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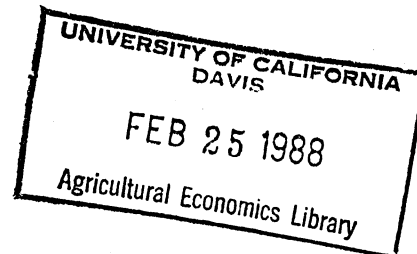
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**Co-operatives in Oligopolistic Industries: The
Western Canadian Fertilizer Industry**

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COOPERATIVES

Abstract

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This paper examines the impact of co-operatives on oligopolistic industries. The theoretical analysis suggests that the existence of a co-operative in the fertilizer industry can improve efficiency. In reality, however, the existing co-operative appears to behave more like a profit maximizing firm, resulting in continued market imperfections.

Co-operatives in Oligopolistic Industries: The Western Canadian Fertilizer Industry

I. Introduction

The standard economic theory of co-operatives assumes that the co-operative is the only firm operating in the industry (Enke; Domar; Helmberger and Hoos). One of the conclusions of this literature is that a co-operative can improve the efficiency of the markets in which their members are directly participating. Enke, for instance, shows that a single consumer co-operative, acting so as to maximize the welfare of its members, will give rise to a pareto-optimal outcome. Helmberger, in discussing marketing co-operatives for farmers, concludes that in many circumstances the existence of a co-operative will push the market towards the competitive outcome.

The belief that the co-operative is the only firm in the market is untenable, however, since the norm is one of co-operatives operating alongside private firms. Examples in western Canada abound: local consumer co-operatives in the retail grocery market with Supervalu and Safeway; the three prairie wheat pools and UGG in the grain handling market with Pioneer and Cargill; and Western Co-operative Fertilizers Ltd. (WFCL) in the western Canadian fertilizer market.

The examples listed above all share one characteristic: the markets between the co-operative and its members is oligopolistic in nature. The question that immediately arises is how does the existence of a co-operative in such markets affect the well-being of both the co-operative members and society as a whole. While this question is an extension of that posed by the theorists above, it has never, to the author's knowledge, been addressed in the literature.

The purpose of this paper is to investigate the impact of a co-operative on a market that is oligopolistic in nature. To provide some focus to the analysis, the western Canadian fertilizer market is chosen for analysis. This market is clearly oligopolistic in nature and the firms in it have allegedly followed a limit pricing scheme in an attempt to keep competitors out (Bayri, Rosaasen and Furtan). In addition, a co-operative operates a plant in this industry.

The paper begins with a review of the structure of the western Canadian fertilizer industry. The impact of a co-operative entering the industry will be analysed from a theoretical point of view and the actual behaviour of the existing co-operative will be discussed and compared to this. A summary concludes the paper.

II. The Western Canadian Fertilizer Industry

The fertilizer industry in western Canada consists of five firms: Cominco, Sherritt Gordon, Simplot, Imperial Oil, and Western Co-operative Fertilizers Ltd. (WCFL). Although there has been a rapid increase in the amount of fertilizer used in recent years, no new firms have entered the industry since WCFL, Simplot and Imperial Oil began production in 1964, 1967 and 1969, respectively (Bayri, Rosaasen and Furtan).

The lack of entry into the industry, along with the small number of firms, suggests that the existing firms in the industry may be restricting entry. Bayri, Rosaasen and Furtan conclude that the existing firms in the industry have followed a limit pricing strategy whereby they earn above normal profits and deter entry by new firms. The ability to adopt such an entry deterring strategy is a result of the cost structure of the industry. Cost of production in the fertilizer industry is generally taken to be L-shaped. Over some initial range of production, average costs fall rapidly as the large fixed costs are spread over greater and greater output. At some point, however, average costs level off and remain relatively constant until the capacity of the plant is reached (Figure 1). The level of output where the scale economies are reached is labelled as the minimum efficient scale (MES).

In the fertilizer industry, the MES for a single plant represents a relatively large proportion of total industry output. Thus, if a new firm were to enter the industry producing at MES (so as to minimize their average costs of production), the impact on the price of the product in the market would be quite substantial. This, in fact, is the logic behind limit pricing. If the existing firms can set price at a level so that entry by new firms operating at MES will drive it down to a level below average costs, then the new firm will be deterred from entering. If the limit price that is set is significantly greater than the costs of production, the existing firms will enjoy abnormally high profits and at the same time deter other producers from entering and capturing market share (Scherer).

Figure 1 illustrates the limit pricing scheme as it might work in the fertilizer industry. The curve, AC, represents the average costs for a fertilizer producing firm. The

demand curve in the industry is given by D . If all the firms in the industry were to behave competitively, then price would fall to p_c and total industry output would be x_c . Now consider what happens if the existing firms were to charge a price of p_L , where p_L is the price associated with the output level x_L , and x_L is determined by subtracting the output level MES from the competitive output level x_c . With a price p_L , new firms will be deterred from entering, since to do so at an output level MES will cause the price to fall to the competitive level and would result in the new entrant making only normal, if any, profits.

Intuitively, the limit price can be set higher the larger is MES and the more inelastic is the market demand curve. In particular, p_L can be calculated using the formula¹

$$p_L = p_c [1 + MES / (x_c |\eta|)]$$

where η is the elasticity of demand.

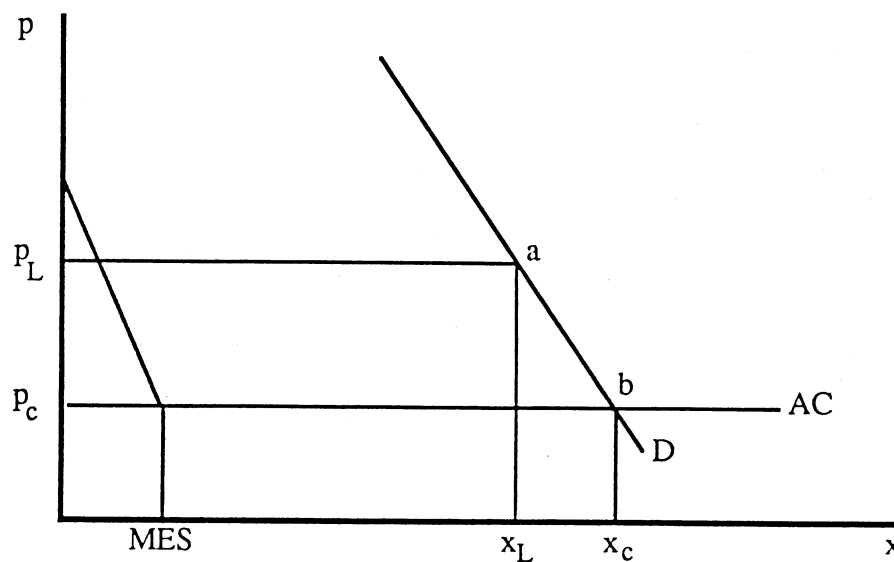


Figure 1 Limit Pricing in the Fertilizer Industry

¹See Koutsoyiannis for details of the derivation of this expression.

Using estimates of p_c , x_c , η and MES, Bayri, Rosaasen and Furtan calculate from a theoretical point of view the limit price that would be expected in the western Canadian fertilizer industry. Comparing it to the actual prices for fertilizer, they find a close relationship and conclude that the existing firms in the fertilizer industry have been practicing limit pricing. While they note that such behaviour is well within Canadian law, the implication is that farmers are paying a higher price for fertilizer than would be the case were the industry competitive in nature.

III. Co-operative Output Behaviour

The theoretical literature on co-operatives suggests that if the co-operative is the only firm in the industry it may be able to have a beneficial impact on an industry, making it more competitive and efficient. What about an oligopolistic market? Can a co-operative improve the efficiency of this type of industry? In particular, what is the effect of a co-operative on a market like the western Canadian fertilizer industry? What kind of behaviour should a co-operative follow to fulfill its responsibilities to its members? To these questions the paper now turns.

To examine co-operative pricing theory it is necessary to look at co-operative members and determine their objectives, since it is presumed that the co-operative is in place to further their goals. For the fertilizer industry, the co-operative members are farmers. As farmers, they demand fertilizer as an input into their production process, i.e., the demand for fertilizer is a derived demand. Assuming that the farmers are interested in maximizing the profits they earn from farming, a measure of the "profits" (or more correctly, the returns to the fixed factors) they receive is given by the area under the derived demand curve and above the price line. That is, the welfare of the farmers is given by the "consumer surplus" associated with the demand curve for fertilizer (Just, Hueth and Schmitz).

As farmers, therefore, the co-operative members would like to see the maximum level of "consumer surplus" possible, i.e., fertilizer at as low a price as possible. However, as members of a co-operative, farmers wear two hats: one as a farmer; the other as an owner. As an owner, the members would like to see the largest profits possible. To

maximize the welfare of members the co-operative must balance off these two objectives. In other words, the co-operative should attempt to maximize the sum of "consumer surplus" plus profits (Enke).

The problem facing the members of the co-operative can be expressed slightly differently. Consider that in becoming involved in the fertilizer industry, the co-operative members are simply integrating backward into the marketing chain. The benefits they receive from being involved in the fertilizer industry are the gross revenues from their farm: these are measured by the area under the derived demand curve. The costs are the costs of building a plant and producing the fertilizer.

If a co-operative wishes to maximize the welfare of its members it should equate marginal benefit with marginal cost. The marginal cost is, of course, nothing more than the marginal cost of producing another unit of fertilizer. The marginal benefit of an additional unit of fertilizer production is the change in the area under the demand curve that this gives rise to; since this is nothing more than the price of the output, the welfare maximizing output level is one where price is equated with marginal cost. If the co-operative is the only firm in the industry, this is equivalent to producing a level of output that equates the demand curve for the product with the marginal cost of producing the good (Enke).

What happens, however, if the co-operative is not the only firm in the industry, but instead is competing with a number of private firms? Two points must be addressed here. The first concerns the level of output the co-operative would produce were it to have plant capacity in place. The second concerns the problem of whether a co-operative would even enter the industry in the first place.

The answer to the first question depends, in large part, on the manner in which the co-operative thinks the other firms in the industry will react to changes in the level of the co-operative's output. For the analysis here, it will be assumed that the co-operative follows Cournot-Nash behaviour; that is, in making its decisions, the co-operative assumes that the other firms in the industry will not change their output levels in response to a change in the output level of the co-operative. In such a situation, the behavioural rule that the co-operative will adopt in order to maximize the welfare of its members is to equate marginal cost with price. By doing so the co-operative ensures that the marginal benefit of

another unit of the good to a member is equal to the marginal costs of producing it and members' welfare cannot be improved by raising or lowering output.

The implication is that the co-operative will produce an output level equal to or greater than MES and charge its members a price of p_c . The result is that the industry will behave in a competitive manner, since the consequence of the co-operative in the market is to lower the price to p_c and increase output to x_c . The co-operative will never produce at an output level less than MES, since if it were to do so, it could always increase members' welfare by increasing production and lowering the price the members have to pay.

The above result indicates the behaviour of the co-operative if it is already established in the industry. Will a co-operative enter the industry or will it be deterred by the limit pricing strategy? As might be expected, the difference in objectives between the co-operative and the private firm suggests that limit pricing designed to keep out profit maximizing potential entrants may not be effective in deterring co-operatives.

To see this, consider a co-operative which is considering entering the fertilizer industry and which is faced with a limit price of p_L (Figure 1). Suppose that to build a fertilizer plant, the co-operative must incur a cost of $\$K$ and that once it has entered the industry, the co-operative expects the price will fall to p_c . The benefit from incurring this $\$K$ capital cost, therefore, is the increase in "consumer surplus" that members receive when the price falls from p_L to p_c . The co-operative will also gain any profits that it might accrue in the production and sale of the fertilizer. However, if the price is reduced to p_c , then the co-operative will only be earning normal profits; these would be presumably be enough to pay the capital cost of $\$K$ and to earn a normal rate of return.

Thus, in net terms, the co-operative sees a total gain equal to the increase in "consumer surplus" received by members. If the co-operative members make up the entire population of farmers, then the change in "consumer surplus" would be equal to the area $p_L abp_c$. If not all farmers are members of the co-operative, then the gains to the co-operative members will of necessity be smaller.

The implication is that when the co-operative has a fairly substantial proportion of the farming population as members, the net benefits to entering the fertilizer market are likely to be both positive and reasonably large. This suggests that a co-operative behaving in the best interests of its members is less likely to be deterred from entering the industry.

Thus, while limit pricing may be effective in deterring the entry of private firms, it may not be so for co-operatives wishing to enter the market. Indeed, the analysis suggests that when market imperfections exist, there is likely to be an incentive for co-operatives to form and enter that industry.

IV. An Application to the Western Canadian Fertilizer Industry

The theoretical model developed above suggests that co-operatives are much more likely to enter the fertilizer industry than would be the case with private firms. In addition, the analysis suggests that given the cost structure of the fertilizer industry, the presence of a co-operative in the industry should result in a price that is roughly at the competitive level.

Neither of these outcomes has appeared when the real world of the fertilizer industry is examined, however. The work by Bayri, Rosaasen and Furtan provides strong evidence that fertilizer is not priced competitively. Nor have co-operatives been lining up to enter the industry. As was pointed out, no new firms have entered the industry since the 1969. Co-operatives do have a presence in the industry; nevertheless, WCFL has not increased its capacity substantially over the years and currently operates two plants that are among the smallest three in the industry (Blue, Johnson and Associated), suggesting it has not been following the type of behaviour the theoretical model would suggest.

The behaviour of WCFL sketched above suggests a firm that is behaving much more like a private firm than a co-operative. While it is impossible to delve into the question fully, it is necessary to attempt to modify the theoretical model above to more fully reflect the manner in which co-operatives behave. Only by doing this can the impact of co-operatives on oligopolistic industries be even partially understood.

Why would a co-operative operate like a private firm? One answer that comes to mind reflects the distinction between a co-operative and a private firm. While a private firm is interested in maximizing profits, the co-operative should have as its goal the maximization of profits plus "consumer surplus". Although this latter goal is an easy objective to give to a firm in a theoretical setting, it is much more difficult to translate into practice. For instance, it is relatively simple for co-operative members, directors and managers to forecast what profits will be from a new or upgraded fertilizer plant; however, it is much more difficult to conceptualize and measure the additional part of the co-operative goal. Thus, to the extent that full knowledge concerning the impact on farmer members of

investment or output decisions in the fertilizer industry is unavailable, it would be expected that the co-operative would make decisions based on the traditional measure of profits. This, in turn, would make the co-operative more like a profit maximizing firm.

Related to this is the possibility that co-operative members and managers may not be fully aware of the differences between their firm and those that are privately owned. For instance, while co-operative economic theory has been discussed for over forty years, the academic emphasis placed on this form of enterprise has been far less than that placed on the private firm. Although there is a body of literature on co-operative pricing and output, it is scattered in journal articles and is not available in any coherent notation or form. No textbook, for example, has ever been written describing the problem facing co-operatives from the same point of view as is done for the private firms. Thus, it may not be surprising that co-operative managers will tend to adopt the thinking and decision making skills of their private firm counterparts.

The congruity between the decisions made by co-operative managers and private firm managers may be also be the result of the bureaucracy of co-operatives and the incentive structure that is in place. Of course, this bureaucracy is present in private firms. However, it may be that in co-operatives the effect is much more consequential.

As Monson and Downs point out, the directors and managers of a private corporation are unlikely to have goals that are in complete agreement with those of the owners. For instance, the well-being of the managers (e.g., promotion, pay raises) may be better served by relatively conservative strategies that do not subject the firm to risks, but also do not maximize profits. As well, managers and directors can be expected to withhold information to the management levels above them if the transmission of such information would prove injurious to their employment or chances of promotion.

The same developments are also likely to occur in co-operatives. While the boards of directors of co-operatives may be presumed to have similar goals to that of the members (they are nothing more than elected members), such a supposition cannot be made in the case of managers. As in private companies, the typical co-operative manager will be interested more in his or her own personal goals than in the objectives of the members who own the co-operative. In fact, since it is likely that the promotion decisions regarding managers are made on the basis of how the co-operative has operated financially, the

managers are more likely to be interested in maximizing profit than in improving the welfare of the members.

In addition, the managers might be expected to withhold information to the members and the board of directors if such information suggested that the co-operative should become involved in an undertaking that would appear to be poor "business". The withholding of information, and the failure to fully carry out the decisions that are made which is a corollary to such behaviour, are likely to erode the power of the board of directors to have policies which it prefers carried out.

The conclusion is that it would be surprising if co-operatives behaved in the manner suggested by theory. Indeed, if co-operatives act consistently at all, the most likely behaviour may profit maximization, not welfare maximization.

V. Summary and Conclusions

The purpose of this paper was to examine the impact of co-operatives on oligopolistic industries. While farm leaders have often extolled the virtues of co-operatives in making markets more competitive, there has been no theoretical work undertaken on the efficacy of co-operatives in industries where there are a small number of privately owned firms.

The theoretical analysis carried out in this paper suggests that the entrance of a co-operative into an industry can be expected to improve the efficiency of the industry. In particular, if the industry has a cost structure similar to that found in the fertilizer industry, the existence of a co-operative can be expected to drive the price down to the competitive level. This result extends the conclusions drawn from an examination of the impact of a co-operative on a monopolistic market. As well, the paper concludes that while a strategy of limit pricing may be effective in deterring entry by private firms, this strategy will not work against member welfare maximizing co-operatives wishing to enter the industry.

Although the theoretical results suggest that co-operatives should be actively entering the fertilizer industry, the situation in reality is much different. In the western Canadian fertilizer market, WFCL has been relatively hesitant in expanding production and has not been acting at all in the manner of a new entrant. In fact, the conclusion would be that the co-operative is behaving more like a private firm than a co-operative.

There are a number of reasons to suggest that such behaviour is to be expected. In the first place, the information required to maximize profits appears to be much less onerous to obtain and conceptualize. Secondly, little work has been done on the economics of co-operatives relative to the private firm. Thirdly, the conclusions of bureaucratic theories of decision making suggest that even if members are aware of the proper thing for co-operatives to do, the managers may not have the proper incentives to carry out their wishes. In fact, since the managers' personal goals are much more closely linked to the profitability of the co-operative than to members' welfare, it is to be expected that the co-operative would follow a path that more closely resembles profit maximization.

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