DRAFT
FOR STAFF USE ONLY

Industrial Organization and International Trade: Some Recent Developments

Ioannis Kessides (Consultant)

CPD Discussion Paper No. 1984-32
June 1984

INDUSTRIAL ORGANIZATION AND INTERNATIONAL TRADE: SOME RECENT DEVELOPMENTS

Ioannis Kessides.

This paper explores the relationship between industrial organization and international trade and the several novel features of analysis which the combination of these two fields produces. The paper takes its viewpoint from the field of industrial organization and reviews the theoretical and empirical research which incorporates the influence of international market linkages on domestic market performance. A major emphasis is placed on the constraints imposed by international trade on domestic allocative inefficiencies and the implications of these findings for an appropriate competition policy in small open economies.

On the theoretical side, the paper focuses on the allocative decisions and the resulting equilibria in imperfectly competitive markets subject to the influence of such international factors as import competition, export rivalry, and the presence of multinational firms. On the empirical front, it seeks to assess the extent to which import competition constrains domestic firm conduct and market performance, the effect of exposure to international trade on the number and size distribution of producers and the resulting technical efficiency in the national market, and the extent to which export opportunities weaken any collusive arrangements among the domestic oligopolists, especially when such oligopolists cannot engage in price discrimination between the foreign and domestic markets.

Aside from its normative contribution, research pertaining to the integration of industrial organization and international trade has a highly significant policy content. The findings of such research point directly to the opportunity of optimally exploiting foreign competition and domestic industry structure in order to achieve a desired competitive outcome in the national economy.

IKessides:mcc

I. Introduction

Until very recently, almost all the theoretical developments in the area of international trade have been based on the assumption of atomistic competition. Individual producers have been conjectured to behave as price takers in the world market even when such producers exercise considerable market power in their respective domestic markets. The only source of monopoly power has been ascribed to the ability of national governments to constrain the flow of trade through the imposition of tariffs and quotas and to cartelize the national firms engaged in international competition.

In contrast, the field of industrial organization devoted to the analysis of the competitive processes characterizing actual product markets has emphasized the importance of market power in affecting the behavior and performance of firms. In this context, models of industrial organization, designed to clarify the causal mechanism responsible for the emergence of concentrated, imperfectly competitive markets, have been based on the closed economy assumption. The potential impact of the forces of international competition on the structure and performance of the domestic industries was largely ignored.

This previous failure to integrate the theory of industrial organization with that of international trade has been attributed by Harry Johnson to the difficulty of reconciling the partial equilibrium approach of the former with the general equilibrium nature of the latter. Another part of the difficulty lies with the apparent emphasis placed by international economics on the pure theory of trade to the relative neglect of empirically relevant problems -- thus, it appears that the field of international trade did not respond sufficiently to the challenge of empirical explanation.

In the last few years, however, a new framework of theoretical analysis of trade has been proposed which recognizes the reality that a significant proportion of international trade takes place in imperfectly competitive markets. The considerable skepticism about the ability of comparative cost theory to explain the actual pattern of trade provided part of the impetus for this line of new research. In addition, recent theoretical and empirical contributions in the area of industrial organization have explicitly incorporated the influence of international market linkages on the competitiveness and performance of the national markets.

Aside from its normative contribution, research pertaining to the integration of industrial organization and international trade has a highly significant policy content. For example, the recognition that international markets are oligopolistic has brought forth new arguments for interventionist trade policies. Clearly, the old literature on the theory of commercial policy under conditions of perfect competition cannot respond satisfactorily to the arguments that have been advanced in favor of a more activist government role. The underlying theory very clearly suggests that policies which are appropriate when trade occurs in oligopolistic markets differ significantly from those designed under the assumption of perfectly competitive markets. In addition, the substantial empirical evidence supporting the view that the forces of foreign competition limit domestic market distortions and restrain domestic allocative inefficiencies suggests that foreign competition provides an attractive alternative to operating directly on domestic industry structure to achieve a desired competitive outcome.

II. The Effect of Foreign Competition on Domestic Industrial Organization

The Structure-Conduct-Performance paradigm which emerged as the principal descriptive model of industrial organization analysis has largely neglected to incorporate the influence of international market linkages on domestic market performance. This has occurred mainly because this model was developed to analyze the relatively insular U.S. market for which, until recently, the closed economy assumption was a reasonable approximation. Such an omission, however, could potentially lead to serious qualitative and quantitative biases when the focus shifts on the industrial organization of the smaller and relatively open economies of Western Europe, Japan, Canada, and also perhaps some of the less developed countries. Even for the U.S., the steady rise in recent years of imports and exports as a percentage of GNP clearly signifies the importance of the subject of foreign competition.

On the theoretical side, we are primarily interested in examining the allocative decisions and the resulting equilibrium in imperfectly competitive markets subject to the influence of such international factors as import competition, export rivalry, and the presence of multinational firms. In addition, we are addressing questions related to the determination of prices, output, employment and profit levels in small open economies, the shift to non-price competition when there is foreign competition, the implications of intra-industry trade on resource allocation policies, and appropriate measures of concentration in the context of international trade. On the empirical front, we seek to assess the extent to which import competition constrains domestic firm conduct and market performance, the effect of exposure to international trade on the number and size distribution of producers and the resulting technical efficiency in the national market, and the extent to which export opportunities weaken any collusive arrangements

among the domestic oligopolists, especially when such oligopolists cannot engage in price discrimination between the foreign and domestic markets.

A. The Import Discipline Hypothesis

In the last few decades, the secular rise of imports has probably provided the most important source of new competition in many of the advanced industrial economies. The proposition that import competition limits the exercise of market power and reduces monopolistic distortions in the domestic economy, and thus should be encouraged to avoid the monopoly welfare loss, has received wide acceptance. At the policy level, import competition has been presented as an attractive alternative to operating directly on domestic industry structure in order to achieve a given desirable competitive outcome, particularly in instances where a vigorous antitrust policy is likely to run into problems of structural efficiency.

Received oligopoly theory suggests two possible avenues through which import competition influences domestic market performance. Entry by foreign firms affects the supply side of the market, increasing the number of actual competitors and thus, in general, effectively reducing domestic seller concentration. In addition, it has been agreed that the pressure of potential competition from foreign suppliers constrains the behavior of domestic firms and limits their ability to extract monopoly returns. The force with which the discipline of potential entry controls the performance of the domestic incumbent firms is less the higher are the entry barriers faced by both domestic and foreign entrants. It is conjectured that when large foreign producers and multinational firms comprise part of the pool of potential entrants, such firms may more easily overcome the impediments to entry and, in fact, it is not uncommon that they face lower entry costs than their domestic counterparts. Thus, potential entry or competition from foreign firms for the

domestic market may exert the strongest influence on the behavior of incumbent domestic firms, and indeed it is conceivable that this external influence could dominate actual competition between the domestic firms within the national market. While these theoretical propositions apply to a variety of market forms, their most dramatic predictions pertain to the case of a domestic market having the attributes of a natural monopoly. If such a market can be freely contested by large foreign producers, then it will perform in a competitive manner even if it is operated by a single domestic seller.

It is important to recognize that foreign and domestic firms belong to two different strategic groups and that the presence of these two or more strategic groups in the national market has significant implications for interfirm cooperation and the likelihood of collusive behavior. The behavior of foreign subsidiaries is also likely to be affected less by structural conditions in the host market, and thus structural indices may become less important predictors of performance in the case of a small open economy. In addition, we should recognize that while the conventional notion of entry involves the creation of new capacity that this is not necessarily so in the case of entry by foreign producers. When the products of foreign firms enter the national market, no new capacity is created. In a similar manner, exit by foreign firms simply implies the withdrawal of products and the decline of the quantity shipped in and not the actual closure and resulting excess capacity in the domestic market. These differences may limit the direct application of the traditional strategic entry analysis to the case of imports and should be explicitly taken into account in the design of public policy towards domestic industry and the role of imports.

1. A Simple Model of Oligopoly

Among the oligopoly models designed to incorporate the influence of international factors, the dominant firm analysis appears to have the greatest potential relevance. This analysis focuses on the pricing behavior of the so-called dominant firms, that is a group of firms controlling a large share of the market but confronted with the actual or potential competition of a number of small rivals comprising the fringe. Each member of the fringe is too small to appreciably affect price through its own output decisions. Thus, each fringe member takes the dominant firm's price as parametric and expands its output up to the point in which its marginal cost equals price. The problem facing the dominant firms then becomes that of adopting an optimal price taking into account the rising supply of the fringe. Collectively the members of the fringe constrain the pricing behavior of the dominant firms.

The first order conditions for profit maximization lead to the following expression for the aggregate Lerner index of monopoly power or equivalently the aggregate industry price-cost margin:

$$L = \frac{H_d(1 - \phi)}{\eta + \varepsilon(1 - \phi)}$$

where L is the aggregate Lerner index, H_d is the Herfindahl index of concentration within the dominant group, η is the absolute value of the price elasticity of domestic demand, ε is the elasticity of supply function of the competitive fringe, and ϕ is the aggregate share of the fringe.

When the domestic firms comprise the dominant cartel and foreign producers represent the competitive fringe, then ϕ is the rate of imports

and H_d is the Herfindahl index of domestic concentration. Equation (1) implies a negative relationship between the rate of imports and the industry price-cost margin, in support of the import discipline hypothesis. The presence of foreign producers in the context of this simple model indeed limits the monopoly power of domestic firms and mitigates the effect of domestic concentration.

2. Previous Theoretical Contributions

While research in industrial organization has failed to explicitly take into account the impact of international forces until the past decade, the proposition that an open trade regime could potentially improve market performance by constraining the price-raising ability of domestic producers has long been recognized. Both Haberler (1959) and Vernon (1961), concerned about the substantial monopolistic control prevalent in many industries, argued that vigorous foreign competition presented the only means of restoring competitive pricing in such industries.

Krause (1952) conjectured that imports will have a significant therapeutic effect upon the domestic industry only when foreign producers have substantial export capacity and when the national firms react competitively to the pressure of rising import penetration by exhibiting a flexible price response. On the other hand, the domestic oligopolists may, because of the presence of uncertainty in import prices and in demand conditions, choose to follow a price-maintaining, myopic short-run profit maximizing strategy. Then imports will probably have only a negligible effect on domestic pricing behavior but in the long-run will force adjustments upon the domestic industry by inducing an erosion in the market share held by the national firms.

In the early studies of Esposito and Esposito (1971) and Pagoulatos and Sorenson (1976,a), imports were hypothesized to represent another element

of structure which affects domestic performance independently of the structural conditions prevailing in the national market. However, in the context of the simple oligopoly model above (also see Appendix A), this assumption about a separate effect of foreign competition on domestic market performance is not appropriate. As equation (1) clearly indicates, the rate of imports interacts with domestic industry structure (concentration) in mitigating the presence of any monopoly power. Nevertheless, Pagoulatos and Sorenson correctly recognized the importance of potential competition for the domestic market arising from potential foreign entrants in disciplining the behavior of the national firms.

In their pioneering works, Caves and Jones (1973), Melvin and Warne (1973), Caves (1974), and White (1974), examined the effect on domestic market power of moving the economy towards a more open trade regime. Their analyses, however, were limited to the extreme case of a domestic monopolist producing an undifferentiated good who becomes just one more competitor in the world market as the national economy becomes wide open. The effects of oligopoly and product differentiation were ignored.

More recent contributions by Pugel (1978, 1980) contain a formal analytical model of a domestic monopolist facing competition from a differentiated foreign product. His analysis shows that the price-cost margin of the monopolist is a function of the share of the domestic market held by the imported good, the own and cross-price elasticities of demand, and the price elasticity of the supply of imports. More specifically, the Pugel model predicts a negative relationship between the domestic price-cost margin and the share of imports, holding the elasticities constant, and therefore captures the basic aspects of the imports as discipline argument. In addition, the Pugel model, despite its restrictive assumptions, provided an

improved guidance to empirical work by offering a theoretical justification for the use of import share as an indicator of import competition.

One of the first models of oligopoly applied to the case of an open economy was developed by Lyons (1980, 1981). Of particular interest is his analysis of how performance is affected when the foreign suppliers and also the domestic firms recognize their mutual interdependence. His model suggests that the price charged by the domestic firms may exceed the marginal delivered cost of imported goods without inducing entry by foreign firms because of the latter's recognition that their entry might induce output expansion by the domestic firms. However, it must be noted that the threat of such a post-foreign entry reaction by the domestic firms is credible only when the domestic industry is characterized by considerable excess capacity (i.e., when the marginal cost of output expansion is small). In the Lyons model, imports are assumed to be exogenously determined while in a more realistic model of oligogoply, imports would normally depend on the pricing behavior of the domestic firms. Huveneers (1981) extended the Lyons model by making the behavior of imports endogenous. His model was designed to analyze the conduct of firms in a small open economy (Belgium) and to clarify the relationship between indices of market power, concentration, and foreign trade variables in equilibrium. In a direct application of the dominant firm-competitive fringe analysis, Geroski and Jacquemin (1981) obtained an expression for the price-cost margin of the domestic firms by assuming that such firms form the dominant cartel and that the foreign suppliers constitute the competitive fringe. Under the assumption then that the dominant firms exhibit Cournot behavior, their model predicts that imports limit the exploitation of power by national firms and that such an effect is conditional upon the structural features of the domestic industry (see Appendix A).

3. Empirical Evidence

The underlying theory of oligopoly for the case of a small open economy suggests that both the import share of domestic sales and the supply elasticity of imports are pertinent in explaining domestic market performance. While the share of imports can be measured with some accuracy, the supply elasticity of imports is largely unobservable. Thus, one of the main difficulties in assessing the effect of import competition has been the construction of suitable proxies.

Most of the statistical tests of the import discipline hypothesis have been based on cross-sectional models specified in the loose and eclectic manner characteristic of most empirical studies in industrial organization -- cross-section regressions of domestic profitability on variables assumed to capture the structural characteristics of the domestic industry and the influence of international factors. Despite the controversy surrounding the appropriate interpretation of this type of regression results, the empirically well-established negative correlation between import share and domestic profitability has been taken as supporting the trade as discipline argument.

The empirical analyses of Esposito and Esposito (1971), Pagoulatos and Sorenson (1976,a) and Pugel (1978, 1980) have demonstrated that there exists a significant negative relationship between profitability and the import share of domestic sales. In addition, Pugel (1980), Jacquemin, de Ghellinck, and Huveneers (1980) and Turner (1980) have found the effect of imports to be more prounounced in less domestically competitive industries. Their findings to some extent confirm the theoretical prediction that the rate of imports interacts with domestic structure (concentration) in mitigating monopoly power or alternatively, as Caves (1982) has noted, that the competitive discipline imposed by imports is conditional upon the competitive

conditions among the domestic producers. Jacquemin et al (1980) have also argued that their statistical analysis demonstrates the inadequacy (and perhaps irrelevance) of structural indices as indicators of market performance in small economies open to international trade. Their claim at least partially supports the proposition that three conditions are necessary for the exercise of monopoly power in small open economies -- high levels of concentration, substantial barriers to entry, and the absence of import competition.

It is important to note that the various measures of profitability signify a difference between price and average (or marginal) cost. Thus, a causal relationship running from import competition to profitability can operate either through an effect on price (implying that imports limit the price-raising ability of domestic producers) or on average costs (implying that import competition forces the domestic producers to become more efficient), or both. Simple cross-sectional analysis which is designed to explain the observed interindustry differences in profitability cannot disentangle these two effects. DeRosa and Goldstein (1981) have attempted to test directly the hypothesis that imports exercise a competitive discipline on the price-raising ability of domestic producers by examining the two-way causation between changes in import competition and domestic price changes. They claim to have shown that in the U.S., increases in import penetration have a restraining effect on domestic prices and consequently on the domestic inflation rate. They have also found the restraining effect of imports to be conditional upon the structure of the domestic industry — in agreement with results obtained from profit rate analysis. On the other hand, Murfin and Cowling (1981), using a simple pricing model, found little evidence that rising import penetration has constrained domestic pricing decisions in the

U.K., when productivity changes are taken into account. The principal conclusion of their study is that the influence of unit cost changes on domestic price changes is considerably more important than the effect of changes in import penetration.

4. New Areas of Policy Oriented Research

Recent developments in oligopoly theory suggest that potential competition from foreign producers for the domestic market could conceivably exercise a greater discipline on domestic firm behavior than actual competition among the established sellers in the same market. Implicit in the above proposition is the assumption that foreign firms with established productive capacity and markets in other parts of the world are more able to overcome the traditional impediments to entry and may indeed face lower entry costs than the domestic market newcomers. The above assumption appears to be reasonable when one examines the sources of barriers to entry. The traditional analysis of the entry process has identified three main sources of barriers: economies of scale in production, absolute unit cost and product differentiation advantages of the incumbent firms. It is easy to see that while the first two barriers may be serious impediments for domestic newcomers (who must create new capacity at a large enough scale so as to be efficient and must also develop technical expertise in a new product line), such barriers could be totally insignificant in entry by foreign established firms. Especially large multinational firms are well-equipped entrants into national product markets in which the incumbent domestic firms are insulated from domestic potential entrants by high structural barriers to entry. It appears, however, that the product-differentiation entry barrier is significant also for foreign established firms. Entry by such firms into national product markets characterized by high differentiation would normally

require large advertising and other promotional expenditures which are irrecoverable in the event of exit. The threat of losing such irrecoverable entry costs would constitute a barrier even for foreign firms with established productive capacity.

The theoretical and empirical research on import competition has failed to explicitly take into account the effect of barriers to entry into the domestic market. This omission is serious particularly since the height of such barriers is probably the single most important determinant of the effectiveness of import competition in disciplining domestic firm behavior. Also, in view of the fact that the height of barriers to entry varies across industries, new questions arise as to the appropriate interpretation of cross-industry analyses designed to test the trade as discipline argument.

In Appendix B, we present a model of intra-industry analysis which seeks to identify the basic conduct of each industry and also to determine how much discipline foreign competition has actually exercised on the domestic industry after the economy has been open to the forces of international trade. This sector-by-sector analysis avoids almost all the difficulties of interpretation surrounding testing procedures based on cross-section inter-industry regressions. It also points to the possibility of actually identifying the causal mechanism through which import competition affects domestic market performance. We present below the basic features and the predictions of the model while we defer the detailed analytics to the appendix.

For an industry composed of n differentiated producers, the model predicts that the price-cost margin of the i^{th} at the optimum is given by:

$$PC_i = 1 - Ks_i^{\theta-1}$$

where $PC_i = \frac{p_i - MC_i}{p_i}$, p_i being the inverse demand facing the i^{th} firm's product and MC_i its marginal cost schedule, s_i is the firm's market share, K is a summary measure of barriers to entry and the pressure exerted by potential entry into the industry (K decreases as the height of such barriers increases and as the production technology available to potential entrants becomes more efficient), and where θ is a measure of economies of scale representing the decline of costs per dollar of revenues.

Thus, in the context of our model, the profitability of the firm has two principal components. The first component consists of the term K which represents the effect of external conditions such as entry barriers and the competitive pressure of new entrants. The second term consisting of $s_i^{\theta-1}$ represents the influence of internal structure. When we look across the firms in the industry, this second term may be interpreted as representing the influence of firm efficiency. When the industry in question is exposed to international competition, K will decrease both because of the removal of the trade barriers and because large foreign firms are likely to be more efficient than domestic newcomers and will, therefore, exert a greater competitive pressure on the domestic industry. In addition, if under the pressure of foreign competition the domestic firms are forced to become more efficient, then the internal structure of the industry will also change (θ will decrease).

Our model, therefore, predicts that import competition will affect domestic market performance through two separate channels: by changing the external conditions and also by modifying the internal structure of the industry. It is useful to illustrate graphically these two effects below:

Profile of Industry Before
Exposure to Import Competition

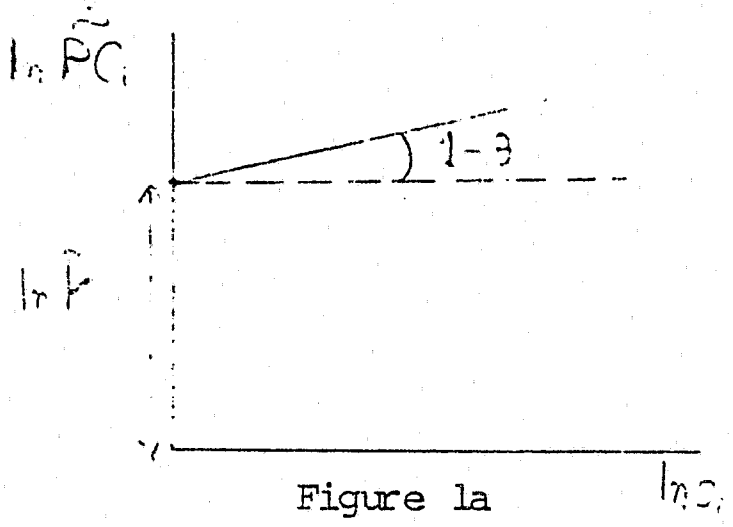

Figure 1a

Profile of Industry After
Exposure to Import Competition

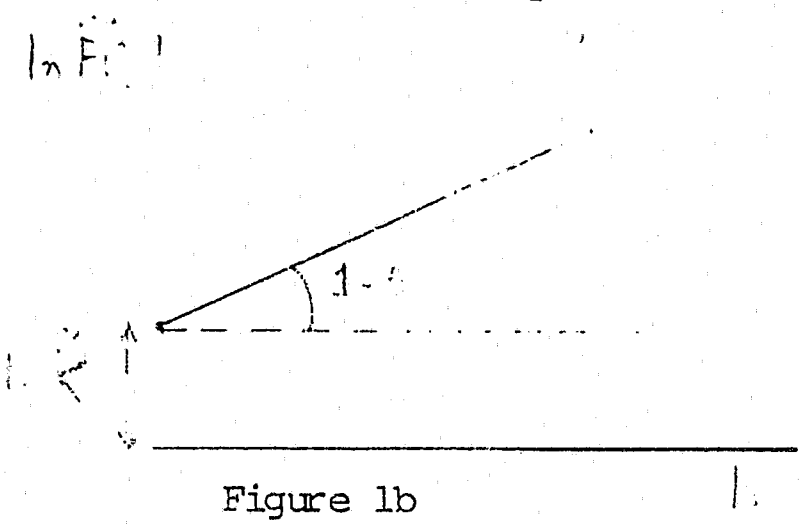

Figure 1b

where $\tilde{PC}_i = \frac{1}{1 - PC_i}$ and $\tilde{K} = \frac{1}{K}$.

An intra-industry regression of firm profitability (an appropriate function thereof) on firm market share before and after trade liberalization will permit us to obtain a measure of the discipline exerted by foreign competition (primarily through a comparison of the intercepts and the slopes).

B. Exports and Domestic Competition

While it is generally recognized that import competition limits market power and could potentially improve allocative efficiency, the theory of oligopoly makes no clear-cut predictions about the effect of exports on domestic conduct and performance. Caves (1974) has argued that under some conditions export opportunities are symmetrical with import competition in affecting domestic market performance and in constraining allocative inefficiency. However, as Caves has pointed out, the assumptions needed to ensure that export opportunities will constrain domestic industries to a more competitive pricing behavior are much stronger than those needed for predicting the effect of import competition.

For the case of a domestic monopolist producing an undifferentiated good, the effect of opening to international trade depends critically on whether the monopolist can discriminate between the domestic and foreign markets. Jacquemin (1982) with Figure 2 below clarifies the above proposition.

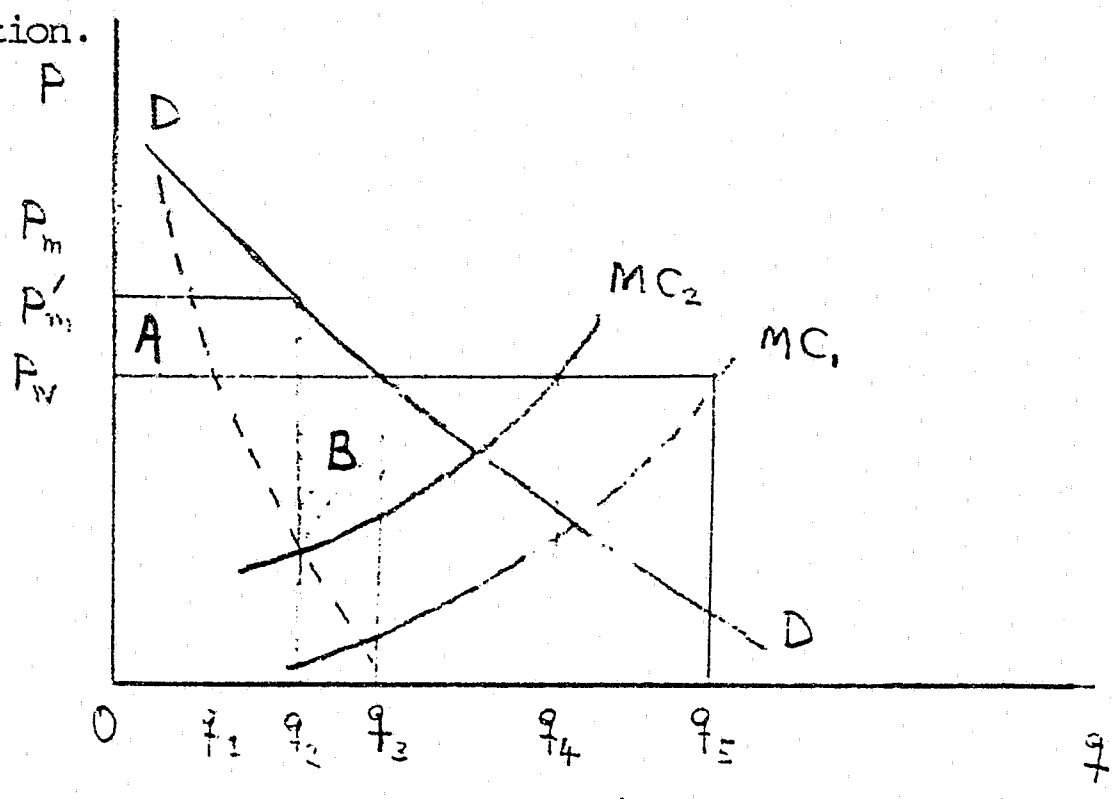

Figure 2

A domestic monopolist facing a marginal cost schedule MC_1 and confronted with a perfectly elastic demand for exports will produce the quantity of Oq_5 (the same quantity which a perfectly competitive industry would also produce). If the monopolist can segment the markets, then the quantity Oq_1 will be sold in the domestic market at price p_m and the quantity q_1q_5 will be exported. Thus, with the introduction of trade, if the world demand curve is more elastric than the domestic one, domestic prices are likely to rise as export sales expand. The possibility of exporting in such a case may lead to an increase in the domestic misallocation of resources due to monopoly power. A competitive industry, on the other hand, will sell Oq_3 to the domestic market at p_w and will export q_3q_5. If the monopolist cannot

discriminate, then he will also sell $0q_3$ at price p_w in the domestic market and export q_3q_5. Thus, exposure to international trade forces the monopolist to adopt a competitive behavior only when the monopolist is unable to segment markets. We should note that anti-dumping restrictions are a necessary but not a sufficient condition in order for export opportunities to constrain allocative inefficiency. If, for example, the domestic monopolist is facing the marginal cost schedule MC_2 and is not permitted to discriminate, then such a monopolist has a choice. He may sell $0q_2$ in the domestic market at price p_m and not export at all or, alternatively, he may produce the competitive output $0q_4$, selling $0q_3$ in the domestic market and exporting q_3q_4. What the monopolist chooses to do depends on the relative magnitude of the producer surplus resulting from the exports (shaded area B) and the excess profits which the monopolist earns by restricting his sales only to the domestic market (shaded area A). Alternatively, it is impossible to predict the effect of the rate of exports on the price-cost margin without specifying cost conditions.

Similar arguments can be applied to the case of domestic oligopolistic firms facing a perfectly elastic demand for exports (see Appendix C). Caves (1974) has suggested that the presence of alternative export markets may render the domestic oligopolists less conscious of their mutual interdependence in the national market and may lead to less collusively determined prices. However, the theoretical links between the rate of exports and profitability are not simple. For a small open economy, if the exporting industry is unable to discriminate between the domestic and the international markets, Huveneers (1981) showed that concentration and the export rate have no effect on the price-cost margin. When national markets can be segmented, then the observed price-cost margin becomes a weighted average of the price-

cost margins obtained in each market (Pugel, 1980). If foreign demand is more elastic than domestic demand, then dumping increases total economic profit but actually lowers the weighted price-cost margin. In this case, the export share of domestic production is inversely related to the observed price-cost margin. If, on the other hand, foreign demand is less elastic than domestic demand, then the export share will be positively related to the price-cost margin. Huveneers (1981) showed that when the domestic firms can segregate the domestic market from the export market, concentration has a positive influence on profitability but that the effect of the rate of exports depends on cost conditions (see Appendix C).

Another possible avenue through which exposure to export opportunities might affect allocative efficiency is that by expanding the total market, trade makes room for more efficient-size sellers in the domestic market. Thus, in this manner, export openness will affect domestic market structure, technical efficiency, and possibly profitability. But again, the effect on profitability is ambiguous. If exporting opportunities leave scope for a larger number of domestic competitors, then the export rate will exercise a negative effect on the price-cost margin (assuming that an increase in the number of domestic competitors depresses their price-raising ability). Alternatively, it may be argued that exporting opportunities by increasing the scale of plants lead to efficiency rents. When product differentiation is present or when economies of scale are substantial, these efficiency rents might not be competed away (as in the pure Chamberlinian case) and thus they potentially could lead to higher price-cost margins. Then, the export rate will have a positive impact on profitability.

Given the lack of any clear-cut theoretical predictions about the effects of exporting on domestic allocative efficiency, it is not surprising

that the empirical results have been mixed. Khalilzadeh-Shirazi (1974), Caves and Khalilzadeh-Shirazi (1977), Geroski (1982) found a significant positive effect of the rate of exports on the profit margin which could be attributed partly to product-differentiation rents, and partly to the effect of exports on the sizes of plants. On the other hand, Jenny and Weber (1976), Pagoulatos and Sorenson (1976,b), Newman, Bobel , and Haid (1979), Caves, Porter, and Spence (1980), Jacquemin, de Ghellinck, and Huveneers (1980) have reported a negative correlation between the price-cost margin and exporting which could be taken as supporting the hypothesis that export opportunities reduce the recognition of mutual interdependence between the domestic oligopolists or, alternatively, that exporting makes room for a larger number of efficient domestic competitors. Finally, Adams (1976), Pagoulatos and Sorenson (1976,a), Marvel (1980), and studies in countries such as Belgium and Japan found no significant effect.

C. Foreign Direct Investment, Multinational Activity, and Industrial Market Structure and Performance

In the last few decades, there has been a significant increase in the role of multinational enterprises in international trade. By 1976, over half of foreign investment originated from such enterprises. 1/ In fact, foreign subsidiaries have become an important component of internal structure in many open economies. 2/ It is, therefore, imperative that existing theoretical models describing the behavior of firms in imperfectly competitive markets be modified to explicitly incorporate the behavior and influence of companies based outside the respective national economies.

1/ See Rugman (1983).

2/ For the case of Canada, for example, see Rugman (1980).

It will be useful to briefly analyze first the factors determining the extent of foreign direct investment undertaken by domestic firms, the scope of their multinational activity, and the influence of these international factors on the profitability of such firms.

It has been argued that horizontal direct foreign investment which results in firms establishing foreign subsidiaries producing the same or similar products to those produced in the domestic market will prevail under oligopolistic market structures characterized by strong product differentiation. Let the firm possess a specific rent-yielding asset such as a differentiated product or a patented invention; then, unless economies of scale dictate exporting, a strategy designed to maximize growth and secure a stream of further rents without suppressing profits in the domestic market will call for foreign production through the establishment of subsidiaries. As Caves (1971) and Caves et al (1980) have noted, organizing a subsidiary tends to be advantageous because of the contractural problems associated with the trade of intangibles between firms at arm's length. In a more recent contribution, Krugman (1982) has argued that a large product variety coupled with fixed costs in production (such as research and development costs) will favor decentralized production. The multinational company's choice, then, between exporting and establishing a subsidiary is affected by trade barriers, transportation costs and the size of the host market. In this context, trade and investment are substitutes.

Vertical direct foreign investment, on the other hand, normally arises in undifferentiated oligopolistic market structures with the objective of producing necessary inputs or raw materials. When upstream foreign investment is undertaken for the production of an input, cost reducing effects in the domestic production will normally obtain. The effects, therefore, of

foreign vertical investment are similar to those of vertical integration in the domestic market. Foreign investment of a vertical nature becomes particularly important in cases where the national firms integrate backward into less developed countries in order to obtain raw materials, the supply of which otherwise would be highly uncertain because of the lack of overhead capital or entrepreneurial talent in the host countries. Strategic control over sources of raw materials secured through vertical investment by domestic producers might create substantial barriers to entry in the domestic market (at the processing level) shielding such producers from the competitive pressures of potential entry.

The above arguments signify the benefits of international diversification and internalization which multinational firms may enjoy. Through internalization, the firm has a better control of its intangible assets, skills, and other advantages and through the use of internal prices, it can discharge the allocative function efficiently. Foreign direct investment by making a full use of the firm's intangible assets (horizontal) and by taking the role of barriers to entry, at the processing level, into the domestic market (vertical), should exert a positive influence on profitability. However, it must be also recognized that there are significant costs attached to an internal market such as those associated with the acquisition of information, coordination and expansion and also those of operating at a distance. Pagoulatos and Sorenson (1976) found a strong positive relationship between the degree of an industry's direct foreign investment and its resulting profitability. Rugman (1983), on the other hand, found that multinational companies have returns which are not significantly different from the all-industry averages of their respective home nations. Thus, there is no evidence that multinationals earn supra-normal profits.

Next, we focus on the relationship between multinational firms and domestic market behavior. We are basically interested in the question of whether the presence of such enterprises constrains domestic allocative inefficiency. Caves (1974) argues that multinational firms may indeed constrain domestic market distortions for the following two reasons. First, they comprise a pool of well-equipped entrants into national product markets surrounded by high structural barriers to entry. The analysis of direct foreign investment has identified such firm-specific assets as ample supply of funds, ability to induce product differentiation, and technical, managerial, and marketing skills, as being among the important determinants of the extent to which firms engage in multinational activities. But these firm-specific assets which induce firms to engage in multinational activities constitute precisely what potential entrants need in order to overcome the principal barriers to entry. Thus, multinational firms represent the most serious threat of potential entry into domestic markets which are otherwise protected by high barriers. Given that such national product markets are easily contestable by multinational firms, then they will perform in a competitive manner even when they are operated by a single domestic seller. Second, the multinational firms operating in a given national market are likely to exhibit significant behavioral differences from the domestic firms of similar market position (holding equal market shares). In general, the multinational firms have better information (than the local firms) about alternative uses of their resources and are less dependent on the domestic scene for their survival. Therefore, such firms might be expected to engage in more rivalrous market actions and to prefer high-yield risky strategies. Also, because of their alien status, multinationals are less likely, especially in their early years, to participate in any collusive arrangements developed previously by the domestic market participants.

Given the ability of multinational companies to overcome high structural barriers to entry and their propensity to engage in rivalrous market conduct, a policy of opening up national markets to such companies would seem desirable on the grounds of reducing domestic monopolistic distortions. However, this policy conclusion should be qualified, in that influences may exist which run in the opposite direction. Consider, for example, the most common asset attributed to multinationals, their "long purse", i.e., access to substantial internal funds. While such an advantage would normally permit a firm to overcome impediments to entry, it would provide the firm with an incentive to engage in predatory behavior designed to drive out single-market domestic rivals and eventually attain a monopoly position. It has also been argued that because of the special nature of their firm-specific assets (e.g. their skill in differentiating their products), multinationals exhibit a propensity towards non-price forms of competition (such as advertising). Such non-price forms of conduct could potentially raise the effective cost of further entry by new firms, thus contributing to future monopolistic distortions.

The hypothesis that entry by multinational firms into national product markets constrains domestic allocative inefficiencies, and eventually neutralizes domestic market dominance, has not been put to a rigorous empirical test. Caves (1974) found a weak negative correlation between the profit rate of domestic firms in the Canadian manufacturing industries and the share of domestic sales held by foreign subsidiaries.

In addition, Caves, Porter, and Spence (1980) found that Canadian industries in which foreign subsidiaries have a large share of the market have lower concentration than their U.S. counterparts. This finding has been taken as supporting the hypothesis that multinational companies constitute an

important source of potential entrants into the various product markets. While it is generally accepted that the presence of multinationals alters the degree of domestic competition, we are still in the dark as to the precise character of such influence. Indeed, there exists no formal model of oligopoly which makes clear-cut predictions about the effect of foreign-subsidiary activity on the industrial structure and performance of the host country.

Since entry by multinationals could potentially pose a serious threat to the market position and profit of the national firms, one might expect such national firms to undertake defensive measures. If, for example, the domestic firms face a disadvantage in terms of relative efficiency because of their suboptimal site, then fusion towards a more efficient domestic structure might be an alternative. Indeed, there is some empirical evidence suggeting that the presence of multinationals induced defensive mergers among the national firms (for suggestive examples from the automobile industry, see Silberston (1958) and Ensor (1971)).

D. International Market Linkages and Technical Efficiency

Most of the theoretical and empirical analysis of the influence of international forces on domestic industrial organization has focused on the potential reduction in the welfare loss due to monopolistic distortions which might be achieved by exposing the domestic industry to foreign competition. However, international trade may also change the domestic industry's performance in another perhaps equally important dimension — technical efficiency.

As was noted in the previous sections, exposure to international trade affects the number and size distribution of producers in the domestic market and possibly its efficiency. Scherer (1975) found in a sample of

twelve industries that the sizes of the lending plants increase much more than proportionately with increases in exports as a percentage of domestic production. By expanding the total market, exports permit the firms to spread their fixed costs over a larger volume and consequently lead to lower average costs. In addition, import penetration, by increasing the competitive pressure on domestic firms, is likely to lead to more efficient resource utilization. Such an effect will be particularly strong in industries where, in the absence of internal competition, firms are free to pursue goals different from profit maximization. Thus, the absence of strong internal competition admits the possibility of inefficiency which can be alleviated only through the influence of external factors.

On the empirical side, there is substantial evidence that the degree of foreign competition is an important factor explaining the variation across industries in efficiency. For the case of Sweden, Carlsson (1972) found that tariffs wield a significant and malign influence on technical efficiency. Also, Bloch (1974) found that in Canada, per unit costs are higher in industries protected from import competition by tariffs, particularly when such industries are characterized by high levels of concentration. Caves, et.al., (1980) concluded that tariff protection increases the number and improves the viability of suboptimal producers, thereby leading to inefficient industrial structures. Saunders (1980) developed a comprehensive model of the determinants of relative productivity in Canadian manufacturing industries. His empirical results seem to indicate that scale economies and product differentiation, in conjunction with strong tariff protection, sustain production units of suboptimal scale. Saunder's statistical results suggest that when the effective protection rate is below 0.25, the forces of foreign competition eliminate inefficient suboptimal production units. Caves and

Khalilzadeh-Shirazi (1977), and Jacquemin, de Ghellinck, and Huvenners (1980) interpreted their finding of a positive influence of exporting opportunities on profits as implying that exposure to export markets increases the scale of plants and thus enhances efficiency.

Finally, we examine the effects of foreign subsidiaries on technical efficiency and progressiveness. One would normally expect a multinational enterprise to be efficient in order to offset the often considerable costs of operating at a distance. Such enterprises can also avoid through their transnational market activities the inefficiency of small scale operations which national firms face, especially in small economies. The empirical findings on the conjectured relationship between multinational companies and technical efficiency are ambiguous. The statistical analysis of Caves, et.al., (1980) seems to indicate a significant positive relation between measures of technical efficiency and the proportion of sales accounted by foreign subsidiaries in the Canadian manufacturing industries. However, their analysis at the same time led to the seemingly contradictory finding of an inverse relation between the proportion of output coming from efficient-scale plants and the domestic market share held by multinationals. With respect to the effects of multinationals on technical progressiveness, it is important to note that such enterprises transfer proprietary intangible assets via their subsidiaries across national markets. The flow of managerial skills, and of new productive knowledge, through the multinationals should signify their positive influence on progressiveness. There is also some evidence that in some industries the multinational companies speed the transfer of technology.

III. The Effect of Domestic Market Structure on Foreign Trade Flows

The increased interest in the relationship between industrial organization and international trade has mainly centered on the potential impact of foreign competition on the structure, conduct, and performance of domestic industries. However, there are sufficient theoretical reasons to also expect a reverse causal relationship, that is a relationship which runs from domestic market structure and performance to foreign trade flows. For example, it would be reasonable to expect import flows to resond positively to increases in the profit rate of domestic industries.

It appears that domestic industry structure affects trade performance only when barriers to trade exist. When there are no such barriers, then import or export performance seems to be invariant to alternative market structures. However, when impediments to trade do exist, monopolistic and competitive industries face substantially different incentives and behave differently with respect to foreign trade flows.

In view of recent proposals to modify public policy towards industry in order to improve the performance of domestic firms in the international arena (e.g., softening the antitrust and antimerger laws in the U.S. so that national producers compete more effectively in export markets and are better able to confront import competition in the home market), it is imperative that we assess the significance of industrial organization variables in explaining import and export trade flows. Also, because of the special appeal of these proposals to some of the developing countries facing balance of payments problems, it would be useful to provide a synthesis of the insights offered by the received theory and also to attempt to highlight the lessons learned from the experience of the more developed countries (e.g., the U.S. or France). At the level of policy, it would also be desirable to compare traditional

exchange rate policies with public policy towards industry as to their relative efficacy in achieving balance of payments objectives.

E. Import and Export Performance of Alternative Market Structures

In a pioneering paper, White (1974) examined the relationship between domestic market structure and trade by comparing the results yielded by a competitive market structure with those obtained in the case of monopoly.

White's analysis suggests that market structure does not affect the level of imports when the domestic and imported goods are perfect substitutes and when there is no uncertainty about the domestic demand and the price of the foreign good. However, when either the domestic demand curve or the import price is subject to uncertainty, then it appears that a monopoly market structure will permit a greater level of imports than a competitive one. Implicit in White's analysis is the assumption of an infinite elasticity of supply of imports. In addition, his conclusions about the import structure relation rest on the presence of uncertainty. However, as the simple graphical analysis (Marvel, 1980) below seems to indicate, similar conclusions about the link between domestic structure and imports are reached without the assumptions about the import supply elasticity or the presence of uncertainty.

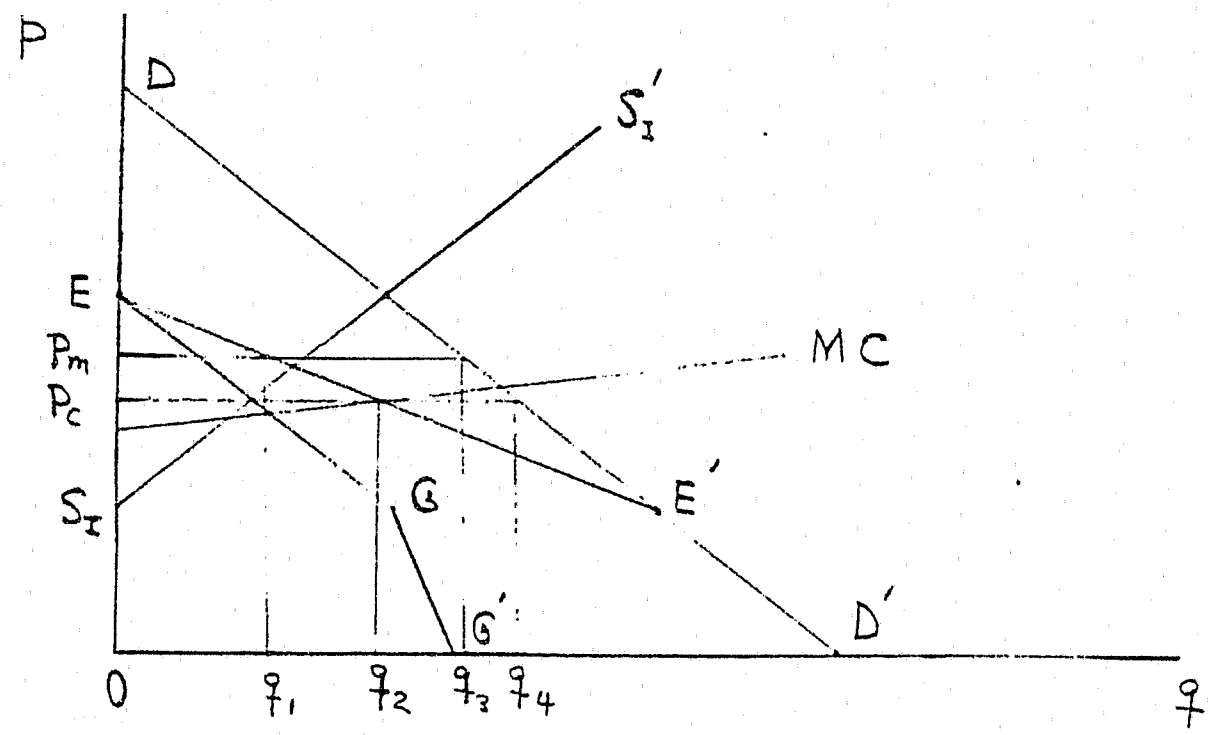

Figure 3

Assume that the domestic and imported goods are perfect substitutes and let DD', S_IS_I' represent the domestic demand and the import supply curves respectively. Then the residual demand curve facing the domestic producers will be $EE'D'$ with associated marginal revenue schedule EGG'. Also let MC represent the marginal cost curve of the domestic producers. Under perfect competition, $0q_2$ will be produced domestically and q_2q_4 will be imported. Under monopoly, on the other hand, $0q_1$ will be the domestic output and imports will rise to q_1q_3. The monopolization of the domestic market leads to both higher prices and a greater import share. Thus, the above analysis suggests that imports will be inflated by the profit-maximizing actions of a domestic monpolist, and import shares should be positively related to the supra-normal profits earned by the domestic firms.

Both Pagoulatos and Sorensen (1975) and Marvel (1980) found considerable support for the proposition that import flows are responsive to domestic market structure. Their statistical analysis very clearly shows that in import-competing situations, the existence of market power is likely to result in industries permitting a higher level of imports.

With respect to the export-structure relation, White's analysis indicates that a monopolist will export more than a competitive industry only if the domestic market can be segregated from the export market (see Section B). However, if dumping is not permitted, then a monoplist can no longer exploit his domestic market power and at the same time export. Thus, a monopolist incapable of international price discrimination faces a choice: forego the monopoly profits from the domestic market and choose to export, essentially becoming just one more competitor in the world market, or he may set high enough prices in the domestic market and forego exporting. As was noted in Section B, what the monopolist chooses depends on the excess profits,

above the world price, which he could earn by restricting his sales only to the domestic market versus the extra producer surplus resulting from the exports. The empirical evidence on the export-structure relation is ambiguous and somewhat contradictory. Pagoulatos and Sorensen (1975) claim to have found support for the proposition that market power exerts a positive influence upon industry exports. Caves et.al., (1980) and Marvel (1980), on the other hand, found the effect of market power on exports to be insignificant. Their results suggest that the price discrimination arguments which have been used to link domestic market structure and exports are not important.

Finally, we examine the impact of another set of factors representing key elements of market structure upon exports: corporate size, economies of scale in the national production, and product differentiation.

The costs associated with entering foreign markets can be at times substantial because of the need to gather information about such markets and also to organize proper distributional channels. The fact that many of these start-up fixed costs are irrecoverable increases the risk associated with foreign operations. The uncertainty about foreign demand conditions, fluctuations in exchange rates and also domestic political developments exacerbate this riskiness. The hypothesis then that large firms are more efficient at exporting is a reasonable one given that such firms amortize the fixed costs they must incur in order to sell abroad over a larger volume of sales. In addition, firms which possess some market power in their respective national markets are likely to have a larger pool of internal funds at their disposal (deep pocket theory) and easier access to credit. Such firms should be more able to overcome the impediments of establishing foreign market operations. Another structural characteristic with a potentially important

influence is the degree of economies of scale characterizing production in the industry. The presence of economies of scale could increase the international competitiveness of domestic firms by providing them with cost advantages in world markets. Finally, the behavior and performance of firms are affected by the degree of product differentiation inherent in the industry. The ability of domestic producers to differentiate their products in foreign markets is expected to be an important determinant of their export performance. Auquier (1980) presented evidence in support of the hypothesis that corporate size exerts a significant positive influence on exports. In addition, Pagoulatos and Sorensen (1980) showed that such industry characteristics as economies of scale and product differentiation are positively correlated with export performance.

IV. Implications for Policy

With the rapid growth in international trade and the increasing links between national product markets, the need to integrate the theory of international trade with that of industrial has become evident. Even, in the U.S. economy, the performance of several of the key manufacturing sectors can no longer be adequately explained without properly taking into account the effect of import competition and export opportunities. In the past few years in particular, imports have probably provided the most important source of new competition in many of the advanced industrial economies. These international linkages particularly cannot be ignored when our attention is focused on the market performance in some of the smaller economies.

The combination of international trade and industrial organization makes a powerful call for the modification of the traditional policies of competition and the types of policies which traditional programs favor -- away

from a policy of deconcentration and towards policies designed to promote domestic market contestability (by exposing the national economy to the forces of international competition).

At the policy level, proposals for structural relief have been criticized as more likely to reduce industrial efficiency rather than curb monopoly power with any accuracy. If indeed there are structural efficiencies associated with high concentration, then foreign competition provides an attractive alternative to operating directly on domestic industry stucture to achieve a desired competitive outcome. A policy which matches increases in concentration with tariff reduction has the generally desirable effects of i) mitigating the monopoly pricing problems which would normally follow in a closed economy, ii) improving the competitiveness of domestic firms in foreign markets, and iii) reducing the likelihood for domestic industries being severely affected by import competition in instances where domestic regulation would lead to inefficiently fragmented structure.

These propositions point to the opportunity of optimally exploiting foreign competition and domestic stucture for an effective competition policy to obtain. The implementation of a coordinated policy would require us to understand how the combination of trade and concentration at the optimum is affected by such factors as: the size of the domestic relative to the international market; the presence of economies of scale; the cost comparative advantage of domestic and foreign firms; the structural and conduct characteristics of the foreign component of the supply side of the market; learning effects and product development casts.

These proposals are especially relevant when one examines some of the smaller economies, including those of the less developed countries. As I have noted in a previous paper:

"In such economies the size of the market, in conjunction with the presence of economies of scale in production, will normally predict a small number of firms for a cost efficient structure to obtain. One of the predictions of the old competitive model is that the incentive of firms in a given industry to push price closer to marginal cost is directly related to the number of firms of the said industry. Thus, the old model would tend to favor policies of deconcentration for the smaller economies, policies which would almost surely run squarely into problems of efficiency. The new theory, on the other hand, suggests that even when a market is operated by a single seller, as long as such a market is easily contestable, it will behave approximately in a competitive manner. Trade liberalization policies which effectively increase the contestability of the domestic market, will therefore receive their greatest justification from the assertion that increased market contestability leads to better market performance." 1/

IK/ik
06/08/84

1/ See Kessides (1984).

APPENDIX A

A Model of Oligopoly with Foreign Competition

In order to clarify the potential impact of imports on domestic firm conduct, we proceed with the so-called dominant firm analysis. Thus, we examine the case of asymmetric oligopoly under the assumption that a group of producers - the dominant group - exhibits price leadership by imposing the selling price to a fringe of rivals, each of which is too small to exert a perceptible influence on price through individual output decisions.

Let us assume that the industry is composed of n producers and that k dominant firms set the selling price. The n-k firms comprising the fringe take the dominant group's price as given and expand output up to the point where their short-run marginal cost of production will be equal to the set price. Assume further that the global demand facing the industry is given by $q = q_d + q_f = F(p)$ where $q_c = G(p)$ is the supply function of the fringe and where $q_d = q - q_f = F(p) - G(p)$ is the demand facing the dominant group.

Given that the function $H(p) \equiv F(p) - G(p)$ has an inverse, we can write the profit of the i^{th} dominant firm as

$$\Pi_i = q_{di} h(q_d) - C_i(q_{di}) \qquad (1)$$

where $h = H^{-1}$ and $q_d = \sum_{i=1}^{k} q_{di}$.

If we assume that the dominant firms entertain Cournot conjectures, then maximization of (1) with respect to q_{di} yields the following equilibrium condition:

$$L_{di} = \frac{p - C_i(q_{di})}{p} = \frac{s_i}{\varepsilon + \eta\,(1-\phi)} \qquad (2)$$

where L_{di} is the price-cost margin (Lerner index) and $s_i = \frac{q_{di}}{q}$ is the market share of the i^{th} dominant firm, $\varepsilon = -\frac{p}{F(p)}\frac{dF(p)}{dp}$ is the elasticity of global demand, $\eta = \frac{p}{G(p)}\frac{dG(p)}{dp}$ is the elasticity of the supply function of the fringe, and ϕ is the market share of the competitive fringe.

Summing over all the industry members, we obtain the following expression for the aggregate monopoly power:

$$L = \sum_{i=1}^{k} \frac{s_i}{s_d} L_{di} = \sum_{i=1}^{K} \left(\frac{s_i}{s_d}\right)^2 \frac{s_d}{\varepsilon + \eta(1-\phi)} = \frac{H_d(1-\phi)}{\varepsilon + \eta(1-\phi)} \qquad (3)$$

where $s_d = \sum_{i=1}^{k} s_i = 1-\phi$ is the aggregate market share of the dominant group, $H_d = \sum_{i=1}^{k} \left(\frac{s_i}{s_d}\right)^2$ is the Herfindahl index of concentration within the dominant group, and where by assumption, $L_i=0$ for the members of the fringe. It should be noted that in equation (3), performance (L) is related to structure (H_d, ϕ), and that alternative definitions of the dominant group and hence different assumptions regarding industry conduct lead to different predictions with respect to the effect of imports on domestic market performance.

If the domestic firms are assumed to constitute the dominant group and the foreign firms to comprise the competitive fringe, then equation (3)

predicts that: the rate of imports (ϕ) will interact with domestic concentration (H_d) and the supply elasticity of imports (η) in limiting the monpoly power of domestic firms; the profitability of domestic firms is inversely related to the elasticity of supply of imports. Given then these specific conjectures about conduct, the dominant firm analysis clarifies the trade as discipline argument.

When the foreign producers form the dominant group and the domestic firms constitute the competitive fringe, then H_d becomes a measure of import penetration and ϕ a measure of domestic concentration (under the assumption that the members of the fringe are identical). In this case, equation (3) predicts that the rate of imports and domestic concentration have no effect on domestic market performance, and hence imports do not discipline the behavior of the domestic firms. Alternatively, there has to be something to discipline and this is not the case when the domestic firms are small, competitive, and dominated by a group of large foreign (e.g., multinational) firms.

In the more realistic intermediate case, we assume that some national firms are members of the dominant group potentially controlling, at least partly, the level of imports through transnational cooperation. In addition, we assume that some foreign producers comprise part of the fringe which also includes the small domestic firms. The dominant firm analysis makes no clearcut predictions for the effect of imports on domestic market performance in this mixed case.

From the policy point of view, of particular interest is also the situation in which a large competitive domestic fringe constrains the pricing behavior of large multinational firms which either export directly to the country in question or choose to produce locally. Then, the possibility exists for the multinational firms to engage in predatory behavior through

temporary price-cuts (or equivalently by flooding the market with imports) with the objective of attaining a monopoly position in the future. The presence of such elements of strategic behavior by foreign firms complicates considerably the design of an appropriate public policy towards imports.

APPENDIX B

A Model of Oligopoly Designed to Assess the Impact of Foreign Competition

Let an industry be composed of n differentiated producers, each supplying the market with output (in physical units) x_i: $i = 1, 2, \ldots, n$. Following Spence (1980), we assume that the inverse demand for the ith firm's product is given by:

$$p_i = k_i B(m)\ A(a_i)\ x_i^{\alpha-1} \qquad (1)$$

where k_i is a summary index of firm specific characteristics (such as reputation), $A(a_i)$ is an increasing function of the ith firm's advertising expenditures a_i, with parameter $0 < \alpha \leq 1$, and where $m = \sum_{j=1}^{n} \frac{k_j A(a_j)\ x_j^{\alpha}}{\alpha}$, and $B(m)$ falls when m increases. [1] The quantity m can be interpreted as an index of congestion in the market. As m increases there is a reduction in the inverse demands facing the firms in the market. The influence which firm characteristics exert on demand is apparent -- if, for example, k_i is taken to represent reputation, then Equation (1) implies that a firm with a higher reputation is able to sell a larger volume of output at a given price or the same volume at a higher price than a competitor enjoying less reputation. The effect of advertising is similar.

The profit of the ith firm may be expressed as a function of its own output and advertising, and the output and advertising levels of the other firms:

$$\Pi_i = k_i B(m) A(a_i) x_i^{\alpha} - c_i(x_i) - a_i \qquad (2)$$

where $c_i(x_i)$ represents production costs. The firm seeks to maximize profit with the use of two instruments: output and advertising expenditures. [2] In

addition we assume that each firm forms a conjectural variation on the output (advertising) response of the other firms, resulting from a change in its own output (advertising). Thus, we take firm i's belief about the responses of other firms to its output and advertising changes as given by:

$$\frac{dx_j}{dx_i} = \mu \frac{x_j}{x_i} \tag{3}$$

and

$$\frac{da_j}{da_i} = \nu \frac{a_j}{a_i} \tag{4}$$

where $i, j = 1, 2, \ldots, n$ and where $0 < \mu < 1$, $0 < \nu < 1$. The parameters μ and ν therefore represent the degree of implicit collusion in the market.[3] In the extreme when $\mu = \nu = 0$, the ith firm entertains Cournot conjectures regarding the output and advertising levels of the other firms, while perfect collusion is approached as μ and ν tend to 1.

Having defined firm conduct we now proceed with the derivation of the first order conditions for the maximization of the ith firm's profit:

$$\alpha - \varepsilon \frac{x_i}{m} \frac{dm}{dx_i} = \beta \frac{c_i x_i^{\beta}}{R_i} \tag{5}$$

and

$$\frac{1}{\gamma} - \varepsilon \frac{a_i}{m} \frac{dm}{da_i} = \frac{a_i}{R_i} \tag{6}$$

where we let $B(m) = qm^{-\varepsilon}$, $A(a_i) = ba_i^{1/\gamma}$, $c_i(x_i) = c_i x_i^{\beta}$, and $R_i = k_i q m^{-\varepsilon} b a_i^{1/\gamma} x_i^{\alpha}$. Thus to maximize profit the ith firm sets the perceived marginal revenue equal to marginal cost.[4]

It is important to note that the competitive interaction among firms takes place through m. We therefore assume that the ith firm takes into account the effects of changes in x_i and a_i on m. Given the conjectural variations in (3) and (4), we obtain the following expressions for these effects:

$$\frac{dm}{dx_i} = \frac{\alpha m}{x_i}[\mu + s_i(1-\mu)] \tag{7}$$

and

$$\frac{dm}{da_i} = \frac{1}{\gamma}\frac{m}{a_i}[\nu + s_i(1-\nu)] \tag{8}$$

where $s_i = \frac{k_i b a_i^{1/\gamma} x_i^{\alpha}}{\alpha m}$ is the ith firm's market share. [5]

By substituting (7) and (8) in (5) and (6) we obtain:

$$\frac{c_i x_i^{\beta}}{a_i} = \frac{\alpha\gamma}{\beta}\frac{1-\varepsilon[\mu + s_i(1-\mu)]}{1-\varepsilon[\nu + s_i(1-\nu)]} \tag{9}$$

for the optimal mix of production and advertising expenditures. This equation represents a necessary condition for industry equilibrium since any deviation from it will lower the firm's profit.

We proceed further by invoking a second necessary condition for industry equilibrium, that the expected profits of potential entrants are non-positive. We assume two possible outcomes following entry into an industry with n established firms: with probability η there will be a passive, non-cooporative response from the incumbents leading to a new industry equilibrium with the entrant staying in; and with probability $1-\eta$ there will be an aggressive, predatory response from the incumbents forcing the entrant to exit. The zero expected profit condition of entry can be written using (2) and (9) as follows:

$$\max_x \{\eta [k_{n+1} q(m + \lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2})^{-\varepsilon} \bullet \alpha\lambda [c_{n+1}^{1/\gamma} x^{\lambda_2} - c_{n+1} x^{\beta(1+\frac{\beta}{\alpha\gamma})}] f$$

$$- (1-\eta) d_x c_{n+1} x^{\beta}\} = 0 \qquad (10)$$

where $\lambda_1 = \frac{b}{\alpha} (\frac{\beta}{\alpha\gamma})^{1/\gamma}$, $\lambda_2 = \alpha + \frac{\beta}{\gamma}$, $f = \int_o^T e^{-rt} dt$, T is the expected lifetime of the entrant in the industry, r is the the discount rate, and where in order to keep the analytics tractable we have assumed that the sunk costs arising from investments in physical capital are proportional to production costs, with d_x being the proportionality constant.[6] In addition we have also assumed for algebraic simplicity that $\mu = \nu$.

Equation (10) permits us to derive the entry-deterring level of market congestion m*. Solving (10) and substituting (3), we have:

$$\lambda_2 \left(\varepsilon \frac{\mu m + \lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2}}{m + \lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2}} - 1\right) + \beta = 0 \qquad (11)$$

as a necessary condition for industry equilibrium. [7] Thus we obtain:

$$m^{*\theta+\varepsilon-1} = \frac{q}{w} \frac{k_{n+1}^{\theta}}{c_{n+1}^{\alpha\theta/\beta}} \frac{1}{T} \varepsilon^{-\varepsilon} (1-\mu)^{-\varepsilon} (1-\theta-\varepsilon\mu)^{1-\theta} (\theta+\varepsilon-1)^{\theta+\varepsilon-1} \qquad (12)$$

for the entry-deterring level of m, where $w = \frac{\gamma^{\theta/\gamma} \beta^{\alpha\theta/\beta}}{\theta\, b^{\theta}\, \alpha^{1-\theta(1-\frac{\alpha}{\beta})}}$,

$\theta = \frac{\beta\gamma}{\beta+\alpha\gamma}$,

and where $T = 1 + \frac{\beta}{\alpha\gamma} + \frac{1-\eta}{\eta} \frac{1}{f} d_x$. [8]

Thus, T is a function of $\frac{1-\eta}{\eta}$, the relative probability of exit as perceived by the entrant, and d_x, the proportion of entry costs which are sunk in the event of failure.

Using (9) we can derive the price-cost margin PC_i at the optimum:

$$PC_i = \frac{\Pi_i}{R_i} = 1 - \frac{c_i x_i^{\beta} + a_i}{k_i q m^{-\varepsilon} b a_i^{1/\gamma} x_i^{\alpha}}$$

$$= 1 - \frac{c_i(1 + \frac{\beta}{\alpha\gamma}) (\frac{\alpha}{b})^{\theta} (\frac{\alpha\gamma}{\beta c_i})^{\theta/\gamma} \frac{1}{k_i^{\theta}} m^{\theta} s_i^{\theta}}{q m^{-\varepsilon} \alpha m s_i}$$

$$= 1 - \frac{w}{q} \frac{c_i^{\alpha\theta/\beta}}{k_i^{\theta}} m^{\theta+\varepsilon-1} s_i^{\theta-1} . \qquad (13)$$

Substituting the entry-deterring level of m from (12) we obtain:

$$PC_i = 1 - \frac{1}{T} D(\theta,\varepsilon,\mu) \frac{k_{n+1}^{\theta}}{c_{n+1}^{\alpha\theta/\beta}} \frac{c_i^{\alpha\theta/\beta}}{k_i^{\theta}} s_i^{\theta-1} \qquad (14)$$

for the price-cost margin at the equilibrium solution where

$$D(\Theta,\varepsilon,\mu) = \varepsilon^{-\varepsilon} (1-\mu)^{-\varepsilon} (1-\theta-\varepsilon\mu)^{1-\theta} (\theta+\varepsilon-1)^{\theta+\varepsilon-1} .$$

We interpret firm output and advertising as being inputs used by the firm to produce revenue. In what follows we assume that the production function of the firm exhibits economies of scale, which implies that:

$$\theta = \frac{\beta\gamma}{\alpha\gamma+\beta} = \frac{1}{\frac{\alpha}{\beta} + \frac{1}{\gamma}} < 1$$

where $\frac{\alpha}{\beta}$ and $\frac{1}{\gamma}$ are the coefficients of the output and advertising inputs respectively.

In equation (14) the term $\frac{1}{T} D(\theta,\varepsilon,\mu)$ is a summary of the following industry characteristics which ultimately determine market congestion: T reflecting the risk arising from the sunk costs; θ , the degree of scale economies exhibited by the production function of the firm; ε , the elasticity of industry price with respect to m; and μ , the degree of implicit collusion inherent in the market. Thus, $\frac{1}{T} D(\theta,\varepsilon,\mu)$ embodies such industry-specific attributes as the degree of sunkness of investments in the industry or the degree of implicit collusion in the market which affect profitability. We interpret $\frac{1}{T} D(\theta,\varepsilon,\mu)$ as a composite index of barriers-to-entry. It is important to note that:

$$\frac{\partial D}{\partial \mu} = -\mu\varepsilon^{-\varepsilon+1} (1-\mu)^{-\varepsilon-1} (1-\theta-\varepsilon\mu)^{-\theta} (\theta+\varepsilon-1)^{\theta+\varepsilon} < 0 \quad .$$

Thus, effective entry barriers increase with the degree of collusion inherent in the market. Alternatively, markets which embody more collusive behavior by incumbent firms must appear more congested to potential entrants.

The term $\frac{k_{n+1}^{\theta}}{c_{n+1}^{\alpha\theta/\beta}}$ represents the characteristics of the potential entrant who is kept out because he faces a non-positive expected profit. In some sense this term reflects the competitive pressure of potential entry. It appears from Equation (14) that, ceteris paribus, the more efficient the production technology available to those firms "waiting in the wings" (smaller c_{n+1}), the greater the pressure exerted on the profit rate of incumbent (smaller PC_i). Alternatively, Equation (12) implies that the entry-deterring level of market congestion m* is higher in those industries in which incumbents face more efficient entrants. The output and advertising levels required for maintaining such an entry-deterring level of market congestion

will deviate from the profit maximizing levels when there is no threat of entry. Consequently potential competion may drive the price closer to marginal cost. [9]

Finally, $\frac{c_i^{\alpha\theta/\beta}}{k_i^{\theta}} s_i^{\theta-1}$ signifies the influence of internal conditions. When we fix the entry barrier parameters and the attributes of potential entrants, and then look across firms within the same industry, Eqn. (14) implies that the profit rate of the firm is positively related to the firm's market share. In fact, according to this model, within the same industry inter-firm differences in market shares are the sole determinant of differences in profitability. [10]

In summary the firm profitability equation has two principal components. The first component consists of the term $\frac{1}{T} D(\theta,\varepsilon,\mu) \frac{k_{n+1}^{\theta}}{c_{n+1}^{\alpha\theta/\beta}}$ which represents the effect of external conditions such as entry barriers and the competitive pressure of new entrants. The term $\frac{c_i^{\alpha\theta/\beta}}{k_i^{\theta}} s_i^{\theta-1}$ comprises the second component. We interpret this second component as representing the influence of internal structure. Next, we note that only the second component varies across firms (within an industry) while the first component is invariant. This formulation, therefore, points to the possibility of separating the effect of external conditions from that of internal structure by examining intra-industry profitability.

From equation (13) we have:

$$\frac{cx_i^{\beta} + a_i}{R_i} = 1 - \frac{w}{q} \frac{c_i^{\alpha\theta/\beta}}{k_i^{\theta}} m^{\theta+\varepsilon-1} s_i^{\theta-1}$$

which using (9) leads to:

$$\frac{a_i}{R_i}\left(1+\frac{\alpha\gamma}{\beta}\right) = 1 - \frac{w}{q}\frac{c_i^{\alpha\theta/\beta}}{k_i^{\theta}} m^{\theta+\varepsilon-1} s_i^{\theta-1} .$$

Thus, we obtain:

$$\rho_i = \frac{a_i}{R_i} = \frac{\theta}{\gamma}\frac{1}{T} D(\theta,\varepsilon,\mu) \frac{k_{n+1}^{\theta}}{c_{n+1}^{\alpha\theta/\beta}} \frac{c_i^{\alpha\theta/\beta}}{k_i^{\theta}} s_i^{\theta-1} \qquad (15)$$

for the advertising intensity (advertising-to-sales ratio) at the equilibrium solution. Our model suggests, therefore, that across firms within the same industry there is an inverse relationship between advertising intensity and market share.

Multiplying (14) and (15) by s_i and summing over the n firms we have:

$$PC = 1 - D(\theta,\varepsilon,\mu) \sum_{i=1}^{n} s_i^{\theta}$$

$$= 1 - \frac{D(\theta,\varepsilon,\mu)}{H(\theta)} \qquad (16)$$

and

$$\rho = \frac{\theta}{\gamma} D(\theta,\varepsilon,\mu) \sum_{i=1}^{n} s_i^{\theta}$$

$$= \frac{\theta}{\gamma}\frac{D(\theta,\varepsilon,\mu)}{H(\theta)} \qquad (17)$$

for the industry price-cost margin and advertising intensity, where

$H(\theta) = \dfrac{1}{\sum_{i=1}^{n} s_i^{\theta}}$ is an index of industry concentration.

Specification and Estimation Issues

Equation (14) predicts that the price-cost margin of the firm is directly related to its market share. The intra-industry cross-section regression specification:

$$y_i = \gamma_o + \gamma_1 z_i + \varepsilon_i \qquad i=1, \ldots, n \tag{18}$$

where $y_i = \ln(1-PC_i)$ and $z_i = \ln s_i$ will permit the testing of this prediction. In addition the above specification will provide estimates of the industry-level parameters D, the summary of entry barrier effects, and θ, the scale of elasticity. A comparison of Equations (14) and (18) indicates the following relationship between the estimated coefficients and the parameters of the model:

$$D(\theta, \varepsilon, \mu) = e^{\hat{\gamma}_o} \text{ and } \theta = 1 + \hat{\gamma}_1 .$$

It should be noted that in the pure cross-section specification above the crucial assumption is made that:

$$E(\varepsilon_i / z_i) = \underline{0}$$

i.e. the expectation of the disturbances conditional on the independent variables is zero. We propose to estimate equation (18) by ordinary least squares (OLS) for each industry in our sample separately.

Because the number of observations in some industries is small and since panel data is available (in our specific case we have observations on a

cross-section of firms within each industry for the years 1974, 1975, and 1976), we proceed next by pooling cross-section and time-series observations.

To start with, let us consider the model:

$$Y_{it} = \gamma_o + \gamma_1 z_{it} + \varepsilon_{it} \quad (i=1, 2, \ldots, n;\ t=1, 2, \ldots, T) \tag{19}$$

where the disturbance $\underset{\sim}{\varepsilon}_i = (\varepsilon_{i1}, \varepsilon_{i2}, \ldots, \varepsilon_{iT})$ is such that $E(\underset{\sim}{\varepsilon}_i) = 0$ and where it is assumed that the disturbance is generated by the stationary, first-order autoregressive process:

$$\varepsilon_{it} = \phi_i \varepsilon_{i\ t-1} + u_{it}$$

where the u_{it} are contemporaneously correlated but are not correlated in different time periods, i.e., $E(u_{it}) = 0$, $E(u_{it}, u_{jt}) = \sigma_{ij}$, and $E(u_{it}, u_{is}) = 0$ for $t \neq s$. This model assumes that the variance of the disturbance may differ across firms and it follows a first-order autoregressive process. This model therefore captures both the effects of heteroskedasticity and autocorrelation, and it can be estimated using generalized least squares (GLS).

When the error term includes firm specific effects as indicated by the specification:

$$Y_{it} = \gamma_o + \gamma_1 z_{it} + \xi_i + \eta_{it} \quad (i = 1, 2, \ldots, n;\ t=1, 2, \ldots, T) \tag{20}$$

then different estimation procedures are called for depending on whether such individual effects are fixed or random. The error term in (20) has been broken into two components: ξ_i, which represents time-invariant unobservable

firm specific characteristics, and η_{it}, which represents random shocks orthogonal to both ξ_i and z_{it}.

Firm specific effects, (ξ_i), such as managerial efficiency might be reasonably assumed to be correlated with the firm's market share (z_i). In that case we propose to use the first-difference method and estimate the model:

$$Y_{it} - Y_{it-1} = \gamma_1(z_{it} - z_{it-1}) + w_{it} \qquad (21)$$

where $w_{it} = \eta_{it} - \eta_{it-1}$. Given the assumption that the η_{it} represent random shocks it may not be unreasonable to estimate (21) using ordinary least squares.

Footnotes

1. Assuming that income effects are negligible, these inverse demands are derived from a constant elasticity of substitution consumer benefit function. See Spence (1976); Koenker and Perry (1981).

2. Spence (1980) viewed the decision faced by the firm as one of selecting revenues and then minimizing costs per dollar of revenues with respect to advertising.

3. We ignore here the possiblility that $\mu < 0$, which would imply that each firm expects the rest of the industry to contract and absorb some of its output expansion.

4. It is assumed here that firms within a given industry face different cost functions. The model provides an explanation of how market shares are formed. It attributes the variation in market shares across firms within an industry to differences in cost conditions and other firm-specific effects such as reputation. However, the presence of such firm-specific effects raises important questions with regard to the choice of appropriate estimation techniques.

5. $$\frac{dm}{dx_i} = k_i ba_i^{1/\gamma} x_i^{\alpha-1} + \sum_{\substack{j=1 \\ j\neq i}}^{n} k_j ba_j^{1/\gamma} x_j^{\alpha-1} \frac{dx_j}{dx_i}$$

$$= k_i ba_i^{1/\gamma} x_i^{\alpha-1} + \frac{\mu\alpha}{x_i} \sum_{\substack{j=1 \\ j\neq i}}^{n} \frac{k_j ba_j^{1/\gamma} x_j^{\alpha}}{\alpha}$$

$$= k_i ba_i^{1/\gamma} x_i^{\alpha-1} + \frac{\mu\alpha}{x_i} \left(m - \frac{k_i ba_i^{1/\gamma} x_i^{\alpha}}{\alpha}\right)$$

$$= k_i ba_i^{1/\gamma} x_i^{\alpha-1} (1-\mu) + \frac{\mu\alpha}{x_i} m \ .$$

Industry revenues are given by:

$$R = \sum_{j=1}^{n} k_j qm^{-\varepsilon} ba_i^{1/\gamma} x_i^{\alpha} = \alpha qm^{-\varepsilon+1} \ .$$

The market share of the ith firm can be written as:

$$s_i = \frac{k_i qm^{-\varepsilon} ba_i^{1/\gamma} x_i^{\alpha}}{\alpha qm^{-\varepsilon+1}} = \frac{k_i ba_i^{1/\gamma} x_i^{\alpha}}{\alpha m} \ .$$

Thus, we obtain:

$$\frac{dm}{dx_i} = \frac{\alpha m s_i}{x_i}(1-\mu) + \frac{\mu\alpha}{x_i} m$$

$$= \frac{\alpha m}{x_i}[\mu + s_i (1-\mu)] .$$

6. For analytic simplicity we ignore any sunk costs resulting from investments in advertising.

7. To find the maximum of the quantity within { } in (10) we differentiate and set equal to zero:

$$\frac{d}{dx}\{\ \} = \eta\ [-k_{n+1} q\varepsilon\ (m + \lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2})^{-\varepsilon-1}\ (\frac{\lambda_2}{x}\mu m + \frac{\lambda_2}{x}\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2}) .$$

$$\alpha\lambda_1 c_{n+1}^{1/\gamma} x^{\lambda_2} + k_{n+1} q(m+\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2})^{-\varepsilon} \frac{\lambda_2}{x}\alpha\lambda_1 c_{n+1}^{1/\gamma} x^{\lambda_2}$$

$$- \frac{\beta}{x} c_{n+1} x^{\beta} (1+\frac{\beta}{\alpha\gamma})]\ f \qquad - \frac{\beta}{x}(1-\eta)\ d_x c_{n+1} x^{\beta} \qquad = 0 .$$

Next, we use the requirement imposed by (10) that this maximum must equal zero to obtain:

$$- k_{n+1} q\varepsilon (m+\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2})\ \lambda_2\ (\mu m + \lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2})\ .\ \alpha\lambda .c_{n+1}^{1/\gamma} x^{\lambda_2}$$

$$+ k_{n+1} q(m+\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2})^{-\varepsilon}\ \lambda_2 \alpha\lambda_1 c_{n+1}^{1/\gamma} x^{\lambda_2}$$

$$= \beta k_{n+1} q(m+\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2})^{-\varepsilon}\ \alpha\lambda_1 c_{n+1}^{1/\gamma} x^{\lambda_2}$$

$$- \frac{\varepsilon\lambda_2(\mu m+\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2})}{m+\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2}} + \lambda_2 - \beta = 0 .$$

8. To derive Equation (12) we proceed as follows:

$$\frac{\mu m + \lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2}}{m+\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2}} = \frac{\lambda_2 - \beta}{\varepsilon\lambda_2}$$

$$\frac{(\mu-1)m}{m+\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2}} = \frac{\lambda_2-\beta-\varepsilon\lambda_2}{\varepsilon\lambda_2}$$

$$\lambda_1 k_{n+1} c_{n+1}^{1/\gamma} x^{\lambda_2} = m\ [\frac{\varepsilon\lambda_2(\mu-1)}{\lambda_2-\beta-\varepsilon\lambda_2} - 1] .$$

Using again the condition that the maximum of the quantity within the brackets in (10) must equal to zero we obtain:

$$q\alpha\, m(\omega-1)\,[r+m(\omega-1)]^{-\varepsilon} - c_{n+1}\, x^{\beta} T = 0$$

where $\omega = \dfrac{(\mu-1)\varepsilon\lambda_2}{\lambda_2-\beta-\varepsilon\lambda_2}$ and $T = 1 + \dfrac{\beta}{\alpha\gamma} + \dfrac{1-\eta}{\eta}\dfrac{1}{f}\, d_x$.

Noting from the previous equation that $x^{\lambda_2} = \dfrac{m(\omega-1)}{\lambda_1 k_{n+1} c_{n+1}^{1/\gamma}}$ we obtain:

$$q\alpha m^{-\varepsilon+1}\,(\omega-1)\omega^{-\varepsilon} - c_{n+1}\,\frac{m^{\beta/\lambda_2}(\omega-1)^{\beta/\lambda_2}}{\lambda_1^{\beta/\lambda_2} k_{n+1}^{\beta/\lambda_2} c_{n+1}^{\beta/\lambda_{2\gamma}}}\, T = 0$$

$$m^{\theta+\varepsilon-1} = \frac{k_{n+1}^{\theta}}{c_{n+1}^{\alpha\theta/\beta}}\,\frac{q\alpha(\omega-1)^{1-\theta}\omega^{-\varepsilon}}{T}\,\lambda_1^{\theta}.$$

A simple manipulation using the expressions for ω and λ_1 yields Equation (12).

9. This model, however, does not explicitly deal with the question of when the maintenance of an entry-deterring level of market congestion, m^*, is an optimum incumbent strategy.

10. Clearly, as we look across firms within the same industry not only will s_i vary, but k_i and c_i will also vary. However, it must be noted that s_i is directly related to $\dfrac{k_i^{\theta}}{c_i^{\alpha\theta/\beta}}$, and it will move in the same direction.

    Thus, changes across firms in k_i and c_i will be captured by the observed variation in s_i.

APPENDIX C

The Price-Cost Margin of an Exporting Industry

It is assumed in the model below, (see for example Huveneers (1982)), that the domestic oligopolists facing exporting opportunities cannot affect the world price and will, therefore, behave as price-takers on the international market. In addition, we assume that all domestic firms produce the same good which is not differentiated with respect to foreign-made goods.

The profit of the i^{th} domestic firm is given by:

$$\Pi_i = q_{di}p_d + q_{xi}p_w - C_i(q_{di} + q_{xi}) - F_i \qquad (1)$$

where: p_d, p_w represent the domestic and world prices; q_{di}, q_{xi} are the quantities sold by the firm in the domestic and export markets; C_i, F_i are the variable and fixed costs facing the firm.

We examine first the case in which the national markets cannot be segmented. Then the world and domestic prices are the same and the optimization problem facing the i^{th} firm is that of maximizing Π_i with respect to q_{di}, q_{xi}, subject to the constraint $p_w=p_d$. The first order condition for profit maximization is simply $p_w= C_i'$ and the i^{th} firm's price-cost margin at the optimum becomes:

$$PC_i = \frac{\Pi i}{p_w(q_{di} + q_{xi})} = \frac{p_w(q_{di} + q_{xi}) - C_i(q_{di} + q_{xi}) - F_i}{p_w(q_{di} + q_{xi})}$$

$$= 1 - \frac{AC_i}{C_i'} = 1 - \frac{1}{k_i} \qquad (2)$$

where AC_i is the average cost of production at the level of output $q_{di} + q_{xi}$, and k_i is the ratio of marginal cost to average cost (elasticity of total cost).

If we assume that the domestic oligopolists face different marginal cost schedules but that the ratio of their marginal to average cost is the same, i.e., $k_i = k$, then we obtain the following expression for the price-cost margin of the domestic industry as a whole:

$$PC = \sum_{i=1}^{n} PC_i s_i = 1 - \frac{1}{k} \qquad (3)$$

where s_i represents the market share of the i^{th} firm. The above equation implies that when the domestic firms cannot segment the national market from the export market, then there is no relationship between the price-cost margin, the export rate, and concentration.

Next, we examine the case in which the domestic firms can isolate national markets from each other. Thus, we assume that the domestic

oligopolists enjoy some market power domestically but still behave as price-takers abroad. The profit of the i^{th} firm in this case is:

$$\Pi_i = f(q_d)\ q_{di} + p_w q_{xi} - C_i(q_{di} + q_{xi}) - F_i \qquad (4)$$

where $q_d = \sum_{i=1}^{n} q_{di}$ and $f(q_d)$ is the domestic inverse demand function. The i^{th} firm then maximizes the expression in (4) with respect to q_{di} and q_{xi}. The first order condition $\frac{\partial \Pi i}{\partial q_{di}} = 0$ leads to the following expression for the i^{th} firm's price-cost margin on domestic sales:

$$PC_{di} = \frac{\Pi_{di}}{p_d q_{di}} = 1 - \frac{1}{k_i} + \frac{1}{k_i}\frac{q_{di}}{q_d}\frac{1}{e_d} \qquad (5)$$

If we fix the k_i's across firms and aggregate over the n firms, we obtain

$$PC_d = 1 - \frac{1}{k} + \frac{H_d}{k\varepsilon_d} \qquad (6)$$

for the aggregate price-cost margin on domestic sales, where $H_d = \sum_{i=1}^{n} \left(\frac{q_{di}}{q_d}\right)^2$ is the Herfindahl index of concentration for domestic sales.

The first order condition $\frac{\partial \Pi i}{\partial q_{xi}} = 0$ leads to

$$PC_x = 1 - \frac{1}{k} \qquad (7)$$

for the aggregate price-cost margin of domestic producers on their export sales.

Since the observed price-cost margin PC shold be considered a weighted average of the price-cost margins obtained in the domestic and export markets, we have:

$$PC = \frac{p_d q_d}{p_d q_d + p_w q_x} PC_d + \frac{p_w q_x}{p_d q_d + p_w q_x} PC_x$$

$$= 1 - \frac{1}{k} + \frac{p_d q_d}{p_d q_d + p_w q_x} \frac{H_d}{k\varepsilon_d}$$

$$= 1 - \frac{1}{k} + \frac{H_d}{k\varepsilon_d}(1 - t_x) \qquad (8)$$

where $q_x = \sum_{i=1}^{n} q_{xi}$ and where $t_x = \frac{p_w q_x}{p_d q_d + p_w q_x}$ is the export rate.

Equation (8) indicates that in the case of price-discrimination, domestic concentration has a positive influence on profitability. In the context of this model, it also appears that the export rate affects the price-cost margin but that the precise nature of this relationship depends on cost conditions.

REFERENCES

Adams, W. J., "International Differences in Corporate Profitability", Economica, Nov. 1976, 367-79.

Auquier, Antoine A., "Sizes and Firms, Exporting Behavior, and the Structure of French Industry", Journal of Industrial Economics, Dec. 1980, 203-218.

Bloch, H., "Prices, Costs, and Profits in Canadian Manufacturing: The Influence of Tariffs and Concentration", Canadian Journal of Economics, Nov. 1974, 594-610.

Carlsson, B., "The Measurement of Efficiency in Production: An Application to Swedish Manufacturing Industries", Swedish Journal of Economics, Dec. 1972, 468-85.

Caves, R., "International Corporations: The Industrial Economics of Foreign Investment", Economica, Feb. 1971, 1-27.

Caves, R., "International Trade, International Investment, and Imperfect Markets", Special Papers in International Economics, #10, Princeton University, 1974.

Caves, R., "Multiplant Firms, Competition, and Productivity in Host-Country Industries", Economica, May 1974, 176-93.

Caves, R., "International Trade and Industrial Organization: Problems, Solved and Unsolved", Paper presented at the 10th EARIE Conference, Aug. 1983, Bergen, Norway.

Caves, R., Jones, R., World Trade and Payments: An Introduction, Boston: Little, Brown and Company, 1973.

Caves, R., Khalilzadeh-Shirazi, J., "International Trade and Industrial Organization: Some Statistical Evidence", in Welfare Aspects of Industrial Markets, ed. A.P. Jacquemin and H.W. deJong, Leiden: Martinus Nijhoff, 1977, pp. 111-27.

Caves, Richard E., Porter, Michael E., and A. Michael Spence, Competition in the Open Economy: A Model Applied to Canada, Cambridge: Harvard University Press, 1980.

DeRosa, Dean A., Goldstein, Morris, "Import Discipline in the U.S. Manufacturing Sector", IMF Staff Papers, Sept. 1981, 600-34.

Ensor, J., The Motor Industry, London: Longmans, 1971.

Esposito, L., Esposito, F., "Foreign Competition and Domestic Industry Profitability", Review of Economics and Statistics, Nov. 1971, 343-353.

Geroski, P.A., "Simultaneous Equation Models of the Structure-Performance Paradigm", European Economic Review, Sept. 1982, 147-58.

Geroski, Paul A., Jacquemin, A., "Imports as a Competitive Discipline", Recherches Economiques du Louvain, Sept. 1981, 197-208.

Haberler, G., International Trade and Economic Development, p.10. National Bank of Egypt, Cairo, 1959.

Huveneers, C., "Price Formation and the Scope for Oligopolistic Conduct in a Small Open Economy", Recherches Economiques du Louvain, Sept. 1981, 209-242.

Jacquemin, A., "Imperfect Market Structure and International Trade - Some Recent Research", Kyklos, No. 1, 1982, 75-93.

Jacquemin, A., de Ghellinck, E., Huveneers, C., "Concentration and Profitability in a Small Open Economy", Journal of Industrial Economics, Dec. 1980, 131-44.

Jenny, F., Weber, A.P., "Profit Rates and Structural Variables in French Manufacturing Industries", European Economic Review, Feb. 1976, 187-206.

Khalilzadeh-Shirazi, J., "Market Structure and Price Cost Margins in United Kingdom Manufacturing Industries", Review of Economics and Statistics, Feb. 1974, 67-76.

Krugman, Paul, "The New Theories of International Trade and the Multinational Enterprise", Paper presented at the 4th Annual Middlebury College Conference on Economic Issues, April 1982.

Koenker, Roger W., Perry, Martin K., "Product Differentiation, Monopolistic Competition, and Public Policy", Bell Journal of Economics, Spring 1981, 217-231.

Krause, L.B., "Import Discipline: The Case of the United States Steel Industry", Journal of Industrial Economics, Nov. 1962, 33-47.

Lyons, B., "Price-Cost Margins, Market Structure and International Trade", Paper presented to the A.U.T.E., Annual Conference, Exeter, 1980.

Lyons, B., "Industrial Behavior, the Technology of Demand, and the Pattern of International Trade Between Identical Countries", Recherches Economiques du Louvain, Sept. 1981, 243-58.

Marvel, Howard L., "Foreign Trade and Domestic Competition", Economic Inquiry, Jan. 1980, 103-22.

Melvin, J., Warne, R., "Monopoly and the Theory of International Trade", Journal of International Economics, 1973, 117-134.

Murfin, Andrew, Cowling, Keith, "Price Formation and Import Penetration in U.K. Manufacturing Industry", Recherches Economiques de Louvain, Sept. 1981, 307-34.

Neuman, M., Bóbel , I., Haid, A., "Profitability, Risk and Market Structure in West German Industries", Journal of Industrial Economics, Mar. 1979, 227-242.

Pagoulatos, E., Sorensen, R., "Domestic Market Structure and International Trade: An Empirical Analysis", Quarterly Review of Economics and Business, Spring, 1975, 45-59.

Pagoulatos, E., Sorensen, R., "International Trade, International Investment, and Industrial Profitability of U.S. Manufacturing", Southern Economic Journal, Jan. 1976, 425-434.

Pagoulatos, E., Sorensen, R., "Foreign Trade, Concentration, and Profitability in Open Economies", European Economic Review, Oct. 1976, 255-67.

Pugel, Thomas A., International Market Linkages and U.S. Manufacturing: Prices, Profits and Patterns, Cambridge: Ballinger Publishing Co., 1978.

Pugel, Thomas A., "Foreign Trade and U.S. Market Performance", Journal of Industrial Economics, Dec. 1980, 119-30.

Rugman, Alan M., Multinationals in Canada: Theory, Performance and Economic Impact, Boston: Martinus Nijhoff, 1980.

Rugman, Alan M., "The Size and Performance of the World's Largest Multinational Enterprises", Paper presented at the 10th EARIE Conference, Aug. 1983, Bergen, Norway.

Saunders, R., "The Determinants of Productivity in Canadian Manufacturing Industries", Journal of Industrial Economics, Dec. 1980, 167-84.

Scherer, F. M., et.al., The Economics of Multi-Plant Operation: An International Comparisons Study, Cambridge: Harvard University Press, 1975.

Silberston, A., "The Motor Industry", in Duncan Burn, ed., The Structure of British Industry: A Symposium, London: Cambridge University Press, 1958.

Spence, M.A., "Notes on Advertising, Economies of Scale, and Entry Barriers", The Quarterly Journal of Economics, Nov. 1980, 493-507.

Turner, Philip P., "Import Competition and the Profitability of United Kingdom Manufactury Industry", Journal of Industrial Economics, Dec. 1980, 155-66.

Vernon, R., "A Trade Policy for the 1960's", Foreign Affairs, Apr. 1961, 458-70.

White, L., "Industrial Organization and International Trade", American Economic Review, Dec. 1974, 1013-20.