An Economic Analysis of Excess Capacity In The Atlantic Fish Processing Industry

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AN ECONOMIC ANALYSIS OF EXCESS CAPACITY IN THE ATLANTIC FISH PROCESSING INDUSTRY

by

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FOREWORD

Over a number of years, various estimates have been made of the capacity of the processing sector in the Atlantic fisheries. These were generally associated with industry throughput to derive an estimate of capacity utilization. The estimates of capacity utilization were expressed in physical terms and they generally revealed low levels of utilization. They were of concern to the formulation of policy for public investment in the fisheries sector.

This report was prepared in the Spring of 1987 to apply the principles of economics to the measurement of capacity and capacity utilization. Opinions, interpretations, and conclusions contained in the report are solely attributable to the author and do not necessarily reflect those of the Department of Fisheries and Oceans.

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ABSTRACT

MacDonald, Doug. 1987. An economic analysis of excess capacity in the Atlantic Fish Processing Industry. Can. Tech. Rep. Fish. Aquat. Sci. 1588:41p

The application of economic theory to the measurement of excess capacity in the fish processing industry in the Atlantic suggests that the industry does not possess that surplus capacity to the extent claimed heretofore. A number of problems related to the measurement of capacity must be resolved. The industry is described as oligopsonistic, in which case the theory offers less precise predictions which depend upon assumptions on the availability of knowledge and defensive reactions to the threat of entry.

RESUME

MacDonald, Doug. 1987. An economic analysis of excess capacity in the Atlantic Fish Processing Industry. Can. Tech. Rep. Fish. Aquat. Sci. 1588:41p

Par l'application de la théorie économique pour mesurer la capacité de l'industrie de la transformation du poisson sur la côte Atlantique, on arrive à la conclusion que cette industrie possède moins de surplus de capacité qu'on le pensait auparavant. Il y a des problèmes reliés à la mesure de capacité auxquels on doit apporter une solution. L'industrie est oligopsonistique et les prédictions découlant de la théorie sont moins précises et dependent de certaines suppositions à l'égard de la disponibilité de connaissances et des réactions défensives face à la menace de nouveaux venus.

1. INTRODUCTION

The existence of excess capacity in the harvesting sector of the fisheries is well documented and well understood. Excess capacity in this sector results from destructive competition for fish by individual fishermen, none of whom possess ownership rights over the fish in the sea. Fishermen invest heavily in vessels and gear to ensure they capture a sufficient share of the total catch to remain viable. Excessive investment in fishing vessels and gear causes unduly low incomes for fishermen and pushes up the cost of raw fish to processors.

The existence of excess capacity in the processing sector of the Atlantic fishery has also been widely documented. The Report of the Task Force on Atlantic Fisheries, 1982, cites several studies which estimate that only 27% to 37% of plant capacity was utilized in sample years. A number of other studies on the Atlantic processing industry reinforce these estimates of a low rate of capacity utilization. (See Fras, August 1974; Cormier, Sept. 1980; Shaffer et al, June 1981.) The Task Force Report summarizes the situation with the following observation:

> "It is widely believed, in both the processing industry and government, that there is substantial excess capacity in the industry and that this causes a severe drain on the financial resources of the industry."
> The Task Force Report, 1982 p. 104-105)

Economists have generated a considerable literature explaining the causes and implications of excess capacity in the harvesting sector of the fisheries. The literature dates back to 1954 with the seminal article by H. Scott Gordon and continues unabated up to the present. Economic analyses of the phenomenon

of excess capacity in the fish processing sector are, however, virtually non-existent. This paper is an attempt to initiate a discussion on the economics of excess capacity in the fish processing sector with special reference to the Atlantic Coast.

The processing sector of the fishing industry does not suffer from the common property problem which characterizes the harvesting sector. It is the common property aspect of the harvesting sector which results in excessive investment in this part of the industry. The absence of this problem at the processing level implies that the over-investment which is associated with it should not occur. Given this fact, what could explain excess capacity which studies have indicated exists in the Atlantic fish processing industry?

There are several reasons why processing capacity could be excessive. These reasons will be explored in this report. The first reason is that excess capacity could result from the structure of the industry and the behaviour which arises from this structure. A great deal of literature is available on the economics of industrial organization. This literature identifies the various ways which an industry can be structured and the behavioural and performance implications of alternative structures.

Other reasons which could explain the findings concerning capacity utilization are not related to inefficiencies in the operation of the market. The variable and stochastic nature of fish markets and landings may induce processors to construct

plants which appear much too large for normal operations. The extra capacity may, however, be a rational (i.e. profit maximizing) response to actual or expected fluctuations in demand and supply.

Another important factor which may lead to excessive capacity is government assistance to the processing sector. Government assistance to the processing industry is substantial. Since fish supplies are virtually fixed, the creation or maintenance of capacity due to government assistance does not lead to additional output.

This paper explores the factors which could explain the documented excess capacity in the processing sector of the Atlantic fishery. The primary focus of the paper will be on structural explanations for excess capacity. There are two reasons for this:

1) A structural explanation for excess capacity would imply that there is an inherent tendency towards excessive capacity and therefore excessive costs in the industry. Prescriptive remedies for the losses associated with this problem require a careful analysis of the source of the problem. A great deal of theoretical and empirical work has been completed which links industry structure to economic behaviour and performance. No systematic efforts have been attempted to apply this literature to the fisheries.

2) The other important explanation for excess capacity,

namely government assistance programs, has been well documented and is well understood by economists. The economic losses attributable to government assistance are also well understood.

A final important caveat is required before proceeding with the analytical component of this report. The market discussed in this study is the input market, that is, purchases of fish by processors from fishermen. A great deal of the discussion relates to the nature of competition among fish buyers in this market. Most of the industrial organization literature deals with the nature of competition among firms which sell products in output markets. The literature on excessive capacity refers to oligopolistic industries while the fish processing industry is more likely an oligopsonistic industry. It is the opinion of the author that predictions and hypotheses regarding excess capacity which apply to oligopolistic industries apply equally to those characterized by oligopsony.

2. PREDICTIONS OF STANDARD ECONOMIC MODELS

Economic theory provides predictions regarding the utilization of plant capacity for three of the four models of industrial structure. The four models: pure competition, monopoly, monopolistic competition and oligopoly will be examined in turn. In the pure competition model both short-run and long-run average costs are minimized. In the monopoly model long-run average costs are not minimized. Short-run average costs are

minimized. Monopolistically competitive firms do not minimize short-run or long-run average costs.

Excess capacity is defined in this paper as the non-minimization of short-run average costs. Given this definition, purely competitive and monopolistic firms would not be expected to exhibit excess capacity. Monopolistically competitive firms would experience excess capacity. Oligopolistic firms may or may not exhibit excess capacity depending on assumptions concerning strategic behaviour. The fourth model, oligopoly, does not share the predictive features and predictions about costs depend on the assumptions that are made.

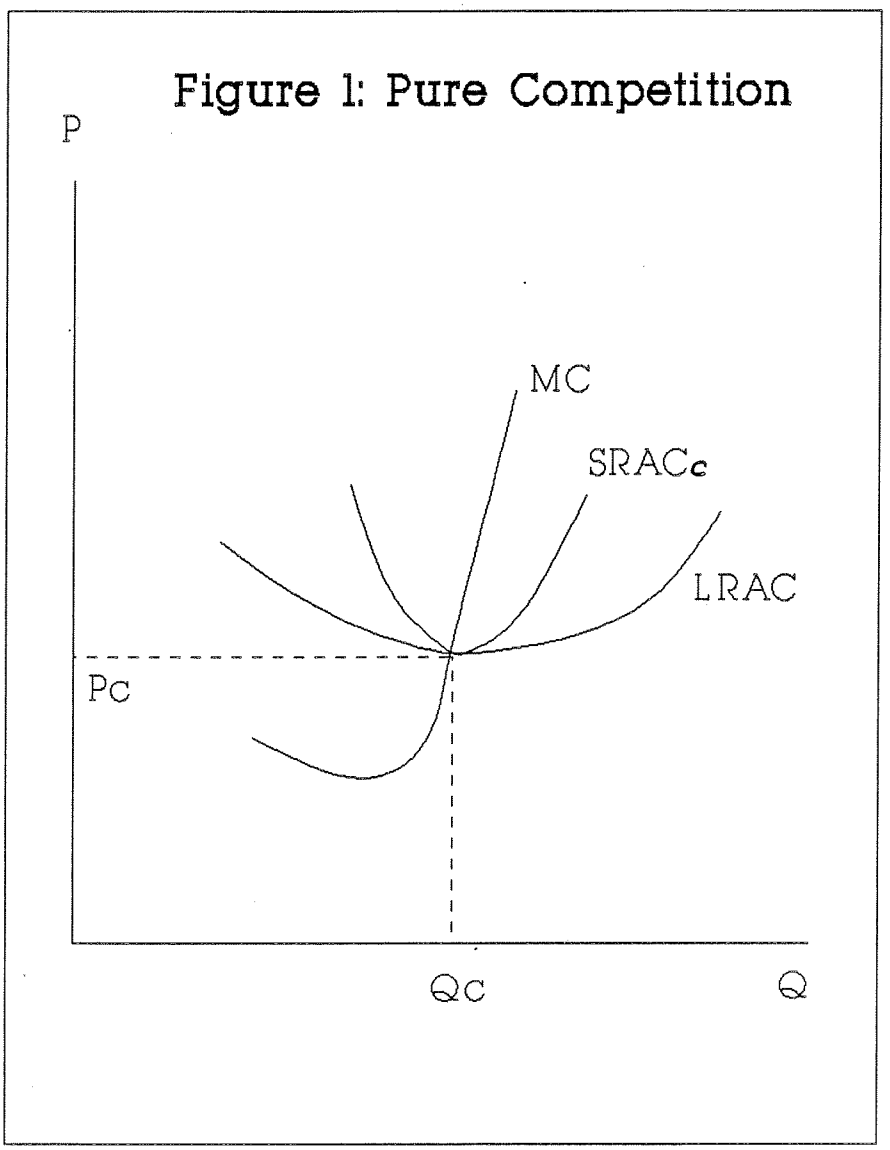
2.1 Pure Competition

An industry characterized by pure competition has a large number of firms. The production of an individual firm is so small relative to total industry output that it does not have an impact on price. Consequently firms face horizontal demand curves. Freedom of entry is another key aspect of the purely competitive industry. The existence of profits will induce entry by new firms until profits return to a normal level at which capital invested earns its opportunity cost.

Under these conditions, individual firms will produce at a point where price equals the long-run average cost of production. Firms can survive only by producing at the minimum point of the long-run average cost curve. Firms that produce at any other point will not earn a normal return on capital invested and will exit the industry. The price and output predictions of the pure

competition model are illustrated in Figure 1.

There are many welfare implications which can be derived from Figure 1.



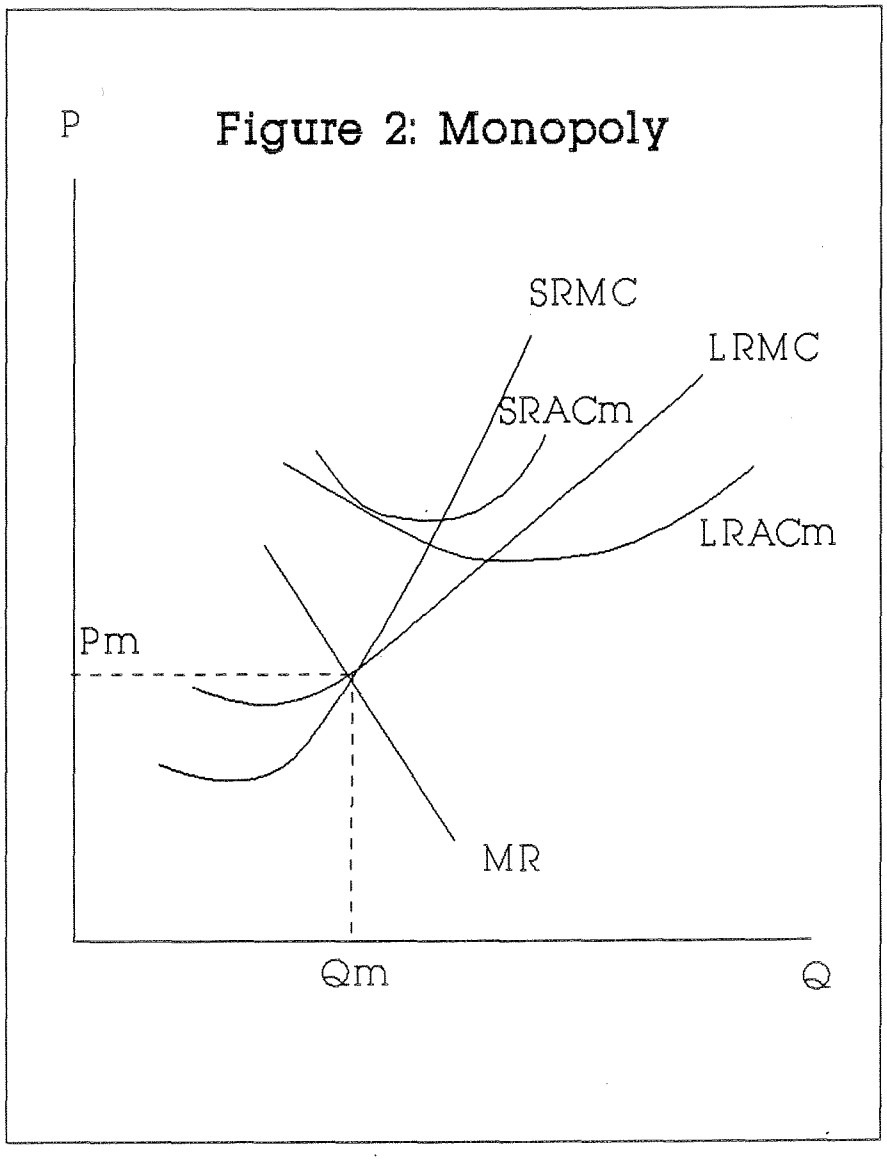
For this discussion, however, only one point has to be noted. Each firm will produce at Q_c, an output level which minimizes both short-run and long-run average costs. Operating at the

minimum point on the short-run average cost curve implies that each firm makes the most efficient use of the plant it constructs. Not only do producers operate at the most efficient point for the plant constructed but they also construct plants which produce industry outputs at the lowest possible cost. Firms which constructed plants of a scale larger or smaller than that depicted by $SRAC_C$ would increase long-run average costs.

Figure 1 provides one definition of optimal capacity utilization. A plant is optimally utilized if production occurs at the minimum point of the appropriate long-run average cost curve.

2.2 Monopoly

Monopoly occurs when one firm accounts for all of the output of an industry. In this situation the price received by a firm depends upon the output it produces. The firm must lower prices to attract more buyers. The revenue attributable to additional units of output is less than the price because marginal buyers of the product value it less than previous buyers. Firms will produce up to the point where the change in revenue associated with a price decrease equals the change in the cost of producing a unit of output. Firms make profits above a normal return on capital because entry is assumed to be effectively blocked. The price and output predictions of a monopolistic industry are illustrated in Figure 2.



The monopolist depicted in Figure 2 produces Q_m units of output where marginal revenue equals long-run marginal cost. The monopolist chooses a plant scale represented by the short-run average cost curve $SRAC_m$ to produce Q_m because it is the cost minimizing way to produce this quantity of output. $SRAC_m$ is, therefore, tangent to the long-run average cost curve, $LRAC_m$.

Note that the long-run equilibrium for a monopoly will, in general, not occur at the minimum point of either the short- or long-run average curves. Monopolists could increase output, in the short-run, and experience declining average costs, along the short-run average cost curve, $SRAC_m$. The monopolist maintains excess capacity and intentionally underutilizes plant capacity. In the long-run production increases would be handled by constructing larger plants and producing along the long-run average cost curve, $LRAC_m$.

2.3 Monopolistic Competition

A monopolistically competitive industry has three key features:

i) There are many firms in the industry.

ii) There is free entry into the industry.

iii) Products are differentiated.

Product differentiation implies that each firm is faced with a downward sloping demand curve and a corresponding marginal revenue curve. Freedom of entry implies price will equal average cost and no firm makes a supra-normal profit. Since price must equal average cost and since the demand curve slopes down, the average cost curve must also be sloping down at the point of tangency to the demand curve. This implies that neither long-run nor short-run average costs are at their minimum point - the famous excess capacity prediction of Edward Chamberlin.

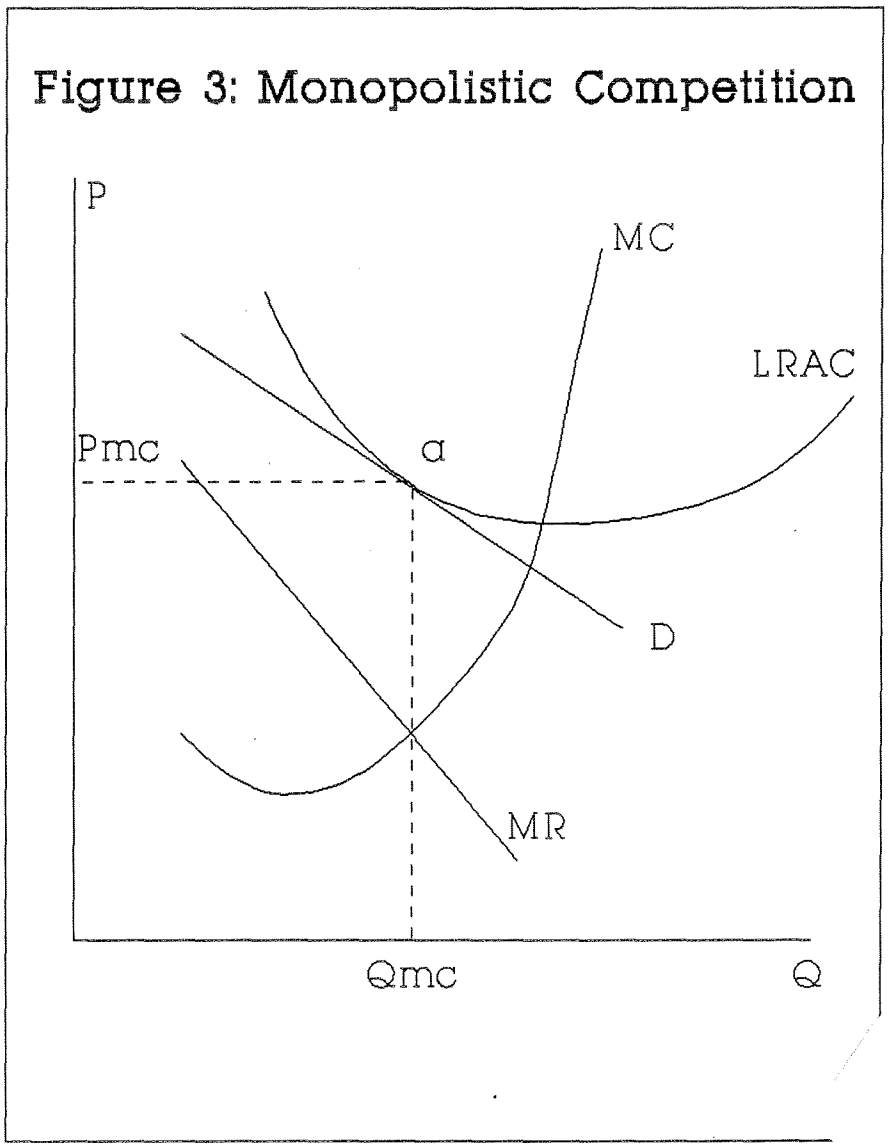


Figure 3 depicts equilibrium price and output by a monopolistically competitive firm. The firm produces where marginal revenue equals marginal cost. The absence of entry barriers implies that supra-normal profits will be competed away so that average costs equal price. Output Q_{mc} is produced at price P_{mc}. Note that output is lower than for a perfectly competitive firm that would face a horizontal demand curve and

produce at the minimum point on the short-run average cost curve.

2.4 Oligopoly

Oligopoly was defined by Scherer as follows:

> "If sellers are sufficiently few in number to have each believe (a) that its economic fortunes are perceptibly influenced by the market actions of other individual firms, and (b) that those firms are in turn affected significantly by its own actions, then the market can be said to be oligopolistic." (Scherer, 1980, p. 11)

Deriving a profit maximizing price-output equilibrium for a firm in an oligopolistic industry is a difficult task. The difficulty arises from three factors:

1) A firm must account for the anticipated reaction by other firms in the industry to its price-output decisions. For example, a firm may want to reduce output in order to increase price. However, if other firms in the industry respond to this action by increasing their output, the firm in question may not receive a significantly higher price due to its actions. The important point is that the benefits of an action by one firm depend on the response by other firms to its action. Note that the response to actions by an individual firm may come from new firms which enter the industry as well as from established firms.

2) The actions and reactions of firms in an oligopolistic industry depend on the amount of information they possess and share on each other's operations. Information sharing is generally greater in industries with a small number of firms and in situations where

firms have interacted with each other over a significant period of time. Common knowledge and understanding can lead to collusive behaviour and a situation where an oligopolistic industry behaves similar to a monopoly. Information gaps can lead to gaming behaviour where firms must make assumptions about the operational and behavioural characteristics of other firms. In this case, actions may be taken to deceive other firms into making incorrect assumptions. Misinformation can result in actions which do not appear rational from a profit maximizing standpoint.

3) Firms may make output decisions which reduce profits in the short-run but increase long-run profits. This can occur if the output decision of a firm inhibits long-run industry output by driving competitors out of the industry.

Predicting the price-output decisions of firms in an oligopolistic industry is precarious. The prediction must rest on assumptions concerning the reaction of firms to actions taken by other firms. "The exact nature of the reaction, however, cannot be determined by a priori reasoning. (Scherer, 1980, p. 105)

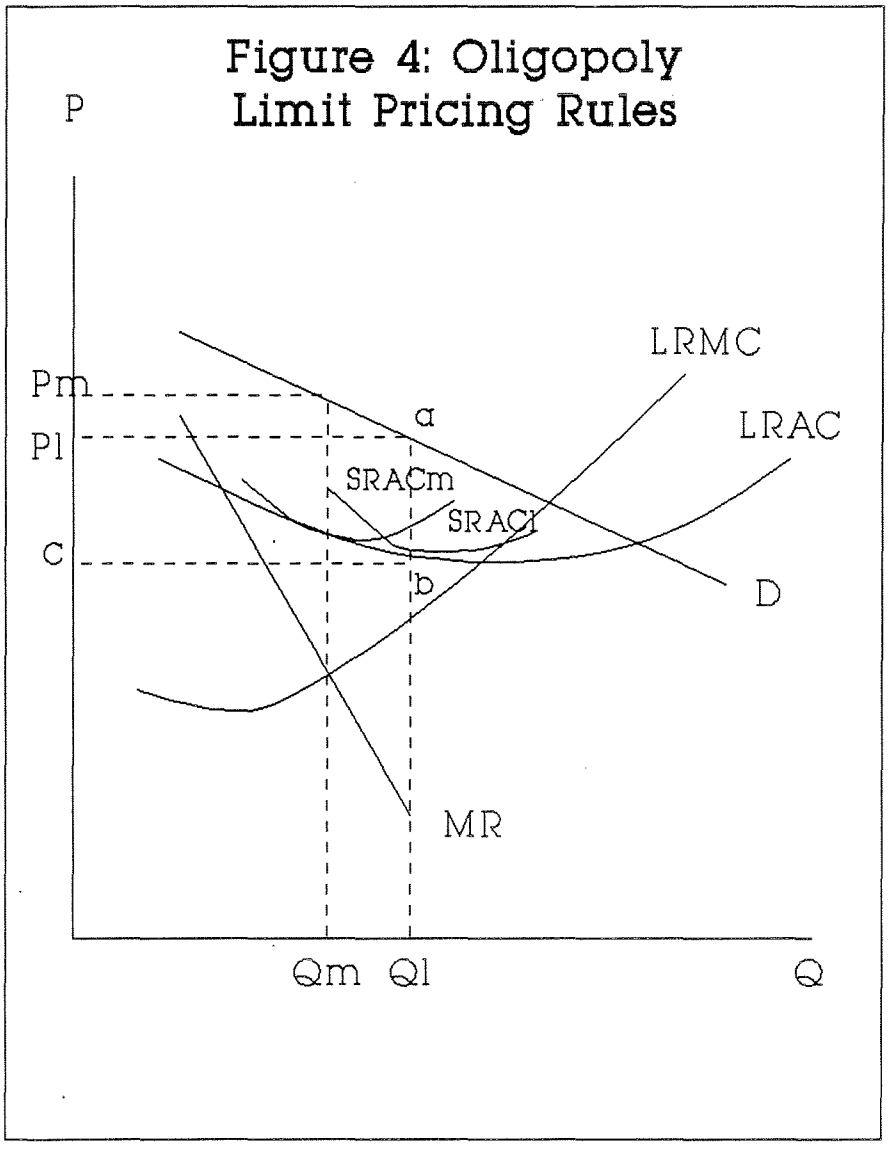
Economists have responded to this confusion and uncertainty by devising rules which govern the actions of firms in oligopolistic industries. Particular attention has been given to the behaviour of existing firms in an industry when entry by a

new firm is imminent. What is the most likely reaction of existing firms to the threat of entry? One theory, subscribed to by Bain and Sylos-Labini is commonly referred to as Sylos postulate. This theory assumes existing firms will keep output constant in the face of new entry. The prospective entrant calculates whether, given this behaviour, it will be profitable to enter the industry. This calculation will take into account the entrant's costs and the effect on price resulting from its addition to industry output.

Sylos postulate leads to another concept which has been postulated for firms in an oligopolistic industry. This is the concept of a limit price. Firms in an oligopolistic industry enjoy supra-normal profits because some entry barriers face prospective entrants. These firms can raise prices (by restricting output) above the competitive level without attracting entry. The question is: how far above the competitive level can prices be raised? The limit price theory provides one answer to this question. If Sylos postulate governs the behaviour of existing firms they can calculate a price which is just below the price which would make entry profitable to potential entrants. The price will be the highest oligopolists can charge while limiting entry to zero.

The limit price theory leads to a prediction regarding capacity utilization. Once firms have calculated the price-output combination which limits entry to zero, a plant scale will be chosen which minimizes the cost of producing that level of

output. Figure 4 illustrates this case.



An oligopolist, using limit pricing rules, sets a price P_L that is just low enough to make it unattractive for potential entrants to enter the industry. The limit price, P_L, is less than that which would be charged by a monopolist (P_m) and output Q_L is greater than the monopolistic output, Q_m.

P_L limits entry to zero while resulting in supra-normal profits of $P_L$abc. The important point for this discussion is that the oligopolist produces at point b on his short- and long-run average cost curves. Average costs of producing Q_L are minimized at this point but, as was the case with monopoly, the oligopolist does not operate at the minimum point of his short-run or long-run average cost curves.

Unfortunately, this model is overly simplistic. The most obvious problem is the assumption that prospective entrants believe that established firms will maintain pre-entry output levels if they decide to enter.

> "Nothing in the level of pre-entry output per se argues for its continuation. Under many conditions it is undesirable even impossible for an incumbent to maintain output after entry, and an entrant who knows this is not deterred by threats to do so." (Dixit, 1982, p. 12)

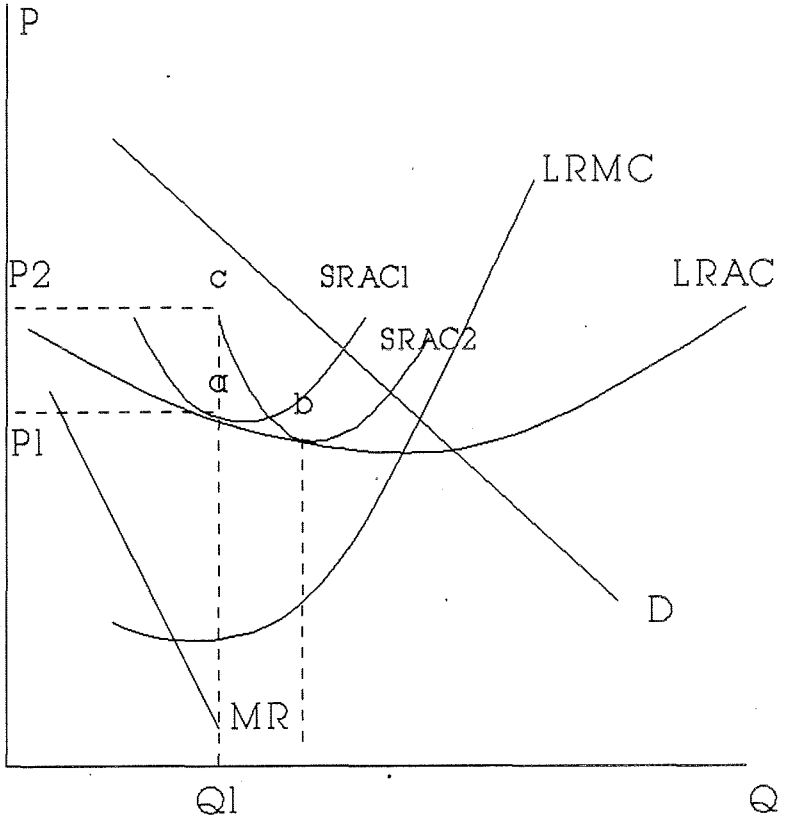
If a prospective entrant knows it is in the best interest of an established firm to decrease output upon entry, the limit price is irrelevant to his decision to enter. The entrant will be concerned instead with what price will prevail <u>after</u> he enters. The post-entry price will depend, among other things, on the reaction of established firms to the entrant.

Let us try to analyze the complex process involved in the attempted entry of a firm into an industry. Established firms would naturally want to force the entrant out of the industry. They may be willing to incur short-run losses to do this. Such a withdrawal would be not only of immediate benefit to established firms but it also would establish a reputation among other

possible entrants that attempts at entry would be met by aggressive deterring behaviour.

Established firms have several methods of attempting to ward off entry. They may store inventories and flood the market when entry is threatened. They could greet the entrant with an advertising blitz to place him at a disadvantage in the market. Finally, and perhaps most likely, they could increase output and decrease prices to make it unprofitable for an entrant to operate.

Figure 5: Oligopoly
Entry Deterring Behaviour



The cost implications of attempting to deter entry by increasing output are illustrated in Figure 5. In the limit price case we assumed the oligopolists attempted to minimize the costs of producing Q_L, operating at point a on the short-run average cost curve $SRAC_1$. The threat of entry may induce him to increase output along $SRAC_I$. Average costs would first decline along $SRAC_I$ until the minimum point was reached. Average costs would then rise along $SRAC_I$, eventually exceeding price.

Short-run losses could be inflicted on the firm in question if per unit costs increase to a level which exceeds price. This, of course, decreases the desirability of deterring entry by increasing output. The liklihood of entry rises in proportion to the costliness of engaging in entry deterring behaviour. Threats to deter entry by increasing output may not be credible if entrants correctly foresee the costliness of this behaviour.

There is a way to reduce the cost of deterring entry. An incumbent firm could construct a plant larger than that which minimized the cost of producing output Q_L. The oligopolist could, for example, construct a plant represented by the short-run average cost curve, $SRAC_2$. The average cost of producing output level Q_L, would rise from a on $SRAC_1$ to c on $SRAC_2$. Entry may be more effectively blocked as output could be increased over a wider range, without increasing average costs, than was the case with the oligopolist operating at point a on $SRAC_I$.

Two key points arise from this discussion:

1) The oligopolist depicted in Figure 5 has an improved

capability to ward off new entrants compared to an oligopolist who chooses a plant scale that minimizes costs for pre-entry output levels.

This capability is reduced to the extent that short-run average costs for producing output Q_L are not minimized. As can be seen in Figure 5, average costs rise significantly from point a to point c. The credibility of the oligopolist in responding to imminent entry depends on his ability to increase output profitably. As stated by Scherer, "...threats that are not credible do not deter" (Scherer, 1980, p. 246). The oligopolist depicted in Figure 5 can lower prices at the sign of imminent entry without experiencing financial stress. It is the lower price that the entrant must contend with, not the price which prevailed prior to the threat of entry. This fact led Needham to conclude:

> "It is not true, as is often stated in elementary price theory texts, that the relevant question for a new entrant is whether existing firms are charging prices at which the new entrant can make above normal profits. Rather, it is whether the reaction of established firms to entry will result in a post-entry price which permits the entrant to make above normal profits." (Needham, 1969, p. 103)

2) Point 1) introduces the possibility that established firms in an oligopolistic industry can maintain pre-entry prices above the limit price. To do this they

must pose a credible threat to prospective new entrants that, if entry is signalled, they can lower prices by increasing output.

> As put by Scherer, "...why should existing industry members limit their price to the value calculated under the Bain-Sylos output maintenance theory? Assuming that they retain sufficient fighting capacity in reserve to support an expansion of output, why not hold the price at the short-run profit maximizing level, leaving open the possibility of a sharp decrease if someone tries to enter? (Scherer, 1980, p. 247)

The larger plant represented by $SRAC_2$ in Figure 5 provides the "fighting capacity" to keep potential entrants out of the industry. This capability may allow established firms to charge prices in excess of limit price levels without inducing entry. Short-run profits would increase relative to the limit price case. The increase in profits would be mitigated by short-run average costs which would be higher than minimum attainable levels. Nonetheless, holding excess capacity may be a strategy which is consistent with profit maximization in an oligopolistic industry.

This postulate has been challenged by recent articles in the industrial organization literature [see Dixit (1980) and Bulow et al (1985)]. The basis of the arguments against the excess capacity theory appear to be consideration of what would happen if entry did occur despite the best efforts of established firms to prevent it. The new firm would enjoy a cost advantage over the established firm because it can choose a plant size which minimizes costs for its output. The large plant held by the

established firm would become a liability if the firm was forced to contract output due to lower prices and competition for market share from the entrant. If the established firm reduced output, costs would rise along the short-run average cost of the plant originally constructed. The possibility of entrants out-competing established firms by minimizing short-run costs may undermine the advantages of installing excess capacity as a strategic deterence weapon.

Bulow et al stated this result as follows:

> "The question is: Will firm 1 ever install capacity that it ends up not using? There cannot be any purpose in installing capacity which it would not use in any circumstance. Nor will the firm install more capacity than it needs after entry, if entry is certain. The only possibility is that it might install capacity which it would not use if no entry occurred, but which serves the purpose of deterring entry. If entry is to be deterred, it must be that the firm would use the capacity in the duopolistic post-entry Nash equilibrium. Thus we can only observe idle capacity if it would be optimal for the firm to use the excess capacity if entry did in fact occur." (Bulow et al, 1985, p. 174)

Dixit (1980) reinforces this result by analyzing several models of oligopolistic behaviour.

> "Prominent among the conclusions was the observation that if the post-entry game is agreed to be played according to Nash rules, the established firm will not wish to install capacity that would be left idle in the pre-entry phase." (Dixit, 1980, p. 106)

Nash rules assume that all firms correctly foresee the implication of their actions on the profitability of other firms. All firms use this information to maximize long-run profits. The dilemma faced by established firms playing by Nash rules is succinctly stated by Dixit.

> "...faced with the irrevocable fact of entry, the established firm will usually find it best to make an accommodating output reduction. On the other hand, it would like to threaten to respond to entry with a predatory increase in output. Its problem is to make the latter threat credible given the prospective entrant's knowledge of the former fact." (Dixit, 1980, p. 95)

The contention that excess capacity is inconsistent with profit maximizing behaviour critically depends on assumptions regarding the amount of information and capital available to prospective entrants. Prospective entrants must have precise knowledge of the cost function of incumbents. They cannot be misled by entry deterring threats and actions even when such actions continue over a protracted period of time.

Prospective entrants also must have easy access to capital to finance the initial battle with incumbents. Significant short-run losses may have to be absorbed during the entry period. Incumbents, who have been earning supra-normal profits before entry, may have considerable cash reserves available to finance a fight.

The murky waters of oligopoly theory yield no easy answers to the question of excess capacity. The oligopoly model, like the monopoly case, will not attain an equilibrium where long-run average costs are minimized. Monopolists and oligopolists employing limit pricing rules will minimize short-run average costs, although they will not operate at the minimum point on their short-run average cost curves. The minimization of short-run average costs could be used as a definition of optimal capacity utilization. Note that this definition is consistent

with the possibility that short-run average costs could decline with an increase in output beyond the optimum point. Oligopolists that attempt to deter entry by constructing a larger than optimal plant may produce at a point on their short-run average cost curve that is not tangent to the long-run average cost curve. That is, they may not minimize the cost of the output they produce. They could carry excess capacity. Arguments against the utilization of this strategy appear to rely on excessively restrictive assumptions concerning the availability of information and capital by prospective entrants. The theoretical ambiguity surrounding the issue means that verification of excess capacity must rely on empirical findings.

3. EMPIRICAL EVIDENCE OF EXCESS CAPACITY IN OLIGOPOLISTIC INDUSTRIES

3.1 Qualifications

Bain noted three problems encountered in measuring excess capacity. The first concerned obsolete capacity. While cautioning readers on the definition of obsolete capacity, Bain suggests that obsolete capacity should not be included in measurements of capacity. Bain also noted that a firm or industry may experience excess capacity due to incorrect expectations regarding demand conditions. The final problem relates the underutilization of capacity due to product or market policies.

> "... there are some industries in which product policies and other market policies are such that plants are utilized for only a part of the year and are

> `redundant' for the rest of the year, when feasible alternative policies would permit year-around use of plant and the satisfaction of total demand with a smaller amount of plant....Avoidable wastes may thus occur from an underutilization of plants which is not strictly a result of `chronic excess capacity'." (Bain, 1968, p. 385)

Attempts to quantify the level of excess capacity have revealed further difficulties. Stanley S. Reynolds made the following observation in interpreting the results of an attempt to measure excess capacity in the U. S. aluminum industry.

> "Other factors need to be introduced in order to explain why actual excess capacity exceeds predicted excess capacity in the simulations. One important factor is measurement error in the excess capacity data, which is discussed below. A second factor may have been overly optimistic expectations by firms about future demand levels. A third factor may have been demand uncertainty, with firms holding excess capacity to guard against fluctuations in demand." (Reynolds, 1986, p. 227)

Finally, Richard Schwindt, in his analysis of the industrial structure of the Pacific fisheries, makes an important point regarding firm versus industry overcapacity in the Pacific coast fish processing industry.

> "The problem here is one of industry capacity versus enterprise capacity. When simplistically reviewed there is significantly more capacity available than is required to process the salmon harvest. If the industry were centrally controlled, capacity could be reduced with no deleterious effects on product flows. However, the industry is not centrally organized and thus each firm maintains the required capacity to handle its own high level or peak processing periods. It should be emphasized that these peaks can be very high relative to average output because of the density of particular salmon runs and the narrowing of harvesting periods imposed by regulations." (Schwindt, 1981, p. 75)

3.2 The Evidence

Despite the difficulties associated with collecting and interpreting data on excess capacity, there is a significant amount of literature on the subject. Bain provides some evidence of chronic excess capacity.

> "The remaining question concerns whether and how the incidence of chronic excess capacity in relation to demand is related to market structure. The principal theoretical hypothesis bearing on this issue is that such excess capacity is likely to occur in industries with perceptible but relatively low barriers to entry, provided that established sellers develop enough concentration to make oligopolistic price raising feasible. In this setting they might find it unattractive to set prices low enough to forestall new entry, and attractive instead to raise prices enough ultimately to induce excessive entry and excess capacity.
> As indicated in Chapter 10, systematic evidence on the incidence of chronic excess capacity is very scanty. It may be worth noting, however, that in all three of the twenty manufacturing industries sampled in which there was reasonably clear evidence of chronic excess capacity (flour, shoes, and cement) the structural conditions were roughly those described in the hypothesis just noted." (Bain, 1968, p. 437)

F. M. Scherer also proposes a connection between oligopolistic industries and excess capacity.

> "Oligopolies frequently settle down into behavioral patterns in which price competition is shunned even though some or all members suffer from appreciable excess capacity." (Scherer, 1980, p. 306)

Scherer goes on to cite evidence of excess capacity in ocean shipping and the cement industries in the United States. Furthermore, he reinforces Bain's assertion that excess capacity is more likely in loose oligopolies characterized by relatively low entry barriers and large numbers.

> "Thus, ocean shipping cartels that perfected their

> monopoly through controls over entry, investment and scheduling were less prone toward costly excess capacity or `overtonnaging' than the looser `open' cartels serving U. S. routes." (Scherer, 1980, p. 468)

Harder evidence on the existence of excess capacity comes from Esposito and Esposito in the 1974 article entitled, "Excess Capacity and Market Structure".

> "This paper employs multiple regression analysis and investigates the quantitative relationship between market structure and a direct measure of excess capacity for 35 American manufacturing industries. In order to capture `chronic' excess capacity, the dependent variable is measured over a period of rising aggregate demand, 1963-1966. The results suggest that partial oligopolies experience significantly more excess capacity than do tight oligopolistic or atomistic industries." (Esposito and Esposito, May 1974, p. 188)

The Espositos conclude as follows:

> "Industries with concentration ratios between 40 and 69 experience excess capacity which are (sic), on the average, 5.32 percentage points higher than industries with four-firm concentration ratios below 40 (the excluded class)." (Esposito and Esposito, May 1974, p. 192)

Industries with concentration ratios greater than 70 (four firms) were found to have excess capacity which was not significantly different than for industries with ratios of less than 40.

The perils of providing convincing evidence of excess capacity can be illustrated by examining the critique of the Esposito paper provided by Mann et al in a February, 1979 issue of "The Review of Economics and Statistics". The main criticism of the Esposito paper is that documenting the existence of excess capacity during growth periods in several industries can not

provide proof of chronic excess capacity. Chronic excess capacity must be observed, as the above quote from Bain states, at a time of peak demand.

> "To press the point, three of the partial oligopolies, structural clay products, boat building, and railroad equipment, started the period with an exceptional amount of excess capacity, operating rates of 56%, 33%, and 56%, respectively, considerably below the sample's average of 79%. The fact that the excess capacity was substantially reduced in each of these industries by the end of the period strongly suggests that the excess capacity at the beginning of the period was a temporary condition, one which cannot be called chronic.
> To conclude, there is no legitimate interpretation that can be drawn from the Esposito's results concerning chronic excess capacity. It is simply not permissible to claim that partial oligopolists are prone to chronic excess capacity when no attempt is made to examine each industry at coincident times of peak demand." (Mann, Meehan, and Ramsay, Feb. 1979, p. 157-158)

John C. Hilke in a December 1984 article in the Journal of Industrial Economics empirically investigated "...the prevalence and efficiency of excess capacity in deterring entry." (Hilke, 1984, p. 233) His results showed that excess capacity is negatively related to entry but the results were not significant at a 10% level of confidence. The Hilke article provides weak evidence that excess capacity is used as an entry deterring strategy.

Stanley S. Reynolds used a dynamic game model of production and capital investment choice to explain the behaviour of leading firms in the post-war American aluminum industry. Reynolds reached the following conclusion:

> "The amount of excess capacity arising from strategic investment was 2 percent or less in all cases examined. It may be necessary to introduce additional factors to explain fully the average observed excess capacity of

approximately 9 percent." (Reynolds, March 1986, pp. 226-227)

Attempts to verify the existence of chronic excess capacity shed only slightly more light on the issue than the theory. The evidence is strong enough to make several tentative conclusions:

1) Empirical studies indicate that oligopolistic industries appear to experience chronic excess capacity.

2) Industries which are characterized as oligopolistic but have relatively low entry barriers, and low concentration levels, tend to experience the greatest degree of excess capacity.

The preceding sections show that the existence of excess capacity in an industry may result from its structure. An industry characterized by perfect competition will not, in equilibrium, experience excess capacity. A monopolistic industry also will not experience excess capacity, although it may not operate at the minimum point on its long-run average cost curve. A monopolistically competitive industry will experience excess capacity. An industry characterized by oligopoly arguably will experience excess capacity, although the empirical verification of this hypothesis is not convincing.

4. THE MARKET STRUCTURE OF THE ATLANTIC FISH PROCESSING INDUSTRY

The prediction of excess capacity in the fish processing industry depends on which of the four models of industrial structure applies to the fish processing industry. Before discussing this issue, it must be once again pointed out that it is input markets, not output markets which are being examined.

Canadian fish products are mostly sold on world markets. Consequently it is oligopsony which is being considered rather than oligopoly. In oligopolistic industries, incumbents will attempt to push output prices above competitive levels by restricting output. Strategic investment in plants may be used to deter entry and push prices further above competitive levels. In oligopsonistic industries, incumbents will attempt to depress input prices below competitive levels. Excess capacity resulting from strategic investment may be used to restrict competition for inputs (by deterring entry) thereby further depressing input prices below competitive levels.[1]

The larger fish processing firms enjoy some market power for certain fish products in Canadian and U. S. markets. For the most part, however, there are enough close substitutes for Canadian fish products to say that Canadian firms are price takers. The degree of competition among buyers of primary fish products is more difficult to assess. There are certainly variations by species, depending, among other things, on the amount of processing required.

Data on buyer concentration would support the contention

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[1] There is another issue that must be addressed regarding the use of strategic investment to deter entry into the fish processing industry. In many instances, total fish supplies to the industry virtually are fixed. If this is the case, increasing fish input prices will not attract additional supplies of fish to the industry as a whole. The share of an individual firm may increase, however, due to the higher prices it offers in response to threatened entry. Extra capacity would have to be available to process the increase in the share of a total catch.

that the fish processing industry is a loose oligopsony. There are many fish buyers but a few firms account for the majority of fish acquired. A study conducted in 1981 by Marvin Shaffer and Associates noted that there were about 600 processing plants in Atlantic Canada. Three hundred of these plants were involved in groundfish processing.

> "While there are a large number of groundfish processors, a large proportion of activity is accounted for by four large vertically integrated firms....These companies own roughly 93% of the offshore trawler fleet, and account for over 50% of the Atlantic groundfish production." (Shaffer et al, 1981, p. 14)

There has been a major restructuring of the Atlantic fish processing industry since 1981. The four largest fish processors merged into two firms. More recently a third dominant firm has evolved through acquisitions of middle sized firms. The net result of these events is probably a tightening up of the oligopsonistic structure of the industry. Nevertheless, the large number of small, independent firms would seem to indicate that a loose oligopsony is likely the best characterization of the Atlantic fish processing industry.

Oligopolies or oligopsonies depend on the existence of barriers to entry. What are the barriers to entry which lead to the oligopsonistic structure of the Atlantic fish processing industry? The entry barriers relevant to the fish processing industry can be divided into two categories: absolute cost advantages and economies of scale. Absolute cost advantages exist if costs incurred by established firms are lower than those experienced by potential competitors, at any given output level.

Economies of scale exist if cost per unit declines as output increases.

Economies of scale can be divided into: product specific economies, plant specific economies and multi-plant economies (see Scherer, 1980, chapter 4). The latter category can be further subdivided into many components, including: economies of investment and physical distribution and economies of risk spreading and finance.

The literature review conducted in preparing this paper has led to the following conclusions:

1) Economies of scale at the product and plant levels are not significant barriers to entry in the processing industry.

2) Two forms of multi-plant economies of scale are important barriers to entry. The first concerns the ability of large, established producers to market their products more effectively than prospective and small firms. The second relates to the ability of large firms to attract investment capital more cheaply than prospective and small firms.

3) The large firms possess absolute cost advantages as a result of their ownership, through the enterprise allocation program, of offshore groundfish stocks. Superior access to these stocks first resulted from the ability of large firms to raise the investment capital required to construct and operate large offshore

trawlers.

4) Small fish buyers and processors often behave as oligopsonists because transportation costs and time constraints fragment the fish buying market. Small operators can enjoy a relatively high share of a discrete subcomponent of the total fish buying market.

Let us briefly examine these four points in turn. Many studies of entry barriers have concluded that economies of scale at the product and plant level are not significant barriers to entry. Scherer made the following observations:

- "With few exceptions, the minimum optimal scale of plant revealed in studies of American manufacturing industries has been small relative in industry size."
- "Second, the long-run cost curves in most industries are much less steep at suboptimal plant scales than one is led to believe by typical text book illustrations."
- "We conclude then that economies of scale at the plant level do not in the vast majority of instances necessitate high national concentration levels for U.S. manufacturing industries." (Scherer, 1980, pp. 94-95)

Evidence examined by R. Schwindt on the Pacific coast salmon processing industry resulted in the conclusion that, "In canning and freezing, plant economies do not explain observed concentration levels." (Schwindt, 1981, p. 23) Schwindt arrived at his conclusion by comparing the percentage of total output accounted for by a given number of the largest plants to the percentage of total output accounted for by the same number of the largest firms. He found the latter percentage much larger than the former. He, therefore, concluded, "In neither canning

nor freezing does the level of plant concentration explain the level of enterprise concentration...." (Schwindt, 1981, p. 23)

Cleo Cormier, in a 1980 review of processors in the Gulf of St. Lawrence area, made a similar observation to Schwindt. "This variation in size is more pronounced if the sector is looked at in terms of firm capacity rather than plant capacity." (Cormier, 1980, p. 3) An industry structure study of the Atlantic fishery arrived at the following conclusion:

> "Nor are economies of scale an apparent problem. In terms of production a small processor can achieve the same per unit costs as a much larger one." (Shaffer et al, 1981, p. 81)

Examination of the role of multi-plant economies yields firmer ground to support the existence of barriers to entry. Scherer drew the following conclusion in attempting to explain observed concentration levels in U. S. industries.

> "Evidently the pre-eminent position of most leading firms can be attributed not merely to maintaining large plants, but to operating many of them." (Scherer, 1980, p. 101)

Two aspects of multi-plant economies, marketing and capital raising advantages, will be examined. The advantages enjoyed by a large firm with multiple plants were described in a general way as follows. "It can mass its cash balance reserves and spread production, market and financial risks over a large volume of activity." (Scherer, 1980, p. 84)

There is evidence that concentration levels in marketing Atlantic fish products is considerably higher than for processing these products. "For both frozen fillets and blocks, while the top 4 firms account for around 70% of total production, they

account for 85-90% of total marketing of these products." (Shaffer et al, 1981, p. 70)

The Shaffer study goes on to make the following observations:

> "Perhaps the most difficult aspect of new entry is the problem not of processing efficiently but rather of marketing. A small processor will not usually have the resources or desire to develop sophisticated marketing channels (including integrated downstream operations), and is forced to sell via agents or to brokers. Selling via agents generally means via the larger firms...." (Shaffer et al, 1981, p. 82)

> "Discussions with industry and government officials suggest that small firms receive lower prices than larger processors for blocks and frozen fillets. This is because of the restricted marketing channels available to the small firm (i.e. greater reliance on brokers and agents) and the high level of buyer concentration and vertical integration in these markets. Inadequate volume and frozen product range also hampers smaller firms in dealing directly with larger buyers, particularly the retail sector." (Shaffer et al, 1981, 108)

The evidence that large processors receive a larger share of the ultimate selling price of the fish is reinforced by a recent American study which drew the following conclusions regarding marketing of fresh fish.

> "Increasingly over the last five years, these (large) Canadian firms have been negotiating direct contracts with large U. S. buyers of fresh fillets, such as supermarkets, as opposed to sending their fish through New England wholesalers or brokers as was common in the past." (Terkla and Schneck, 1986, p. 14)

> "Most independent processors in this segment of the market are not large enough to negotiate direct sales contracts with large U. S. fresh fish buyers and thus must rely on New England brokers and wholesalers to market their fresh fish....Prices received through this process are often much lower than what is available from direct marketing of fish to large U. S. retailers." (Terkla and Schneck, 1986, p. 16)

The advantages of size in raising capital is well documented in the industrial organization literature.

> "Economies of scale are also encountered when firms raise capital through common stock issues and borrowing. Indeed, this appears to be one of the most persistent advantages of corporate size, with small incremental capital cost savings being enjoyed out to very large scales." (Scherer, 1980, p. 104)

Scherer goes on to specify one aspect of the advantages enjoyed by large firms due to superior cash flow and borrowing power. "Because of its superior access to capital, the large firm may have greater staying power in periods of unusually sharp competition." (Scherer, 1980, pp. 107-108) This factor may be critical in enabling established firms to ward off potential entrants. Even if these entrants may be able to produce and market as efficiently as established firms, there remains a relative inability to raise the capital required to sustain a challenge to an established firm.

Access to capital in the Atlantic fish processing industry is complicated by the fact that the government provides a large amount of subsidized capital to firms. Government criteria for assisting firms may exacerbate the capital market disadvantages of small or prospective firms. The Task Force Report made the following statement which indicates a potential bias in the provision of government assistance.

> "Governments have been reluctant to permit business failures when many jobs would be lost or markets for fishermen seriously disrupted. Consequently a number of exceedingly weak businesses have been able to continue despite a financial condition that in another industry would have produced bankruptcy....The smaller companies have operated in a less secure financial

> environment, being of less social importance than plants employing many workers. These smaller companies have had to accept more conservative financing - less debt, more equity...." (The Task Force Report, 1982, p. 109)

Superior access to capital has allowed large firms to raise the capital required to purchase large offshore trawlers. As a result, they have attained almost exclusive control over about 50% of the total groundfish catch. The implementation of the enterprise allocation management system in 1982 formalized the de facto ownership rights possessed by the large companies. The large companies consequently enjoy an absolute cost advantage relative to small or prospective firms. Landed prices for offshore groundfish are set solely by each large company, subject only to the bargaining power of unionized offshore trawlermen. It is well documented that offshore prices are lower than inshore prices. In 1987 offshore groundfish prices were in the 20 to 25 cents per pound range while inshore prices fell between 40 and 50 cents per pound.

Ownership of offshore fish supplies imparts several advantages to large companies in addition to lower prices. The virtual year around availability of the offshore catch permits large companies to provide a relatively even flow of product to their plants and to the market place, particularly for fresh fish products. A more even flow to the plants facilitates a longer operating season and allows large processors to make better use of fixed capital. The ability to supply a variety of groundfish products year around results in the marketing advantages enjoyed

by large producers as described above.

A final important observation must be made regarding the nature of competition in the Atlantic fish processing industry. The paradigm often used to describe the industry is one with a few dominant firms surrounded by a competitive fringe consisting of hundreds of small firms. The large number of small firms composing the fish buying market could be cited as evidence that pure competition exists among these firms. Free or virtually free entry into this purely competitive sector has been assumed, "...the basic point to note is that new entry into year-round, offshore supplied processing is very difficult, while entry into seasonal, inshore supplied processing is relatively easy." (Shaffer et al, 1981, p. 53)

Caution should be exercised in making connections between the large number of small processors and the existence of pure competition. Scherer alerts us to the danger of associating smallness with pure competition.

> "The power over price possessed by a monopolist or oligopolist depends on the firms size relative to the market in which it is operating. It is entirely possible for a firm to be very small in absolute terms, but nonetheless have considerable monopoly power." (Scherer, 1980, p. 12)

The key phrase in the above quote is "...relative to the market in which it is operating." Transportation costs can fragment a market into many smaller discrete sub-markets. Small firms may represent a significant portion of the fish bought in a discrete sub-market with a few small firms accounting for its total output. Scherer's definition of oligopoly (actually

oligopsony) quoted earlier would obviously be relevant to these markets where the few firms believe their economic fortunes are perceptibly influenced by each other's behaviour. Strategic entry deterring behaviour could be expected to arise in these markets, "...in one dimensional geographic space with substantial transportation costs, entrants impinge upon the markets of only two plants - one on each side of the entering plant's chosen location. An entering plant's output contribution is almost certain to be large in relation to the market served by those two plants;...." (Scherer, 1980, p. 256)

The significance of this discussion is that oligosonistic behaviour on the part of the many, small firms may induce excess capacity among these firms in the same way as it would for large firms. For this to be true, it would have to be proven that market fragmentation arising from transportation costs exists as a significant force in input markets of the fish processing industry. There is evidence that, at least in Newfoundland, this is the case.

> "...in almost 25% of Newfoundland's ports there is only one buyer. In over 40% of the ports there is only one or two buyers. ...There would appear to be many instances where fishermen are quite limited in the number of buyers they face." (Shaffer et al, 1981, pp. 47-48)

The number of buyers available to an individual fisherman would likely be much larger in other parts of the Atlantic Provinces, particularly southwest Nova Scotia. In these areas, the market structure probably more closely approximates the purely competitive model.

5. DISCUSSION OF EVIDENCE SUPPORTING THE EXISTENCE OF EXCESS CAPACITY IN THE ATLANTIC FISH PROCESSING INDUSTRY

The focus of the discussion up to this point has been to discuss the theoretical and empirical bases for excess capacity. Features of this Atlantic fish processing industry were examined to determine if a structural explanation for excess capacity was tenable. It is now appropriate to review some of the data that has been used to conclude that excess capacity is significant. The question addressed is: does the evidence confirm the existence of chronic excess capacity as defined by Bain? The contention of this paper is that the studies of excess capacity in the Atlantic fish processing industry provide no evidence of its existence in the strict economic sense. The Task Force Report cited the following evidence of excess capacity:

> "Processing plant over-capacity (or under-utilization) has been studied repeatedly for years. The low average utilization of many facilities, measured against a standard of year-round operations, is a matter of record. A 1967 study of processing capacity in Newfoundland by Professor S. S. Mensinkai, using data through 1963, estimated a utilization rate for freezing plants of only 37 percent against a standard year of 250 eight-hour days. An estimate made in 1974 indicated only 27 percent utilization of physical capacity in the Atlantic region. The problem is evidently not of recent origin." (The Task Force Report, 1982, p. 106)

A study completed in 1982 by a DFO/DREE working group showed that groundfish freezing capacity on the east coast of Newfoundland was about 145% of peak landings in 1980 but only would be about 86% of landings by 1985.

It would be possible to criticize studies of excess capacity

on a variety of grounds such as their failure to exclude redundant capacity from the measurements. Other factors such as changing demand conditions for fish products and processors' anticipation of these changes can also lead to a misinterpretation of measurements of excess capacity taken at any point in time. To be instructive, measurements of excess capacity must be made over a sufficiently long period of time to show excess capacity exists...<u>persistently, over considerable periods of time.</u>" (Bain, 1968, p. 384)

There are, however, two over-riding issues that must be addressed in interpreting the data on capacity utilization. The first is the seasonal nature of the fisheries. The second is the role of government assistance in the processing sector. The Task Force Report and most other studies of processing sector capacity, attribute excess capacity primarily to these two factors.

The role of seasonality in measurements of excess capacity is critical. Some of the evidence backing the conclusion that capacity is excessive is based on a standard of year-round operations. Fish landings, particularly in the inshore, are, however, concentrated in a few months. Under-utilization of capacity due to seasonality is not an indicator of chronic excess capacity as defined in this paper. Studies using the year-round definition of operations are not useful in documenting the existence of chronic excess capacity.

Some studies have attempted to measure excess capacity just

for the season in which a fishery occurs. These measurements come closer to measuring excess capacity in the sense of J. S. Bain. Since landings may fluctuate significantly within a season, studies showing the under-utilization of capacity over a season do not prove the existence of excess capacity.

Seasonality of landings is caused by the biology of the fish, harvesting technology, government regulation and the propensity of fishermen to compete for a share of the catch. Regardless of the cause, processors must make capacity decisions in the face of stochastic variations in supply from fishermen. Chronic excess capacity could be proven only if capacity exceeded fish supplies at their absolute peak over an extended period of time. It would have to be demonstrated that individual firms in an industry exhibited this characteristic.

The Task Force Report quoted a 1982 DFO/DREE study as follows:

> "In examining the reasons for such an increase in fish processing capacity, two factors emerge: federal and provincial government incentives to invest in the fish processing industry and the optimism within the industry that was generated by the provincial governments following the extension of jurisdiction in 1977....The overall effect of these government support programs or subsidies has been to encourage investment in excess of the normal level." (The Task Force Report, 1982, p. 108)

The Task Force Report went on to show that federal assistance in the creation of new processing capacity accounted for over $46 million of the total investment of $157 million incurred between 1969 and 1980.

Ordinarily, government subsidization would induce excessive

production. This phenomenon is well documented in the agriculture industry. In fisheries, output virtually is fixed by biological factors. Subsidization of the industry will add to capacity without any increase in output. Efficient producers may reap windfall gains as a result of government subsidization. Inefficient producers may continue to operate due to subsidies. Government subsidization of processors undoubtedly is the most important factor causing excess capacity in the Atlantic fish processing industry. It exacerbates the tendency toward over-capacity which may result from strategic entry deterring behaviour in the industry.

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