here $p_0 < k$ as in Figure 3. Consumer surplus increases by $G + J$, producer surplus decreases by $G + H + I$. Thus, total surplus decreases by $I - J$. The firm resets its price to equilibrium if $G + H + I > z$.

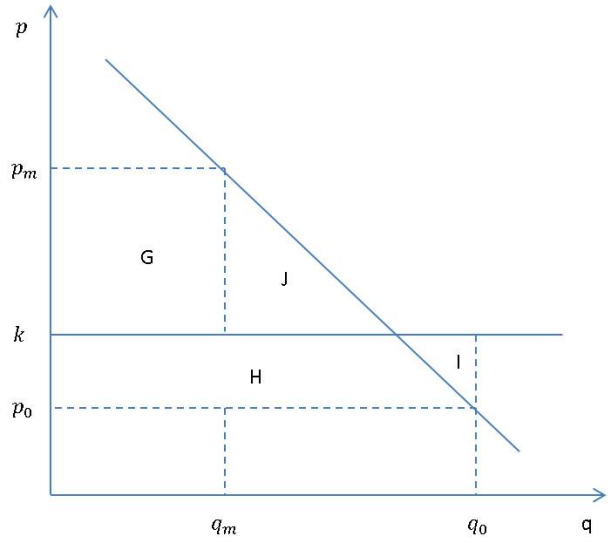

FIGURE 3.

Proposition 5. *If the firm resets its price, total surplus is decreased by the menu cost. If the firm does not reset its price, total surplus change is ambiguous, but total surplus does not decrease by more than the menu cost.*(proof: if the firm does not reset its price, then $G + H + I < Z$, This implies that $I - J < z - J - G - H < z$.)

Proposition 6. *An expansion in aggregate demand reduces welfare by no more than the menu cost, and may even increase welfare. A contraction in aggregate demand unambiguously reduces welfare, possibly by much more than the menu cost.*

Conclusion The main objective of this paper is to examine the efficiency effect of price stickiness due to menu cost (i.e. if firm don't set price back to equilibrium due to menu cost, how the total welfare changes), since setting price back will at most cause menu cost loss to the firm or society. It turns out that in the demand expansion case, if firm don't set price back, total welfare could increase or decrease but will not decrease by more than the menu cost. In the demand contraction case,

total welfare always decreases, and sometime decreases by **much more than the menu cost**. The followings are the main conclusions of this paper:

- Trivial menu cost can cause a large welfare loss.
- The model displays an asymmetry between contractions and expansions, since the natural rate of output is below the social optimum.
- From the viewpoint of a social planner, the nominal price level maybe "stuck" too high, but it is never "stuck" too low.
- The models asymmetry parallels an observed phenomenon: namely, that while aggregate demand contractions are associated with grotesquely inefficient underproduction, aggregate demand expansions are not associated with similarly inefficient overproduction.
- The primary conclusion that trivial menu costs have important efficiency effects would remain true in the context of general equilibrium.(e.g. interfirm purchase would exacerbate price rigidity)
- Monetary authority could react to stabilize the exogenous demand shocks to mitigate the efficiency effect of trivial menu cost.