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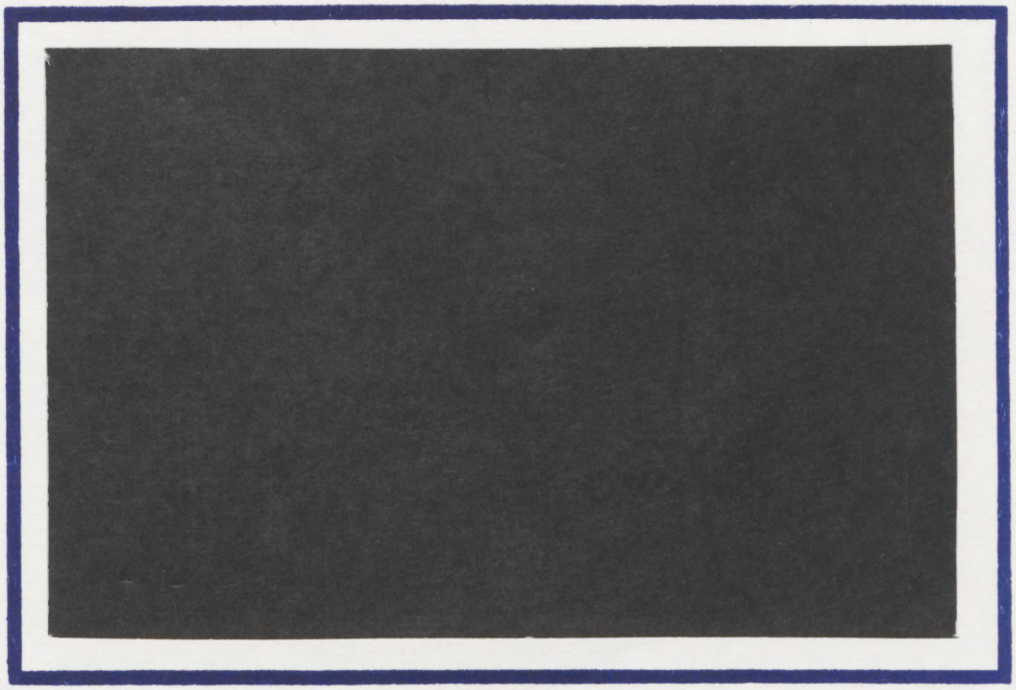

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THE NON-COMPETITIVE THEORY OF INTERNATIONAL TRADE AND TRADE POLICY

by

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I. Introduction

A decade of intensive research on increasing returns to scale and market structure has generated a host of interesting insights about their role in international trade and trade policy. The new approach has closed considerably a gap that existed between theory and application. It provides explanations for a number of empirical regularities and new tools for policy analysis. One of its major conclusions underlines the need for a case by case approach to policy design. The vitality of this work has not faded, however, and recently it has been redirected to deal with dynamic concerns.

In the following sections I survey those theoretical developments, explaining many important results with an eye toward application. My hope is that economists who work on applied issues of trade and development will find in them useful guidance. The coverage is rather selective, however, mostly due to space limitations. I only comment on some points, altogether disregard others, and devote more space to issues of particular interest. Nevertheless the allocation of space is not always proportional to the importance of each and every argument.

The next two sections deal with trade structure. Oligopolies are discussed in Section II while monopolistic competition and multinational corporations are discussed in Section III. Dynamic structural issues, long run growth, and product cycles are reviewed in Section IV. In Section V, which is devoted to policy, I review arguments about the role of one-sided market power, strategic trade policy, and growth oriented policies. A short section with concluding comments closes the paper.

II. Oligopoly and Trade Structure

Contrary to perfect competition, there exists no single form of oligopolistic competition. The multiplicity of ways in which a limited number of firms can interact generates a proliferation of economic models. It is pointless to deal with the entire taxonomy in this paper. I therefore confine attention to a small number of cases in order to bring out some special implications of this market structure. In this section I deal with markets for homogeneous products, with most of the discussion devoted to Cournot competition. International markets may be integrated or segmented.

II.A Integrated markets

In an integrated market a seller charges the same mill price to every buyer. Consequently, prices can differ across countries only as a result of transport costs, tariffs, excise taxes, and the like. For current purposes I assume that there exist no taxes or transport costs, and that goods can be shipped freely across national borders. Under these circumstances market integration implies that commodity prices are the same everywhere.

Now suppose that in addition to traditional constant returns to scale competitive industries there also exist industries with increasing returns to scale in which firms play a Cournot quantity game. All firms have the same technology and free entry prevails. Entry leads to the emergence of a large number of firms with zero profits (an alternative to this assumption is discussed below). If in addition trade leads to factor price equalization, all firms in an industry look alike (I concentrate on the symmetric

equilibrium). Namely, they employ the same inputs, use the same techniques of production, and produce the same output levels.

First observe that when preferences are homothetic, then under these circumstances the factor content of net trade flows obeys Vanek's chain rule. Namely, a country exports services of primary inputs with which it is relatively well endowed. It imports the services of other primary inputs. Moreover, the factor content of country k's net export flows satisfies:

$$(1) \qquad t_V^k = V^k - s^k V,$$

where V^k is the vector of its factor endowment, s^k represents its share in world spending, and V the vector of the world's factor endowment (see Helpman and Krugman (1985, chap. 5)). The first term on the right hand side (the endowment vector) represents the factor content of production while the second term represents the factor content of consumption. The difference between the two equals the factor content of net exports. When the difference is positive for a particular input, it indicates that the country is a net exporter of this input; when it is negative, it indicates that the country is a net importer of the input. These results are the same as in the factor proportions theory (see Helpman and Krugman (1985, chap. 2)).

These predictions survive generalization to oligopolistic markets with increasing returns to scale for the following reasons. In the symmetric equilibrium average input use per unit of output is the same in every firm. Therefore the factor content of production of a unit of output does not depend on the country of origin. Consequently, calculations of the factor content of net trade flows do not differ from the standard ones.

Next observe that in oligopolistic industries the direction of commodity trade can be related to relative degrees of concentration. Country k consumes a proportion s^k of world output of every product and its consumption of good i equals $s^k X_i$, where X_i denotes world output of good i. Its output of good i equals $n_i^k x_i$, the product of the number of its firms in sector i and output per firm x_i in the industry. The latter is not country specific. However, world output of the good equals output per firm x_i times the number of firms that produce it in the world economy n_i. Therefore country k exports the good (its output exceeds its consumption) if and only if $s^k < n^k_i/n_i$. Namely, if and only if its share in consumption falls short of its share in the number of firms.

These predictions about the pattern of trade do not depend on the assumptions of free entry and zero profits; they also apply to economies with restricted entry and positive profit levels in oligopolistic industries as long as factor price equalization obtains and the Cournot game leads to a symmetric outcome. However, factor price equalization is less likely with restricted entry or when industries cannot support a large number of firms. We do not yet understand the trade implications of more realistic economic structures in which factor prices differ across countries and industries consist of a relatively small number of competitors who differ in size and profit rates. The treatment of the within-sector differences in characteristics of firms requires more general theories of the firm and industrial organization. It should help to shed additional light on the structure of world trade in general and on trade between developed and developing countries in particular. An understanding of the effects of differences in factor rewards will also help to shed light on those issues. This is evident from the fact that differences in factor rewards can be

related to cross-country differences in factor endowments. In the older factor proportions theory factor price equalization required countries to have factor compositions that do not differ too much. With oligopolies this is a necessary condition but may not be sufficient. It is definitely not sufficient when industries cannot support a large number of firms. All these issues have not received sufficient attention in the literature.

II.B Segmented markets

The pattern of the factor content of net trade flows remains the same when markets are segmented, although the pattern of commodity trade takes on a radically different form. In the trade literature market segmentation refers to situations in which producers designate output levels to particular markets ex ante. In particular, following Brander (1981) it refers to situations in which firms play Cournot, but instead of choosing an output level for the world market at large taking the output level of every rival as given every firm chooses a vector of sales -- with each element of the vector representing sales to a different country -- taking as given the vectors of sales of every rival. If there exist neither taxes nor impediments to trade, factor prices are the same in all countries, the same technology applies worldwide, free entry drives profits down to zero, and preferences are identical and homothetic, then the factor content of net exports satisfies (1) and we obtain the usual prediction concerning implicit trade in factor services. The reason for this result is again the fact that under these circumstances the average factor content of a unit of output is the same in every country. Here, however, the direction of commodity trade can be very different.

In the competitive models with integrated markets a homogeneous product is either exported or imported by a country. This outcome does not constitute a unique equilibrium in a frictionless world. On the contrary, in a frictionless world there typically exists a continuum of equilibria which differ with respect to the volume of trade. Take, for example, a two-country world in which the home country produces 10 units of wheat, the foreign country produces 20 units of wheat, and each country consumes 15 units of wheat. Clearly, this consumption pattern can be supported by a trade pattern in which the home country imports 5 units of wheat. It can, however, also be supported by a trade pattern in which the home country exports 10 units of wheat and imports 15 units of wheat, or any pattern in between. In a frictionless world all these are equilibrium trade patterns. We typically choose the minimum trade volume pattern as the equilibrium. This choice relies on the reasoning that in integrated markets even negligibly small transport costs eliminate all but the minimum trade volume pattern as an equilibrium. This logic does not apply to segmented markets.

The key to the understanding of the peculiar properties of segmented markets as developed by Brander and used by others (e.g., Krugman (1984) and Venables (1985)) is to observe that under this hypothesis a firm takes as given the sales level of each rival in every single market. That is, it conjectures that not only will rivals not change their output levels in response to its behavior, but that they also will not reallocate sales across markets in response to its behavior. Now consider a firm that does not sell in market i. Taking as given sales of all other firms into this market it calculates that its marginal revenue in market i equals the prevailing price (the revenue from the first unit equals the price). Absent impediments to trade, a technology with constant marginal costs and factor price equalization

imply that our firm finds it profitable to penetrate this market if (a) it produces at all (it incurs in any case whatever fixed costs there may exist); and (b) the rivals are not losing money on sales in market i (price exceeds marginal costs). This argument implies that with factor price equalization every firm sells in every market. Hence, the homogeneous product is simultaneously imported and exported by every country that has active firms in sector i. This implies two-way trade in identical products; i.e., intra-industry trade. This possibility is not eliminated by the existence of transport costs, contrary to what happens in integrated markets (see Brander and Krugman (1983) and Helpman and Krugman (1985, chap. 5)). In any case, here two-way trade does not arise as one among many possible equilibria in a frictionless world, but is rather an inherent feature of the market structure.

How reasonable is this formulation of segmented markets? This question has no simple answer and one suspects that the answer depends on context. One way to deal with it is to treat Cournot oligopoly as in modern industrial organization. Cournot's original work was criticized by Bertrand for disregarding price competition. Kreps and Scheinkman (1983) have shown, however, that if firms interact in two stages, choosing capacity in the first stage in anticipation of price competition in the second stage, and then play a Bertrand price game in the second stage (every firm chooses its price, taking as given the prices of rivals), then the rational expectation (sub-game perfect) equilibrium of this two-stage game coincides with the one-shot Cournot game.

The original Kreps-Scheinkman formulation was designed for an integrated market. Ben-Zvi and Helpman (1988) have extended it to a segmented market structure. This extension includes a third stage in which firms allocate sales across markets. Thus, after announcing prices firms obtain orders and

decide how to allocate their output across markets in line with the available orders. Hence, firms do not precommit sales to particular markets as in Brander, but rather precommit output and can respond to their rivals with sales reallocations.

Under this reformulation of the segmented market hypothesis two-way trade in identical products is not an equilibrium outcome. Transport costs, however small, prevent two-way shipment of goods. Moreover, cross-country price differences are limited by the size of transport costs and in the limit, when impediments to trade go to zero, the outcome of the three stage game coincides with the integrated market Cournot outcome.

In segmented markets in which firms play a straight Bertrand game there also cannot be two-way trade. Take the case in which marginal costs are constant (and products are homogeneous). Then it is well known that in equilibrium the firm with the lowest marginal cost takes over the entire market and charges a price equal to the next lowest marginal cost (see Tirole (1988, chap. 6)). Clearly, in this case there can be no two-way trade, especially in the presence of cross-country transport costs.

This discussion shows that market segmentation per se cannot explain intra-industry trade and that trade structure depends in important ways on both market structure and conduct. In fact, the details of oligopolistic interaction can be important determinants of trade patterns as well as of commercial and industrial policy effectiveness (as argued below).

III. Monopolistic Competition and Trade Structure

An alternative approach to the explanation of intra-industry trade rests on the observation that many industrial products are not homogeneous, but

rather differentiated. If countries have a taste for variety; namely, if there exists a demand for a wide variety of the same product (such as consumer electronics or cars) and there are variety specific economies of scale in manufacturing, then we expect the emergence of intra-industry trade in differentiated products (see Balassa (1967)). Variety-specific economies of scale ensure specialization in brands while the demand for a wide spectrum of products ensures their desirability in every country. Under these circumstances each country specializes in particular brands and imports the brands produced by its trading partners. The result is intra-industry trade.

The formal theory that was developed on the basis of this insight was designed to deal simultaneously with a number of phenomena. First, it is consistent with the factor proportions view of the factor content of net trade flows. Second, it explains large trade volumes between similar countries. Third, it explains the determinants of the composition of the volume of trade; i.e., intra-industry versus intersectoral. (See Helpman and Krugman (1985, Part III).) These explanations apply to consumer as well as producer goods (see Ethier (1982) and Helpman (1985a)).

III.A Factor content

In order to understand the inner logic of these explanations consider again a simplified world in which technologies and prices (including factor rewards) are the same everywhere. In differentiated product industries there is monopolistic competition a la Chamberlin. If sectorial demand functions have unitary income elasticities (homothetic aggregate preferences) and the within industry preferences for brands are symmetric, then every manufacturer of a brand charges the same price and produces the same quantity with the same

composition of inputs. Hence, average input per unit output is the same in every country and every country has the same composition of demand. Under these circumstances (1) applies. Namely, the factor proportions theory's prediction about the factor content of net trade flows remains valid. Now, however, the gross trade flows are very different, because in every industry that produces differentiated products there exists intra-industry trade in country specific brands. For this reason the volume of trade exceeds the volume predicted by the original factor proportions theory.

In order to see the power of these extensions and elaborations, consider a simple 2-country, 2-sector, 2-factor economy. Figure 1 presents a box with the world's factor endowment. We measure the home country's endowment of labor and capital from origin H and the Foreign country's from origin F. The triangle HQF represents structures in which the Home country has relatively more capital and factor prices are equalized. I confine the discussion to this subset of endowments.

III.B Trade volume

If both sectors produce homogeneous products under constant returns to scale, the volume of trade remains the same for all endowments in HQF that are at an equal distance from the diagonal HF; i.e., endowments on a line that is parallel to the diagonal, as depicted in the figure. No trade takes place on the diagonal and the volume of trade is larger the farther away from the diagonal the isovolume trade line. Hence, in the traditional theory the volume of trade is larger the larger the difference in factor composition while the size of the trading partners does not play an important role. This is inconsistent with the facts. Linneman (1966), for example, found a strong correlation between trade volumes and country sizes.

On the other hand, if one of the two sectors produces differentiated products the isovolume of trade contours are not parallel to the diagonal but rather curve in towards it. Lines that are further away from it represent higher trade volumes. Hence, it remains true that differences in the composition of factor endowments feed trade, but now relative country size also affects its volume. In particular, holding constant the joint size level (as measured by GDP) the volume of trade is larger the more similar the size of the trading partners. In the extreme case in which both sectors produce differentiated products only relative country size matters (differences in factor composition per se do not affect the volume of trade).

The last point can be seen as follows. When both sectors (or all sectors in a multi-sector world) produce differentiated products country k imports from j a proportion s^k of j's output of every variety and therefore a proportion s^k of j's gross domestic product Y^j. In this case the volume of trade between the countries equals

$$s^H Y^F + s^F Y^H = 2s^H s^F (Y^H + Y^F),$$

provided expenditure levels are proportional to GDP levels. A redistribution of the world's endowment across countries does not change their joint GDP level as long as factor prices do not change. Consequently, the volume of trade is larger the closer is s^H to s^F (their sum equals 1).

III.C Composition of trade

When only the relatively capital intensive sector produces differentiated products the share of intra-industry trade in the total volume of trade equals

$$s^H X^F / s^F X^H,$$

where X^k represents k's volume of output of differentiated products (which

equals the number of domestically produced brands time output per variety). Hence, holding constant relative country size the share of intra-industry trade is larger the smaller the relative output of differentiated products in the relatively capital rich country. Since this relative output volume is smaller the smaller the difference in factor composition (a Rybczynski effect), it implies that the share of intra-industry trade is larger the smaller the difference in factor composition. Indeed, in the absence of a difference in factor composition (when the endowment lies on the diagonal) all trade consists of intra-industry trade. Clearly, under these circumstances the share of intra-industry trade also depends on relative country size (see Helpman and Krugman (1985, chap. 8) for a precise description), but this relationship is rather involved because in a fixed size world one cannot change the relative size of countries without affecting relative output levels.

When both sectors produce differentiated products the share of intra-industry trade depends in no direct way on relative country size. This is a clean case in which relative size affects the volume of trade while differences in factor composition affect its division between intra-industry and intersectoral trade, because in this case the share of intra-industry trade equals $1 - (\theta^H - \theta^F)$, where θ^k represents the share of the relatively capital intensive industry in country k's GDP. Since the home country has more capital per worker and a country's share of the capital intensive industry in GDP rises with its capital labor ratio, this formula implies that the share of intra-industry trade declines the larger the cross-country difference in factor composition.

The relationship between the share of intra-industry trade and measures of differences in factor composition have been widely studied (e.g. Loertscher

and Wolter (1980), Havrylyshyn and Sivan (1984), Balassa (1986) and Helpman (1987)). All studies find the theoretically predicted relationship. Helpman (1987) reports also results for the volume of trade that confirm the theoretical prediction.

III.D Multinational corporations

What happens when differences in factor composition exceed the boundary HQF in Figure 1? This question is particularly relevant to South-North trade, although there also exist many countries within the North as well as within the South that have substantially different factor proportions. Clearly, in this case factor prices will differ across regions unless factors or activities are reallocated. Observe that within HQF there are no differences in factor rewards so that there exists no economic pressure for factor migration or reallocation of movable activities. Above it, however, the incipient pressure on factor rewards toward lowering relative wages in Foreign and lowering the relative reward to capital in Home will induce labor migration from F to H, reallocation of capital equipment from H to F, and reallocation of labor intensive activities from H to F and capital intensive activities from F to H. In the reminder of this section I discuss the reallocation of economic activity within multinational corporations (for factor movements see Helpman and Razin (1983)).

In order to deal with multinational corporations it is necessary to expand the description of the production technology. In manufacturing industries there exist overhead costs that result from a combination of activities that generate what might be called headquarters services. These include product development and design, accounting, marketing, financial

management, and the like. Activities of this type can be locationally disjoint from actual manufacturing and they typically require a different combination of inputs. But there also exist other activities, such as the manufacturing of intermediate inputs, that need not be located together with the final good's product line. In particular, these activities can be located in different countries (see Caves (1982) for a more detailed description, including empirical evidence). In the context of our discussion this possibility implies that large differences in factor composition induce Home companies to go multinational by shifting labor intensive manufacturing activities to Foreign while maintaining at home capital (perhaps human capital) intensive headquarters activities. This approach was developed in Helpman (1984a, 1985b) into a formal model of trade with multinational corporations (see also Markusen (1984)).

The model implies that whenever the composition of world resources is not too far away from HQF the emergence of multinationals restores factor price equalization. In those circumstances the factor content of net trade flows depends on factor endowments in the same way as in the traditional theory. It results again from the fact that activities that are performed in more than one country use the same average inputs per unit output everywhere. But now the pattern of trade in goods can change. For example, in the 2x2x2 case in which the capital intensive industry produces differentiated products while the labor intensive industry produces homogeneous products, Home is a net exporter of differentiated products in HQF. For larger differences in factor composition multinationals emerge in the differentiated product sector (assuming that production of homogeneous goods has no separable activities). If the difference in factor composition is not too large, however, Home continuous to be a net exporter of differentiated products despite the fact

that some of its companies manufacture their goods abroad and these goods are imported back home. But for sufficiently large differences in factor composition Home becomes a net importer of differentiated products because many of its companies are multinationals that locate manufacturing in the foreign country. The model predicts a larger degree of multinationality the larger the difference in factor composition.

As far as the volume of trade is concerned, the emergence of multinationals does not alter in any fundamental way its dependence on factor composition and country size. To be sure, the functional relationship changes, but not the qualitative links (see Helpman and Krugman (1985, chap. 11)). In this case, however, the relationship between differences in factor composition and the share of intra-industry trade cannot be monotonic. Holding constant relative country size, this share increases with the difference in factor composition when the degree of multinationality is relatively low and the original negative association is restored when the degree of multinationality becomes large. Moreover, the model predicts that the share of intra-firm trade is larger the larger the difference in factor composition. Intra-firm trade consists of exports of headquarters services and intermediate inputs from Home multinationals to their subsidiaries in Foreign.

IV. Trade Dynamics

The static model of monopolistic competition that was described in the previous section has been extended by Grossman and Helpman (1988) to a dynamic framework. Since fixed costs are often associated with product development and design, their proper treatment requires a dynamic model in which these

(and other) costs are incurred before actual manufacturing takes place and they are gradually recovered over time as the entrepreneur collects monopoly profits. This Schumpeterian view of dynamic competition can be combined with Chamberlin's view of monopolistic competition in order to shed light on a number of trade issues, such as the dynamic evolution of trade when technology changes over time, the role of technological leadership, the role of product imitation, and the like.

The decision to develop a new product is a central ingredient in this line of inquiry. An entrepreneur needs to hire resources at cost $c_n(t)$ in order to design a product. He then needs to estimate the future flow of profits $\pi(\tau)$, $\tau \geq t$, that can be derived from the ownership of the exclusive knowledge or right to manufacture and market the product. (Naturally, product specific monopoly power may be lost at some future point in time, as I will discuss below. At this stage, however, assume that it lasts forever.) Then the entrepreneur will choose to develop the product if and only if the present value of these profits does not fall short of the R&D costs. If there exists free entry into this line of business (a dynamic version of Chamberlin's large group case) and there are no indivisibilities (strictly speaking the number of products is a continuum) then in an active equilibrium the present value of profits just equals product development costs. In this case the instantaneous profit rate π/c_n plus the capital gain on R&D costs (the rate of increase in c_n) equals the interest rate. This dynamic relationship (asset pricing equation) can be embedded in a complete model in which (a) consumers use prevailing interest rates to optimally allocate spending and savings over time; (b) full employment of resources takes account of their use in R&D; and (c) all markets clear, which also implies equality of savings and investment. Grossman and Helpman (1988)

have done just that in the framework of a simple 2x2x2 model with fixed coefficients of production and no factor accumulation, so that all dynamics result from product development.

IV.A The evolution of trade

In this framework it is useful to think about capital as human capital rather than machines and equipment, which makes it natural to suppose that R&D is the most capital intensive activity. Also let manufacturing of differentiated products (that were developed) be more capital intensive than production of the homogeneous product. Then in an equilibrium with factor price equalization (although factor prices change over time) in which no country begins with a relative advantage in the number of products (i) the relatively capital rich country develops relatively more products; (ii) the trade pattern at each point in time resembles the Chamberlin-Heckscher-Ohlin model (despite the fact that trade is not balanced); and (iii) the volume of trade grows faster than world GDP, which is of course a well established fact in the post war period. The world converges to a steady state in which product development ceases. The steady state looks very much like an equilibrium of a static world.

In a South-North interpretation, where the North is taken to be the relatively capital rich country, these results suggest that in a free trade environment the North's technological leadership lasts forever, as do its net exports of manufactured differentiated products. This conclusion rests, of course, on the particular model, which is restrictive in many ways. But it does point out a realistic mechanism at work. More mechanisms need, however, to be considered.

This model can also be used to predict the point in time at which multinationals will emerge. As investment in R&D declines over time and employment in the manufacturing of differentiated products rises, the joint capital labor ratio employed in these two activities -- described by the ray HQ in Figure 1 -- rotates clockwise. For this reason a world structure that permits factor price equalization without multinationals in the early stages of development may reach a point in time at which this will no longer be possible. That is, even if initially the endowment point lies in HQF, the fact that HQ rotates clockwise may lead over time to a situation in which eventually HQ falls below the endowment point. This happens necessarily when the capital labor ratio in manufacturing of differentiated products exceeds H's endowed capital labor ratio. In these circumstances from the point in time at which total capital per worker in the differentiated product sector exceeds H's capital labor ratio multinationals exist. The structure of trade will be as described in the previous section and the degree of multinationality -- as measured by employment in subsidiaries, their volume of output, or the number of brands produced by subsidiaries -- will increase over time until the steady state is reached. The steady state looks very much the same as a static world with multinational corporations.

Recent research has focused on attempts to discover mechanisms that generate dynamics even in the long run. At this point trade and development theories that explore implications of economies of scale have joined forces with new approaches to economic growth (for the latter, see Romer (1986,1988), Lucas (1988), and Helpman (1988)). At the heart of these approaches are dynamic economies of scale (such as the above described product development process) coupled with externalities associated with knowledge capital. Thus, in Grossman and Helpman (1988) growth peters out because the profit rate falls

over time as more and more brands crowd the differentiated product sector. This reduces the return on R&D until it stops being profitable. If, however, knowledge capital serves as an input in R&D and this capital stock rises over time as a result of experience (i.e., learning by doing a la Arrow (1962)), it may counteract the product crowding effect on the profitability of R&D and thereby sustain product development and growth in the long run.

IV.B Multiple equilibria

Before we discuss the effects of knowledge capital on long run growth, however, I want to pause in order to point out its contributing role to the emergence of multiple equilibria. I will, in fact, use this opportunity in order to provide a broader discussion of multiple equilibria.

It is evident that product specific learning by doing tends to perpetuate every initial pattern of specialization. This, in turn, introduces persistence into trade patters. Krugman (1987), for example, constructed a model with product specific learning by doing in which every historically determined pattern of trade and specialization lasts forever. Under these circumstances temporary shocks have lasting effects. The shocks may originate from technology, policy, or other sources. The important point is that temporary events have permanent effects.

The last observation applies to a wide variety of phenomena in economics. It results from two sources that have been widely studied. One is a case in which the long run equilibrium depends on initial conditions, for which Krugman's model of learning by doing provides a case in point. (For other examples see Drazen's (1985) growth model with costs of adjustment and Drazen and Gottfries' (1987) insider-outsider model of unemployment.) In those circumstances shocks that change initial conditions extract long run effects.

In the other case there exists more than one long run equilibrium and the economy can converge to each one of them from the same initial conditions, depending on expectations. This phenomenon has been known in international trade at least since Graham's (1923) famous argument for tariff protection. He envisioned a two-sector economy whose opening to international trade may lead to resource migration from its increasing returns to scale to its decreasing returns to scale industry, thereby depressing GDP to an extent that outweighs the terms of trade gains. This observation led to a heated debate between Graham and Knight (see Helpman (1984) for a review of the debate). Graham was vindicated by Ethier (1982b) who studied countries that have an industry with external economies of scale and perfect competition (i.e., a firm's productivity depends on aggregate output, but the firm treats productivity as an exogenous parameter). In this type of economy there can be a number of trading equilibria that differ in the degree of specialization in the increasing returns industry. In the absence of intersectoral adjustment costs the instantaneous allocation of resources relies entirely on expectations about factor rewards and there exist several sets of expectations that are self-fulfilling, each one leading to a different outcome. These outcomes can be Pareto ranked (see Helpman and Krugman (1985, chap. 3)).

In order to understand these possibilities consider a two-sector economy with a single resource, say labor, that faces constant terms of trade and a constant labor-output ratio in the non-increasing returns to scale sector. The firms' perceived marginal product value of labor in the increasing returns sector, say sector X, depends on the industry's output level; the larger aggregate employment and output the larger the marginal value product. Suppose also that the perceived marginal value product equals zero when the industry's output equals zero and that the marginal value product in X is

larger than in the alternative use when X employs all resources. Then clearly there exist two self-fulfilling expectations equilibria with complete specialization. In one all labor works in the constant returns to scale industry and the wage rate equals its marginal value product in that sector. Labor's marginal value product in X equals zero and so there exist no incentives to produce in X. In the other equilibrium all labor works in X and the wage rate -- that equals the marginal value product in X -- exceeds labor's marginal value product in the constant returns industry. Clearly, the country is better off in the latter equilibrium.

Recently Krugman (1989) has extended this analysis to an economy with adjustment costs in factor reallocation. As usual, this brings about gradual intersectoral adjustment in response to economic incentives. He finds that there generally exist subsets of initial conditions and a steady state associated with each subset such that from every initial condition within a subset the economy converges to its associated steady state. In the remaining subset of initial conditions it may converge to either one of the possible steady states, depending on expectations (self fulfilling expectations are assumed throughout). In the latter case the resulting dynamics involve cycles of rising amplitude. Expectation driven equilibria are of course not special to international trade; they also play a prominent role in other areas, such as macroeconomics (see, for example, Diamond (1982), Shleifer (1986), Cooper and Jones (1987), and Murphy, Shleifer and Vishny (1988)).

All this implies that there exist circumstances in which an economy's trajectory is unpredictable, because it may follow more than one equilibrium trajectory, or that small shifts in initial conditions may have dramatic long run effects. In either case it may be possible to use policies to shift initial conditions or affect expectations in order to force the economy to

follow a desired path. An appealing feature of such policies is that often they need to last only a limited amount of time. As usual, however, there are formidable practical difficulties in their design, because the required information is seldom available. The long standing debate about infant industry protection is a good example of this reasoning. It also exemplifies the more general point that policies that aim directly at resource allocation rather than trade policies are required to achieve the first best (see Baldwin (1969)).

IV.C Long run growth

We now return to long run growth. Suppose that current experience with product development reduces R&D costs to all future product developers. In this case a product developer generates a joint output; an appropriable blueprint that he uses to acquire future monopoly rents and a contribution to knowledge capital that is not appropriable. The contribution to knowledge may disseminate at the same speed to all future entrepreneurs, or it may be faster to entrepreneurs from his own country. Also suppose that the differentiated product sector provides intermediate inputs that are used in the manufacturing of final consumer goods (as in Ethier (1982a)). Each country has the technology to produce a different consumer good and they trade in both intermediate and final goods.

Grossman and Helpman (1989a) have studied a two-country economy of this type. In their framework both countries converge to the same long run growth rate, even if they differ in size and sectorial productivity levels. The long run growth rate depends on the size of each country and the composition of demand for their final goods. When knowledge gets disseminated at an equal

speed to both countries the larger the country with comparative advantage in R&D and the smaller the relative demand for the final good in which it specializes, the faster the common growth rate. The growth rate may be increasing or decreasing with the size of the country that has comparative disadvantage in R&D, but it is definitely higher the larger the relative demand for the final good in which that country specializes.

The last point deserves an explanation, because it identifies a mechanism that is of more general relevance. The larger the relative demand for the final good of the country that has comparative advantage in R&D the larger the demand for its resources and the lower the demand for resources in the other country (ceteris paribus). Under these circumstances the intermediate product sector and the R&D sector contract in the former and expand in the latter. Given the structure of comparative advantage aggregate effective employment in product development declines in the world economy, thereby slowing down growth that is related to the equilibrium size of the R&D sector.

If we interpret this model in a South-North context -- where the country with comparative advantage in R&D is the North -- this analysis suggests, for example, that the South grows faster the larger the North, but that the North's growth rate may be slowed down by a larger South. It also suggests that a shift of demand from Northern to Southern final goods raises the world's growth rate.

So far our discussion has relied on what may be termed "natural" comparative advantage in R&D, that builds on endowed differences in technology. We have seen that it plays an important role in the determination of long run growth (and in policy effects, as I discuss in the next section). If, however, the diffusion of knowledge is faster within countries than across them, then natural comparative advantage does not fully determine a country's

long run overall comparative advantage. This stems from the fact that under those circumstances a country that does more R&D to begin with acquires a lasting cost advantage. In this case the final position of comparative advantage depends also on the relative size of its resource base and the derived demand for its resources for other uses. Thus, other things equal, long run comparative advantage in R&D is larger the larger the resource base and the smaller the demand for its final goods. This mechanism adds a contributing factor to long run growth and has a bearing on various policies (see below).

IV.D Innovation and imitation

Comparative advantage in R&D has played a prominent role in discussions of North-South trade problems. It is manifested in an extreme form in Vernon's (1966) product cycle and its later elaborations. In this approach only the North is capable of developing new products. Immediately after a product is developed the North has also the cost advantage in its manufacturing, until the production techniques are standardized. Afterwards, the cost advantage -- and with it production -- shift to the cheap labor region, i.e., the South.

Vernon's approach was formalized by Krugman (1979) (see also Dollar (1986) and Jensen and Thursby (1986,1987) for extensions and elaborations), who assumed that the rate of growth of new products g (rate of innovation) and the rate at which the South imitates products in which the North has monopoly power μ (rate of imitation) are constant. This specification suffices to fully describe the evolution of products that are manufactured in every region without specifying additional details of economic structure. In

the steady state the South produces a proportion $\mu/(\mu+g)$ of the available products. By imposing on these dynamics a model of oligopolistic price competition in differentiated products with labor as the only primary input, Krugman showed that the long run relative wage of the South is proportional to $(\mu/g)(L_N/L_S)$, where L_S is the the South's labor force and L_N is the North's labor force. Hence, the South's relative wage is larger the larger the rate of imitation, the smaller the rate of innovation, and the smaller its relative labor force.

Grossman and Helpman (1989b) have reexamined the long run implications of the product cycle approach by recognizing the fact that both the rate of innovation and the rate of imitation result from the interaction of market forces with explicit decisions of Northern entrepreneurs to innovate and Southern entrepreneurs to imitate. Imitators invest resources in learning and reversed engineering in expectation of future monopoly profits, just like the innovators who invest resources in R&D in expectation of future monopoly profits. The latter are, however, uncertain as to when their product will be imitated by a Southern entrepreneur, which determines the date at which their monopoly profits will cease. For this reason they discount profits with a risk premium inclusive interest rate, the risk premium being equal to the rate of imitation.

In this environment the long run rates of innovation and imitation depend on country size and sectorial productivity levels. Innovation is faster the larger the North or the South (with one minor exception), while the rate of imitation is larger the larger the South and the smaller the North. Both regions grow faster when they trade with each other than in autarky. Now the relative wage of the South rises with the South's relative labor force (taking account of the endogenous response of innovation and imitation). This is just

the opposite of Krugman's finding. It shows the importance of the explicit decisions to innovate and imitate that bring out in full force the role of dynamic economies of scale.

In order to understand this point, consider Grossman and Helpman's wide gap case. This is a case in which the relative wage of the South is sufficiently low so that a Southern imitator can charge his monopoly price without facing the danger of being undercut by the Northern original innovator. In the wide gap case the South's relative wage is proportional to $(\mu/g)(L_N-g)/(L_S-g)$ (using a suitable normalization). Hence, for constant g and μ this relative wage increases with the North's labor force and declines with the South's labor force, as in Krugman. When account is taken of the effects of labor on g and μ, however, the results are reversed. That is, the indirect effects that changes in labor have on innovation and imitation are stronger than the direct effects.

V. Policy

In competitive economies there may exist two efficiency considerations for trade policy: Improvement in the terms of trade and a second (or third) best improvement in resource allocation in the presence of domestic distortions. Both exist in non-competitive environments. In fact, imperfect competition necessarily involves a domestic distortion because firms do not engage in marginal cost pricing. For this reason it is not surprising to find that various policies can be helpful (at least from the point of view of a single country). Rather, the interesting question is whether there exist broad policy conclusions, such as "whenever domestic firms compete against foreign oligopolistic firms in export markets we should subsidize their

exports" or "whenever domestic import-competing firms face non-competitive foreign exporters in the domestic market we should impose import restrictions." The answer to this question turns out to be negative; there exist no valid policy conclusion of this sort. In order to design successful policies it is necessary to tailor instruments to particular industries on the basis of their degree of concentration, the conduct of firms, the position of domestic firms relative to foreign, the industry's links with other sectors of the economy, and the like. In short, in order to exploit imperfect competition for policy purposes one requires detailed information about the economy, information that is seldom available (see Helpman and Krugman (1989)). Moreover, experiments with actual data have so far revealed that the potential gains embodied in such successful policies are rather small (see Helpman and Krugman (1989, chap. 8)) while existing tariff structures are very detrimental (see Harris and Cox (1984)).

The proliferation of cases that need to be considered is described in Figure 2 for a single market that can be a domestic import competing market or a foreign export market (thereby immediately doubling the number of cases). Perfect competition requires all parties to be competitive. In addition, there exist two cases of one-sided market power and a case of two-sided market power. When market power is one sided it makes, of course, a great deal of difference whether domestic or foreign producers have market power. Now, a matrix of this type applies to different cases of conduct; one matrix for single firms with monopoly power, one for Cournot oligopolies, one for Bertrand oligopolies, one for a cartel of a particular form (say with Nash bargaining), and so on. Then there exist links with other industries, we need to know how each policy affects entry, etc. This sounds like a hopeless task, but in fact is not. In what follows I describe a number of important results

that exemplify various considerations and the information required for a successful policy.

First I discuss situations in which the number of firms is constant and all firms minimize costs. This ensures efficiency of production (i.e., output is on the transformation surface) although the composition of output need not be (and typically is not) efficient. If we restrict attention to homogeneous products and trade taxes only, the change in aggregate welfare can be measured by

$$(2) \qquad dU = - m \cdot dp^* + t \cdot dm + (p - c) \cdot dX \ ,$$

where m is the vector of net imports (a negative component represents exports), p^* stands high for the foreign price vector and p for the domestic price vector (for consumers and producers), $t \equiv p - p^*$ represents the vector of trade taxes (a positive component represents an import tariff if the good is imported and an export subsidy if the good is exported), c is the vector of marginal costs, and X stands for the output vector.

The first term on the right hand side represents the usual terms of trade effect. The remaining two terms represent efficient supply considerations. The last term says that an expansion of domestic output of goods that are priced above marginal cost raises welfare. Competitive industries price according to marginal cost, so that their contribution to this term equals zero. In non-competitive sectors price exceeds marginal cost, which implies that expansion of their output is desirable (because domestic valuations exceed supply costs). Hence, other things equal, policies that lead to an average expansion of noncompetitive sectors raise welfare. A similar interpretation can be applied to the second term. Think about imports. The

marginal cost of imports equals the foreign price. If the domestic price exceeds the foreign price (a tariff or a quota) an expansion of imports is desirable. Much of the welfare analysis of various policies concerns the tradeoffs among these three considerations.

V.A One-sided market power

As a first example, consider Bhagwati's famous (1965) paper. In his analysis of a tariff in the presence of a domestic monopolist and fixed foreign supply price he shows that if the situation depicted in Figure 3 applies; namely, the foreign price p^* is below the prohibitive domestic price P, gradual tariff increases (beginning from zero) that raise the domestic price towards P induce the monopolist to expand output. In this range he chooses output by equating price to marginal cost. Hence, the contribution of the third term in (2) equals zero (the contribution of the first term also equals zero because the foreign price is fixed) and welfare declines because imports contract and the domestic price exceeds the foreign price. When the domestic price reaches the prohibitive price P imports cease and are never renewed for further tariff increases. Further tariff increases, however, induce the monopolist to reduce output, because now he equates price with demand until the monopoly price p_M is reached. In this case the second term in (2) equals zero (because there are no imports), but welfare declines due to the third term, because price exceeds marginal costs and output declines. This example also shows that with imperfect competition import protection can be effective even when imports equal zero. Here the mere threat of imports imposes a non-negligible effect.

In this case a tariff is more restrictive than a quota in the following sense. Suppose we replace the tariff with a quota that equals the import volume under the tariff. Then the monopolist responds by cutting back output. Consequently, quotas lead to lower consumption and a higher price. It is important to understand the reasoning that leads to this result. A quota reduces the elasticity of demand perceived by the monopolist. In its absence a price increase leads him to lose sales to consumers on account of the downward sloping demand curve and to importers who replace his sales (when imports are imperfect substitutes for his output; otherwise he loses all sales to importers). In its presence he does not lose sales to importers, and so his effective demand curve becomes steeper. This lowers his marginal revenue and he responds by contracting output. The same reasoning applies to Cournot oligopolies. It can also be used to show that a quota equal to the free trade level of imports leads the monopolist or a Cournot oligopoly to contract output. Hence, contrary to a competitive environment in which a quota at the free trade level of imports has no effects, here it does. Moreover, with monopoly power quotas that exceed the free trade level of imports (up to a limit) also lead to lower consumption and a higher price. Hence, in the case of an oligopoly the quota leads to a more collusive outcome.

The question of whether quotas facilitate collusion is of great interest (or more generally, whether quantitative restrictions facilitate collusion). The previous analysis suggests that they do. I think that this is a reasonable presumption, although there exist exceptions. I now discuss one exception that also serves to illustrate additional considerations.

The previous analysis relied on a static environment. Recently, however, much of oligopoly theory has been reformulated in a dynamic environment in which firms interact repeatedly. Repetition brings in important new elements,

such as the possibility of implicit collusion (as opposed to a binding agreement) and the formation of reputations. In what follows reputation issues are not discussed. As is well known from infinitely repeated games, implicit collusion may force an oligopoly to charge a price that is lower than the monopoly price. That is, implicit collusion may not be sufficient to reach the fully cooperative outcome that would emerge if it were possible to write a binding contract (explicit collusion). (The interest in implicit collusion derives from the fact that explicit collusion is often impossible, because a binding contract cannot be specified or such contracts are illegal.) This stems from the following reasons. In order to sustain an implicit agreement it has to be in the self interest of each member. This means that the present value of profits that one obtains from the cartel does not fall short of the present value of profits that one derives by deviating from the implicit agreement. It is then usually supposed that if a member deviates the cartel falls apart in the next period and the non-cooperative equilibrium (say Cournot) gets established forever (this equilibrium is time consistent, or in the language of game theory subgame perfect). Hence, a potential deviator has to compare the one period gains from choosing his best deviant strategy when everyone else obeys the implicit agreement, with the present value of future losses that will result from the non-cooperative outcome. The comparison depends on the size of the one period gains, on how bad the non-cooperative outcome is relative to the cooperative outcome, and on the rate at which future profits are discounted. Naturally, the smaller the one period gains from a deviation and the worse the non-cooperative outcome the less likely it is that a deviation will pay off.

For these reasons there exist circumstances in which an implicit agreement needs to specify a price below the monopoly price in order to

sustain collusion. The lower price reduces the gains from deviation to the point at which collusion is viable, while at the monopoly price the gains from deviation are too high to sustain collusion (because when everyone restrains output in order to achieve the monopoly price the deviant can make large one period profits). Rotemberg and Saloner (1988) have shown that under those circumstances a quota at the free trade level may restrict collusion rather than facilitate it. In their example the quota raises the non-cooperative equilibrium profit level (which is possible, as we have seen above, despite the fact that the quota exceeds the non-cooperative import level). This forces the cartel to reduce price in order to prevent profitable deviation. Their example (even if not realistic) shows how important repetitive interactions can be for policy considerations (see also Davidson (1984) on tariffs).

We have dealt so far with import competing markets in which domestic firms have market power. Now we turn to examples of import competing markets in which the domestic firms are competitive and foreign suppliers have market power. Here an interesting result is that a desirable trade policy may consist of import subsidies rather than tariffs.

Suppose that the foreign supplier is a monopolist. Then he chooses a strategy that equates marginal revenue of the import demand function to his marginal costs. Now suppose that we impose a small tariff. If foreign supply were competitive and upward slopping, the tariff would have improved the terms of trade and would have raised welfare. With the foreign supply controlled by a monopolist there is no guarantee that a small tariff improves the terms of trade, and the terms of trade are the only relevant consideration. In order to see the last point first observe that under those circumstances the last two terms on the right hand side of (2) are zero, because domestic firms price

according to marginal costs and the initial tariff rate equals zero. Hence, we only need to consider the effect of a small tariff on the terms of trade. Now, the tariff, of say $1 per unit imports, raises the monopolist's marginal costs of supplying the domestic market by $1. Assume for simplicity that his marginal costs are constant. Then the contraction of his sales equals the inverse of the slope of the marginal revenue curve, because he equates marginal revenue to marginal costs. The increase in the domestic price equals the contraction of sales times the slope of the demand curve. Therefore the domestic price rises by less than $1 if and only if the marginal revenue curve is steeper than the demand curve. If the domestic price rises by less than $1 the terms of trade improve and the terms of trade worsen when the domestic price rises by more than $1 (because the import price p^* equals $p-1$). For example, when the demand curve is linear it is flatter than the marginal revenue curve and a tariff improves the terms of trade. On the other hand, when the demand curve has a constant elasticity that exceeds 1 it is steeper than the marginal revenue curve and a tariff worsens the terms of trade. In the latter case an import <u>subsidy</u> improves the terms of trade. We have therefore a simple condition on the relative slopes of the demand and marginal revenue curves that determines whether a tariff or an import subsidy is desirable (see Brander and Spencer (1984)).

An important point about this type of one sided market power is that even in cases in which a tariff improves welfare, its replacement with a quota reduces welfare below the free trade level. This does not result from differences in the level of domestic production. Indeed, if the quota equals the import level that prevails under the tariff both policies lead to the same levels of imports, domestic production, and domestic price. The difference results from the fact that under the quota the foreign monopolist exploits the

quantitative restriction to charge the consumer price. Therefore instead of an improvement in the terms of trade the quota leads to their worsening. Alternatively, under a quota the equivalent of the tariff revenue (which translates into quota rents under competition) accrues to the monopolist rather than to domestic owners of import licenses (see Shibata (1968)). This result applies also to foreign oligopolies (that compete with imperfect substitutes) as long as the quota exceeds a minimal level. It is shown in Helpman and Krugman (1989, chap. 4) that for sufficiently small quota levels domestic owners of import licenses collect rents, but that in the linear demand case these are never sufficient to compensate for the initial losses (see also Krishna (1988a,b)). It remains an open question whether there exist circumstances in which a quota can bring about a less collusive outcome of the foreign oligopolies to a degree that will make it preferable to free trade.

V.B Strategic policy

In the presence of two-sided market power economic policy has a strategic value as well. By this we mean that it changes the terms on which domestic non-competitive firms interact with foreign non-competitive firms. The best known examples in international trade concern precommitment strategies. In particular, in situations in which domestic firms do not have the means to precommit to a particular course of action -- despite the fact that it is desirable -- the government can sometimes act in order to ensure (albeit indirectly) the desired precommitment. This typically requires the government to have the first mover advantage; namely, to be able to announce or execute a reliable policy before firms complete their strategic choices.

The following simple case exemplifies this element. Suppose that a domestic firm competes against a foreign firm in a third country market. We are concerned only with our firm's gross profits. Competition takes place in two stages. In the first stage firms decide whether to enter the market. This may involve the development of a product or the set-up of a marketing network. Afterwards, in the second stage, they produce and compete in either price or quantity. Now suppose that the market is small, so that when only one firm enters its second stage profits exceed its first stage entry costs and when both enter second stage profits fall short of entry costs in each one of them. In this case there exist two subgame perfect equilibria: one in which only the domestic firm enters and the other in which only the foreign firm enters. Clearly, the domestic firm and the home country prefer the former.

Since there exist two equilibria and one is preferred to the other, the domestic government may want to force the establishment of the better equilibrium. In this example this can be achieve by the following strategic policy. Before the firms make their entry decisions the government provides the domestic firm with an entry subsidy that exceeds the loss that materializes when both firms enter. Under these circumstances the domestic firm chooses to enter independently of the the foreign firm's decision. Consequently, the foreign firm does not enter and this is the unique equilibrium. The same can be achieved by a government commitment to a lump-sum export or production subsidy as long as the commitment is made prior to the entry decision and there exists a mechanism to make it good. Second best policies in the form of ad valorem export subsidies can also be used for this purpose. Naturally, the foreign government has an incentive to also engage in a strategic policy, and so the outcome may be a three stage game in

which governments choose policies in the first stage, firms make entry decisions in the second, and production and sales take place in the third (see Dixit and Kyle (1985)).

Country competition for ownership of profit making firms applies beyond the specific features of this example. As an alternative consider oligopolistic competition in integrated markets with a limited number of firms, as was discussed in Section II. There we saw that the direction of trade flows depends on the number of firms that reside in each country relative to its economic size. But it was also shown in Helpman and Krugman (1985, chap. 5) that for a given world structure there may exist many equilibria that differ in the allocation of profit making firms across countries. All of them look alike from the point of view of world aggregate variables. In this case a country can welfare-rank the equilibria; it is better off the higher its aggregate pure profits. Consequently, it has an incentive to engage in a strategic entry promotion policy in industries with profit making firms, or in various second best policies. The purpose of these policies is to shift pure profits to the home country by means of shifting profit making firms from the foreign to the home country.

Strategic policies do not apply, however, only to entry; they can also be used effectively in situations in which domestic and foreign firms have established themselves in a market. In order to illustrate this point consider an export market with an established domestic and foreign firm that compete a la Bertrand with imperfectly substitutable products. Let each firm's best price response be an increasing function of its rival's price; i.e., we have strategic complementarity. In this case the domestic government can raise its firm's gross profit level (and therefore welfare) by taxing exports (see Grossman and Eaton (1986)). This can be seen from the following

argument (see Helpman and Krugman (1989, chap. 5)). The firm equates perceived marginal revenue to marginal costs, where perceived marginal revenue is calculated for a fixed price of the rival. When the domestic firm reduces price, however, the rival responds with a price reduction of his own. Nevertheless the home firm cannot take advantage of this information as long as both play simultaneously. If one could exploit this information one would recognize that true marginal revenue is lower than perceived marginal revenue, because the foreign firm's price response to the home firm's price reduction brings about an increase in home sales that is smaller than the perceived sales increase. For this reason it is desirable to induce the home firm to charge higher prices and limit sales. An export tax achieves just that. The government can exploit the first mover advantage by establishing an export taxation program that acts as a precommitment device. Then the firms compete with the program in place and the outcome is higher prices for both products. Contrary to the previously discussed entry promotion programs, however, here both countries gain higher profits, because the best response of a firm leads to higher profits the higher the rival's price. In this case a two-stage game in which both governments choose taxation programs in the first stage and firms choose prices in the second leads to a subgame perfect equilibrium in which both countries are better off than under free trade.

We have seen that strategic policies need not lead to a conflict of interest. In the entry promotion case there was indeed a conflict of interest; one government's successful policy harmed the rival country. On the other hand, in the export oriented policy case one government's successful policy imposed a positive benefit on the other country. From this one should not conclude that the difference stems from the policies' domain; i.e., entry versus exports. The issue is more subtle, and it relates to the question of

strategic substitutability. In the first example entry decisions were strategic substitutes (when one firm entered the other abstained from entering) while in the second example prices were strategic complements (when one firm raised its price the other responded with a price increase). The distinction between strategic substitutability and complementarity in the firms' interactions also plays a central role in the understanding of the direction of desired policies.

These points can be demonstrated by means of an alternative example of two established firms that compete in an export market and governments intervene in foreign trade. Now, however, instead of competing a la Bertrand, suppose that the domestic and foreign firms compete a la Cournot. In this case it is most likely that a firm responds with an output contraction to an output expansion of its rival. Indeed, assume this to be the case, which ensures that we have strategic substitutability. The critical difference from the previous example is not the strategy space of the firms but rather the strategic relationship. Now an export subsidy rather than an export tax proves to be desirable (see Brander and Spencer (1985)).

The argument can be made as follows (see Helpman and Krugman (1989, chap. 5)). The domestic firm chooses output that equates perceived marginal revenue with marginal costs. It calculates perceived marginal revenue for a fixed output of the rival. The rival, however, responds with an output decline to an output increase of the domestic firm. Consequently, true marginal revenue exceeds perceived marginal revenue and the firm would earn higher profits if it could precommit to a larger output level. Unfortunately it cannot, because both firms play simultaneously. The government can improve the outcome by providing the necessary precommitment. In order to raise output the government should subsidize exports. The subsidy has to be put into place (or

committed to be put into place) prior to the output decisions of the firms. Under those circumstances the firms choose outputs recognizing the existence of the export promotion program and end up in an equilibrium in which the domestic firm sells more and the foreign firm sells less.

Two points need to be underlined about this example. First, contrary to the Bertrand case here export subsidies are required rather than export taxes. Second, countries face a conflict of interest in their trade policies. When one country engages in export promotion the other loses. This stems from the fact that the policy active country forces its rival to contract output, and output contraction as a best response to the domestic firm's output expansion leads to lower profitability of the foreign firm. This conflict of interest leads to a Prisoners' Dilemma in the policy game. For suppose that there are two stages. In the first stage governments choose their export policies and in the second stage firms play Cournot. For simplicity, also assume symmetry and constant marginal costs. Then in the resulting subgame perfect equilibrium both governments subsidize exports and both firms sell more then under free trade. Observe, however, that even under free trade a Cournot duopoly produces too much, in the sense that joint output exceeds the output level of a single monopolist. For this reason a further output expansion reduces profits per firm. Hence, the two countries are better off in the free trade equilibrium than in the equilibrium with active policies. The problem is, however, that when one country does not promote its exports it pays the other to engage in export promotion. Consequently, free trade is not an equilibrium unless policies are coordinated (i.e., governments cooperate in the first stage).

We have seen that one can make a case for export taxation as well as export promotion on strategic grounds, depending on circumstances. In either

set of circumstances the existence of more than one domestic firm strengthens the need for taxation. This stems from the fact that the policy maker cares about aggregate profits of the exporting firms while each firm cares only about its own profit level (see Dixit (1984)). Naturally, when a single domestic firm considers the effects of its price or output decisions on perceived marginal profits it does not take into account the effects on profits of other firms. Therefore, other things equal, prices are too low and output levels too high. In order to offset this negative externality an export tax is called for. Clearly, in the Bertrand case this strengthens the need for export taxation. In the Cournot case it conflicts with the need to subsidize exports on strategic grounds. The net result may be the need for lower export subsidies or taxation.

V.C Entry

So far our discussion has concentrated on cases in which the number of firms is fixed, or more to the point, cases in which firms do not enter or exit in response to policy measures. This, however, is not a safe assumption. Export subsidies may lead to entry while export taxes may lead to exit of domestic firms, independently of conduct. This consideration plays a major role whenever there are firm-specific increasing returns to scale. Take for example the case in which there exist fixed entry costs. Then one needs to take account of the resource loss from entry that can be measured by fdn, where f denotes the fixed entry cost and n is the number of firms (see Helpman and Krugman (1989, chap. 5)). This consideration weakens the case for an export subsidy and strengthens the case for an export tax. In the presence of free entry that drives to net zero profits export promotion damages welfare while a small export tax raises welfare (see Horstman and Markusen (1986)).

The last point applies to all forms of conduct and can be seen as follows. If -- as has been assumed so far for the industry under discussion -- domestic firms export but do not sell in the local market, the change in welfare equals the change in aggregate gross profits. On the other hand, aggregate gross profits equal aggregate net profits plus tax revenue minus the subsidy bill. Free entry ensures zero net profits. Therefore the change in welfare equals the change in net revenue. The imposition of a tax raises revenue and thereby raises welfare. The provision of a subsidy reduces revenue thereby hurting welfare.

All this suggests that if anything there is a presumption in favor of export taxation rather than export promotion. Export promotion is desirable only when firms' choice variables are strategic substitutes, their number is rather small, and there is very limited scope for entry in response to export subsidies.

V.D Intersectoral links

A final point that I wish to discuss concerns intersectoral dependencies. In order to evaluate the response of resource allocation to policy we need to use correct measures of marginal costs. Much of the previous discussion relied on the assumption that firms use social marginal costs in their profitability calculations. This supposition is correct when all other sectors are competitive but is typically incorrect when other sectors are non-competitive. For this reason knowledge of the difference between true and perceived marginal revenue is insufficient for policy design; one also needs to know the difference between true and perceived marginal costs. The implication is that one cannot design a successful policy without properly

taking account of intersectoral links (see Dixit and Grossman (1986)). For example, when true marginal revenue in an export sector exceeds perceived marginal revenue it does not guarantee that export promotion will increase welfare. For suppose that when the subsidized sector expands in response to the policy incentive by drawing resources from another export sector in which true marginal revenue exceeds perceived marginal revenue, then if the latter divergence is sufficiently large the net result will be a decline in aggregate profits. Alternatively, in this case the true marginal costs of output expansion in the targeted sector exceed perceived marginal costs, and if this divergence is large enough true marginal revenue will be below true marginal costs, thereby implying that an export disincentive should be provided rather than export promotion.

V.E Differentiated products

In the presence of product differentiation there exist additional considerations that have a bearing on policy design. There still exist the terms of trade and efficient supply effects that appear in (2), but there also exists a variety effect. Before we discuss it, however, I wish to make two points. First, the supply of many brands does not eliminate a country's market power even when the country is very small. Gros (1987) has demonstrated this in the following way (see Helpman and Krugman (1989, chap. 7) for a simple exposition). In a one-sector, one-factor, two-country world with product differentiation a la Dixit and Stiglitz (1977) output per product is independent of country size. This stems from the fact that the elasticity of demand does not change with the number of products. In addition, the number of brands is proportional to country size. Under these circumstances

ad valorem trade taxes, which do not affect the elasticity of demand, cannot change the number of brands that each country produces or output per brand. Hence, if they affect anything at all it must be the terms of trade. Calculating the optimal tariff for the home country one finds that it equals $1/(1-s)(e-1)$, where s represents the share of world spending allocated to the home country's products and e represents the constant elasticity of demand (equal to the elasticity of substitution). The smaller the country the smaller s and the smaller the optimal tariff. But even when the relative size of the country shrinks to zero the optimal tariff remains positive. This stems from the fact that no matter how small a country is it specializes in a range of products in which it maintains monopoly power; the demand for a variety is downward sloping and even a small country can affect its terms of trade.

The second point concerns the production efficiency effect. Consider a case in which the number of products and relative prices are constant but output per brand can change (see Helpman and Krugman (1989, chap. 7) for a model that ensures it). Then the imposition of import duties on brands that compete with domestic products shifts domestic demand from foreign to domestic varieties and it shifts demand away from all varieties. For this reason output per domestic brand may expand or contract and welfare may increase or decline (see Flam and Helpman (1987) and Helpman (1989)).

Finally, consider the effect of variety on welfare. Ceteris paribus consumers prefer more variety. One can, in fact, think about a consumer price index that is lower the larger the variety choice. If a tariff reduces this price index by raising the available variety choice (as in Flam and Helpman (1987)) or by changing the composition of products (in the presence of transport costs) in favor of the home country at the expense of the foreign

country (as in Venables (1987)), it necessarily raises home welfare. But the increase in variety is not guaranteed in all circumstances (see Markusen (1988) and Helpman (1989)). A tariff may shift demand away from differentiated products to a degree that will bring about a reduction in available variety. This contraction of variety choice may result in a decline in welfare. On the other hand there exist circumstances in which the tariff raises available variety and welfare (e.g., Flam and Helpman (1987) and Venables (1987)). Hence, it is not clear a priori whether small tariffs are desirable; all the above mentioned effects have to be taken into account. Large tariffs lead to additional welfare losses that stem from the undersupply of imports (i.e., the second term in (2)). Moreover, even in those cases in which tariffs are desirable they constitute a second best policy that corrects in an indirect way the distortion that emerges from monopolistic or oligopolistic competition. If possible, it is preferable to act directly on the price-cost margin.

V.F Growth promotion

In a dynamic economy the static issues that have been reviewed so far have to be augmented by an explicit consideration of the links between policy and growth. In the growth models that were described in Section 4 commercial policy and other forms of industrial policy affect long run growth rates and thereby exert strong influences on welfare. The resulting relationships are, however, far from simple. For example, in the world studied by Grossman and Helpman (1989a) -- where both countries develop new intermediate products and one of them has a comparative advantage in R&D -- an import tariff on final consumer goods slows down world growth if imposed by the country with

comparative advantage in R&D and it speeds up world growth if imposed by the country with comparative disadvantage in R&D. The intuition behind this result reveals a channel of influence that is not model specific. When a country imposes a tariff on imports of final goods it thereby shifts the composition of demand towards its own final goods. The expansion of the final goods sector draws resources from manufacturing of middle products and product development. Opposite shifts in resource allocation take place in the other country. In particular, its product development sector expands. Whether these changes accelerate or slow down growth depends on whether the contraction of the R&D activity in the tariff imposing country is smaller or larger than the expansion of the R&D activity in the other country. The answer depends on comparative advantage in R&D; world output of R&D declines if and only if the tariff imposing country has a comparative advantage in R&D.

In this type of a world one expects R&D subsidies to speed up growth. This indeed turns out to be the case when the subsidy is provided by the R&D relatively more efficient country or when both countries subsidize at an equal rate. When the R&D relatively less efficient country subsidizes product development, however, it may lead to slower growth. The outcome depends on structural features that cannot be spelled out in the available space.

On the other hand, in the North-South model with a product cycle that was discussed in Section 4 (due to Grossman and Helpman (1989b)) innovation subsidies in the North and imitation subsidies in the South speed up growth. However, they affect differently the rate of imitation and thereby the average length of the first phase of the product cycle. Innovation subsidies reduce the rate of imitation and the average length of the first phase while imitation subsidies raise the rate of imitation and shorten the average length of the first phase.

Grossman and Helpman (1989c) study a small country variant of their growth models with a focus on welfare consequences of various policies. The resulting equilibrium differs from the first best for two reasons: markup pricing in the differentiated intermediate product industry and the externality that a product developer imposes on future product developers through his contribution to knowledge capital. Since the percentage markup is constant in their specification, the second best rate of growth -- that can be achieved with an R&D subsidy -- equals the first best growth rate. Larger subsidies speed up growth further but reduce welfare. A small tariff that speeds up growth may raise or reduce welfare. But whether it speeds up or slows down growth depends on the factor intensity of the import competing sector relative to the exporting sector and the product development activity. Here quotas also affect growth and welfare. They are particularly damaging relative to tariffs if they induce rent seeking that uses up entrepreneurship in which product development is relatively intensive.

VI. Concluding Comments

It is evident from this review that the new theory of international trade and trade policy encompasses a large number of relevant elements. Although reasonable people may form different judgments about the degree of importance of each one of them, I believe that there should be no controversy over the significance of the entire package. Existing empirical evidence on trade structure (e.g., Havrylyshyn and Sivan (1984), Balassa (1986), and Helpman (1987)) support the new view, and 'calibration' studies of policy experiments (see Helpman and Krugman (1989, chap. 8) for a review) provide quantitative support to many of the considerations that were discussed in Section V. The

most recent studies that embody those elements in a dynamic setup should make the approach even more useful in the future.

One major conclusion is that there do not exist simple answers to many important questions. It applies with particular force to policy concerns as is evident from both theory and the 'calibration' studies. Proper evaluation of outcomes requires detailed information about conduct, market structure, entry constraints, intersectoral links, and the like. This calls for more empirical studies designed to reveal this information. As in the past they will also help to identify weaknesses in the theory and directions for future research. In any case, since (a) the information needed for a successful policy design is not available; (b) policy recommendations are very sensitive to this information; and (c) 'calibration' studies indicate that good policies improve welfare only slightly; free trade remains a good rule of thumb. This is the more so when one takes account of retaliation, the desirable competitive pressure of a free trading world system, and the political economy of protection.

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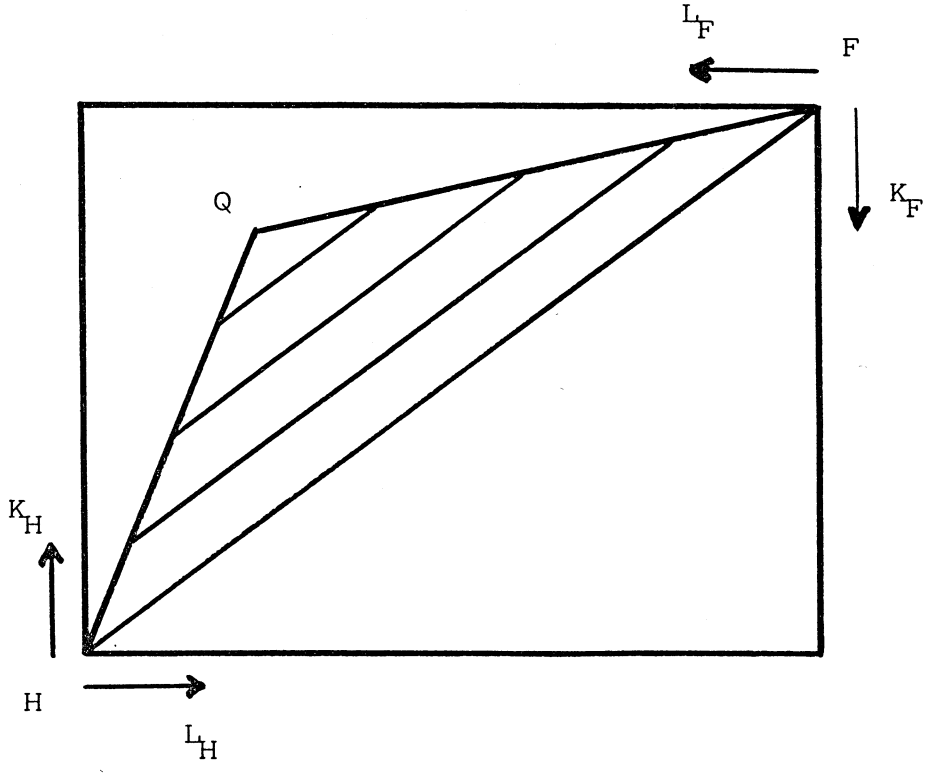

Figure 1

		Foreign	
		Competitive	Market Power
Home	Competitive	Perfect Competition	One-Sided Market Power
	Market Powers	One-Sided Market Power	Two-Sided Market Power

Figure 2

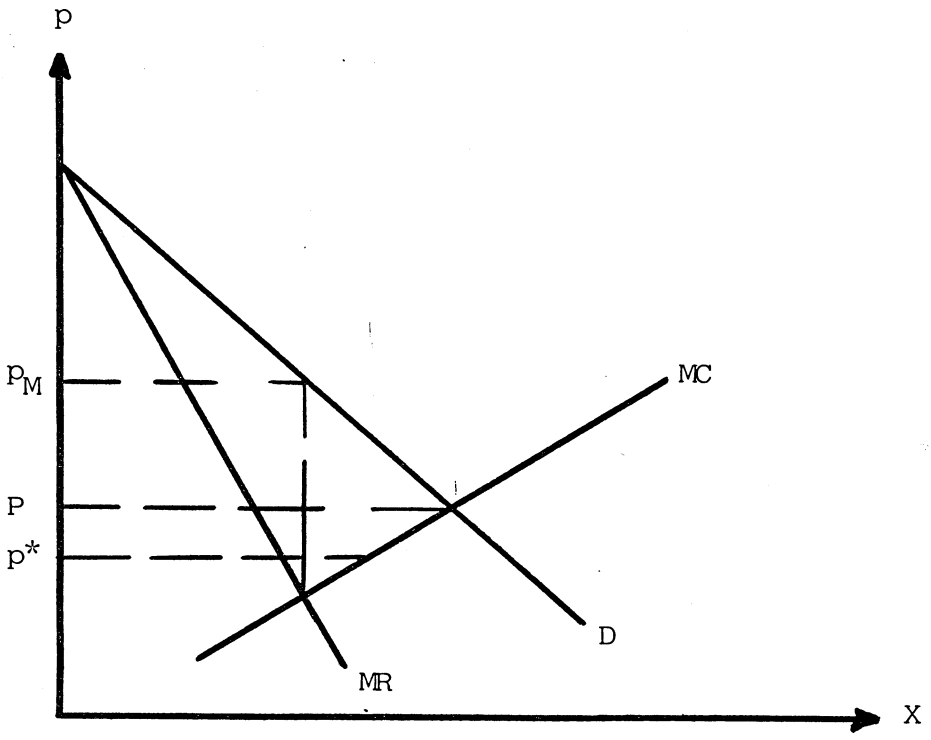

Figure 3