PETRO-CANADA, ANTITRUST LEGISLATION

AND

VERTICAL INTEGRATION IN THE CANADIAN PETROLEUM INDUSTRY*

by

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1. Introduction

The issue of government intervention in the Canadian petroleum industry has received considerable attention since the dramatic increase in the relative prices of petroleum products in 1973. Recently the Government of Canada's entry, Petro-Canada, has acquired a major stance in the industry. Petro-Canada was created on July 30, 1975 when an enabling act passed by the Canadian Parliament received Royal Assent and it began operations in January 1976. Its mandate emphasized the following goals: to increase the supply of energy available to Canadians, to assist the government in the formulation of its national energy policy, and to increase the Canadian presence in the petroleum industry. Through the acquisition of the governments 45% equity in Panarctic Oils Ltd. and the purchase of Atlantic Richfield Canada Ltd. and Pacific Petroleums Ltd., Petro-Canada ranks fourth in combined oil and natural-gas-liquids output after Imperial Oil Ltd., Texaco Canada Inc., and Gulf Canada Ltd. The government enterprise ranks about fifth in reserves.

The purpose of this paper is to consider the case for intervention in the petroleum industry via Petro-Canada versus other modes of intervention, particularly divestiture and antitrust legislation. A popular opinion is that the large integrated oil companies posses substantial market power permitting them to raise prices and to earn profits in excess of the normal rate of return. Furthermore, this market power is related to the fact that the companies are integrated from the exploration stage to the distribution and retail stage. A popular solution is "to make the industry competitive" by breaking up the integrated companies through vertical and horizontal divestiture legislation and by preventing re-

integration through antitrust legislation. This legislation would legally constrain the organizational form taken by industry participants and force interactions between stages in the industry to take the form of "arms length" transactions in product markets. With the industry consisting of a large number of firms who only resolve their interdependence through product market transactions, the popular belief is that market power would be eliminated and that relative prices of petroleum products would be lower.

The popular solution has three problems. First, the size of the Canadian market may permit only a small number of firms to take full advantage of the economies of scale at a particular stage of the industry (e.g., refining). Horizontal divestiture would increase the cost of producing the stage's product. Second, vertical integration may result in economies or reduced costs. The basis of these economies which depend on the cost of market exchange are outlined in Section 3. Third, if a firm with market power at one stage sets the price of its product above the competitive price, then substitution away from this factor by firms in the next stage will result in inefficient factor proportions. The firm with market power has on incentive to integrate into the next stage to "capture" some of this efficiency loss in the form of increased rents by restoring efficient factor proportions. Integration in the presence of market power may increase social welfare.

If these effects are substantial, policy makers are caught in a dilemma. While divestiture and antitrust legislation may eliminate market power, the result could be higher costs and higher relative prices of petroleum products. The purpose of this paper is to ascertain whether intervention in the form of Petro-Canada can be a solution to this dilemma.

Note that it is beyond the scope of this paper to examine the many other reasons cited for intervention via Petro-Canada. These include the argument that oil and gas supplies are too crucial to Canada's strategic interests to be left exclusively in the hands of private firms, particularly when the large integrated companies are foreign owned, and arguments related to the sub-optimal bearing of risks by private enterprise. For an analysis of the role of Petro-Canada in exploration in Canada's High Arctic see Wiens [1979].

The argument for intervention by Petro-Canada considered here is based on the premise that without its presence, the Canadian petroleum industry is oligopolistic, output is restricted, price exceeds marginal costs, and that the Government of Canada cannot or will not remove the barriers to entry that sustain the economic rents.

Government intervention in an industry can take various forms. Antitrust legislation, fiscal policy (tax/subsidy), price and quantity control and nationalization are alternative modes that the state has available to regulate an industry. Petro-Canada's form of public organization is one where the public firm competes directly with privately owned firms in an oligopolistic setting.[1,2] Harris and Wiens [1977] have addressed themselves to the normative question of how such a government firm should be used to promote economic efficiency within a non-competitive environment.

Their fundamental result is that a government firm that acts as a dominant firm in an oligopolistic industry can induce an "optimal" allocation of resources. This allocation is optimal in the sense that all firms behave in a competitive manner. The government enterprise simply

announces that it will make up any differences between target industry output and the output of the private firms. Provided the announcement is credible each private firm faces a fixed output price and its profit maximizing decision is to produce where marginal cost equals price. Provided target industry output is set where industry marginal cost equals price, the government enterprise will also produce where its marginal cost equals price.

The purpose of this paper is to compare the Wiens-Harris form of regulation of a vertically integrated industry via Petro-Canada with antitrust and divestiture legislation. An important aspect of government firm regulation in this situation is the extent to which the government firm should integrate. The answer is that, starting at the factor markets, the government firm should locate itself at those stages where private firms exercise market power and use the Wiens-Harris mode of regulation. To ensure efficiency, the government firm must also integrate into stages if doing so results in reduced costs.

The paper proceeds as follows. In Section 2 we summarize the Wiens-Harris mode of regulation. Section 3 examines some potential economies of vertical integration in the petroleum industry, Section 4 considers the evidence concerning the potential for market power at any stage of the industry and analyzes the effect that market power would have if present. In Section 5 we compare government firm regulation with antitrust and vertical divestiture legislation, while the final section presents some caveats and conclusions. The entire paper draws heavily on the work by Oliver Williamson [1968, 1975]; Sections 3 and 4 contain material by David Teece [1976]. Parts of Sections 2, 4 and 5 appeared in Wiens

[1978a]. The results of this paper are general and do not apply only to Petro-Canada and the Canadian petroleum industry. They apply to any vertically integrated industry where market power may exist.

2. Government Firm Regulation:

The following framework was used by Harris and Wiens [1977] to analyze the "reaction function mode" of regulation via a government firm. Consider an oligopolistic industry where all firms produce the same homogeneous good sold domestically. Assume that either through explicit or implicit collusion industry output is restricted, thus rents are being earned by the firms[3] and domestic consumers suffer a loss of consumer surplus. If the government becomes aware of this situation and decides to take remedial action, its intervention can take various forms. Assume it decides to intervene either by purchasing an existing firm or by creating a new firm. If the state purchases a firm previously privately owned it will immediately acquire information on cost and demand conditions in the industry. In either case it will obtain valuable information in the day-to-day operation of its firm.

The government can then extrapolate this information to the entire industry. The accuracy of this extrapolation depends on the correlation between the government firm's and the private firms' cost schedules. Since a substantial subset of the relevant factor prices are the same for all firms in any industry and given equal access to technology, one would expect that the degree of correlation is quite high. The principal source of variance between cost schedules would be location or firm specific

advantages and technologies. At any rate the government can use information about its cost and demand conditions to estimate industry demand and cost schedules.[4]

Suppose the government's initial suspicion is confirmed and it discovers that monopoly rents are being earned. By correctly operating its firm it can eliminate these rents and achieve an "optimal" allocation of resources.

The procedure is quite simple. Given its information regarding demand and cost conditions the government firm can compute that level of industry output for which industry marginal Cost equals price of output.[5] The government firm announces that it will make up any difference between target industry output and what the private firms choose to produce. This reaction function ensures that all private firms face a fixed output price and their optimal decisions are to choose their output levels so that price of output equals marginal costs at that output for each firm. Notice that if each private firm is setting output so that price equals its marginal cost; then the above reaction function will ensure that the government firm sets output so that price equals its marginal cost.

Of course, to be effective the government firm's reaction function must be credible. If the private firms decide to test the resolve of the government firm and continue to restrict output after the government firm announces its strategy, then the government firm could incur losses in the short-run. During this period it would produce output at a level were its marginal cost of output exceeded the price of output. Thus the credibility of the government firm's strategy depends on the financial backing of the government.

Furthermore, the government firm must have sufficient plant capacity to make up any difference between desired output and total private output. In the extreme case where all private firms decide to close down their operations it would be necessary for the government firm to produce all the desired output. This aspect of the problem requires an explicit dynamic framework which takes the strategic intertemporal interaction of the government and private firms into account and is treated in Wiens and Harris [1977].

Given that it is credible, the above scheme has the following interesting features. First, the dominant strategy for any private firm is to produce where price equals its marginal cost independent of what other firms are doing. Second, the scheme is stable against collusion by private firms since it will be impossible for any group of private firms to make themselves collectively better off by colluding. In effect the government firm's reaction function negates the interdependence among firms which results from the industry demand function and the small number of firms. It is important to note that while the government firm determines the optimal level of production for the industry, profit maximization on the part of the private firms determines the optimal distribution of production across firms.

The above analysis shows how a government firm can be used to regulate an oligopolistic industry producing a homogeneous good. It assumed the industry consisted of a fixed number of firms, such that in an allocation with all firms having price equal to marginal cost, no firms incur a loss. Harris [1978] has shown that these results hold in the situation where

firms have fixed costs or increasing returns and where the number of firms in the industry is taken as endogenous. Here the government firm's reaction function takes into account the effect that profits and losses have on entry and exit.

A government firm can also be used to regulate an industry characterized by a few firms producing products which are close substitutes or complements. In this monopolistically competitive situation the above results hold in a weaker sense. If the government firm can shift each private firm's demand function through changes in the price of its product, a reaction function exists which will enforce a desired allocation of output across firms. However this reaction function has neither the dominant strategy property nor is it stable against coalitions. In effect the government firm threatens individual firms with retaliation in the form of increased or decreased output. The government firm may be unable to backup its threat if more than one firm decides to call its threat. It could, however, increase the number of goods it produces and thereby increase the potency of its threat.

We now proceed to analyze some cost advantages of vertical integration.

3. Cost Advantages of Vertical Integration

Vertical integration results in a firm owning productive assets and engaging in productive activities in more than one stage of an industry. The major stages of the oil industry are exploration and production, the transportation of crude oil and refined products, refining, and marketing of refined products. In this section we will discuss the advantages that

a firm obtains by owning assets in more than one of these stages even though it has no market power at any stage.

The alternative to vertical integration is to engage in transactions in intermediate product markets. An independent refiner can purchase crude oil from crude oil suppliers and sell his refined products to firms specializing in the marketing of these products. Why do integrated firms choose intra-firm transactions to inter-firm transactions? One important reason is that market exchange may not be the least cost method.

Consider the options available to the independent refiner in obtaining crude oil. They are:

1. A series of short-term contracts with crude suppliers specifying price and quantity of crude to be delivered on certain dates,

2. An incomplete long-term contract with one or more crude suppliers. Certain aspects of the contract, like price or quantity, to be negotiated at future dates, and

3. A long-term (once and for all) contract specifying terms for all future contingencies of importance to the refiner and suppliers.

The first option is costly because of uncertainty regarding both price and quantity. Spot crude prices vary and quantity is not assured if prices and/or quantities are being regulated. The cost here is the risk associated with variance in spot market prices (particularly if delivery contracts of refined products are of a longer term) and the increased per unit costs of sub-capacity operations. Furthermore, once the refinery has been linked to suppliers by a pipeline, the suppliers could attempt to obtain a higher price for their crude. Bargaining costs to refiners are potentially greater because a refinery is a major long-term investment.

Refineries depreciate even when not in use, while crude reserves do not.

Incomplete, long term contracts are also risky. Terms which have not been completely specified may be subject to opportunistic bargaining at execution time. Williamson [1975] defines opportunistic behavior as the propensity for individuals to distort information or make false promises or threats in a self-serving manner. While these effects can be reduced by clauses which bind the parties to joint profit maximize plus distribute unforseen costs and benefits on a pre-determined basis, opportunistic misrepresentation by one or more parties could still occur.

Finally, the complex, contingent claims contract of option 3 is not feasible. To compute the impact of all relevant future events and to specify what each party must do would be very complicated and costly. Further more, in most situations it would be impossible to delineate, at the time the contract is written, all future events that might be relevant to the parties concerned.

The alternative to transactions in intermediate product markets via contracts is for the refiner to integrate backwards into crude production (or crude suppliers to integrate forward by purchasing and/or developing assets in this stage). By substituting an internal mode of organization for product market transactions, the refiner could eliminate the market transaction costs referred to above.

The incentive to integrate will vary with these market costs. Market costs will be positively correlated with two important factors. First, the period of time over which real investments associated with the contract are to be used. With long-term contracts, the cumulative effect of any initial mistakes could be very costly and it would be difficult to re-

negotiate if they benefit the other party. Second, the extent to which quasi-rents associated with these investments can be appropriated by someone other than the party having title to these assets. The productive facilities of refineries, pipelines, and oil and gas fields are highly specialized. Once installed their alternative uses are limited. The refinery is a "hostage" of the pipeline and crude suppliers, the crude suppliers are a "hostage" of the refinery and pipeline, etc. An incentive exists for one or more parties to engage in opportunistic behavior, at the loss to his "hostages", to improve the terms of trade.

Given these apparent advantages of integration, why do we observe independents competing with integrated companies at all stages of the industry and engaging in market transactions with these integrated companies and other independents? The reason is simply that trading in spot markets has its advantages. As the scope of vertical integration is extended transactional diseconomies may eventually be encountered. The above arguments do not imply that firms will always choose intra-firm transactins to inter-firm transactions. Rather, a firm will choose that combination of transactions that results in optimum expected profits and risk (for an analysis of the limits of vertical integration in the U.S. Petroleum Industry see Teece (1976)).

Other advantages of vertical integration are the following. First, it permits internalization of technological interdependencies. Refinery capacity needs to be linked with pipeline throughout. However, if it was possible to write, execute, and police contracts without incurring costs, these investment interdependencies could be resolved through market transactions. Thus internalization again revolves around economizing on transaction costs.

Second, production complementarities exist between the various stages of the oil and gas industry. The industry is characterized by volumetric interdependence and high inventory costs. Vertical integration facilitates information flows, harmonizes interests, and permits scheduling problems to be resolved within the organization.

Third, vertical integration may reduce risk and therefore a vertically integrated firm's capital costs will be lower. Lower capital costs imply lower overall costs of operation.

The "market failure" relating to vertical integration may not in fact be a failure. Firms may choose to engage in a once-and-for all transaction in the asset market (acquire productive assets at upstream or downstream stages) rather than employ the intermediate product markets on a continuing basis if consequently costs are reduced. Legislation preventing these asset market transactions may impair the overall efficiency of the industry.

However as Stigler [1968] points out, vertical integration loses its innocence if there is an appreciable degree of market power at even one stage of the product process. In the next section we discuss the possible anticompetitive effects of vertical integration in the petroleum industry.

4. Market Power and Vertical Integration

In the last section we described some merits of vertical integration - vertical integration may reduce costs. We now consider some possible demerits. The demerits of vertical integration revolve around the issue of market power at one or more stages of the industry. A firm is defined to have market power (or a degree of monopoly power) if it can earn profits

in excess of a normal rate of return by restricting output and thereby increase the price of its product. One source of market power is the barrier to entry due to increasing returns to scale in a given stage of the industry. Economies of scale may result in market power if the number of firms that can take advantage of these economies is small because of the limited size of the market relative to the minimally efficient plant size. These firms could obtain rents by restricting output through explicit or implicit collusion without attracting new entrants provided prices weren't increased too much. Oil refining in Canada is a potential candidate where economies of scale could permit some degree of market power.

Two other types of barriers to entry are important. The most obvious is monopolization (or catelization) of a factor supply. If one or a small number of parties can gain effective control over a substantial portion of the existing supply of a given factor, crude oil reserves for example, then the factor's price could be set above its competitive price. The second source of barriers to entry are government erected barriers. Examples of government barriers are tariffs, quotas, and price and quantity restrictions.

Some economists have claimed that vertical integration itself is a barrier to entry. This argument is really analogous to the increasing returns to scale argument. Suppose that the least-cost organizational form is a vertically integrated firm and suppose that the number of firms who can take full advantage of this form is small. The cost advantages of vertical integration referred to in Section 3 are then a barrier to entry. Provided prices are not increased too much above the competitive price, these vertically integrated firms could obtain rents.

The question of whether or not rents are actually being earned in the (Canadian) petroleum industry is a very difficult one to answer and is beyond the scope of this report. Note that the presence of a competitive sector at each stage of the industry does not rule out the possibility of market power at any of these stages. The explanation of a competitive fringe based on mutual cost advantages given in Section 3 applies even though market power exists at some stage. Another explanation is that the integrated firms permit a competitive fringe to survive as protection against divestiture and antitrust legislation.

Suppose that market power does exist at some stage. How will market power affect the industry? What gains in addition to cost reduction accrue to a party possessing market power from vertical integration? What are the social benefits and/or costs of these events? To illustrate the situation consider the following variable proportions/distortions argument.

A monopolist in a factor market sells his product to a competitive industry. To capture rents he restricts output and prices the factor above its competitive or efficient price. This has two effects. First, if the competitive industry maintains the factor proportions used previously, then its cost schedule shifts upward with an increase in the price of the monopolized factor. Second, given variable proportions in production, the competitive industry will substitute away from the monopolized factor partially shifting down the relevant cost schedule. Here inefficient factor proportions prevail.

This situation is illustrated in Diagram 4.1. The curves DD' and RR' are respectively the industry demand and marginal revenue schedule. For ease of exposition we have assumed a linear homogeneous production func-
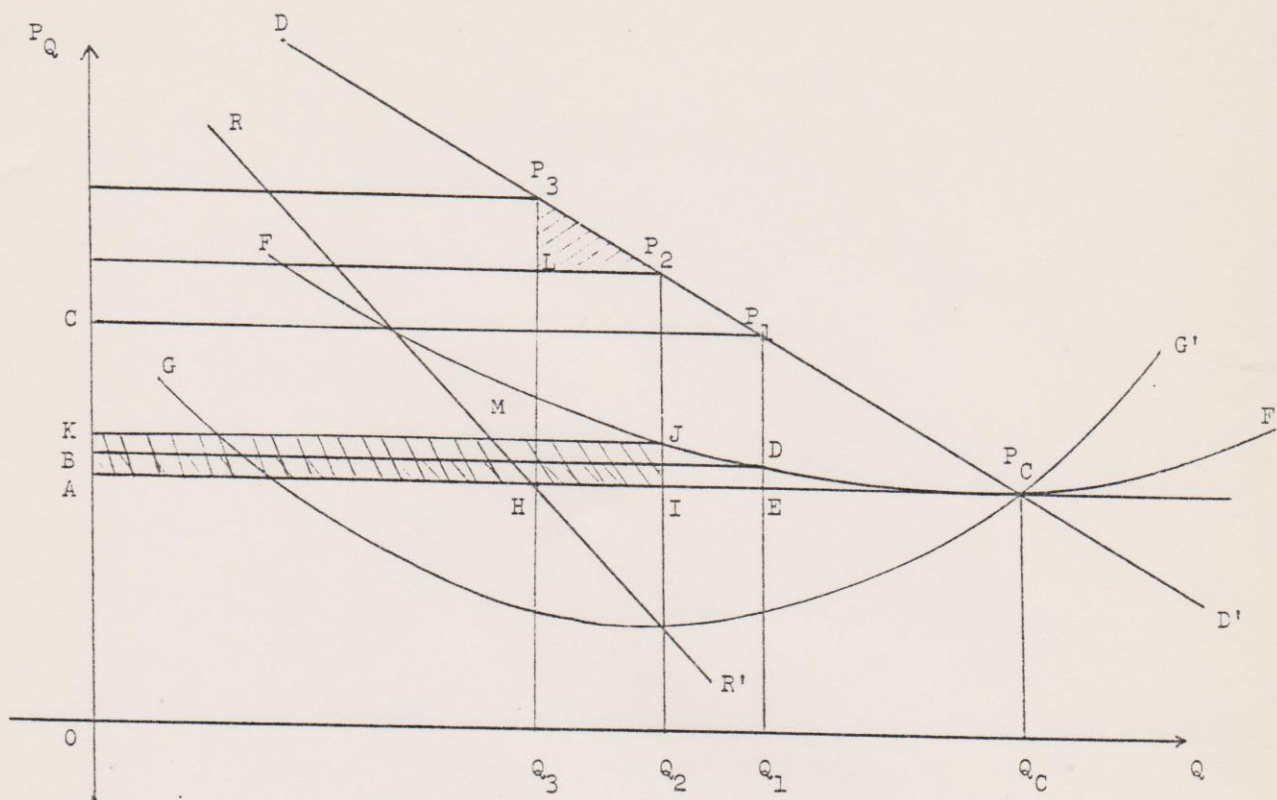
Diagram 4.1

tion and a linear demand schedule for the initially competitive industry.
At the competitive factor price P_C, the industry cost schedule is the
horizontal line AP_C, at the factor price P_1, the schedule is CP_1.

To understand the curve FF' consider the situation when the factor
price is P_1. At this price the industry cost schedule is CP_1. Entry or
exit will take place until industry output is OQ_1. The vertical distance
Q_1P_1 represents the average cost to the competitive industry using the in-

efficient factor proportions at price P_1. The distance Q_1D represents these same factor proportions valued at the competitive price P_C. Thus the curve FF' represents the value, at competitive factor prices, of the inefficient factor proportions used by the competitive industry to produce a unit of output. We call this schedule the competitive industry's average cost schedule from the monopolist's point of view.

Other important information can be obtained from Diagram 4.1. The monopolist's rent, at factor price P_1, is given by the rectangle BCP_1D. The efficiency loss at this price due to substitution away from the monopolized factor is given by the rectangle ABDE. We also call the schedule GG' the industry's marginal cost schedule from the monopolist's point of view. It is the curve marginal to the total cost schedule corresponding to the average cost curve FF'. The monopolist will be maximizing profits when he sets the factor price P so that at the corresponding level of output Q, industry marginal revenue equals the industry's marginal cost from the monopolists' point of view. In Diagram 4.1 this occurs at a factor price of P_2 and output of Q_2 at the intersection of schedules RR' and GG'.

We have assumed that the monopolist is content to sell his factor to the competitive industry. However, he can do better by integrating into this industry. The source of his increased rent is the efficiency loss described above due to inefficient factor proportions. By integrating forward and substituting efficient factor proportions he can increase his profits. But integration may result in a further reduction of output. This is clearly the case in Diagram 4.1 where the fully integrated monopolist is maximizing profits at output Q_3. At this level of output, industry marginal revenue equals marginal cost where the relevant cost schedule now

is AP_C. (If vertical integration also results in transaction economies as discussed in Section 3 then the cost schedule would shift downwards with integration tending to increase output).

Whether integration results in an increase or a decrease in output depends on whether the intersection of GG' and RR' falls to the left or to the right of Q_3.[6] Diagram 4.2 illustrates the situations where integration results in an increase in output.[7] In the situation of Diagram 4.1, integration results in a net welfare gain if the loss in consumer surplus (triangle LP_2P_3) is less than the removal of the dead weight loss (rectangle AHMK) and if we regard monopoly rent as a neutral transfer payment from consumers to the monopolist.[8] One would expect that in most situations where the demand schedule lies well to the right of the vertical axis that the rectangle would be larger than the triangle. In the situation of Diagram 4.2, integration results in an unambiguous welfare gain. Of course, in both cases industry output is less than competitive industry output Q_C.

In the analysis above we assumed that a monopolist in a factor market sells his product to a competitive industry. The diagrammatic analysis shows in a simple manner the potential trade-off inherent in merger or vertical integration between increased efficiency on one hand and restricted output on the other.[9] Attempts by the state to limit the natural evolution of organizational forms, in the interests of "increased competition", may impair efficiency and may in fact decrease output. In Section 5 of this paper we will present one solution to this dilemma.

The analysis above can be modified in a straightforward manner to tackle the problem we are concerned with in this chapter. Suppose the factor producing industry is an oligopoly instead of a monopoly. If the members

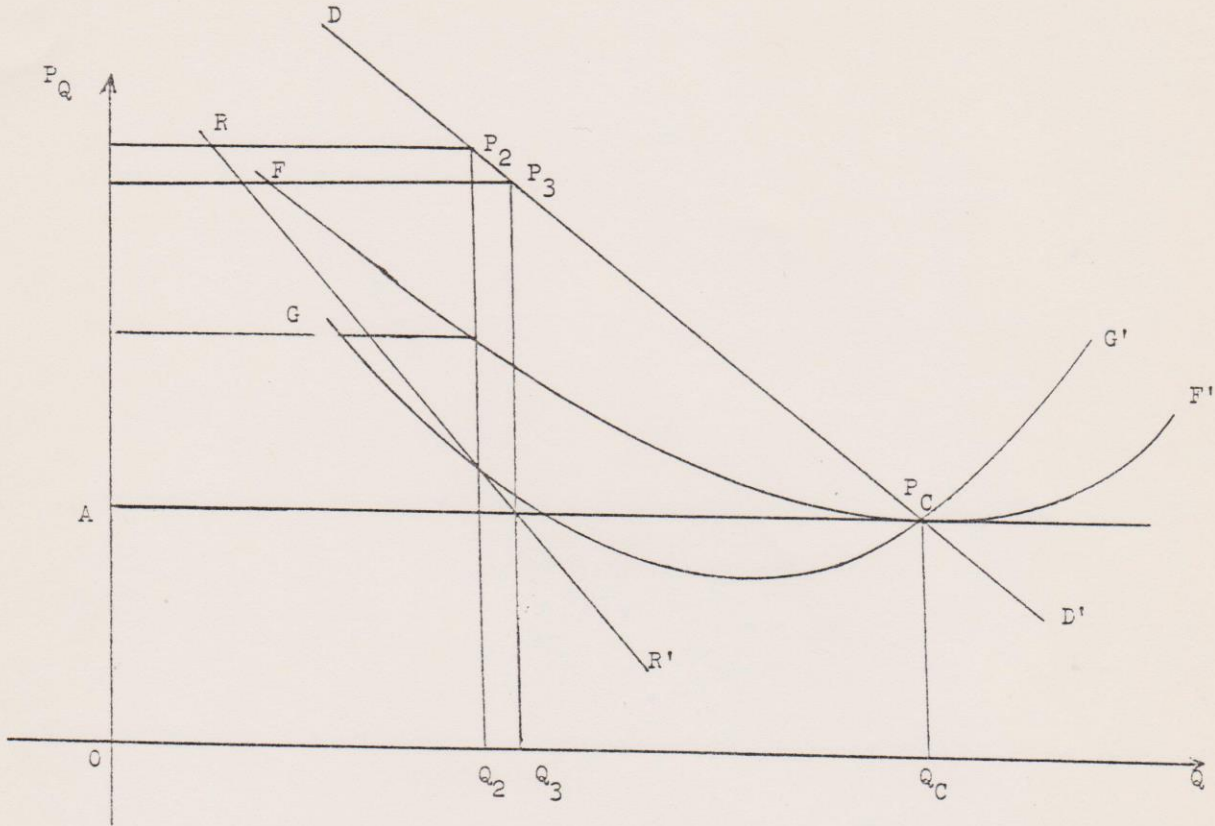of the oligopoly are earning rents, then the same efficiency loss

Diagram 4.2

described above will prevail. Each oligopolist will have an incentive to

integrate forward to capture some of this loss in the form of profits by

substituting efficient factor proportions. Furthermore, the industry pur-

chasing the factor need not be a competitive industry for this incentive

to exist. The potential for an efficiency loss exists if the factor pro-

ducing industry is earning rents and if production at the next stage admits

variable factor proportions. Following integration, industry output may

increase or decrease. In either situation output is less than the competitive level of output.

Another incentive for a firm with market power to integrate forward is the potential gain from exploiting differing elasticities of demand among its customers. If customers can resell the good in question the firm with market power must necessarily charge a single price. By purchasing the productive assets of customers with the lowest elasticities of demand (and operating these assets itself), the firm can charge a higher price to the remaining customers with relatively high elasticities of demand. The benefits of integrating to the firm with market power are obvious. The social costs and benefits are less clear. The situation with those customers taken over is analogous to the discussion above regarding variable proportions distortions. Because of the higher price paid by the remaining customers for one of their inputs, their output levels will decrease (provided they are not the ultimate consumer) and their factor proportions will be further distorted if input proportions are variable. Clearly, these latter events are not socially desirable. Curiously, given the variable proportions argument, it might be socially desirable for the firm with market power to purchase these customers as well (again provided they are not the ultimate consumers).

We conclude this section with the following comments. Vertical integration when market power exists at some stage is not necessarily socially undesirable. In fact, we have argued above that in most situations we expect that vertical integration performed voluntarily by firms with market power is socially desirable. In the previous section we have examined some important cost advantages of vertical integration. The prob-

lem is not the vertically integrated nature of the petroleum industry, but

the possibility that these firms have market power and therefore are earn-

ing rent (income in excess of the normal rate of return) by restricting

output. The persistence of rent depends exclusively on the existence of

barriers to entry. Barriers to entry that are important for the Canadian

petroleum industry are:

1. Government Barriers: These include import
   and export quotas, tariffs, price and
   quantity regulations.

2. Economies of Scale: The economies of scale
   associated with pipelines are obvious. The
   traditional solutions are public monopolies
   or regulated private monopolies. The
   economies of scale of refineries, while
   less obvious, may be of most importance.
   Particularly if the minimally efficient plant
   size is large relative to the market.

3. Economies of Integration: If integration
   results in substantial economies, efficiency
   in the industry requires that most firms be
   vertically integrated. If the market can
   only support a small number of wholly integrated
   firms, then these economies constitute a barrier
   to entry.

4. Monopoly (Cartel) Ownership of a Factor: OPEC
   countries own the bulk of world crude reserves.
   Their ability to influence prices, at least in
   the short-run is self evident given the events
   since 1973.

Since Canada is a small country, its impact on world crude prices

is negligible so the last barrier to entry need not concern us. Government

erected barriers are best handled by the government in question. The

second and/or third barriers to entry cannot be eliminated. In the next

section we discuss how market power derived from these barriers to entry

can be eliminated, while maintaining all the economies of vertical integra-

tion and large scale operation.

5. Vertical Integration and the Dominant Public Firm

     We will now show how a government firm can be used to maintain the cost advantages of integration and still ensure that output levels are competitive. Thus government firm regulation obtains a first best solution. In Section 6 we then consider the specific case of Petro-Canada. Consider an industry with the following structure.

     The production process consists of a number of stages where the production units of one stage can be taken to be separated from those of the next. Furthermore, the industry of interest consists of a small number of integrated firms which may compete with independent firms at each stage.

     A government concerned that firms in the industry are earning rents has various instruments at its disposal. Harris and Wiens [1977] have discussed the advantages and disadvantages of intervention in an oligopolistic industry using government firms, tax/subsidy, antitrust, and price and quantity regulation. Comments made there apply equally to an oligopolistic industry where firms are vertically integrated. The traditional mode of intervention in a vertically integrated industry is vertical divestiture and antitrust legislation. This mode of intervention has some very important disadvantages.

     Divestiture and antitrust legislation which limits integration and which forces firms to divest themselves of some of their production units may have anti social consequences. Antitrust legislation does not permit firms to obtain the economies discussed in Section 3. Antitrust legislation places constraints on the behavior of firms in the asset markets.

This forces these firms to use the intermediate product markets instead. However, as shown in Section 3, these intermediate market transactions (contracts) are costly. Thus antitrust legislation (if in fact it is a binding constraint) forces firms into a more costly mode of operation.

Even if the integrated firms are earning rents, antitrust legislation may be undesirable. As shown in Diagrams 4.1 and 4.2, limiting integration will result in lower rents to these firms. However, these lower rents are obtained at the price of overall decreased efficiency in production (because of variable proportions distortions) and in the situation of Diagram 4.2 at the price of reduced output. In most situations, even ignoring the costs of implementation, antitrust legislation is a third best response to rents being earned by vertically integrated firms. The second best solution is to do nothing. With government firm regulation these problems do not occur.

The government firm should use the following procedure. Starting from the factor markets, the government firm should enter those stages of production where it suspects that firms are exercising market power. (If the barriers to entry are due to economies of integration then it should enter as an integrated firm). It should use the reaction function method described in Section 2 to eliminate rents at these stages to obtain an "optimal" distribution of productive resources. Furthermore, if the conditions of Section 3 are relevant, the government firm should integrate into those stages were integration results in efficiency gains to its own operations. Provided that it operates on a cost minimizing basis, this will ensure that the government firm provides its regulation service efficiently and it will ensure that a first best allocation of resources obtains for the entire industry.

6. The Case of Petro-Canada

We have been primarily concerned with intervention in the form of Petro-Canada to eliminate rents in the oil and gas industry due to barriers to entry. It is possible that other rationales exist for intervention via Petro-Canada. Wiens [1979] examines the role that Petro-Canada can play with respect to collecting resource rents and to stimulating exploration.

If the barriers to entry in the Canadian oil and gas industry are due to economies of scale and/or economies of vertical integration, if these barriers are "high" relative to the size of the market resulting in a small number of firms who account for most of the industry's production, then the possibility exists that these firms could restrict output and increase the price of their products through explicit or implicit collusion. The rationale for intervention is established.

In this vertically integrated industry, intervention via Petro-Canada has a very important advantage over intervention via antitrust and divestiture legislation. (The advantages of Petro-Canada over price and quantity regulation are discussed in Harris and Wiens [1977]). Unlike antitrust and divestiture legislation, regulation via Petro-Canada does not place constraints on the organizational form of the privately owned firms. The discussion in Section 3 and the work by Williamson [1975] has clearly spelled out the social shadow price of these constraints in the form of decreased over all efficiency. Government firm regulation permits firms to choose a profit maximizing (and thus cost minimizing) organizational form. Market power and rents which may result from increased concentration are offset by direct competition from the government firm. By acting as a decentralized regulating agent, Petro-Canada can respond quickly to cost and demand

conditions. By using the correct reaction function, by acting as the dominant firm in the industry, and by entering the appropriate stages of the industry, Petro-Canada can simulate a competitive environment to obtain an optimal allocation of resources.

With the acquisition of Pacific Petroleums in late 1978 Petro-Canada entered all stages of the petroleum industry including retailing. Previous to this takeover Petro-Canada was only involved in the exploration and extraction stages of the industry.

The general belief among economists is that government agencies do not cost minimize. If an enterprise's criterion of success is not profit maximization then cost minimization does not necessarily follow.[10] This efficiency loss represents the social price of regulation via a government firm. If this price is less than the welfare gain of increased output, then government firm regulation appears desirable.[11] The arguments above suggest that Petro-Canada is the preferred mode of intervention in the oil and gas industry for the purpose of eliminating rents.

FOOTNOTES

[1] Other prominent examples of firms owned by the Government of Canada which compete with privately owned firms are Canadian National Railways, Air Canada, Canadian Broadcasting Corporations, Polymer, Eldorado Nuclear and the Atomic Energy Commission. Examples of firms owned by provincial governments are Pacific Western Airlines and the Insurance Corporation of British Columbia.

[2] The positive issue of how such firms actually behave is still largely unexplored. For references see Merrill and Schneider [1966], Footnote 1.

[3] As Archibald [1971], p. 153 points out, in this situation the persistence of rent depends exclusively on the existence of barriers to entry. We are assuming that the government in question cannot or will not remove these barriers.

[4] This "window on the industry" source of information is not available to other forms of regulation and is a built-in advantage of government firm regulation.

[5] Harris and Wiens [1977] have devised an interative scheme which will converge to the desired level of industry output when the government firm only knows the industry demand function and its own cost function.

[6] For the monooplist to be in a profit-maximizing equilibrium in the pre-integration situation, the second order sufficient conditions require that at the point of intersection, the slope of RR' be less than the slope GG'. This condition can be satisfied either to be left or to the right of Q_3.

[7] Which situation obtains depends, in a complicated manner, on the elasticities of substitution in production and consumption. See Schmalensee [1973] for a complete analysis.

[8] If the monopolist is foreign owned, the opposition to the monopoly rents will be stronger.

[9] Burstein [1960a], [1960b] has shown that firms with monopoly power with respect to one good need not integrate forward to increase their rents. In his theory of "full-line" forcing, he shows how tie-in sales and other mechanisms can be used for this purpose.

[10] Wiens [1978b] has devised an incentive scheme which will cause the managers of a government firm to produce a given level of output using the least cost combination of inputs. This incentive scheme is compatible with the self-interest interactions of the parties with an interest in the price that obtains in an oligopolistic industry and it will induce the government firm managers to behave as regulators.

[11] Policing an industry via antitrust and divestiture legislation is also costly as is any form of government intervention.

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