Resale price controls and non-price competition in the fluid milk industry
by Thomas Vance Cummings

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Applied Economics
Montana State University

Abstract:
The impact of resale price controls on the number of firms in a market is considered. To study the influence of price controls on the number of firms a model for non-price competition in a price regulated market is presented. The model explores how non-price competition in a competitive, but price regulated, market shifts a firm's cost curves. The shift in the cost curves for individual firms in the regulated market is related to changes in the number and size of firms in the market. It is concluded that the effects of price regulation on the number and size of firms cannot be determined a priori without more limiting assumptions or information. In an attempt to empirically determine how price controls may affect the number of firms in a market the fluid milk industry is examined. Using both a system of equations and a single equation the influence or regulation on the number of plants is estimated. Based on the econometric results it is concluded that price controls have a tendency to increase the number of plants in a market, but the effect is not statistically significant.

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ABSTRACT

The impact of resale price controls on the number of firms in a market is considered. To study the influence of price controls on the number of firms a model for non-price competition in a price regulated market is presented. The model explores how non-price competition in a competitive, but price regulated, market shifts a firm's cost curves. The shift in the cost curves for individual firms in the regulated market is related to changes in the number and size of firms in the market. It is concluded that the effects of price regulation on the number and size of firms cannot be determined a priori without more limiting assumptions or information. In an attempt to empirically determine how price controls may affect the number of firms in a market the fluid milk industry is examined. Using both a system of equations and a single equation the influence or regulation on the number of plants is estimated. Based on the econometric results it is concluded that price controls have a tendency to increase the number of plants in a market, but the effect is not statistically significant.

CHAPTER 1

INTRODUCTION

The purpose of this thesis is to consider the effects of resale (retail and wholesale) price controls on the structure of an industry. Specifically, the impact of a regulated price, set above the equilibrium price, on the number of firms in a market will be examined. In an attempt to empirically estimate the effects of price regulation on the number of firms, this study will focus on the fluid milk industry. The fluid milk industry's long history of price controls provides economists with an excellent opportunity to analyze this type of problem.

Price controls were introduced into the fluid milk industry during the 1930s because of an alleged need to stabilize the industry. Kessel (1967) argues that the claimed instability was a result of producers trying to maintain a two-price system for fluid and manufactured milk.[1] In this system, producers attempted to obtain a relatively high price for fluid milk and a lower price for manufactured milk. Competition, however, led to instability in the two-price system. Because fluid milk dealers could find producers willing to sell their milk for the manufactured price, the price differential was often reduced until it only reflected cost differences. As a result, Kessel argues the two-price systems "were unstable and hence produced instability in milk prices to producers and handlers."[2]

In an attempt to stabilize the fluid milk industry, price controls were established at both the federal and state levels. The federal government, after unsuccessfully regulating retail prices, shifted its policy to establishing minimum class prices for milk sold by farmers to milk handlers. State governments, on the other hand, passed regulations for controlling milk prices at the producer, wholesale, and retail levels. The state controls, initially regarded as temporary measures, became a permanent part of the fluid milk industry. Although the number of states regulating resale prices gradually declined after 1940, the trend reversed by the late 1950s. In 1964 and again from 1966 to 1970 a post-war high of fifteen states regulated resale prices.[3] Today only Maine, Montana, Nevada, North Dakota, and Pennsylvania regulate retail milk prices. Several other states regulate producer prices.

These statistics indicate that at one time resale price controls were a major movement in the fluid milk industry. Since over 30 percent of the states have implemented price controls, it is possible price controls have had a significant impact on the number and size of fluid milk processors in the industry. The model presented in Chapter 3 argues price controls can influence the number and size of firms by restricting competition to non-price margins. The resulting non-price competition shifts the cost functions of the firms in the market. Changes in the cost of production can lead to changes in the number and size of firms. Therefore, states which have enacted price controls may have played an important role in determining the number and size of fluid milk processors.

As previously mentioned, one of the reasons given for price controls has been the argument that controls would stabilize the fluid milk industry. One method in which price controls would supposedly accomplish this stabilization goal is by preventing price wars among wholesalers and retailers. Price wars would presumably hurt dairy farmers by driving wholesalers or retailers out of business. A reduction in the number of firms would give the remaining distributors or retailers monopsony power. Although the above argument for price controls is suspicious, the predicted effects of the controls may still be valid.[4] That is, price controls may prevent smaller firms from going out of business. A USDA (1971) report indicates that states with price controls may indeed be keeping smaller firms in business. "In nine states with retail price control for all of the 18 years between 1948 and 1965, the decline in plant numbers was 44 percent, compared with 55 percent in 33 states that did not have retail price control."[5]

This study will attempt to determine the impact of resale price controls on the number of fluid milk firms in a market. The results will indicate if resale price controls have acted to keep small fluid milk processors in business, firms that might not survive in an unregulated market. Such information could be useful in determining who benefits from price controls and, therefore, who would want them.

Although this report will focus on resale price controls in the fluid milk industry, other facets of the industry are also regulated. Trade practices such as sales below cost, price discrimination, discounts, and rebates are also regulated. In addition, some states

require price filing at the retail and/or wholesale level.[6] Antitrust regulation has also been extensive in the industry.[7]

In spite of the numerous forms of regulation in the fluid milk industry, this thesis will limit its scope to the effects of resale price controls on the number of firms in a market. The relevant theoretical work is reviewed in the following chapter. Chapter 3 develops a new theoretical model which tries to analyze the effects of price regulation in terms of non-price competition. Results of previous econometric analyses and the results obtained in this study are presented in Chapter 4. Finally, Chapter 5 contains the summary and conclusions of the thesis.

FOOTNOTES

[1]Reuben Kessel, "Economic Effects of Federal Regulation of Milk Markets," The Journal of Law and Economics 10 (October 1967):52.

[2]Ibid.

[3]U.S., Department of Agriculture, Economic Research Service, Dairy Outlook and Situation, (Washington, D.C., September 1971), p. 25.

[4]Johnson points out that states which regulate retail prices also regulate producer prices or have producer prices determined by a federal milk marketing order. Hence, the monopsony power of distributors would be limited. Ronald N. Johnson, "Retail Price Controls in the Dairy Industry: A Political Coalition Argument," Working paper (August 1983), pp. 3-4.

[5]U.S., Department of Agriculture, Economic Research Service, "Pricing Milk and Dairy Products: Principles, Practices, and Problems," AER No. 207, (Washington, D.C., June 1971), p. 53. Cited by Charles N. Shaw, "Economic Effects of Resale Price Regulation on Market Performance in the Fluid Milk Industry" (Ph.D. dissertation, Pennsylvania State University, 1973), p. 14.

[6]U.S., Department of Agriculture, Economics, Statistics, and Cooperative Service," Government's Role in Pricing Fluid Milk in the United States," AER No. 397, (Washington, D.C.: Government Printing Office, 1978), p. 16.

[7]U.S., Federal Trade Commission, Economic Report on the Dairy Industry, by Russel C. Parker, (Washington, D.C.: Government Printing Office, March 1973), pp. 12-22.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews previous studies which can be used to evaluate the effects of resale price regulation on the number of firms in a market. The general conclusion reached by most of these investigations is resale price regulation leads to more and smaller firms operating in the market. Although Chapter 3 will argue that there are other possible results under resale price controls, it is still important to examine these studies to see how their conclusions were reached. The discussion will begin by examining the work of Masson and DeBrock (1980).

Masson and DeBrock's Model

Masson and DeBrock have attempted to model the effects of retail price regulation on an industry. Using Chamberlin's monopolistic competition framework, Masson and DeBrock's model implies that retail price regulation results in more firms producing at a smaller rate of output (as compared to a non-regulated market). Their graphical model is reproduced in Figure 1.

Masson and DeBrock use the standard monopolistic competition argument where each firm perceives a relatively more elastic demand curve (curve d in Figure 1) than the demand curve it actually faces (curve D in Figure 1). This inaccurate perception is the result of each firm believing it can change its own price without other firms reacting

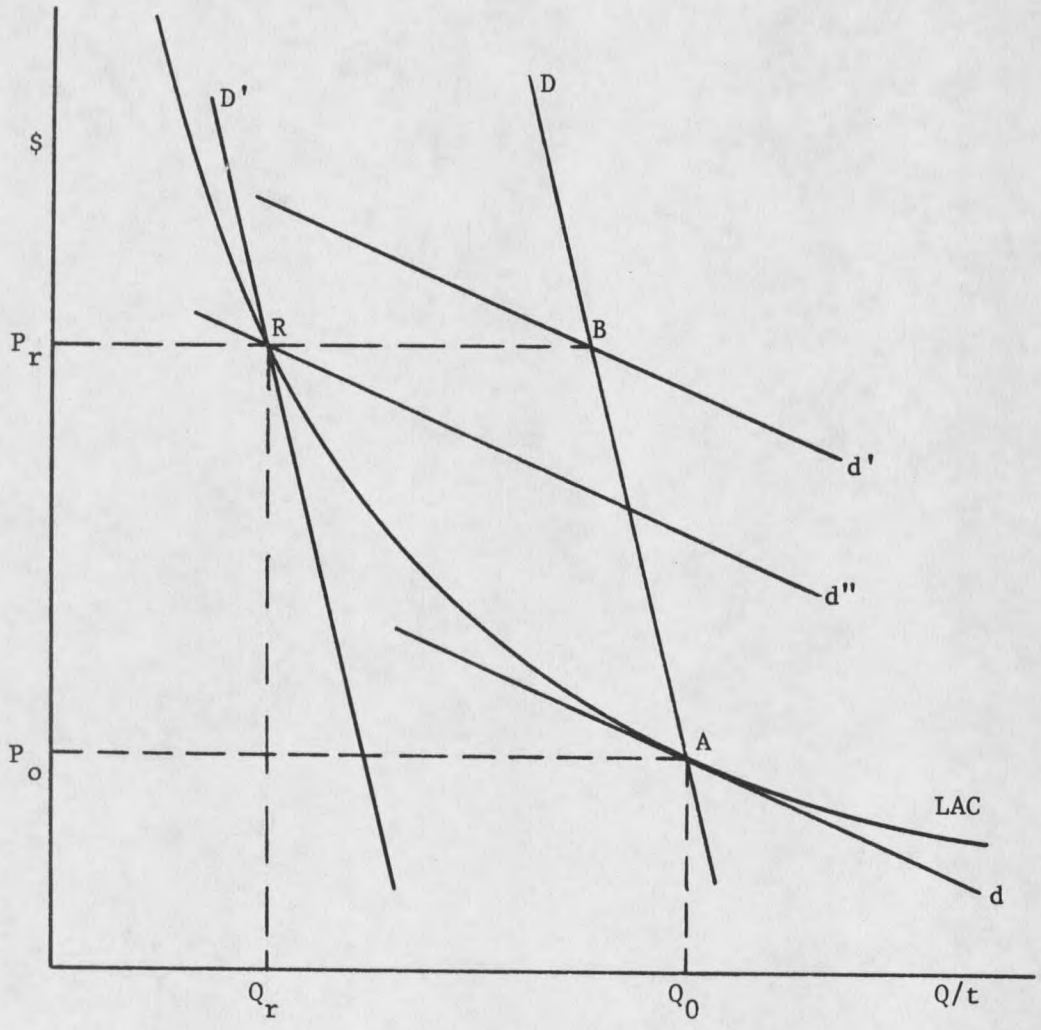

Figure 1. Masson and DeBrock Model.

Source: Robert Masson and Lawrence DeBrock, "The Structural Effects of State Regulation of Retail Fluid Milk Prices," The Review of Economics and Statistics 62 (May 1980):225.

to the price change. However, D is the appropriate demand curve because it takes into consideration the change in sales when all firms in the industry simultaneously change price. D is obtained by dividing the total market demand by the number of firms in the market.

Point A in Figure 1 represents the market equilibrium position without price regulation and equilibrium price P_o and quantity Q_o. With the introduction of price regulation, price is assumed to be set at a level higher than P_o. If P_r is the regulated price, firms will initially move to point B where they will earn profits. Profits will attract new firms into the industry; this entry will reduce each firm's market share. The reduction in market share shifts D to the left until it reaches D'. On D' firms will operate at point R where only a normal rate of return is earned, stopping entry into the industry. The result of the regulated price is, in this model, an increased number of firms operating at a smaller scale compared to the unregulated equilibrium.

Gould and Preston's Model

Looking at a similar situation under resale price maintenance (r.p.m.), Gould and Preston (1965) present a model where r.p.m. results in more and smaller retail firms. After assuming the manufacturer is successful in maintaining r.p.m. and that retailers believe they can not increase their sales volume with additional expenditures, Gould and Preston begin their argument by showing the relationship between the margin and the size of the retail outlet under r.p.m. The diagram they used to demonstrate their argument is reproduced in Figure 2.

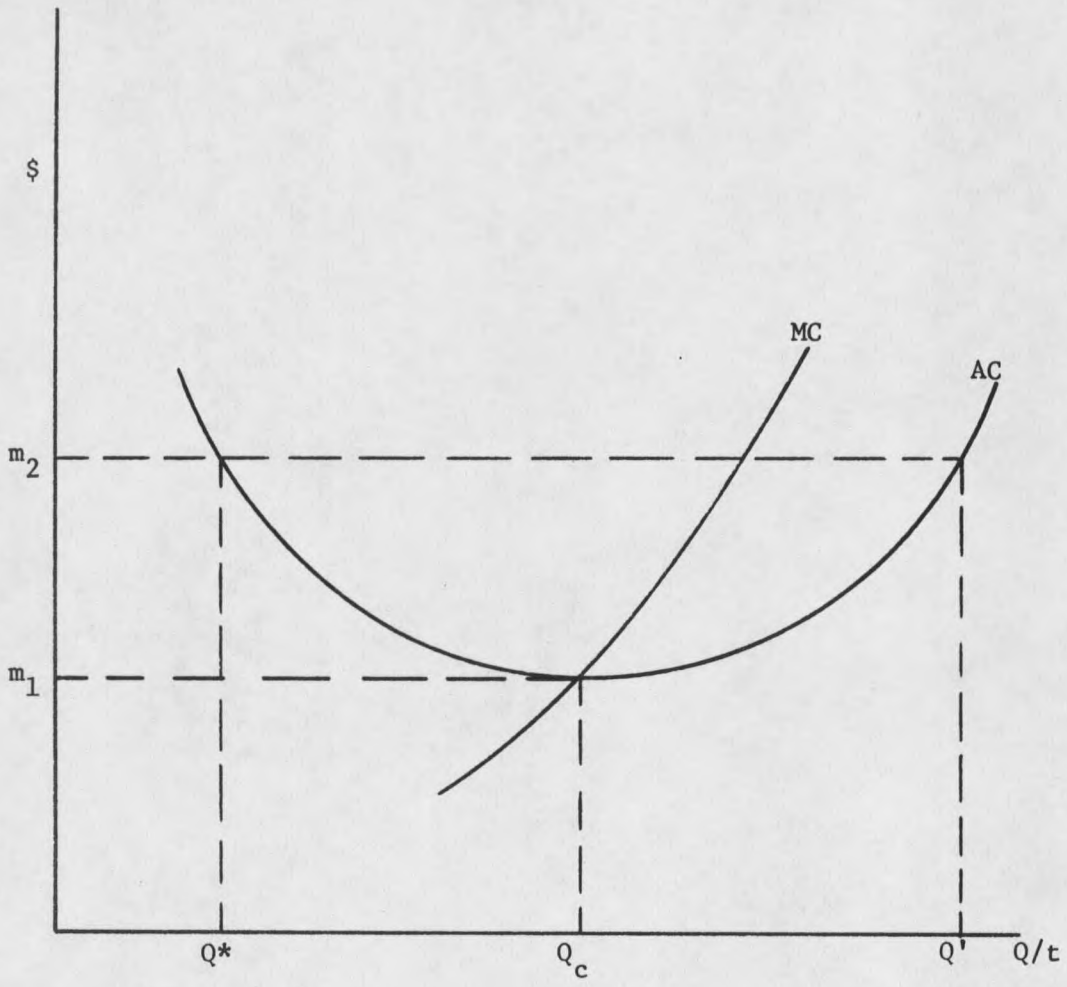

Figure 2. Gould and Preston Model.

Source: J. R. Gould and L. E. Preston, "Resale Price Maintenance and Retail Outlets," Economica 32 (August 1965):304.

In Figure 2, Q_c represents the competitive equilibrium quantity where average per unit retail cost equals the average per unit margin (M_1). (The margin equals the retail price minus the manufacturer's price.) When the manufacturer introduces r.p.m. the margin increases to M_2. At margin M_2 there are only two possible quantities that correspond to zero economic profits, Q' and Q*. Gould and Preston argue that firms will not operate at Q' because marginal cost exceeds marginal revenue. As firms reduce output from Q' they will begin to make a profit which will induce new firms to enter the industry. Firms will continue to enter the industry until the economic profits disappear, which occurs at the output rate Q*. Gould and Preston state that "the falling phase of the average retail operating cost curve may be said to define the size of the retail firm as a function of the unit margin established by the manufacturer practicing r.p.m."[1] Therefore, Gould and Preston conclude that r.p.m. results in more and smaller firms. They ignore the possibility of firms merging in order to move down the average cost curve to obtain economic profits. Also, at Q* marginal revenue does not equal marginal cost, a fact which led them to rule out Q' as a possible equilibrium position. The possibility of merging and the fact marginal revenue does not equal marginal cost indicates Q* is a far less stable equilibrium than Gould and Preston presume.

Both Masson and DeBrock and Gould and Preston have ignored the implications of non-price competition. Although Gould and Preston do mention that firms may attempt to expand sales by special services or advertising they do not present an explicit model describing the effects of such non-price competition.[2] Telser (1960) states that the quantity

sold of a product can be a function of both price and services provided with the product. He also mentions that one of the reasons manufacturers may practice resale price maintenance is that they believe retailers will be induced to provide their products with special presale services. Such special services might include demonstrations of the product or additional advertising. Manufacturers hope that these additional services will entice more consumers to buy the product, shifting the demand curve for the product to the right. It must be remembered that under resale price maintenance, manufacturers specify the minimum price at which retailers may sell their product and that this price (if it is to have meaning) is above the market equilibrium price. This situation is very similar to retail price controls where the product's price is fixed by government fiat above the market equilibrium price. It seems reasonable, therefore, that firms in a price regulated market may also try to compete in a non-price manner.

Stigler (1968) and White (1972) have looked at non-price competition in price regulated industries. Unfortunately, both studies approached the problem by holding the number of firms in the industry fixed. Nevertheless, Stigler and White present arguments which state that firms will tend to compete away potential profits by offering a higher quality product. Koutsoyiannis (1982) has also looked at this question. The rest of this chapter will be used to examine his model.

Koutsoyiannis' Model

Koutsoyiannis views the product of a firm as a multidimensional variable which may include characteristics like quality, design, style,

special services, and technical attributes. These are the dimensions firms may compete on when price is regulated.

For a given market Koutsoyiannis assumes all firms produce a product equal in quality but different in some attribute like color or design. "It is also assumed that each firm produces a single variety and that within each quality grade the preferences of buyers are equally distributed."[3] Assuming costs for the same quality grade are equal across firms, Koutsoyiannis argues that the above assumptions imply firms have equal market shares.[4]

Another important assumption made by Koutsoyiannis is that average cost and demand are assumed to be increasing functions of quality, with demand increasing at a decreasing rate. That is, each successively higher level of quality will shift the demand curve to the right, with each shift being smaller than the previous one. Figure 3 represents this process. In Figure 3 each consecutively higher cost curve represents a higher quality level which has a corresponding demand curve. The price is given and denoted as $\bar{P}$.

As the firm increases the quality level of its product it moves up to a higher average cost curve and a higher level of demand. If the set of points on each of the average cost curves which represent the quantity produced for each level of quality (as determined by demand) were to be traced out, the resulting curve would be the firm's average cost option (ACO) curve.

The ACO curve shows the cost of supplying the quantities demanded for the different quality levels at the given price P. As Koutsoyiannis points out, "The shape of the ACO curve depends on the shape and shift

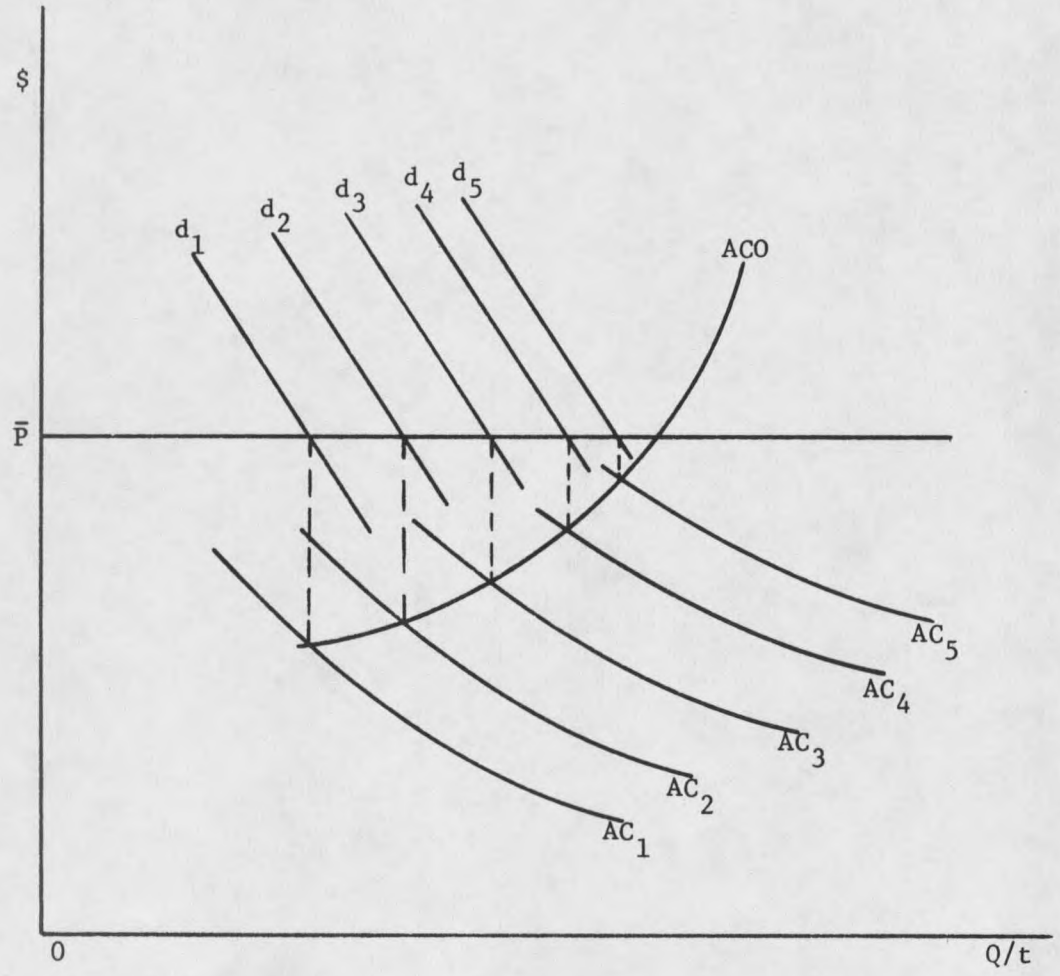

Figure 3. Derivation of the ACO Curve.

Source: A. Koutsoyiannis, Non-Price Decisions, New York: St. Martin's Press, 1982, p. 14.

of the average cost curves."[5] If firms were to move into the industry, the ACO curve would shift to the left. This is the result of the demand curves (d_i in Figure 3) shifting to the left, reflecting the smaller market share of each firm. Similarly, as firms exit the remaining firms will each have a larger share of the market, causing their demand curves to shift their ACO curve to the right.

Koutsoyiannis also discusses the marginal cost option (MCO) curve "which shows the rate at which cost changes in order to supply an additional unit of output of improved quality (his emphasis)."[6] The relationship between MCO and ACO is the same as the relationship between all marginal and average functions.

Figure 4 shows the short run equilibrium for a firm in Koutsoyiannis' framework. In the short run the firm will produce where the price $\bar{P}$ (which equals marginal revenue) equals MCO. The firm will produce the quantity Q* as determined by the demand curve d* and the average cost curve AC*.

Because the firm in Figure 4 is earning profits new firms will enter the industry. Entry will decrease each firm's share of the market and shift the demand curve d* to the left. This will generate a new set of ACO and MCO curves which are to the left of the short-run equilibrium point. Entry will continue until all the firms are making a normal rate of return. This occurs when the ACO curve is tangent to the price line as shown in Figure 5.

At the long-run equilibrium point, price $\bar{P}$ equals MCO which equals ACO. Compared to the short-run equilibrium in Figure 4, the long-run equilibrium consists of more and smaller firms ($Q' < Q^*$).

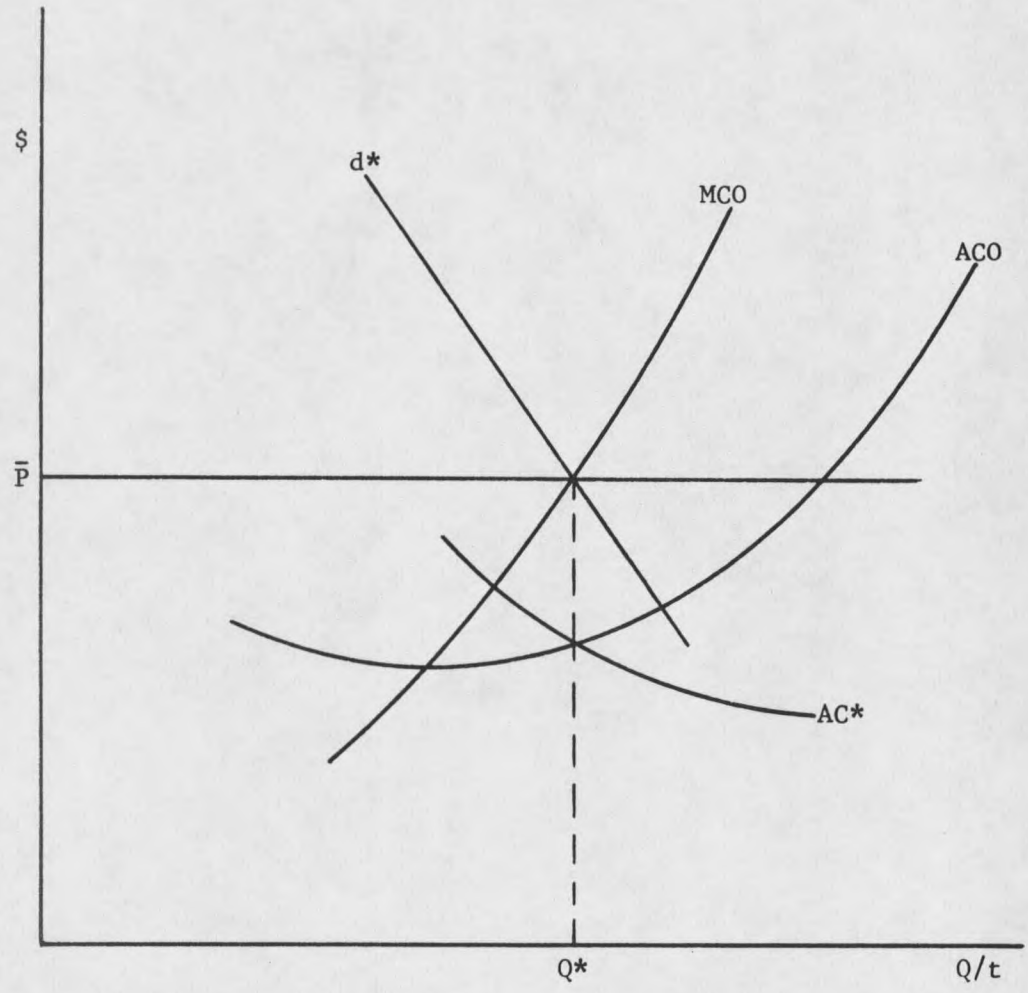

Figure 4. Short-Run Equilibrium.

Source: A. Koutsoyiannis, Non-Price Decisions, New York: St. Martin's Press, 1982, p. 18.

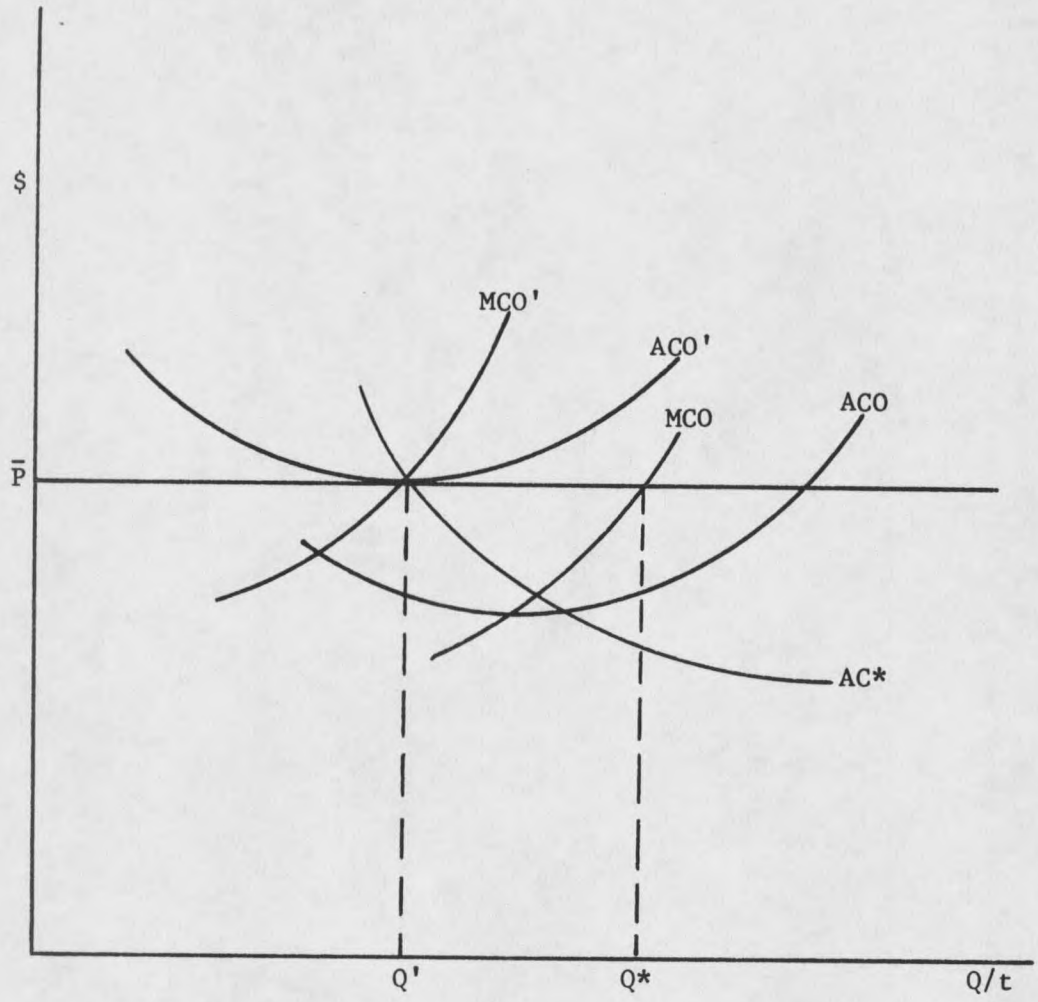

Figure 5. Long-Run Equilibrium.

Source: A. Koutsoyiannis, Non-Price Decisions, New York: St. Martin's Press, 1982, p. 19.

It is important to note that Koutsoyiannis has assumed that the market price is given. By this he means:

> Price can be given either by custom, by government regulation, by a leader, by collusion, or it may have been established in the market without collusion as a result of the historical evolution of moves and counter moves of rival firms; or price may have been set by a previous decision of the firm.[7]

If it is assumed that the price level in the long-run equilibrium position shown in Figure 5 is unregulated and that regulation establishes a price above $\bar{P}$, then the equilibrium position under price regulation will be to the left of Q'. (The adjusting mechanism would be the same as that described above.) This implies that even when non-price competition is considered, retail price controls will lead to more and smaller firms operating in the market, a conclusion consistent with Masson and DeBrock and Gould and Preston.

Although Koutsoyiannis claims the equilibrium represented in Figure 5 is a long-run equilibrium, he fails to explain why a firm does not expand output along AC*. Apparently, Koutsoyiannis' assumption of equal market shares and equal distribution of buyer preferences is supposed to constrain firms from expanding sales. Unable to expand sales, firms presumably operate to the left of the minimum point on the average cost curve AC*. However, if firms somehow broaden the appeal of their product (by producing the product in a wide variety of colors, for example) then sales could possibly expand, allowing firms to move down AC*. If this possibility is considered, then Koutsoyiannis' long-run equilibrium, as shown in Figure 5, appears to be based on a tenuous argument.[8]

Chapter Summary

This chapter has examined the models of Masson and DeBrock, Gould and Preston, and Koutsoyiannis. Masson and DeBrock and Gould and Preston's models were found to be lacking because they did not consider non-price competition in price regulated markets. Although Koutsoyiannis' model focused on non-price competition, it contains questionable assumptions. The long-run equilibrium in his model does not appear to be stable because firms are not operating at the minimum point on the average cost curve (AC* in Figure 5).

The next chapter presents a model for non-price competition in a price regulated market. The model considers the effects of non-price competition on a firm's cost function. Specifically, the model explores how non-price competition in a competitive environment shifts a firm's cost curves. The shift in the cost curves for firms in the regulated market is then related to changes in the number and size of firms in the market.

FOOTNOTES

[1]J. R. Gould and L. E. Preston, "Resale Price Maintenance and Retail Outlets," Economica 32 (August 1965): 304.

[2]Ibid., pp. 311-312.

[3]A. Koutsoyiannis, Non-Price Decisions: The Firm in a Modern Context (New York: St. Martin's Press, 1982), p. 12.

[4]Ibid.

[5]Ibid., p. 15.

[6]Ibid., p. 17.

[7]Ibid., footnote 16, p. 12.

[8]Koutsoyiannis offers a model of cut-throat product competition which results in an equilibrium where firms operate on the minimum point of AC* (pp. 29-30). He develops the cut-throat model by assuming firms are willing to accept losses in order to increase their market share, firms believe an increase in quality will force other firms out of the market, and firms maximize sales not profits. However, the model presented in Chapter 3 also obtains an equilibrium where firms operate at the minimum point on their average cost curves. The model obtains this equilibrium without the assumptions of cut-throat product competition.

CHAPTER 3

A MODEL FOR NON-PRICE COMPETITION IN THE FLUID MILK INDUSTRY

The previous chapter discussed different models that could be used to analyze the effects of resale price controls on the number and size of firms in a market. This chapter presents an alternative model. It is argued that when an industry is regulated by price controls the firms in the industry compete in a non-price fashion through changes in the service level. Furthermore, it is shown that this non-price competition is difficult to adequately model and, as a result, it is difficult to predict what will happen to the size and number of firms in the regulated industry.

Assume an industry is in a long-run competitive equilibrium position with price P^o, total production Q^o, and firm production q^o, as shown in Figure 6. If resale price controls are introduced and the regulated price p^r is set above the equilibrium price P^o, firms will be making an economic profit at the output rate q^o. Gould and Preston argued that firms will enter the market until production per firm drops to q'. However, they failed to mention the incentive for firms to merge, move down the average cost curve, and obtain economic profits. Furthermore, as Stigler and White have argued, firms will try to increase their share of the market by offering a higher quality product, and in the process, compete away any potential profits.

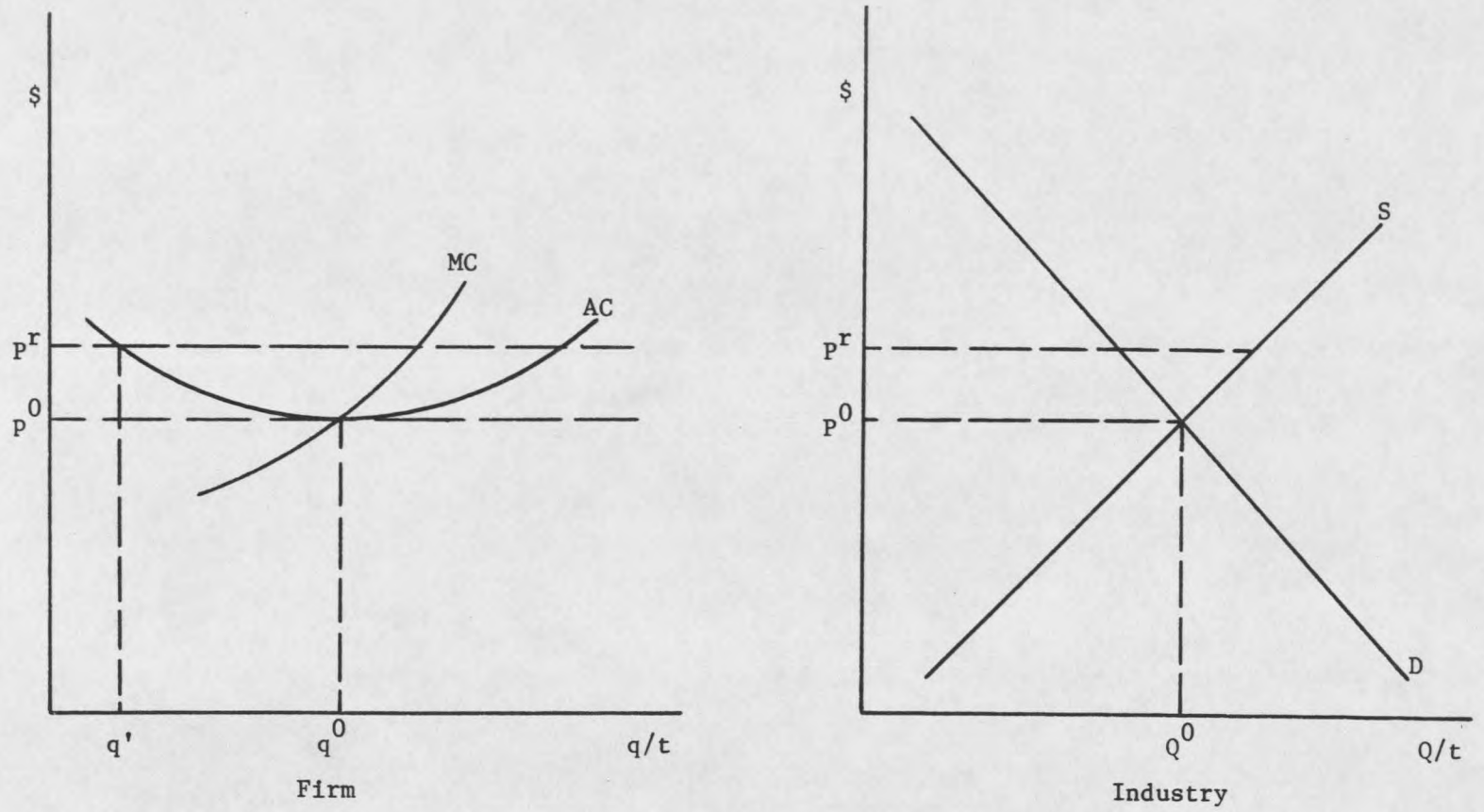

Figure 6. Long-Run Competitive Equilibrium.

Non-Price Competition in the Milk Industry

The milk industry has exhibited both of these effects (mergers and non-price competition). A 1973 report on the dairy industry done by the Federal Trade Commission shows the industry has averaged 160 mergers per year between 1920 and 1972.[1] The report also mentions some of the forms non-price competition has taken. The report states:

> It has been customary in the dairy industry for the processors to finance some capital investments for their customers. A typical example is in store refrigeration equipment such as the dairy case. This and other equipment might be provided on a long-term, interest-free basis as a means of retaining the customer as an outlet.[2]

Campbell and Marshall (1975) have stated that in markets with fixed prices, handlers tend to compete for store accounts by marking prices, stocking, arranging display cases, and providing other services.[3] A study by Williams et al. (1970), on the midwest dairy industry states that in the fluid milk and ice cream industries:

> Implicit price competition and non-price competition involve a variety of practices, such as providing advertising allowances or rebates, providing free display cases, servicing and repair of display equipment, and loans or other financing of retailers. The existence of these practices is well established in the literature . . . .[4]

Bartlett has also noted the existence of such practices.[5]

But as was mentioned in the introduction, trade practices are regulated in the milk industry. In 1981, 25 states regulated trade practices in the milk industry.[6] Federal laws also apply to many of the trade practices in the industry.[7] The existence of such laws implies that many of the above mentioned forms of non-price competition are illegal. The presence of resale price laws will lead firms to practice

illegal forms of non-price competition if the expected benefits are greater than the expected costs. Bartlett has written:

> State control of retail prices has created a situation in which efficient distributors are prevented from offering the consumer the benefit of their savings. Under such conditions some distributors have sought to increase sales by offering wholesalers services and discounts that are considered illegal. The total number of individuals, locations and opportunities available for breaking the law is so great that adequate policing is nearly impossible.[8]

Williams et al. have also mentioned that firms are competing illegally by using some forms of non-price competition in the fluid milk industry. In discussing the enforcement problem they state:

> Much of the legislation is inherently difficult to enforce, both because it is hard to define the prohibited practices precisely and because many of those practices, such as granting rebates, are easily hidden yet accepted as general practice by the trade.[9]

This evidence indicates that even though many forms of non-price competition in the fluid milk industry are illegal, they are nevertheless practiced. This is an important point because the model developed in this chapter will center on the possible results of non-price competition in a price-regulated market. Since the model will be applied to the fluid milk industry it will be argued that firms in that industry compete along non-price margins even though it is illegal to do so.

Non-Price Competition and the Firm's Cost Function

As firms begin to compete in a non-price manner their costs will increase. Because cost curves are derived from some production function

$$Q = f(X_1, X_2, \ldots, X_n)$$

where the X_is are factor inputs and Q is a uniform output, a change in the product implies a new production function and a new set of cost curves. Non-price competition may involve adding new inputs or mixing previous inputs in a new manner in order to obtain the change in product.

Without knowledge of the cost functions it would seem difficult to predict where the new average cost curve (for the new product) is located in relation to the previous cost curve. Although the new average cost curve will be located above the old curve, it appears difficult to determine where above the old curve it will be. The new curve could be to the left, right, or directly above the previous average cost curve. Furthermore, if changes are made to the physical product it appears inappropriate to even compare outputs resulting from two different production functions.

In order to avoid problems of comparing rates of output, the assumption that no changes are made to the physical product in non-price competition will be made. Instead, it will be assumed that firms compete by offering increased levels of service. This assumption seems especially appropriate for the fluid milk industry where changes in the physical product have been limited and competition through service levels is known to exist.

A modified version of Silberberg's (1978) analysis of factor price changes for firms in a long-run equilibrium shall be used to demonstrate the possible effects of non-price competition. Assuming no changes in the physical product, the difficulty of predicting the shifts in a firm's cost function (caused by a change in the service level) is

demonstrated. In trying to determine the shifts of the cost curves resulting from a change in the service level, the analysis will center on the output rate associated with the minimum average cost.

In a highly competitive model where the firms are price takers the point of minimum average cost can be represented by

$$MC(\bar{w}, y', \alpha) = AC(\bar{w}, y', \alpha) \qquad (1)$$

where MC and AC are the marginal and average cost functions, respectively. These costs are written as functions of a factor price vector $\bar{w}$, the output rate associated with the minimum unit cost y', and a shift parameter α. The shift parameter is used to displace the equilibrium of the firm and can be interpreted as the service level associated with the output rate y'.

Because the change in the output rate associated with the minimum average cost (y') caused by a change in the service level (α) is being considered, the function

$$y' = \hat{y}(\alpha) \qquad (2)$$

is assumed to exist. In order to use the implicit function theorem it is sufficient for the partial of the function

$$MC(\bar{w}, y', \alpha) - AC(\bar{w}, y', \alpha) = 0$$

with respect to y' to not equal zero. That is,

$$\frac{\partial MC}{\partial y'} - \frac{\partial AC}{\partial y'} \neq 0 \; . \qquad (3)$$

The term $\partial AC/\partial y'$ equals zero since y' is the output rate at the minimum point on the average cost curve. If we assume the typical U shaped average cost curve, then $\partial MC/\partial y'$ is greater than zero at the minimum of the average cost function.

Substituting (2) into (1) results in

$$MC(\bar{w}, \hat{y}(\alpha), \alpha) = AC(\bar{w}, \hat{y}(\alpha), \alpha). \tag{4}$$

Differentiating (4) with respect to α yields

$$\frac{\partial MC}{\partial \alpha} + \frac{\partial MC}{\partial y'} \frac{\partial \hat{y}}{\partial \alpha} = \frac{\partial AC}{\partial \alpha} + \frac{\partial AC}{\partial y'} \frac{\partial \hat{y}}{\partial \alpha} . \tag{5}$$

Again, $\partial AC/\partial y' = 0$. This means the last term in (5) drops out. Solving (5) for $\partial \hat{y}/\partial \alpha$ yields

$$\frac{\partial \hat{y}}{\partial \alpha} = \frac{1}{\frac{\partial MC}{\partial y'}} \left[\frac{\partial AC}{\partial \alpha} - \frac{\partial MC}{\partial \alpha}\right] \tag{6}$$

Equation (6) represents the change in the output at minimum average cost due to a change in the service level. Since $\partial MC/\partial y' > 0$ the change in y depends on the magnitudes of $\partial AC/\partial \alpha$ and $\partial MC/\partial \alpha$. The relative size of these partial derivatives cannot be determined without a more restrictive set of assumptions or additional information. Consequently, it is not possible to determine which way the cost curve shifts when the service level is changed. If the marginal cost curve shifts less than the average cost curve the minimum point of the new average cost curve will be to the right of the old minimum and vice versa. It is also possible for the two magnitudes to cancel each other out, leaving the new minimum point at the same output rate (but at a higher level of cost).

It is possible for the cost curves to make these kinds of shifts if the service level is increased. For example, if an increase in service means servicemen must do more work then their wages may have to be increased. Silberberg has shown that an increase in a factor price can, if the output elasticity of the factor is greater than one, shift the

cost curves to the left. If the elasticity equals one the curves shift straight up. An elasticity less than one shifts the curves to the right.[10] Also, if the firm purchases a new piece of equipment to increase its service level, its fixed costs increase. The increase in fixed costs shifts the firm's average cost curve up along the marginal cost curve. This shift results in the minimum point of the new average cost curve to be located to the right of the old minimum.

In any event, it is clear from equation (6) that without additional information regarding the cost functions of a firm, it is difficult to predict where the firm's cost curves will shift. This point has important implications. Referring back to Figure 6, p^o and q^o represent the long-run equilibrium price and output for a firm. If retail price controls are introduced and the regulated price p^r is set above p^o, the market is thrown out of equilibrium. Producers would like to produce more at the higher price than consumers are willing to pay. Firms will use non-price competition in an attempt to increase their market share. Non-price competition, such as a higher level of service, will increase the firm's costs. Unfortunately, the ambiguous results of equation (6) means a priori reasoning can go no further. The firm's new rate of output can be greater than, less than, or equal to the initial equilibrium output rate q^o.

Up to this point the analysis has concentrated on the effects of non-price competition on a single firm. Equation (6) has been used to demonstrate that non-price competition shifts to the firm's cost curves in indeterminate fashion. Now the discussion will turn to the subject of how non-price competition in a price-regulated market influences the

number of firms in the market. In order to determine the changes in the number of firms, the effects of non-price competition on the demand for the product must be considered.

From the firm's viewpoint, non-price competition is used to try to expand the firm's market share. When a firm can not compete by price, it turns to different margins of competition, such as a higher quality product or an increased service level. But if the quantity sold of a product is a function of both price and quality (or service level) an increase in quality means an increase in demand. The higher quality level persuades more consumers to buy the product.

Figure 7 portrays this situation. In Figure 7 the initial long-run equilibrium occurred at price p^o and output rates q^o for the firm and Q^o for the market. Price controls raise the price to p^r. Firms will initially try to set their marginal cost equal to their marginal revenue (p^r). The presence of profits induces other firms to enter the market. However, the higher price means quantity demanded decreases to Q^r. This means the firms are competing for sales in a smaller market. Each firm will try to attract new customers by offering higher service levels or increasing the product's quality. With demand being an increasing function of product quality and service level, non-price competition shifts the demand curve out. This is represented in Figure 7 by the shift from D' to D". Unfortunately, without more information it is difficult to predict how far the demand curve will shift. Being unable to quantify this shift only serves to make predicting the number of firms in the market more difficult.