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THREE ESSAYS ON THE THEORY OF MULTINATIONAL FIRMS

By

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ABSTRACT

THREE ESSAYS ON THE THEORY OF MULTINATIONAL FIRMS

By

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This dissertation consists of three essays on the theory of multinational firms (MNF). The first two deal with commercial policy in the presence of transfer pricing, viewed as an instrument for shifting profits between different fiscal jurisdictions. The first models a horizontally integrated MNF which sets transfer prices on a final good, and the second models a vertically integrated MNF. The MNF is assumed to maximize global profits and the host-country government is seen to maximize host-country welfare.

The final-good model reveals that in the presence of transfer prices (at arm's-length level), source-country demand and cost conditions have an influence on the welfare-maximizing host-country tariff on intra-firm trade. The tariff rate is also influenced by host-country demand conditions and the cost structure of the MNF's subsidiary. The welfare change in response to movements in the ad-valorem tariff rate is decomposed into tax and tariff revenue, and consumer surplus.

The intermediate-good model focusses on a situation in which transfer price limits are generated indirectly by anti-dumping and local content legislations. Here we incorporate factor market considerations while analyzing host-country welfare. This study establishes the ambiguity of the relationship between the welfare-maximizing tariff and the wage offered by the multinational to host-country labor. The welfare impacts of higher ad-valorem tariffs and stricter local content legislation run counter to each other.

The third essay on market disruption analyzes the impact of expected "explicit" and "implicit" protection on the current-period trade and production-location decisions of a horizontally-integrated multinational. The probability of future protection is related directly to the level of import penetration. It reveals that the symmetry or the lack therein of the comparative-static effects of changes in the expected tariff and the threshold level, depend on the assumed nature of the firm's perceptions. The analysis shows that the higher expected tariffs can cause a decline in host-country production. This runs counter to the theory of tariff jumping and has important implications for lobbying activities.

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I have incurred all the usual debts in the writing of this dissertation, and it is a pleasure to record them here.

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One, of course, learns not only from one's teachers but also, generally and significantly, from one's fellow students. My experience has not been, happily, exceptional in this respect. In particular I would like to place on record my continuing interaction with Tom Schuster.

The final version of this dissertation was typed by Kari Foreback, with great care and in a short time. I am in her debt. I thank her as also Ann Feldman, Beverly Janz and Terie Snyder for the many acts of kindness during the four years (1985-89) of my association with the Department of Economics as a graduate student.

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

I. Introduction

International Trade Theory is amongst the most eclectic of fields in economics. There is no single theory of international trade and the discipline is characterized by the use of "relevant" specifications in "particular" situations. The heterogeneity of theoretical developments in this field, reflects the multi-faceted nature of the international economic sphere and an orientation of the subject towards applied issues.

An increasingly important sub-field is the theory of multinational firms. The main difference between classical trade theory and the theoretical literature on multinational firms, lies in their treatment of market structures. In the classical tradition imperfectly competitive markets were relegated to the black box of "special cases", and perfectly competitive markets were treated as the norm. With the post-war expansion of foreign direct investment, trade is increasingly dominated by oligopolistic multinationals and not by perfectly competitive national firms. The profession's recognition of the changing structure of international trade is evidenced by the large volume of research papers on

imperfect competition and trade in leading economic journals. The influential book by Helpman and Krugman (1985) marks an important step in the advancement of this literature. A comprehensive survey of the work in this area is contained in Caves (1982), where he attempts "... a synthesis of the international enterprise as an economic actor, modelled and interpreted in the light of economic theory."

Another important aspect of the rapidly changing international economic structure is that an increasing proportion of multinational trade is intra-firm trade, i.e., transfers among different parts of the multinational enterprise (MNE). For the U.S., in 1970, thirty nine percent of MNE-related exports and fifty percent of MNE-related imports fell in the category of intra-firm trade (Murray 1981). A study by Helleiner (1981) shows that by 1977 forty eight percent of all U.S. imports and an equal proportion of all exports consisted of intra-firm trade. An implication of this trend is that an increasing proportion of international transactions are occurring outside the confines of the market.

The objectives of a private multinational enterprise are invariably in conflict with the goals of national governments. Quite often the multinational's decisions are designed to circumvent constraints imposed upon them by the nation states. Consequently, in the theoretical literature and in practice one comes across an undertone of an adversarial relationship between the multinational enterprise and the nation state. This state of conflict is evident even in the choice of terms

used within these contexts, e.g., protectionist threat, transfer price manipulation, and market disruption. These are just a few amongst the many areas of conflict identified and studied within the field today.

The two areas which are the subject of study in this dissertation are: (a) transfer pricing and its impact on commercial policy, and (b) the phenomenon of market disruption and its impact on multinational decision-making. Whereas the two essays on transfer pricing deal with a specific aspect of the "relationship of conflict", the essay on market disruption addresses the problem at a general level.

II. Transfer Prices

Transfer prices are the prices set on transactions between different divisions of the multinational enterprise, as distinct from the market prices set on transactions between independent economic agents. The choice of transfer prices by a multi-divisional firm is governed by two main considerations. First, transfer prices are used to create an incentive system within the organization in order to induce efficient allocation of resources. Second, transfer prices are used to shift profits from a high-tax jurisdiction to a low-tax jurisdiction, thereby facilitating the minimization of global tax and tariff payments.

The first theoretical treatment of the transfer price problem within a multi-divisional enterprise was attempted by Hirshleifer (1956). In this seminal article, he proved that

in the absence of tariffs and corporate profit-tax differentials, the efficient transfer price is the marginal cost of the selling division. In this context "efficient" transfer prices are defined as those that induce a resource allocation between the divisions which maximizes the global profits of the organization. If the transfer price is higher (lower) than the marginal cost of the selling division then the selling (buying) division does better at the expense of the buying (selling) division. However, in either of these scenarios the global profits are less than in the case where the transfer price is equal to the efficient transfer price. Furthermore, if a perfectly competitive external market exists, and there are no costs of transacting in this market, then the efficient transfer price is equal to the market price.

However, when the unit of analysis is the multinational enterprise, then corporate profit-tax differentials and tariff barriers do come into play, and the profit-shifting capability of transfer price mechanisms is highlighted. The first theoretical contributions explicitly analyzing transfer prices in a multinational setting were by Horst (1971) and Copithorne (1971). These are partial equilibrium microeconomic models which assume that the multinational chooses transfer prices to maximize global after-tax profits.

Horst, (1971), modelled a horizontally integrated multinational operating as a price discriminating monopolist in two countries, under different fiscal regimes and a tariff

barrier. The classic result was that the multinational firm will always choose either the lowest possible or the highest possible transfer price. If the relative tax-differential between the importing and the exporting country is less than the importing country's tariff rate then the multinational will always desire the transfer price to be as low as possible. On the other hand, if the relative tax-differential exceeds the tariff rate, then the firm will choose the maximum possible transfer price. The conclusions of this analysis were based on the assumption of a higher profit-tax rate in the importing country. With a lower tax rate in the importing country the multinational would always want to set the transfer price at the lower limit. The rationale behind this is that lower transfer prices would imply lower tariff payments and at the same time increase the nominal profits reported in the importing country, i.e., shift profits to the lower tax jurisdiction. However, in the event of lower tax rates in the exporting country, lower transfer prices would imply lower tariff payments and at the same time result in higher overall tax payments. Therefore, if the tax rates in the importing country are lower than the tax rate in the exporting, then the transfer pricing decision is based on the comparison of the tariff rate and the relative tax differential.

Copithorne (1971), analyzed the pricing and output decisions of a vertically integrated multinational under alternative policy objectives. The basic conclusion of the

study was: transfer prices are irrelevant in determining price-output decisions and are generally indeterminate. They are determinate only if the multinational is constrained by a policy objective, e.g., a minimum profit constraint, or is induced to move nominal profits from one jurisdiction to another in order to maximize global after-tax profits. This paper modelled the multinational firm's profit maximizing exercise as a two-stage process. In the first step the prices and outputs are chosen in order to maximize the consolidated pre-tax profits, and in the second step transfer prices are chosen in order to minimize the global tax bill. When the transfer price is determinate, then the multinational, as in the Horst formulation, is seen to choose either the upper or the lower limit. An underlying assumption in this analysis is that the multinational maintains two sets of books; one for the purpose of internal coordination and the other for reporting its fiscal liabilities.

Other articles which extend the basic formulation of Horst and Copithorne are by Booth and Jensen (1977) and Itakagi (1979). The first article explores the relationship between the constraints faced by a multinational enterprise and the determinateness of transfer prices. In keeping with the Copithorne formulation, this study analyzes the impact of minimum-profit constraints on the choice of transfer prices by multinational firms. The latter study highlights the impact of profit-taxes on international trade in the presence of transfer pricing. Thus, this study reveals the importance

of one country's domestic tax policies in determining another country's commercial policy.

The first theoretical attempt at a synthesis of a vertically integrated and a horizontally integrated model of a multinational was by Eden (1978). The main contribution of this paper is an analysis of the interaction between "external" (profit-shifting/money) transfer prices and "internal" (efficient/shadow) transfer prices. The model considers a multinational operating in three countries and engaging in primary as well as secondary intra-firm trade. The paper aims to show how profit taxes and tariffs through the influence of money transfer prices constrain the multinational enterprise and cause it to alter its resource allocation decisions. It is observed that by affecting cost and revenue functions, money transfer prices do alter the shadow prices of exports and influence the level of intra-firm trade. This analysis assumes that the money transfer prices are completely regulated and the multinational does not have the ability to manipulate these prices. As Eden herself notes: "Normally the transfer price will be at least partly under the company's control..." Nonetheless, it will always be true that a given tariff rate will be more distortionary if the money transfer price, on which the tariff is assessed, is higher. Thus, the tax and tariff effects on real trade flows among the divisions depend on the values of the transfer prices, and the tax and tariff rates.

III. Endogenous Transfer Prices

All of the above papers assume that the transfer prices are fixed at the lower limit or the upper limit, and do not depend on the output, sales, and trade decisions of the multinational enterprise. Consequently, the actual values of the transfer price are exogenous in as much as the transfer price limits are constrained by the relevant trade and fiscal authorities.

However, Samuelson (1982), using a model similar to Horst (1971), showed that in the presence of imperfect competition and non-constant costs, the actual values of the transfer price limits are a function of the firm's price and output decisions. Samuelson assumes that the multinational faces "arm's length" constraints on its transfer prices. "Arm's length" prices are defined as the prices which would be set in the event of transactions between independent economic units. This explanation of endogeneity is particularly relevant in a multinational setting, where imperfect competition and non-constant costs are certainly not uncommon. In a recent paper, Kant (1988), carries the level of endogeneity a step further. He creates a scenario where, under government surveillance of transfer price practices, the multinational might charge a transfer price which lies in the interior of the feasible region, and is not equal to one of the limits as suggested by received theory.

IV. Commercial Policy

Although some of the papers do look at the comparative-static effects of changes in the tariff rate (Samuelson 1982, Eden 1983), the literature is extremely sparse when it comes to analyzing host-country commercial policy in the presence of transfer pricing. The only article which focussed explicitly on transfer pricing and commercial policy was Katrak (1981). This paper is an extension of an earlier paper (Katrak 1977), where the analysis considers a horizontally integrated multinational exporting from a host country. The study concentrates on analyzing specific export taxes in the presence of transfer pricing of exports. The export tax has two effects. It brings in revenues directly but at the same time, by decreasing the multinational's profits, it reduces profit-tax revenues. Thus, the optimal export-tax is modelled as a revenue-maximizing tax which takes into account the tradeoff between higher (lower) export-tax revenues and the correspondingly lower (higher) profit-tax revenues. In the optimal solution the marginal increase in export-tax revenues are exactly equal to the marginal decline in profit-tax revenues. This paper refers transfer prices below the marginal revenue of exports as "low" and those above the marginal revenue of exports as "high". The main finding of the paper is that if the firm charges a low transfer price, then the optimal export tax is higher, and with a high transfer price the optimal export tax is lower, for a given corporate profit-tax rate. The reason is that the higher is

the transfer price the higher is the marginal gain from the profits tax relative to the gain from the export tax. Thus, for high transfer prices, total host-country revenues are maximized by lowering the export tax, inducing the multinational to increase exports and profits, and thereby increasing profit-tax revenues. Eden (1985) replicates the Katrak (1981) result for a revenue-maximizing tariff imposed by an importing country, in the presence of transfer pricing by a multinational enterprise.

This thesis (first two essays) deals directly with the issue of host-country commercial policy in the presence of transfer pricing by multinational firms. Unlike earlier work in the field we incorporate the influence of consumer surplus and factor market considerations on the determination of host-country commercial policy. No previous study in this area has explicitly modelled the tariff as an outcome of "welfare maximization" by the host-country government. On the other hand, in our analysis the host-country government, while choosing the welfare-maximizing tariff, internalizes the multinational firm's comparative-static responses to changes in the tariff rate. In other words, the government acts as a Stackleberg leader vis-a-vis the multinational enterprise. The essays on transfer pricing also provide a detailed analysis of the impact of endogenous transfer prices on the multinational firm's decisions. The impact of this endogeneity on host-country welfare is also laid bare in this study. The studies by Katrak (1981) and Eden (1985)

overlooked the importance of endogenous transfer in the determination of host-country commercial policy.

Although there is a considerable amount of work on vertically integrated multinationals, it is hard to come across a specific analysis of factor market considerations in the theoretical literature on transfer pricing. Therefore, the explicit modelling of factor market considerations (second essay) within a model of transfer pricing is a novel feature of this thesis.

V. Multinationals and Market Disruption

The traditional approach to commercial policy in trade theory has been to assume either its pre-existence or to look upon it as the end product of "social welfare" maximization by the government. Though fruitful in answering many important questions, this approach overlooks an important aspect of policy formulation, i.e., the political-economy dimension.

This shortcoming has been remedied to an extent by the considerable amount of work on the political-economy of protection over the past two decades. The first detailed analysis of the influence of pressure groups on the determination of commercial policy was by Pincus (1975). The main point of his study was to show that the rate of protection on a particular product, is determined by the "intensity of pressure group activity", and by the "legislative response to that pressure". The analysis

identifies a number of factors which influence these determinants. Pincus did not present a formal model to derive his hypotheses; but, the study contains an empirical analysis of the United States Tariff Act of 1824.

However, the "political-economy of trade" literature is definitely not lacking in formal models of protectionism. Baldwin (1984), in his survey article, provides a detailed classification of the political-economy models of trade. Most of the theoretical work in this area is couched in general equilibrium terms, and concentrates on tariff formation in the presence of pressure groups. A typical treatment of the problem consists of looking at tariffs as outcomes of non-cooperative games between politicians and pressure groups. The analytical structures model the policy makers as Stackleberg leaders who internalize the lobbying responses of interest groups. The studies by Brock and Magee (1978 and 1980), and Young and Magee (1985) are representative of this approach.

Feenstra and Bhagwati (1982) couch the problem as a Stackleberg game where "...labor uses real resources to lobby for protection, and the actions of the government are determined jointly by its willingness to grant (or perhaps its inability to resist the granting of) tariffs in the face of political pressure and by its desire to maximize social welfare." The solution to the problem is provided by an "efficient tariff", where tariff revenue are used to provide compensation to labor. This study notes that the "efficient

tariff" for a small open economy will be lower than the tariff determined in a situation where a labor lobby exists but there is no scheme of specific compensation to labor.

Cassing and Hillman (1985), in an interesting study, make use of the concept of a "political support function" to exhibit the non-equivalence of tariffs and quotas in a political economy context. This study investigates "... the choice between tariffs and quotas as alternative instruments of protection for a non-competitive industry when governments seek to maximize a political-support function which trades off the interests of industry-specific interests against the interests of consumers of the industry's output." The reason for the non-equivalence is that in the presence of imperfect competition in domestic import-competing industries, one cannot find an equivalent tariff which yields the same domestic price level, industry profits and revenues as an import quota. Hence, there is a fundamental asymmetry in the political choice between tariffs and quotas.

A common feature of most of these studies has been the internalization of political-economy considerations by the policy making authorities. In contrast, one rarely comes across models which deal with political-economy internalization by those who are on the receiving end of protectionism. An early exception to this was the paper by Bhagwati and Srinivasan (1976), in which they used a two-period model to analyze the impacts of market-disruption-induced-protection on an exporting country. Market disruption

describes a situation where an "unacceptable" level of imports induces the importing country to impose trade restrictions and thereby disrupt the free trade environment. The basic theme of this paper was to look at the optimal export policy of a country, when there is a positive correlation between current period exports and the probability of future protection. Under this scenario, the optimum trade policy for the home country is an export tax in the current period, which lowers the exporting country's expected losses in the next period.

Two recent papers which incorporate the market disruption approach in order to analyze the political-economy impacts on trade and production-location decisions are, Bhagwati, Brecher, Dinopoulos and Srinivasan (1987), and Dinopoulos (1989). Bhagwati et al. (1987) use a two-period general equilibrium model to analyze the current-period export and foreign direct investment (FDI) decisions, when the probability of future protection depends directly on current-period exports and inversely on current period FDI. The existence of a negative relationship between future protection and host-country production leads to "tariff-threat-defusing" investment, where the level of FDI in the current period is increased in order to reduce the probability of future protection. It is argued that, in contrast to "tariff jumping" investment (Uzwawa 1969, Brecher and Diaz-Alejandro 1977), this form of investment can occur even if the expected tariff is never actually invoked. Dinopoulos (1989) modifies this analysis to concentrate on the issue of market

structures. His study shows how, in the absence of government intervention, source country firms will internalize the threat of future protection through an appropriate adjustment of current-period trade and production-location decisions.

Despite the considerable developments over the past two decades, there are many unexplored issues in the theory of political economy as it pertains to international trade. With the internalization of political-economy considerations, particularly in a two-period framework, one encounters an interesting interaction between the "efficiency" and the "strategic" dimensions of optimal decisions. A clearer understanding of this interplay might help further our understanding of multinational behavior in an uncertain policy environment.

Although a large proportion of the literature deals with the determinants of the probability of protection, not much is said about the implications os using different functional forms for the probability function. When the analysis is embedded in a probabilistic framework, the perceptions of the economic agents are a crucial factor, and adopting a particular functional form entails an implicit assumption about the perceptions of relevant economic agents.

The essay on market disruption (third essay) attempts to shed light on some of these issues while analyzing the comparative-static effects of changes in the parameters of expected protection. The analysis contrasts the firm's comparative-static responses to changes in the level of

protection within a two-period model of probabilistic protection, with its comparative-static responses to changes in the level of protection within a traditional single-period model of trade intervention. Comparing the results under a linear probability of imposition with those under a non-linear probability of imposition, reveals the sensitivity of current-period decisions to the perceptions of relevant economic agents.

CHAPTER II

COMMERCIAL POLICY THE TRANSFER PRICING OF FINAL GOODS

I. Introduction

It is a well documented fact that a multinational firm (MNF) has the ability to manipulate its transfer prices in order to maximize global after-tax profits. This feature of the firm's decision-making process comes into light when it faces different tax and tariff schedules in different countries. The optimal policy for the firm is to charge a high transfer price if the tax differential between the two trading countries is higher than the tariff rate on intra-firm trade and a low transfer price if the tax differential is exceeded by the tariff rate. This result was made explicit in a paper by Horst (1971). It is also known that governments are likely to restrain the firm's ability to manipulate transfer prices. Copithorne (1971) and Booth and Jensen (1977) analyzed the case in which the MNF is constrained by a minimum-profit requirement in each of its subsidiaries. The imposition of minimum-profit constraints is seen to generate upper and lower bounds on the transfer prices of the MNF. Horst (1971) and Itakagi (1979) examined a situation in which the MNF is constrained by "arm's length" limits, which are determined by the government and taken as given by the firm during the course of its decision process. The "arm's length" restraints usually limit the transfer price so as not to

exceed the price at which the good is sold to unrelated customers in the source country, or fall short of the marginal cost of production. All of the above analyses assume that the limits themselves are exogenous to the decision making process of the firm.

Samuelson (1982) and Eden (1983) mark a departure point from the earlier work in that they argue that the limits of the transfer prices set by the firm are affected by the firm's decision variables and are endogenous. In particular, Samuelson (1982) points out that if the multinational is imperfectly competitive or experiences non-constant costs, the actual value of the "arm's length" limits would be functions of the firm's decisions as regards the level of sales and intra-firm trade. In his paper Samuelson (1982) also looks at the comparative-static effects of tariff changes on the decision variables of the MNF under the "high transfer price" and the "low transfer price" regimes. Eden (1978, 1983) has also looked at the comparative-static effects of tariffs in the presence of transfer pricing.

Katrak (1981) and Eden (1985) also delve into some issues of commercial policy in the presence of transfer pricing. Whereas Katrak (1981) looks at a revenue maximizing export tax, Eden (1985) concentrates on the revenue maximizing tariff for an importing country. Neither of these studies explicitly address the issue of endogenous transfer pricing and the implications therein for commercial policy.

This paper develops an endogenous transfer pricing model, similar to the one used by Samuelson (1982) in his analysis of the differences between endogenous and exogenous transfer pricing. We look at a horizontally integrated multinational producing in both countries, and analyze the comparative-static effects of changing tariffs under the two possible cases of a "high" and a "low" transfer price under the "arm's length" regime. However, the main contribution of the paper is in the realm of commercial policy in the presence of transfer pricing. A welfare function is defined for the host government and it includes tax revenues, tariff revenues and also captures the consumers surplus effect. We identify six distinct effects which influence the welfare of the host country in the event of a change in the ad-valorem tariff on intra-firm trade. This analysis highlights the inter-dependence between the cost and demand conditions of the horizontally integrated multinational and the host country's welfare-maximizing tariff on intra-firm trade. The differences in the channels of influence, as one compares the high desired transfer price with the low desired transfer price, are also laid bare in this study.

The plan of the paper proceeds as follows. Section II develops the basic model. In section III we analyze the "high desired transfer price" scenario, while section IV considers the "low desired transfer price" case. Section V compares the two regimes and analyzes the policy implications. Finally the analysis is concluded in section VI.

II. The Model

The multinational

Consider a horizontally integrated multinational firm which has a parent firm in the foreign country (F) and a subsidiary in the host country (H). The parent firm sells a part of its output in a monopolistic market in F and exports the surplus production to its subsidiary in H. The subsidiary also is assumed to be a monopolist in H, and its sales comprise of domestic output and the imports from the parent firm. Intra-firm trade takes place at a transfer price p which is subject to "arm's length" constraints. In order to keep the analysis tractable we assume that the firm faces linear demand schedules, and has linearly increasing marginal cost curves, in both countries.

The inverse demand functions of the MNF are:

$$P^F=a^F-b^FX^F \quad ;a^F,b^F>0 \qquad (1)$$

$$P^H=a^H-b^HX^H \quad ;a^H,b^H>0 \qquad (2)$$

where,

P^F=price in the foreign country

P^H=price in the host country

X^F=sales in the foreign country

X^H=sales in the host country

The implicit assumption here is that the MNF is able to discriminate between the two markets in terms of the prices it charges for the final good. Relations (1) and (2) ensure that the MNF faces declining marginal revenues in both countries.

The cost conditions of the MNF are:

$$TC^F=C^F(X^F+E)^2/2 \quad ;C^F>0 \tag{3}$$

$$TC^H=C^H(X^H-E)^2/2 \quad ;C^H>0 \tag{4}$$

$$dTC^F/d(X^F+E)=C^F(X^F+E)>0 \tag{5}$$

$$dTC^H/d(X^H-E)=C^H(X^H-E)>0 \tag{6}$$

where,

E=level of intra-firm trade

Equations (3) and (4) describe the total production costs in the parent firm and the subsidiary respectively. The particular form of the cost functions adopted here give rise to linear and increasing marginal cost curves which are depicted in equations (5) and (6). C^F and C^H are the constant slopes of the marginal cost curves in the foreign country and the host country respectively.

It is further assumed that the multinational is faced with proportionate profit taxes of g^F and g^H in countries F and H, and is assessed a tariff of t on the value of goods transferred from the parent firm to the subsidiary. The firm's profits are:

$$M=(1-g^F)[P^FX^F+pE-TC^F]+(1-g^H)[P^HX^H-TC^H-p(1+t)E] \qquad (7)$$

Maximizing this expression is equivalent to maximizing (redefining M)

$$M=P^FX^F-TC^F+G[P^HX^H-TC^H]+(1-GT)pE \qquad (8)$$

where,

$G=(1-g^H)/(1-g^F)$ and $T=(1+t)$

This maximization is performed subject to the "arm's length" constraints, wherein $p-C^F(X^F+E)\geq 0$ and $P^F-p\geq 0$. This formulation is an extension of the one used by Samuelson (1982).

Equation (8) makes it clear that if $(1-GT)>0$, then profits are increased by setting the transfer price at its upper limit where $p=P^F$. On the other hand if $(1-GT)<0$, then the profit are maximized by setting the transfer price at its lower limit where $p=C^F(X^F-E)$. We will consider these two cases separately.

The host government

The host government is assumed to understand the maximization process of the firm and is seen to maximize welfare while accounting for the transfer pricing behavior of the multinational. The welfare of the host country is directly related to the tax and tariff revenues, and the consumer surplus derived from the sales of the MNF in country H.[1]

The consumer surplus derived from the industry is:

$$U(X^H)-P^HX^H \qquad (9)$$

where $U(X^H)$ is the total utility derived from the consumption of X^H. Moreover, as we are looking at one particular industry in the economy and are essentially in a partial equilibrium framework, we can further assert that,

$$dU(X^H)/dX^H=P^H \qquad (10)$$

The derivative of the utility function with respect to the level of consumption is equal to the price of the commodity. This implies that the marginal utility of income is unity. In keeping with the assumption of linear demand we can lend a specific form to the utility function which satisfies equation (10).

$$U(X^H)=a^HX^H-b^H(X^H)^2/2 \qquad (11)$$

Taking the derivative of this with respect to X^H we get,

$$dU(X^H)/dX^H = a^H - b^H X^H = P^H \qquad (12)$$

Equation (12) is consistent with (10) and it also shows us that the marginal utility declines with the level of consumption.

Substituting (11) and (12) in (9) gives us the specific value for consumer surplus

$$U(X^H) - P^H X^H = b^H (X^H)^2/2 \qquad (13)$$

The tax revenue which the host government collects from the multinational's operations in the host country's market are,

$$g^H(P^H X^H - TC^H - pTE) \qquad (14)$$

Equation (14) reveals the relationship between the tariff rate and the tax revenue. A higher tariff rate will, **ceteris paribus**, increase the import costs of the subsidiary and have a downward impact on its profits. This in turn will lower the host country tax revenues. The tariff revenue that the host government earns from the ad-valorem tariff it imposes on intra-firm trade is,

$$(T-1)pE \qquad (15)$$

where (T-1)=t and pE is the value of intra-firm trade.

Collecting (9), (14) and (15) together gives us the welfare function which the host government will maximize,

$$H=U(X^H)-P^HX^H+g^H(P^HX^H-TC^H-pTE)+(T-1)pE \qquad (16)$$

Equation (16) tells us that the welfare of the host country is a sum of the tax and tariff revenues, and consumer surplus. The assumption underlying this specification is that the welfare derived from a dollar of consumer surplus is the same as the welfare gain from a dollar of tax or tariff revenues. In essence we are abstracting from distributional issues.

III. High Desired Transfer Price:(1-GT)>0

In order to determine the conditions for profit maximization under the high transfer price case we have to set $P=P^F$ in (8) and differentiate with respect to X^F, X^H and E. The subscripts represent the partial derivatives with respect to the subscripted variable. The first order conditions given linear demand and linear marginal costs are:

$$Mx^F=a^F-2b^FX^F-C^F(X^F+E)-(1-GT)b^FE=0 \qquad (17)$$

$$Mx^H=G[a^H-2b^HX^H-C^H(X^H-E)]=0 \qquad (18)$$

$$M_E=GC^H(X^H-E)+(1-GT)[a^F-b^FX^F]-C^F(X^F+E)=0 \qquad (19)$$

The structure of our model ensures that the second order conditions for profit-maximization are satisfied. A simultaneous solution of these relations gives rise to an interior solution denoted by X^{F*}, and X^{H*} and E^*. Notice that in the above system of equations, it is only in (19) that all of the endogenous variables enter directly and equations (17) and (18) feature only two endogenous variables. This property of the system enables us to depict the equilibrium in a two quadrant diagram as shown in Figure 1. The conditions for profit maximization ensure that the $M_E=0$ locus is steeper than the $Mx^F=0$ locus in the X^F,E plane and that the $M_E=0$ locus is steeper than the $M_X^H=0$ locus in the X^H,E plane. The diagram also shows the slopes of the different loci and the values of the intercepts in equilibrium. The values of the intercept clearly reveal the inter-dependency between X^{H*} and X^{F*} in equilibrium.

The comparative-static analysis with respect to the tariff rate can be done by totally differentiating the first order conditions with respect to the endogenous variables and T. The results are laid out in detail in Appendix A along with a complete specification of the firm's profit maximization process under a high desired transfer price. The impact of a change in the tariff rate on the equilibrium can also be shown on a diagram by appropriately adjusting the slopes and the intercepts of the various loci. Figure 2 shows the impact of a rise in the tariff rate on the equilibrium levels of the endogenous variables. It must be kept in mind

that the movement of the loci have to capture both the direct and the indirect changes of a higher tariff on the endogenous variables. A look at the values in Figure 1 reveals that the direct and the indirect impacts in this case essentially reinforce each other. Hence the comparative-static effects are unambiguous, (note that T=(1+t) and a rise in T implies a rise in t).

$$dX^{F*}/dT>0 \tag{20}$$

$$dX^{H*}/dT<0 \tag{21}$$

$$dE^{*}/dT<0 \tag{22}$$

Thus, we see that an increase in the ad-valorem tariff on intra-firm trade results in the contraction of intra-firm trade, raises the optimal level of sales in the foreign country and reduces the optimal level of sales in the host country[2]

The host government is assumed to incorporate the optimal choices of the firm when it looks at the welfare impacts of a change in the ad-valorem tariff assessed on intra-firm trade. For the high desired transfer price case we know that $p=a^{F}-b^{F}X^{F*}$. Equation (16) can be rewritten as[3]:

$$H^{U}=b^{H}(X^{H})^{2}/2+g^{H}[P^{H}X^{H}-TC^{H}-T(P^{F}E)]+(T-1)P^{F}E \tag{23}$$

Differentiating (23) with respect to T will give us the change in the welfare level when the ad-valorem tariff rate changes. Accounting for the specific structure of the model we have:

$$H_t^U = b^H X^H dX^H/dT + g^H[(a^H - 2b^H X^H)dX^H/dT - C^H(X^H - E)(dX^H/dT - dE/dT) - T(P^F dE/dT - b^F E dX^F/dT) - P^F E] + (T-1)[P^F dE/dT - b^F E dX^F/dT] + P^F E \quad (24)$$

Setting this derivative equal to zero yields the welfare-maximizing tariff for the high desired transfer price case. The objective of this analysis is to identify the different factors which will influence the level of the optimal tariff. This purpose is best served by isolating the different terms in (24) and deciphering how each of them would affect the welfare level in the event of an increase in the tariff rate. The six distinct effects on welfare are (a) the consumers surplus effect, (b) the revenue effect (c) the import substitution effect, (d) the direct tariff effect (e) the volume of trade effect and (f) the transfer price effect.

(a) Consumer surplus effect

$b^H X^H dX^H/dT$

It is clear that as long as dX^H/dT is negative this term will have a negative impact on the welfare of the host country if the tariff is increased. Moreover, it is seen that this effect is larger when the value of b^H is larger. A large value of b^H, for a linear demand curve, would be associated with a larger intercept a^H for a given equilibrium value of X^H.

Hence the consumer surplus effect around the same equilibrium value of X^H and a larger b^H would be associated with a relatively inelastic demand curve. The implication is that the consumer surplus effect will be stronger when the demand in the host country is inelastic. As this effect has a downward impact on the welfare-maximizing tariff, the optimal ad-valorem tariff will be positively related to the elasticity of demand for the good in the host country. The intuition here is the same as the one which is encountered in analyzing the incidence of a tax burden, wherein the consumers bear the brunt of the higher tariff when the demand is relatively inelastic.

(b) Revenue effect

$g^H(a^H-2b^HX^H)dX^H/dT$

Given a positive level of marginal revenue and a decrease in the equilibrium value of X^H in response to a higher tariff, this effect has a negative impact on welfare of the host country. We know from basic theory that the monopolist operates in the elastic region of the demand curve and consequently a reduction in the level of sales in the host country will drive down the total revenue of the subsidiary. Smaller revenue will, **ceteris paribus**, push down the profits of the subsidiary and in turn result in smaller tax revenues for the host country. Hence, the revenue effect has a downward impact on the welfare-maximizing tariff imposed on the value of intra-firm trade.

(c) Import substitution effect

$-g^H C^H (X^H - E)[dX^H/dT - dE/dT]$

The domestic production of the subsidiary is the difference between the level of host country sales and its intra-firm imports and can be written as $X^H - E$. The change in the subsidiary's production level in response to an increase in the ad-valorem tariff rate is given by $dX^H/dT - dE/dT$ and using the comparative-static results it can be shown that this is positive. This result is consistent with the idea of "tariff jumping", wherein multinationals upon facing higher tariffs decrease the level of intra-firm trade and increase domestic production in the host country. Given a positive marginal cost of production this increases the total production costs of the subsidiary. An increase in these costs will, **ceteris paribus**, decrease the profits of the subsidiary and consequently lower the tax revenues earned by the host country. Therefore the import substitution effect has a downward impact on host country welfare in the event of an increase in the ad-valorem tariff on intra-firm trade. It is further seen that the marginal impact on profits, and consequently tax revenues, is greater when the subsidiary's marginal cost of production is higher. The implication of this is that the optimal tariff will be lower as the subsidiary's marginal costs of production are higher.

(d) Direct tariff effect

$(1-g^H)P^FE$

This effect shows the welfare impact of a higher tariff rate at a given level of intra-firm trade and transfer price. The overall impact on host country welfare will always be positive as long as $g^H<1$. P^FE reflects the higher tariff payments which the firm has to meet and g^HP^FE is the associated decrease in the subsidiary's tax payment in the host country. For all values of $g^H<1$ the former will always dominate the latter and the direct tariff effect will have a positive impact on host country welfare.

(e) Volume of trade effect

$(T-1-g^HT)[P^FdE/dT]$

We know that $dE/dT<0$, and it can be shown that $(1-GT)>0$ implies that $(T-1-g^HT)<0$[4]. The higher tariff rate results in a lower level of intra-firm trade and at a given level of transfer price this implies lower tariff revenues, which in turn lower the welfare level. At the same time lower tariff payments, **ceteris paribus**, result in higher profits for the subsidiary and higher tax revenues for the host country which in turn imply a higher welfare level. As we are in a regime where $(1-GT)>0$, the tax effects are seen to dominate the tariff effects and the overall impact of the volume of trade effect on welfare is positive.

(f) Transfer price effect

$(T-1-g^{H}T)[-b^{F}Edx^{F}/dT]$

This effect reflects the influence of a fall in the transfer price in response to a higher tariff on intra-firm trade. We know that the transfer price in this case is equal to the sales price in the foreign country, and given the monopolistic nature of the multinational's market in the foreign (parent) country, a rise in foreign sales in response to an increase in the tariff will ensure a decrease in both the foreign sales price and the transfer price. The welfare effects are determined by the consequent fall in the tariff revenues and a rise in the tax revenues of the host country. Given that $(1-GT)>0$ the tax effect dominates the tariff effect, and determines the welfare outcome. Consequently, the transfer price effect has a positive impact on host country welfare when there is an increase in the tariff rate. It is further noted that the magnitude of this effect increases when b^{F} is large. A larger value of b^{F} at a given equilibrium level of X^{F} would entail a larger intercept for the foreign demand curve. Larger slopes and intercepts around a given equilibrium level of X^{F} imply a lower elasticity of demand. Hence the transfer price effect is larger when the foreign demand is relatively inelastic. The intuition is that for a given rise in the foreign sales the fall in the price of the good will be larger if the foreign demand curve is more steeply sloped. As a steeper slope causes a sharper decline in the transfer price and, **ceteris paribus**, a sharper fall in

the tariff revenue, it results in a larger increase in the host country tax revenue. Therefore, given the welfare dominance of tax revenues over tariff revenues, this implies that a marginal increase in the tariff rate has a stronger positive impact on host-country welfare if the foreign demand curve is steeper. The main import of this analysis is that, for a given level of source-country sales, the host-country optimal ad-valorem tariff on intra-firm trade is inversely related to the foreign elasticity of demand.

IV. Low Desired Transfer Price (1-GT)<0

In this section of the paper we consider the case where the desired transfer price is at the lower arm's length limit. Setting $p=C^F(X^F+E)$ in (8) and differentiating with respect to the endogenous variables we get the first order conditions for profit maximization:

$$M_X^F=a^F-2b^FX^F-C^F(X^F+E)+(1-GT)C^FE=0 \qquad (25)$$

$$M_X^H=G[a^H-2b^HX^H-C^H(X^H-E)]=0 \qquad (26)$$

$$M_E=G[C^H(X^H-E)]+[1-GT]C^F(X^F+2E)-C^F(X^F+E)=0 \qquad (27)$$

Once again, given that the second order conditions for profit maximization are satisfied, a simultaneous solution of these conditions will give rise to optimal values of the MNF's endogenous variables. As before we notice that only (27)

depends explicitly on all three endogenous variables. This property of the system enables us to depict the equilibrium solution in a two quadrant diagram (see Figure 3). The profit maximization conditions ensure that the $M_E=0$ locus is steeper than the $M_X^H=0$ locus in the X^H,E plane and that the $M_E=0$ locus is steeper than the $M_X^H=0$ locus in the $X^F=0$ in the X^F,E plane. The diagram also depicts the slopes of the different loci and the values of the different intercepts are also stated. The intercept of the $M_X^F=0$ locus and the intercept of the $M_X^H=0$ locus reveal the interdependency of X^{H*} and X^{F*} in equilibrium.

The comparative-static results in response to a change in the tariff rate can be derived by applying Cramer's rule to the total derivatives of the first order conditions with respect to the endogenous variables and T. The details of this exercise are laid out in Appendix B. The results of this analysis are:

$$dX^F/dT \gtrless 0 \tag{28}$$

$$dX^H/dT \gtrless 0 \tag{29}$$

$$dE/dT \gtrless 0 \tag{30}$$

The analysis indicates that the comparative-static response of the endogenous variables to changes in the tariff

rate will in general be ambiguous. As noted in the earlier section, the comparative-static changes can also be depicted diagrammatically. Whereas in the high transfer price case the diagrammatic approach was essentially a restatement of the algebraic conclusions, in the low transfer price case it augments the analysis. The diagrams reveal that there are only three plausible scenarios of which the most likely result is the traditional one where $dX^H/dT<0$, $dX^F/dT>0$ and $dE/dT<0$. The other two cases would occur only if the indirect effects of the tariff changes strongly dominated the direct effects. A look at Figure 3 reveals that the slope and the intercept of the $M_X^H=0$ locus are invariant to changes in the tariff rate or the endogenous variables. Moreover, the only impact on the $M_X^F=0$ locus is an inward movement of its intercept on the E axis when there is a rise in T. Given these constraints the three possible scenarios in response to a tariff increase are described in Figure 4 by (X^H_1, X^F_1, E_1), (X^H_2, X^F_2, E_2), and (X^H_3, X^F_3, E_3). The solution subscripted by 3 could occur only if the $M_E=0$ locus moved down in the X^H,E plane. A look at the values in Figure 3 reveal that this would occur only if the indirect impacts of the tariff change are dominant. Similarly, it can be seen that the solution depicted by the subscript 1 is likely when the direct impacts of the tariff dominate the indirect impacts. The type 2 solution is one in which all three endogenous variables fall in response to a rise in the tariff. Figure 4 shows us that for this result to occur the $M_X^F=0$ locus has to intersect the $M_E=0$ locus

between points A and B. Hence, the probability of this scenario is relatively low.

In the welfare analysis which follows we will restrict ourselves to the traditional result wherein a higher tariff on intra-firm trade causes a contraction of intra-firm trade, a contraction of total sales in the host country and an expansion of the MNF's sales in the foreign country. For the low desired transfer price we know that $p=C^F(X^F+E)$ and this enables us to rewrite the welfare function (16) as:

$$H^L=b^H(X^H)^2/2+g^H[P^HX^H-C^H(X^H-E)^2/2-TC^F(X^F+E)E]+[T-1]C^F(X^F+E)E \quad (31)$$

Differentiating (31) with respect to T will give us the change in the host country welfare when the tariff on intra-firm trade changes. Taking into account the structure of the model we have:

$$H_T^L=b^HX^HdX^H/dT+gH[C^H(X^H-E)dE/dT-T(C^F(X^F+E)dE/dT+C^F(dX^F/dT+dE/dT)E) -C^F(X^F+E)E]+(T-1)[C^F(X^F+E)dE/dT+C^F(dX^F/dT=dE/dT)E]+C^F(X^F+E)E \quad (32)$$

Setting (32) equal to zero would give us the implicit solution for the welfare-maximizing tariff. However, as mentioned in the previous section, the analysis is more illuminating if we isolate the different effects and deal with them individually.

As we move from the high desired transfer price case to the low desired transfer price case, the consumers surplus effect, the revenue effect, import substitution effect and the direct tariff effect stay the same. Hence, it is still true that the welfare-maximizing tariff is inversely related to the subsidiary's marginal cost of production and directly related to the elasticity of demand in the host country. The two effects which do portend different implications for host country welfare are the volume of trade effect and the transfer price effect.

We had observed in the high transfer price case that $(1-GT)>0$ always implied that $(T-1-g^{H}T)$ would be negative and consequently a relatively high tax differential would be associated with a tax effect that would dominate the tariff effect whenever the two were in conflict. However, one can not make as conclusive an assertion for the low transfer price case. It can be shown that $(1-GT)<0$ could be associated with a dominant tax or a dominant tariff effect. In particular for tariff rates sufficiently close to the critical tariff rate $t=g^{H}-g^{F}/1-g^{H}$ the tax effects will dominate the tariff effects, on the other hand for high tariff rates the tariff revenue effects will be dominant.[5] We will look at the transfer price effects and the volume of trade effects in the presence of a dominant tariff effect. The welfare results for a dominant tax effect are symmetric to the results arrive at in this analysis. Hence for our analysis we have $(T-1-g^{H}T)>0$.

Volume of trade effect

$[T-1-g^{H}T](C^{F}+E)dE/dT)$

This represents a reduction in the subsidiary's cost due to a lower level of imports. This has a dual impact on the host country's welfare level. On the one hand, it implies higher welfare due to higher tax revenues, and on the other hand it implies lower welfare due to smaller tariff revenues. Given the dominant tariff effect the overall impact of the volume of trade effect is negative in the event of a rise in the tariff rate. Hence under a low transfer price and a dominant tariff effect the volume of trade effect has a downward impact on the welfare maximizing tariff.

Transfer price effect

$[T-1-g^{H}T](C^{F}(dX^{F}/dT+dT+dE/dT)E$

We know that the level of sales in the foreign country expand in response to a higher tariff rate and the level of intra-firm trade contracts when a higher tariff is assessed on the value of intra-firm trade. The marginal cost of production in the foreign country, which is the transfer price in this case, rises when X^{F} goes up and falls when E goes down. The net change in the marginal cost will depend on the relative strengths of the two comparative-static effects. A look at the comparative-static results in Appendix B shows us that dX^{F}/dT is dominated by dE/dT and a higher tariff on intra-firm trade results in lower production in the foreign (parent) country. This causes the marginal cost of production

and hence the transfer price to go down. The explanation of this result lies in the fact that a reduction in E has a stronger marginal impact on the MNF's profits than an increase in X^F in response to a higher tariff rate. Given that we are operating in an environment where the tariff rate exceeds the tax differential, the firm's objective is to charge a low transfer price. As E falls in response to a higher tariff rate it has a downward impact on the marginal cost of production in F. This lowers the transfer price and therefore the downward movement in E is reinforced by the transfer price objectives of the firm. On the other hand, a rise in X^F has an upward impact on marginal cost of production which runs counter to the transfer price objectives of the firm. Consequently, we have $dX^F/dT+dE/dT<0$ and observe a decline in the foreign marginal cost of production. The lower transfer price combined with a dominant tariff effect has, **ceteris paribus**, a downward impact on host country welfare-maximizing tariff.

It is also evident that the transfer price effect is stronger if C^F, the slope of the foreign marginal cost, is higher. The reason for this is that, for a given fall in the level of production, the decline in the marginal cost is going to be larger if the marginal cost curve has a larger slope. The main conclusion to be drawn from this analysis is that the host country optimal ad-valorem tariff on intra-firm trade is inversely related to the slope of the multinational's marginal cost of production in the foreign country.

V. Choice of Regimes and Policy Decisions

The policy framework we are operating in is one in which the host country government is looking for an optimal ad-valorem tariff for given levels of proportionate profit taxes in the host and the foreign country. The situation can be described as a Stackleberg game in which the host country sets the tariff t and the MNF responds by choosing profit maximizing values of X^{F*}, X^{H*}, and E^{*}. The comparative-static results are like reaction functions which the government of the host country accounts for in its decision as regards an optimal t.

As one moves from the H^{U} regime to the H^{L} regime to the H^{L} regime the tariff rate changes from $t^{U}<t'$ to $t^{L}>t'$, where t' is the critical tariff, at which (1-GT)=0, and is determined by the exogenously given tax rates. The comparative static results tell us that H^{L} will be characterized by lower levels of host country sale sand intra-firm trade, and a higher level of sales in the foreign country in comparison to the H^{U} regime. Hence, the H^{U} regime will always have a higher level of consumer surplus, however, one can not make definitive statements as regards the relative values of the tax and tariff revenues between the two regimes, and their magnitude will depend on the exogenously given demand and cost conditions. Consequently, an optimal tariff t^{L*} under the H^{L} regime can not be welfare-ranked vis-a-vis an optimal tariff t^{L*} or t^{U*} as $H^{L}(t^{L*})$ is greater than or less than $H^{U}(t^{U*})$.

An exceedingly important issue from the policy point of view is of the consistency of policy choice. When H^L is maximized with respect to t, the assumption is that the MNF's transfer price is $C^F(X^{F*}+E^*)$ as t lies above t', where t' is the tariff rate at which the multinational is indifferent between charging a low transfer price and a high transfer price. If the value of t^{L*} obtained from $H^L_t=0$ is below t', the optimal tariff under this regime would not be attainable. If one went ahead and set the tariff at t^{L*} obtained from $H^L_t=0$ is below t', the optimal tariff under this regime would not be attainable. If one went ahead and set the tariff at t^{L*} where $t^{L*}<t'$, then the MNF would set the transfer price at $P^F(X^F)$ and the tariff would no longer be maximizing welfare as we would be in the "wrong" regime. An identical problem could arise when we look at t^{U*} in the H^U regime. A close look at the various effects reveals that it is highly unlikely that both the equilibria are inconsistent at the same time. For the t^{L*} equilibrium to be in the "wrong" range we would need dominant consumer surplus, total revenue, and import substitution effects. The reason for this is that these effects have a downward impact on the welfare-maximizing tariff. On the other hand, as these effects act in the same direction in both the regimes, the dominance of these effects will ensure that t^{U*} stays in the "right" range.

However, to have a complete specification of the policy rules, one must also consider the unlikely case wherein t^{U*} and t^{L*} are inconsistent at the same time. This is like a

situation where there are no interior solutions and one has to look for corner solutions as viable alternatives. It is clear that at the corner solution both the regimes have the same tariff value and it is equal to the critical tariff t'. The appropriate thing to do in this case would be to evaluate H^U and H^L at t' and see if one dominates the other. When the tariff takes on the value t' it is clear that (1-GT)=0. A look at the first order conditions reveals that, (1-GT)=0 makes these conditions identical between the two regimes. This in turn ensures that the values of X^{F*}, X^{H*}, and E^* at the critical tariff are the same for the two scenarios. Consequently, a comparison of the two regimes is quite straightforward and after some algebraic manipulation it can be shown that,

$$H^L(t')>H^U(t') \qquad (33)$$

where

$$t'=(g^H-g^F)/(1-g^H)$$

At t=t' the MNF is indifferent between the high and the low transfer price because the tariff rate is equal to the relative tax differential and changing the transfer price merely relocates profits without any influence on the global after-tax profits. Therefore to ensure that the H^L regime is

attained the host government should set the tariff at t^{**}, such that

$$t^{**}=t'+e \qquad (34)$$

where,

e>0, and is arbitrarily small.

Thus, in the event of a corner solution, setting $t=t^{**}$ ensures that the MNF sets the lower limit on the transfer price $C^F(X^F+E)$, and the host country welfare is given by,

$$H=H^L(t^{**}) \qquad (35)$$

The intuition behind this result draws upon the fact that when t=t', the tax effects dominate the tariff effects (see endnote 5). Therefore, when the MNF sets the low transfer price, and all the other variables are the same, the result is lower tariff revenues and higher tax revenues. Given the dominant tax effects this implies higher welfare as compared to a situation where the transfer price is at its upper limit.

VI. Conclusions

In this paper we have analyzed the interaction between a horizontally integrated multinational which has monopoly power in both its markets, and a host government which attempts to maximize domestic welfare while searching for an optimum

tariff on the value of intra-firm trade. The multinational is restricted by "arm's length" constraints on its transfer prices and is able to endogenize the value of the limits due to its monopoly power and non-constant costs. Hence, the actual values of the limits are a function of the MNF's profit maximization decisions.

The comparative static results follow the "traditional" pattern for the high transfer price case. The sales in the host country and intra-firm trade contract as the level of foreign sales rises in response to a higher ad-valorem tariff on intra-firm trade. Although there is an element of uncertainty in the low desired transfer price case, the "traditional" result seems the most likely one. We are able to narrow down the uncertainty with the use of diagrammatic analysis in section IV and show that there are only two "non-traditional" cases which are possible outcomes. In the first case all of the MNF activities contract in response to a higher tariff, and in the second one foreign sales contract while both the host country sales and intra-firm trade expand. The "traditional" result will hold in the low transfer price case as long as the direct impacts of a tariff change dominate the indirect impacts.

Sections III and IV reveal that the welfare impact of the "consumer surplus effect", "the revenue effect", "the import substitution effect" and "the direct tariff effect" is invariant between the low transfer price and the high transfer price regimes. While the first two have a negative impact on

welfare, the third one has a positive welfare impact in the event of an increase in the tariff rate. The main conclusion is that the optimal tariff will always be related positively to the elasticity of demand in the host country and negatively to the marginal cost of production of the MNF's subsidiary in the host country.

The explicit interaction between the tax and tariff effects on welfare, come into play when we consider the "volume of trade effect" and the "transfer price effect". We concluded in section IV that, while the high transfer price will always be associated with a tax effect that dominates the tariff effect in terms of the welfare outcome, the low transfer price could be associated with either a dominant tariff or a dominant tax effect. In particular, if the tariff rate is sufficiently close to the critical tariff, the tax effect will dominate the tariff effect despite the fact that the tariff rate exceeds the relative tax differential. Consequently, in the presence of a high transfer price, a fall in the volume of trade in response to a higher tariff will always have a positive impact on host country welfare. On the other hand, in the presence of a low transfer price, the welfare impact of a change in the volume of trade is ambiguous and will depend on the relative strengths of the tax and tariff effects.

The "transfer price effect" shows us that if the multinational is charging a high transfer price in the face of arm's length constraints, the welfare-maximizing tariff for

the host country is inversely related to the elasticity of demand in the foreign country. In other words, the optimal tariff on the value of intra-firm trade will be higher if the foreign demand for the multinational firm's product is relatively inelastic. In the low transfer price case the transfer price is the marginal cost of production in the foreign (parent) country. The analysis in section IV shows that as long as the tariff effect is dominant, the transfer price effect has a negative impact on the welfare-maximizing tariff. It was also seen that the optimal ad-valorem tariff on intra-firm trade is negatively related to the slope of the parent firm's marginal cost curves.

The incorporation of endogenized "arm's length" transfer pricing in the decision framework of a host country reveals the importance of foreign country demand and cost conditions in determining the optimal commercial policy for the host country. It is also noted that in the final determination of tariff rates the issue of consistency is an important one. Section V spells out the ground rules for commercial policy in this context.

The analysis in this paper has been couched in a partial equilibrium framework, in that we focus on the impacts of changing tariff rates for a given tax structure. A logical extension would be to relax the assumption of inflexible tax rates and explore the issues of tax and tariff coordination in the presence of endogenous transfer pricing.

ENDNOTES

1. The welfare specification adopted here is similar to the one used by brander and Spencer (JIE, 1985) in their work on optimum export subsidies.

2. Although these comparative-static results are qualitatively no different from what one would get from a model with exogenous transfer pricing, there are bound to be magnitudinal differences due to the relationship between the transfer price and the foreign price.

3. For the sake of convenience we leave out the * on the variables during the welfare analysis. However, it must be kept in mind that one is always dealing with the optimal choices of the firm.

4. We know that by definition $G=1-g^H/1-g^F$ and $T=1+t$.
Now, we have $(1-GT)>0$. This implies the following:
$1-GT=[1-(1-g^H/1-g^F)(1+t)]=[g^H-g^F+t(g^H-1)]/(1-g^F)>0$ (N.1)

Equation (N.1) implies,

$[g^H-g^F+t(g^H-1)]>0$ (N.2)

Equation (N.2) implies,

$(g^H-g^F)/(1-g^H)>t$ (N.3)

Now,

$[T-1-gHT]=t^H(1+t)=t(1-g^H)-g^H$ (N.4)

It is quite clear from (N.4) that,

$[T-1-g^H]\gtrless 0$ as $t\gtrless g^H/(1-g^H)$ (N.5)

Combining (N.3) and (N.5) it is evident that for all $g^F>0$,

$(1-GT)>0$ implies $[T-1-g^HT]<0$ (N.6)

5. An identical derivation to the one in Note 4 would show that,

$(1-GT)<0$ implies $t>g^H-g^F/1-g^H$ (N.7)

It is quite clear from (N.7) that,
$(1-GT)<0$ is consistent with $t<g^H/1-g^H$ and $t>g^H/1-g^H$

Therefore, $(1-GT)<0$ is consistent with both $[T-1-g^HT]<0$ and $[T-1-g^HT]>0$.

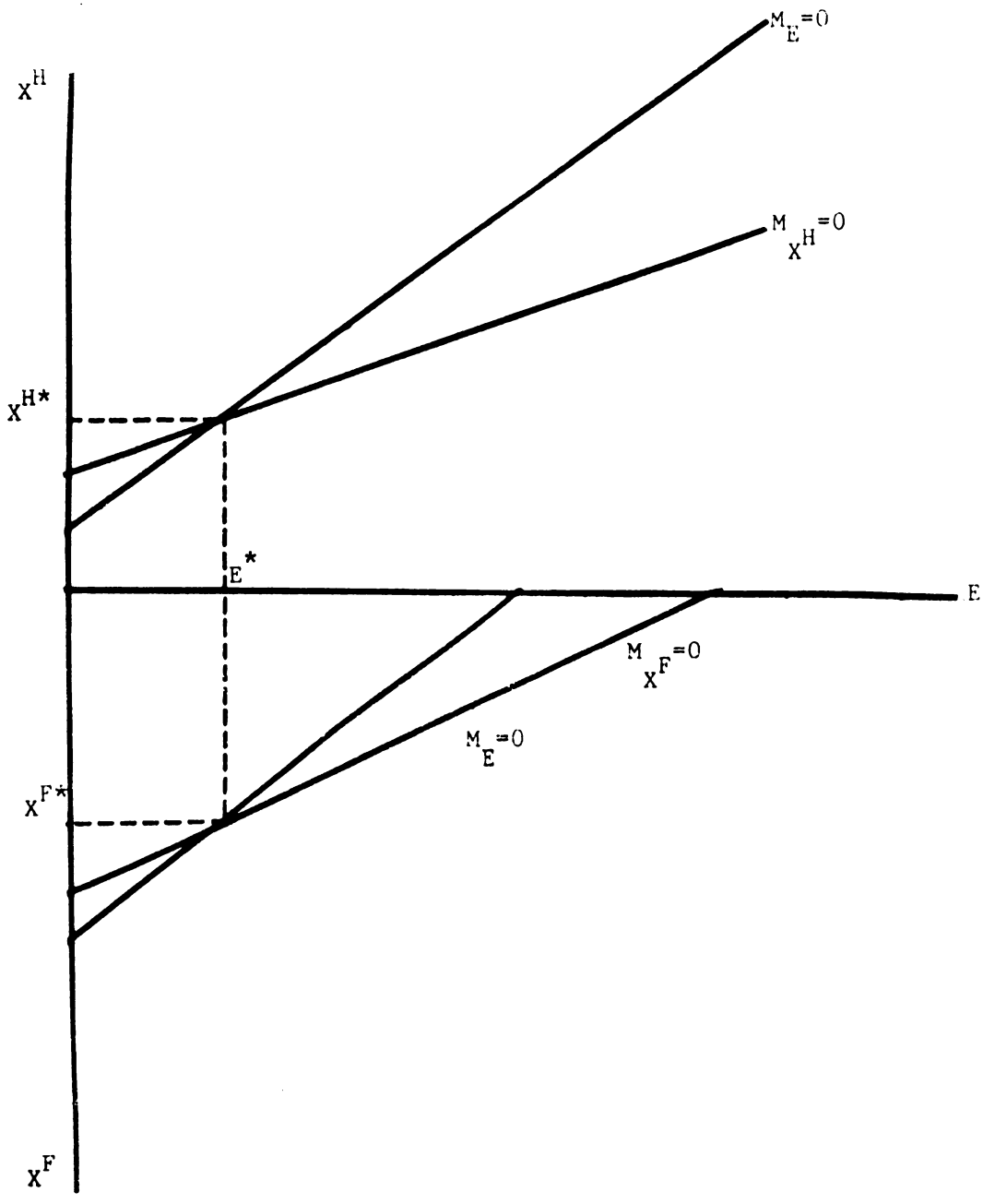

FIGURE 1
PROFIT MAXIMIZING EQUILIBRIUM FOR (1-GT)>0

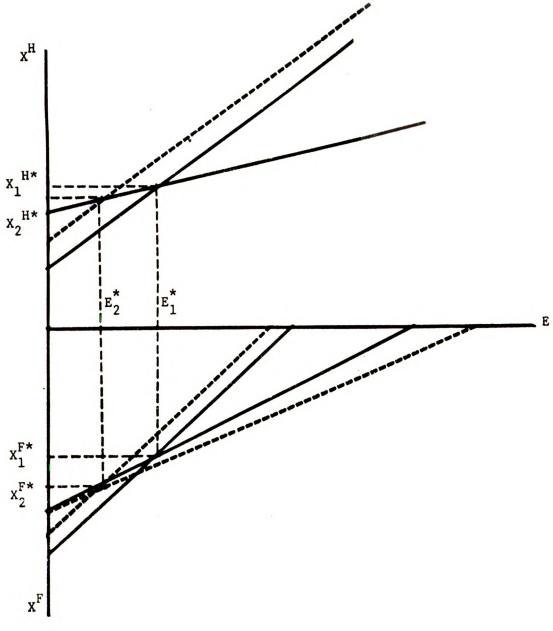

FIGURE 2
COMPARATIVE STATICS FOR (1-GT)>0

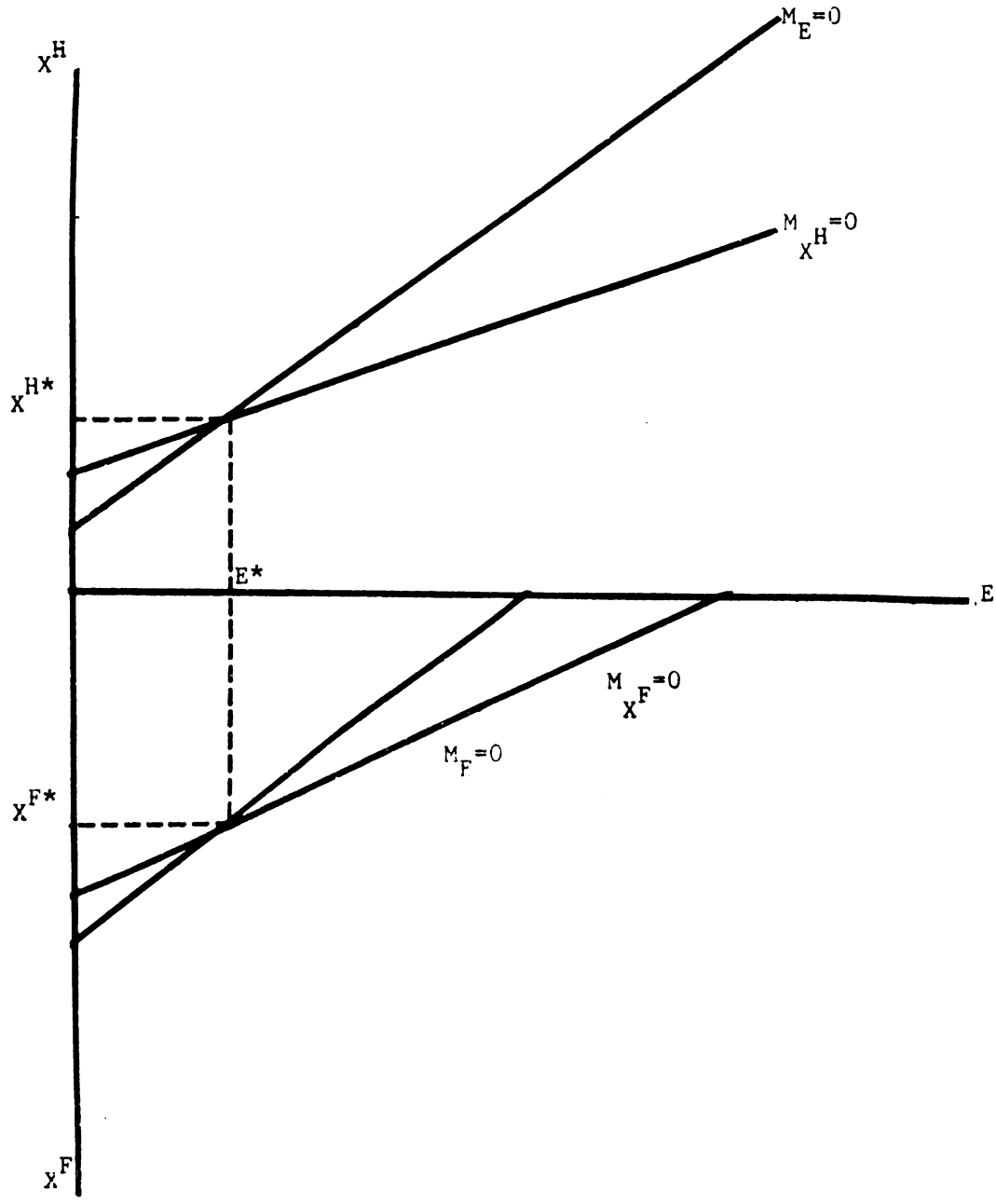

FIGURE 3
PROFIT MAXIMIZING EQUILIBRIUM FOR (1-GT)<0

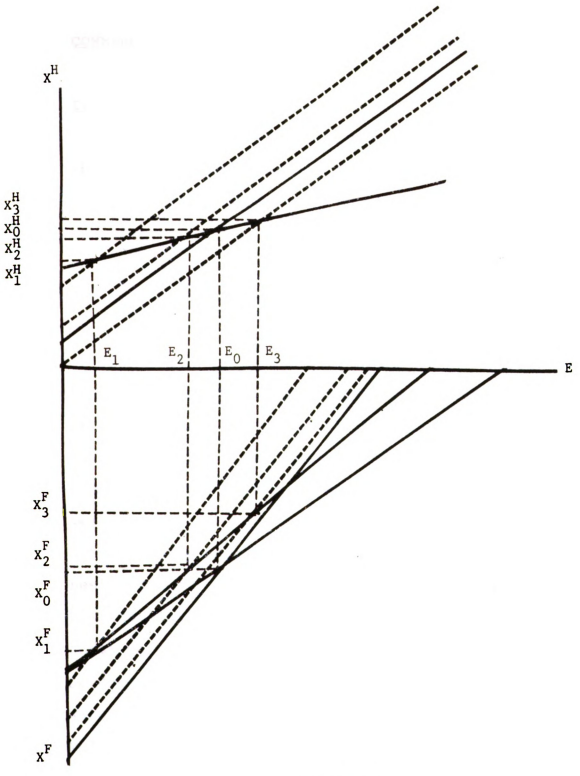

FIGURE 4
COMPARATIVE STATICS FOR (1-GT)<0

Chapter III

COMMERCIAL POLICY AND TRANSFER PRICING OF INTERMEDIATE GOODS

I. Introduction

Lorraine Eden (1985) in her comprehensive survey of the theoretical literature on transfer pricing noted that:

> An obvious omission is the failure to model factor markets i.e., to go behind the MNE's cost curves to determine the impacts of transfer pricing, taxes and tariffs on factor demands and factor incomes. ... the welfare and income distributional effects of transfer pricing on home and host country need further development, e.g., consumer and producer surplus effects...

Eden goes on to identify several other issues which need to be addressed in the theory of transfer pricing as it pertains to the multinational enterprise. The issue of factor markets remains largely unexplored and has not been explicitly modelled in the context of commercial policy and host country welfare.

It would seem that the factor market considerations are best tackled within a model of vertically integrated multinational. Consequently, this paper is developed along these very lines: it models a multinational enterprise which produces and sells a final good in two separate countries, without inter-country, intra-firm trade. However, the multinational engages in intra-firm trade in an intermediate product. The seminal paper on vertically integrated multinationals is Copithorne (1971), wherein transfer prices

are used in order to maximize global post tax profits through the equalization of marginal tax payments in the different fiscal jurisdictions. Other important papers dealing with vertically integrated multinationals and transfer pricing are Booth and Jensen (1977) and Eden (1978).

In order to highlight the factor market effects we model the multinational company explicitly in terms of its production function, wherein it chooses optimal input levels. Unlike the earlier work in this area we also specify an explicit welfare function for the host country. The welfare function consists of consumer surplus, total profit taxes garnered from the MNE's host country operations, tariff revenues derived from intra-firm trade and the total value of labor employment in the multinational's host country operations. It must be kept in mind that the welfare function and the analysis of the paper in general are couched in a partial equilibrium framework in that we are analyzing one specific industry. The welfare analysis is carried out in terms of a decomposition of the various elements of total welfare and their responses to a change in an ad-valorem tariff on intra-firm trade. The study identifies the various determinants of the welfare-maximizing tariff and analyzes the differences in the channels of influence between the "low transfer price" and the "high transfer price" regimes. The low transfer price case is looked upon as a situation where the firm faces an anti-dumping restriction and is unable to lower the transfer price below the marginal cost of

production. In the high transfer price case we analyze a situation in which the multinational is confronted with local content legislation, which in turn gives rise to an upper limit on the transfer price. The low transfer price model of the third section is in the tradition of the original "exogenous" transfer price models, e.g., Copithorne (1971) and Horst (1971). On the other hand the high transfer price formulation of the fourth section is akin to the more recent models of "endogenous" transfer prices, e.g., Samuelson (1982).

The plan of the paper is as follows: in the second section the basic model is developed and in sections three and four the low transfer price case and the high transfer case are analyzed respectively. The analysis is summarized and some conclusions are drawn in the last section.

II. The Model

The core of our model deals with the transfer pricing behavior of a vertically integrated multinational which has monopoly power in the final goods market in its source (foreign) country as well as in the final commodity market in the host (domestic) country. The total sales of the final good in the two countries constitute entirely of locally produced goods. Thus, it is assumed that the multinational has production operations in each country and there is no intra-firm trade in the final commodity. It is further assumed that the production of the final good requires the use

of labor and an intermediate good which is produced only in the source country by an intermediate-product division of the multinational enterprise. Intra-firm trade takes place in the intermediate product and the price that the intermediate division charges the final production divisions for the sale of the intermediate input is the transfer price. The multinational's divisions are seen to encounter proportionate profit taxes in the two countries and it is also assumed that the host country assesses an ad-valorem tariff on intra-firm trade in the intermediate product.

At this juncture it must be noted that we are concentrating on the use of transfer pricing as a profit-shifting instrument and not as an incentive mechanism used to facilitate decision making within a multi-divisional enterprise. Consequently, the transfer price between the intermediate-good division and the final-product division in the source country is of no importance to our analysis as these two divisions operate within the same tax jurisdiction. On the other hand, the transfer price between the intermediate-good division and the final-product division in the host country can be manipulated by the multinational enterprise in order to minimize global tax and tariff payments.

Demand structure

The multinational faces downward sloping demand in the two countries and the inverse demand curves are,

$$p_h^{-1/e} \qquad (1)$$

$$p_f = x_f^{-1/e} \qquad (2)$$

p_h = price of the final commodity in the host country (h)

p_f = price of the final commodity in the foreign country (f)

x_h = total sales of the final commodity in the foreign country

e = price elasticity of demand of the final commodity

The underlying assumption is that the two markets are segregated in that the multinational is able to charge different prices in the two markets. Moreover, for the sake of simplicity we assume that the demand curves are characterized by constant price elasticities of demand, which are identical across the market.

The multinational

The final product divisions use labor L and an intermediate input Z to product the final commodity x. The production technology is described by the following Cobb-Douglas production functions,

$$x_h = L_h^a Z_h^b \qquad (3)$$

$$x_f = L_f^a Z_f^b \qquad (4)$$

where,

L_f = The total amount of labor employed in the production of x_f

Z_f = The total amount of intermediate input used in producing x_f

L_h = The total amount of labor employed in the production of x_h

Z_h = The total amount of intermediate input used in producing x_h

We also assume that the technology exhibits non-increasing returns to scale. In terms of the Cobb-Douglas specification this implies that the sum of the output elasticities is no greater than one, i.e., $a+b \leq 1$. This ensures an interior solution to the multinational's profit-maximizing problem. The MNE faces proportionate profit-tax rates of g^f and g^h in the source and host countries respectively. At the same time the host country government imposes a tariff t on the value of intra-firm trade in the intermediate commodity. Substituting (1) and (2) in (3) and (4), the total after-tax profits of the two final sales divisions are denoted by,

$$M^f = (1-g^f)(L_f(^{(a(e-1)/e)}Z_f^{(b(e-1)/e)} - w^f L_f - R_f Z_f) \quad (5)$$

$$M^h = (1-g^h)(L_h^{(a(e-1)/e)}Z_h^{(b(e-1)/e)} - w^h L_h - R_h(1+t)Z_h \quad (6)$$

where,

w^f = the exogenously given wage rate in the foreign country

w^h = the exogenously given wage rate paid by the host country subsidiary

R_f = the transfer price assessed on each unit of Z_f

R_h = the transfer price assessed on each unit of Z_h

The intermediate input Z is produced by the multinational's intermediate-good division in the foreign (source) country. The production of Z entails the use of a composite input C and for simplicity it is assumed that it takes one unit of C to produce one unit of Z. The cost of a unit of C is exogenous to the firm's decisions and is denoted by r^c. For the sake of simplicity we assume that the intermediate-good division is characterized by constant marginal costs. Hence, the total cost of production in the intermediate-good division is $r^c(Z_f+Z_h)$. The after-tax profits of the intermediate division are given by,

$$M^z=(1-g^f)(R_hZ_h+R_fZ_f-r^c(Z_h+Z_f)) \qquad (7)$$

Combining (5), (6), and (7), we can write the after-tax global profits of the multinational as follows,

$$M = (1-g^f)(L_f{}^uZ_f{}^v+R_hZ_h-r^c(Z_h+Z_f)) + (1-g^h)(L_h{}^uZ_h{}^v-w_h^h-R_h1+t)Z_h \qquad (8)$$

where,

$u = a(e-1)/e$

$v = b(e-1)/e$

Maximizing (8) is equivalent to maximizing the following expression which can be attained by redefining (8),

$$M^* = L_f^u Z_f^v - w^f L_f - r^c Z_h + Z_f + G(L_h^u Z_h^v - w_h^h) + (1-GT)R_h Z_h \qquad (9)$$

where,

$G = (1-g^h)/(1-g^f$

$T = (1+t)$

It is quite clear from (9) that if the tax rate in the foreign (source) country is greater than the tax rate in the host country, i.e., $g^f > g^h$, then (1-GT) is always negative and M^* will be maximized by setting the transfer price at the lowest possible value. On the other hand, if the tax rate in the host country is greater than the tax rate in the foreign country i.e., $g^h > g^f$, then the sign of (1-GT) depends on the values of the relative tax differential and the ad-valorem tariff rate. If $(1-GT)<0$ then once again the multinational's profits are maximized by setting the transfer price at its lower limit. In the event that the relative tax differential exceeds the tariff rate then it is clear that $(1-GT)>0$ and the multinational will maximize global after-tax profits if it sets the transfer price at the upper limit. Hence, the multinational maximizes global profits by choosing L_f, L_h, Z_f,

and Z_h subject to the constraint that the transfer price lies within the "acceptable" limits.

Host country welfare

The welfare that the host country derives from the multinational's operations are measured in terms of the tax revenues paid by the final goods subsidiary in the host country, the tariff revenues arising from intra-firm trade in the intermediate commodity, and the consumer surplus generated by the sale of the final good in the host country. In addition to these three effects we also look at an employment effect where the multinational employees domestic resources at a wage w^h which is higher than the average wage in the host country.

The tax revenues generated by the multinational subsidiary's operation are given by,

$$\text{tax revenues} = g^h(p_h x_h - w^h L_h - (1+t) R_h Z_h)$$

As the multinational subsidiary imports the intermediate product and is assessed a tariff on the value of intra-firm trade, the tariff rate influences the production costs of the subsidiary. It is quite evident from the expression above that the tax revenues are lower if, **ceteris paribus**, the tariff rate is higher. At the same time a higher tariff rate would mean, **ceteris paribus**, higher tariff revenues. Thus, there is a welfare tradeoff represented by higher (lower) tax

revenues and lower (higher) tariff revenues, which must be accounted for in the course of determining tariff rates. Total tariff revenues are given by,

tariff revenues = tR_hZ_h

The consumer surplus is given by the following expression,

consumer surplus is given by the following expression,

consumer surplus = $\int x_h^{-1/\bullet} dx_h - p_h x_h$

The welfare effect in terms of employment captures the fact that the host country resources (labor) will earn wages higher than the average host country wage if they are employed by the multinational's subsidiary. The employment effect is given by,

employment effect = $(w^h - w_a)L_h$

w_a = the average wage in the host country.
w^h = the wage paid by the multinational subsidiary.

This specification describes a situation in which there is an element of labor market segmentation in the host-country, and the multinational firms offer a higher wage than the domestic firms. Although valid within the context of most

LDCs, this description might not capture the situation in the developed countries where one would expect greater wage parity between multinational firms and domestic firms. In such a case the specification would have to be modified to account for $w^h=w_a$, and the employment effect would drop out of the welfare function.

For the sake of tractability we assume that the welfare function of the host country is a linear sum of the four effects we have specified. This assumption essentially enables us to abstract from distributional issues as it implies that a dollar will generate the same amount of welfare irrespective of the effect it is associated with. Collecting the various terms, host country welfare can be written as follows,

$$H = g^h(p_h x_h - w^h L_h - (1+t)R_h Z_h) + tR_h Z_h + (w^h - w_a)L_h + (1/e-1)x_h^{((e-1)/e)} \qquad (10)$$

In the ensuing sections we analyze the impact of a change in the tariff rate on the welfare of the host country while assuming that the tax rates are exogenously given and $g^h>g^f$. The welfare impacts of a change in the tariff can be evaluated by taking the partial derivative of the welfare function (10) with respect to the tariff rate after we have substituted for the optimal values of L_h, L_f, Z_h, and Z^f for given tax and tariff rates. The welfare maximization problem of the host country is akin to a Stackleberg game, wherein the government chooses the tariff rate and the multinational's comparative-

static responses to changes in the tariff rate are like reaction functions which the government accounts for during the course of its decision problem.

III. Low Desired Transfer Price: (1-GT)<0

In the event that the tariff rate exceeds the relative tax differential the firm would have an incentive to lower the transfer price as far as possible. The firm's ability to lower its transfer price is in general restrained by the host country authorities and a typical situation is one in which the transfer price is not allowed to fall below the cost of production. Invariably one comes across such restrictions in the realm of anti-dumping legislation, which are normally aimed at protecting domestic industries. In certain environments tariffs are also seen to be a major source of fiscal revenue and the lowering of transfer prices is thus perceived as undesirable even in the absence of domestic competition (Plasschaert 1985). Thus, the following analysis can be viewed as one in which the firm encounters an "antidumping" legislation and it sets the transfer price on the intermediate commodity at a lower limit which is taken to be the marginal cost of producing the intermediate commodity. Usually under anti-dumping legislation the lower limit is defined in terms of the average cost of production or the source country sales price. In our specification the marginal cost of producing Z is constant and thus equals the average cost. Since the intermediate division does not sell on an

outside market the source country price of Z is a captive price. As the Z division and the x_f division operate in the same tax jurisdiction there is no incentive to manipulate the price of Z in the source country. Thus, the captive price is determined on efficiency grounds and an efficient transfer price in the absence of outside markets is equal to the marginal cost of production (Hirshleifer 1956). Hence, under the assumption of constant marginal costs and no external markets the transfer price is the same under either definition of anti-dumping and we have,

$$R_h = r^c \qquad (11)$$

Where R_h is the transfer price on the transactions between the intermediate-good division and the host-country subsidiary. Substituting equation (11) in (9), we can write the multinational's profit maximization problem for the low desired transfer price case as follows,

$$\text{Max } M^* = L_f^u Z_f^v - w^f L_f - r^c(Z_h + Z_f) + G(L_h^u Z_f^v - w^h L_h) + (1-GT) r^c Z_h \qquad (12)$$

The first-order conditions for an interior solution for the multinational's profit-maximization exercise are,

$$M^*_{Lf} = uL_f^{u-1} Z_f^v - w^f = 0 \qquad (13)$$

$$M^*_{Zf} = vL_f^u Z_f^{v-1} - r^c = 0 \qquad (14)$$

$$M^*_{Lh}=G(uL_h^{u-1}Z_h^{v}-w^h)=0 \qquad (15)$$

$$M^*_{Zh}=G(VL_h^{u}Z_h^{v-1}-(1+t)r^c)=0 \qquad (16)$$

The first-order conditions can be solved for the closed form solutions and these are:

$$L_F = \left(\frac{w}{u}\right)^{\frac{1-v}{v+u-1}} \left(\frac{r^c}{v}\right)^{\frac{v}{v+u-1}}$$

$$Z_F = \left(\frac{w}{u}\right)^{\frac{u}{v+u-1}} \left(\frac{r^c}{v}\right)^{\frac{1-u}{v+u-1}}$$

$$L_H = \left(\frac{w}{u}\right)^{\frac{1-v}{v+u-1}} \left(\frac{(1+t)r^c}{v}\right)^{\frac{v}{v+u-1}}$$

$$Z_H = \left(\frac{w}{u}\right)^{\frac{u}{v+u-1}} \left(\frac{(1+t)r^c}{v}\right)^{\frac{(1-v)}{v+u-1}}$$

Given the assumptions of our model, the second-order conditions for profit maximization are satisfied and a simultaneous solution of the first-order conditions will give rise to the optimal values of L_h, L_f, Z_h, and Z_f. In this formulation the value of the value of the transfer price is exogenous to the multinationals decision problem and does not influence the multinational's decisions as regards its endogenous variables in an explicit manner. The first order conditions state that in equilibrium the marginal revenue product of each input used by the multinational is equal to the price of that input. It must be noted that in the

equilibrium condition for Z_h, denoted by (16), the marginal revenue product is set equal to the price of the intermediate input for the host country subsidiary which includes the ad-valorem tariff imposed on intra-firm trade.

The multinational's comparative-static response to changes in the ad-valorem tariff rate can be derived by totally differentiating the first order conditions and applying Cramer's rule. The assumption of constant marginal cost in the production of the intermediate product isolates the multinational's host-country operations from its source-country operations. In particular, it is seen that the optimal values of L_f and Z_f are insensitive to changes in the rate of the ad-valorem tariff imposed on intra-firm trade in the intermediate product. The details of the comparative-static exercise are laid out in Appendix C. The basic results are,

$$dZ_h/dt=u(u-1)L_h^{u-2}Z_h^{v}r^{c}/D<0 \qquad (17)$$

$$dL_h/dt=-uvL_h^{u-1}Z_h^{v-1}r^{c}/D<0 \qquad (18)$$

Thus, an increase in the ad-valorem tariff on intra-firm trade causes a decline in the use of both the intermediate input and the labor input in the host-country operations of the multinational. The precise intuition behind these results can be grasped from equations (15) and (16). The first order conditions can also be looked upon as marginal profitability

conditions wherein the marginal profitability of each variable is equal to zero in equilibrium. From (16) it is clear that a rise in the tariff rate t increases the effective price of Z_h as the negative relationship between the quantity of the input and its marginal revenue product ensures that a fall in Z_h moves the system towards equilibrium. There is no direct impact on the marginal profitability of L_h, however the decline in Z_h makes the marginal profitability of L_h negative as a reduction in the total amount of intermediate input reduces the marginal productivity of labor for any given level of employment. This induces a reduction in the total amount of labor input and the consequent rise in the marginal revenue product raises the marginal profitability of L_h back to zero. The indirect impact of a change in t on the level of Z_h due to the decline in L_h also causes a decline in the level of Z_h, and reinforces the direct impact of an increase in the ad-valorem tariff rate. As the direct and indirect impacts of a change in the tariff reinforce each other the comparative static results are unambiguous and the optimal level of L_h and Z_h fall in response to an increase in the ad-valorem tariff rate.

Welfare effects

This section examines the welfare effects of changes in the ad-valorem tariff where welfare consists of consumer surplus, employment, and host government revenue. The welfare function for the host country in this scenario can be obtained

by appropriate substitutions in (10). After some manipulation we have,

$$H=(1/e-1)x_h^{(e-1)/e}+g^h(x_h^{(e-1)/e}pw^hL_h-Tr^cZ_h)+(w^h-w_a)L_h+tr^cZ_h \qquad (19)$$

The change in host country welfare due to a change in the ad-valorem tariff rate on intra-firm trade is attained by partially differentiating (19) with respect to t. It is given by the following equation where the subscript on H represents a partial derivative,

$$H_t=(1/e)x_h^{(-1/e)}dx_h/dt+g^h[x_h^{(-1/e)}(e-1/e)dx_h/dt-w^hdL_h/dt-r^cTdZ_h/dt]$$
$$-g^hr^cZ_h+(w^h-w_a)dL_h/dt+tr^cdZ_h/dt+r^cZ_h \qquad (20)$$

As seen in (20) the overall welfare impact of a change in the level of ad-valorem tariff is uncertain and the optimal tariff is attained when the negative and positive impacts in (20) are exactly balanced. Nonetheless, we can gain a better understanding of the factors which influence host-country welfare by studying the underlying components of change in welfare. This objective can be achieved by decomposing the welfare change into its various components and analyzing them with the help of the comparative-static results we have established.

Consumer surplus

The change in the level of consumer surplus due to a change in the ad-valorem tariff is given by,

$$(1/e)x_h^{(-1/e)}(dx_h/dt) \qquad (I)$$

Clearly, the sign of this effect depends on the sign of dx_h/dt, i.e., the output response to a change in the level of the tariff, which in turn is influence by the changes in the equilibrium input levels in response to a change in the tariff level. Keeping in mind the signs of (17) and (18) and using (3) we have,

$$dx_h/dt=a(L_h^{a-1})(Z_h^{b})dL_h/dt+b(L_h^{a})(Z_h^{b-1})dZ_h/dt<0 \qquad (21)$$

Thus, there is a decline in the level of consumer surplus with an increase in the ad-valorem tariff on intra-firm trade in the intermediate input. The underlying intuition is that the decrease in the final output due to higher tariffs on the inputs leads to lower consumption at higher prices by the consumers in the host country. The consumer surplus effect has a downward impact on the level of the welfare-maximizing tariff. Moreover, the magnitude of this influence is negatively related to the value of e for given levels of x_h. Although it is true that a higher value of e will cause an increase in $x_h^{(-1/e)}$, using the assumption of a constant returns technology it can be shown that the consumer surplus effect

is negatively related to the price elasticity of demand.[1] If we allow x_h to vary with e, then one would expect a fall in $x_h^{(-1/e)}$ if e goes up because under this formulation $x_h^{(-1/e)}$ is the price of the final good. Hence, the optimal ad-valorem tariff on intra-firm trade is inversely related to the price elasticity of demand for the final commodity.

Total revenue effect

The total revenue effect looks at the change in the tax revenues due to a change in the level of the multinational's total revenues in the host country. The reason for isolating this effect from the impact of changes in total cost on total tax revenues is that each of the firm's cost elements also have welfare impacts other than those related to tax revenues. The total revenue effect is,

$$g^h(e-1/e)x_h^{(-1/e)}(dx_h/dt) \qquad \text{(II)}$$

We know that for an interior solution in the case of a monopoly we have e>1 and from (21) we know that $dx_h/dt<0$. Consequently, it is clear that the total revenue effect (TRE) is negative, in that a large value for TRE will be associated with a lower value for the welfare-maximizing tariff assessed on the value of intra-firm trade in the intermediate product. The basic intuition here is that a higher tariff reduces the level of output and given e>1 this implies a reduction in total revenues. This reduction will, **ceteris paribus**, reduce

the multinational's profits in the host country, thereby reducing the tax revenues and the welfare level in the host country. One can see that the magnitude of this effect is directly related to the level of e and g_h. Thus, in an environment with a high price elasticity of demand and a high profit-tax rate this effect increases in importance in terms of the determination of the optimal tariff to be assessed on the value of intra-firm trade in the intermediate input.

Employment effect

A change in the level of employment has a direct impact on the host country welfare due to a change in the total wage bill, and an indirect impact on total welfare due to changes in the tax revenues caused by a change in the total labor costs of the multinational in its host country operations. The total employment effect is given by,

$$[(1-g^h)w^h-w_a](dL_h/dt) \qquad \text{(III)}$$

From (18) we know that $dL_h/dt<0$, i.e., the level of labor employed falls as the ad-valorem tariff on the intermediate input rises. As long as $g^h<1$ it is clear that $(1-g^h)w^h$ is positive. However, the sign of $[(1-g^h)w^h-w_a]$ is indeterminate and the overall welfare impact of the employment effect will in general be ambiguous. After an appropriate manipulation of (III) we can show that the welfare impact of lower employment in response to higher tariffs on the intermediate

input is positive if the host country profit tax rate is greater than the relative wage differential. On the other hand, if the proportionate profit-tax is lower than the relative wage differential then the employment effect is negative. Writing this formally we have,[2]

$$(III) > 0 \text{ as } g^h > (w^h - w_a)/w^h$$

Relation (22) tells us that the welfare-maximizing tariff will be higher when the host country profit tax rate exceeds the relative wage-differential offered by the multinational's subsidiary as compared to situation in which the relative wage-differential exceeds the profit-tax rate.

Thus, the employment effect reveals an interesting interaction between the tax rate and the relative wage-differential in the determination of the tariffs on intra-firm trade. The kind of policy prescription which can be drawn from this analysis is as follows: it is not necessary that a multinational offering a relatively higher wage-differential than another multinational should be given preferential treatment (face lower tariffs).

If this analysis was carried out in the context of an industrialized country where $w^h = w_a$, (III) would be reduced to,

$$-w^h g^h dL_h/dt > 0 \qquad (III')$$

Within this scenario a change in the employment level does not have a direct impact on host-country welfare. However, one still encounters the indirect impact which occurs due to an increase in tax revenues associated with a reduction in the multinational firm's labor costs.

For the sake of theoretical completeness, one must consider the unlikely situation where $w^h<w_a$, i.e., the multinational offers a wage which is lower than the average host-country wage. Within that case the total employment effect can be written as,

$$[(w^h-w_a)-g^hw^h]dL_h/dt>0 \qquad \text{(III'')}$$

Thus, in the event that the multinational is offering a wage which is lower than the average wage in the host country, the total employment effect is unambiguously positive.

Tariff revenue effects

The changes the tariff revenues have a dual impact on the welfare of the host country in that an increase (decrease) in the tariff revenues will always be associated with a decrease (increase) in the total tax revenues of the host country.

First, there is the direct tariff effect (DTE), wherein total tariff revenues change at the given transfer price and volume of trade when there is a marginal change in the tariff rate. This is given by,

$$(1-g^h)r^cZ_h \qquad \text{(IV)}$$

In addition to the direct tariff effect there is also the value of trade effect. As the level of intra-firm trade in the intermediate input responds to a change in the tariff rate, it translates into a change in the tax and tariff revenues of the host country. The total value of trade effect (VOTE) of a tariff change can be given by,

$$[t-g^h(1+t)]r^c(dZ_h/dt) \qquad \text{(V)}$$

As long as g^h is less than one, DTE will always be positive and this effect will be stronger if the transfer price is larger. In this case it implies that the importance of DTE in terms of pushing up the value of the welfare maximizing tariff on the value of intra-firm trade is directly related to the marginal cost of production of the intermediate-product division in the parent country.

Since $dZ^h/dt<0$ (from equation (17)), the sign of VOTE clearly depends on, and is inversely related to, the sign of $[t-g^h(1+t)]$. We are operating in a situation where $(1-GT)<0$, i.e., a low transfer price is desired due to the fact that the host country tariff rate exceeds the relative tax differential between the parent country and the host country. It can be shown that $(1-GT)<0$, i.e. a low transfer price is desired due to the fact that the host country tariff rate exceeds the relative tax differential between the parent country and the

host country. It can be shown that $(1-GT)<0$ is consistent with both $[t-g^h(1+t)]>0$ and $[t-g^h(1+t)]<0$.[3] In other words, even if the host-country tariff rate is larger than the relative tax differential, the tax effects might still dominate the tariff effects on total revenues. If the tariff effects dominate the tax effects on host country revenues then VOTE and DTE counteract each other and the relationship between the optimal ad-valorem tariff and the marginal cost of production in the intermediate commodity division is uncertain. On the other hand, a dominant tax effect implies an increase in host country welfare as the reduction in tariff revenues are outweighed by an increase in the tax revenues when, **ceteris paribus**, there is a reduction in the volume of trade. In the event of this occurrence the host country's optimal tariff would be directly related to the marginal cost of production in the intermediate commodity division in the parent country.

IV. High Desired Transfer Price: $(1-GT)>0$

This section analyzes a situation where the relative tax differential exceeds the host-country tariff rate and the multinational firm maximizes its after-tax global profits by increasing the transfer price as much as possible. The multinational will, of course, not be able to manipulate its transfer price without restraint as this would run counter to the host country's policy objectives. The determination of the transfer price limit is not an easy task and the absence

of an outside market for the intermediate product makes the issue even more nebulous. Section (e) of the U.S. Tax Regulation 1.482-2 states that the transfer price should be defined as:

> ...the price that an unrelated party would have paid under the same circumstances for the property involve in the controlled sale.

The Regulation defines guidelines for acceptable pricing methods and finally states that where all else fails and where facts and circumstances justify, any other pricing method may be used (Benvignati '85). Thus there is no clear cut method for choosing transfer prices and in reality one will encounter many different possibilities. At times one will come across situations in which transfer price limits are generated by legislation primarily motivated by issues other than transfer price regulation. Booth and Jensen (1977) and Copithorne (1971) analyze one such situation, where minimum-profit constraints on the different divisions of a multinational enterprise give rise to upper and lower limits on the transfer price charged on any transactions between the various divisions. In this study we adopt the view that the upper limit of the transfer price is determined indirectly by the existence of local content legislation in the host country. Such legislation can be in the form of an upper limit placed on the allowable proportion of the value of the imported input to the total value of the final sales in the host country. Writing this formally we would have the following,

$$q \geq (r_h Z_h) / (p_h x_h) \qquad (23)$$

where,

q = the upper limit on the ratio of the total value of the intermediate input used in the host country operations to the total value of the final sales in the host country.

As is clear from equation (9), in equilibrium the transfer price will be set at its upper limit. Given that the legislation is effective in the sense that the constraint q is not redundant, relation (23) will be satisfied as an equality. The explicit value of the upper limit can be got by substituting (1) in (23).

$$R_h = q x_h^{(\bullet-1)/\bullet} Z_h^{-1} \qquad (24)$$

Equation (24) shows us that the actual value of the transfer price will be directly influenced by the multinational firm's choice of its endogenous variables. Thus our model of this section belongs to the tradition of "endogenous transfer price" models (Samuelson 1982). Incorporating (24) into equation (9) we can write the multinational firm's maximization problem as follows,

$$\text{Max } M^* = L_f^u Z_f^u Z_f^v - w^f L_f - r^c (Z_f + Z_h) + G(L_h^u Z_h^v - w^h L_h) + (1-GT) q L_h^u Z_h^v \qquad (25)$$

The first-order conditions for profit maximization are,

$$M^*_{Lf}=uL_f^{u-1}Z_f^{v}-w^f=0 \qquad (26)$$

$$M^*_{Zf}=vL_f^{u}Z_f^{v-1}-r^c=0 \qquad (27)$$

$$M^*_{Lh}=G(uL_h^{u-1}Z_h^{v}-w^h)+qu(1-GT)L_h^{u-1}Z_h^{v}=0 \qquad (28)$$

$$M^*_{Zh}=G(vL_h^{u}Z_h^{v-1})-r^c+qv(1-GT)L_h^{u}Z_h^{v-1}=0 \qquad (29)$$

From (28) and (29) we can derive the equilibrium values of L_H and Z_H:

$$L_H = (r^c)^{-b(e-1)}\,(Gw^H)^{(b(e-1)-e)}\,(v)^{(b(e-1)}\,(u)\,(^{(e-b(e-1))} \cdot (q(1-GT)+G)^e$$

$$Z_H = (Gw^H)^{-1(e-1)}\,(r^C)^{(a(e-1)-e)}\,(u)^{a(e-1)}\,(v)^{(e-1(e-1))}\,(q(1-GT)+H)^e$$

The specific assumptions of our model ensure that the second order conditions for profit maximization are satisfied and a simultaneous solution of the first order conditions will give rise to the optimal values of L_f, L_h, Z_f and Z_h. From (26) and (27) one can see that in equilibrium the marginal revenue product of labor and the marginal revenue product of the intermediate product are equal to their respective prices in the multinational's parent country operations. In order to cover the possibility of a low desired transfer price and a

high desired transfer price with a single specification, our analysis has been based on the assumption that $g^h > g^f$, which implies that $G<1$. Combining this with the case being analyzed in this section where $(1-GT)>0$, and after the appropriate substitution in (28), it is clear that in equilibrium the marginal revenue product of labor being used in host country operations is less than the unit price of labor input. As the marginal revenue product of labor is inversely related to the amount of labor being utilized, labor is "overemployed" in this situation. This phenomenon is clearly a result of the transfer pricing motives of the multinational enterprise. Equation (24) shows that for a given level of the local content legislation the maximum allowable transfer price is directly related to the level of labor employed in the host country operations. As the multinational desires a high transfer price it increases the amount of labor up to the point where the marginal benefits of a higher transfer price are equal to the marginal cost of increasing the divergence between the marginal revenue product and the price of labor. Equation (24) also reveals that the upper limit of the transfer price is inversely related to the level of intermediate input being used in the host country operations. In the present case, the tax differential exceeds the tariff rate and the multinational's basic objective is to increase its tariff payments in order to decrease its taxable profits in the host country. While a decrease in Z_h increases the tariff payments by increasing the allowable transfer price,

it also has a downward impact on the total value of tariff payments as the volume of trade goes down. Whether or not the transfer pricing motive results in "underemployment" or "overemployment" depends on which of these two effects is dominant. Equation (28) reveals that for large values of the relative tax differential, which is what one would expect for (1-GT)>0, the marginal revenue product of the intermediate input is higher than the marginal cost of producing the input in the parent country.[4] Even in the absence of the transfer price motive, the very existence of a tariff on intra-firm trade in the intermediate good creates a wedge between the marginal revenue product and the marginal cost of production thus resulting in "underemployment" ad compared to a free trade situation. The main objective of the transfer price motive in this particular scenario is to increase the value of trade as much as possible. Multiplying equation (24) by Z_h yields the maximum allowable value of trade for a given level of the local content legislation. This value rises as Z_h is raised, suggesting that the volume of trade effect dominates the transfer price effect. This implies that the transfer price motive counters the underlying distortion created by the tariff, however, in equilibrium the underlying tariff effect dominates and the intermediate input is "underemployed" in that its marginal revenue product is less than the marginal cost of production of the intermediate commodity division.

The comparative-static response of the system can be examined by totally differentiating the first order conditions and applying Cramer's rule, as laid out in Appendix D. Once again the structure of our model ensures that the equilibrium value of the parent country variables are insensitive to changes in the value of the ad-valorem tariff imposed on intra-firm trade in the intermediate product. The response in the equilibrium values of Z_h and L_h are,

$$dL_h/dt=-Guvq(G+(1-GT)q)[L_h^{2u-1}Z_h^{2v-2}]/D < 0 \qquad (30)$$

$$dZ_h/dt=-Guvq(G+(1-GT)q)[L_h^{2u-2}Z_h^{2v-1}]/D < 0 \qquad (31)$$

Thus, the equilibrium value of labor employed and the equilibrium quantity of the intermediate commodity used in host country operations decline as the ad-valorem tariffs on intra-firm trade in the intermediate product rises.

An increase in the tariff rate decreases the difference between the relative tax differential and the tariff rate. This weakens the transfer pricing motive of the multinational and the marginal benefits of increasing the amount of labor employed are equal to the marginal cost of increasing the divergence between the marginal revenue product and the price of labor at a lower level of employment. Similarly an increase in the tariff rate reduces the marginal gains from an increase in the level of Z_h because the marginal benefits of a higher transfer price are lower due to the decline in the

difference between the tax differential and the tariff rate. Consequently, there is a decline in Z_h and L_h as the ad-valorem tariff on intra-firm trade is increased.

Welfare effects

As in the case of the low desired transfer price we will now analyze the impact of a change in the tariff rate on the level of host country welfare. From the policy point of view this can be looked upon as a situation in which there are across the board profit taxes which are taken as fixed while determining optimal tariff rates for the specific industry in question. Moreover, it is also assumed that the source-country profit-tax rate is exogenous to the host country's decision problem. The welfare function for the host country in the case of a high desired transfer price can be obtained by modifying (10) for this particular case and after the appropriate substitution we have,

$$H=(1/e-1)x_h^{(e-1/e)}+g^h(x_h^{(e-1/e)}-w^hL_h-Tqx_h^{(e-1/e)}) \qquad (32)$$
$$+(w^h-w_a)L_h+tqx_h^{(e-1/e)}$$

The impact of a change in the level of host country welfare due to a change in the ad-valorem tariff on intra-firm trade in the intermediate input can be arrived at by partially differentiating H with respect to t. This can be written as follows with the subscript t on H representing the partial derivative,

$$H_t=(1/e)x_h^{(e-1/e)}(dx_h/dt)+g^h(e-1/e)x_h^{(-1/e)}(dx_h/dt)$$
$$+(1-g_h)(w^h-w_e)dL_h/dt+(1-g^h)qx_h^{(e-1/e)} \qquad (33)$$
$$+[t-g^h(1+t)](q(e-1)/e)x_h/dt)$$

As indicated in the equation above the welfare impact of a change in the ad-valorem tariff is uncertain and the optimal tariff for the high desired transfer price case would be achieved when all the positive and negative elements are in balance with each other. In keeping with our previous analysis we will analyze the different components of the welfare change by isolating the different terms in (33). Comparison of (33) and (20) shows that the consumer surplus, the total revenue and the total employment effect are the same in either of the two transfer price scenarios. The difference in the two cases in terms of the welfare considerations comes about when we consider the tariff effects.

Tariff effects

Once again, we notice that there are two distinct tariff effects, the first one being the impact of a marginal change in the tariff rate on tax and tariff revenues. It can be written as,

$$(1-g^h)qx_h^{(e-1)/e} \qquad (VI)$$

This effect is always going to be positive as long as $g^h<1$.

For the low desired transfer price case we looked at the volume of trade effect as the transfer price was constant. In the low desired transfer price case the transfer price was constant and the entire impact on the total value of trade could be attributed to a change in the volume of trade. On the other hand, in the high desired transfer price case the value of trade changes due to changes in the volume of trade as well as in the transfer price. The value of trade effect (VOTE) for the high transfer price case is,

$$[t-g^h(1+t)][(e-1)/e]^{(-1/e)}(dx_h/dt) \qquad \text{(VII)}$$

As dx_h/dt is always negative, the sign of VOTE depends inversely on the sign of $[t-g^h(1+t)]$. We are in the high desired transfer price situation where $(1-GT)>0$ and it can be shown that this implies that $[t-g^h(1+t)]$ is always negative.[5] The implication therefore is that VOTE is always positive and the impact of these tariff effects on the determination of the optimal tariff rate are stronger as the values of q and e are higher.

Thus, as the "local content legislation" becomes less stringent one would see an increase in the optimal ad-valorem tariff on intra-firm trade in the intermediate input. A higher price elasticity of demand for the final good would imply a higher optimal tariff and would strengthen the positive relationship between the optimal ad-valorem tariff and the price elasticity of demand as implied by the consumer

surplus effect. A negative relationship between the price elasticity of demand for the final good and the optimal tariff would come into play in the unlikely case wherein the total revenue effect dominates the direct tariff effect, the value of trade effect and the consumer surplus effect.

V. Summary and Conclusions

This paper has analyzed the impact on host country welfare of changes in the ad-valorem tariff imposed on the intra-firm trade within vertically integrated multinational which is using transfer prices as a mechanism for minimizing its global tax and tariff payments. The general setting is one in which the multinational is a monopolist in the final goods markets and produces an intermediate good in the parent country which is used by its final commodity divisions in the parent country and the host country. Thus, there is intra-firm trade in the intermediate-good and an ad-valorem tariff is levied by the host country on the trade between the intermediate division in the parent country and the final goods division in the host country. It is also assumed that there is no outside market for the intermediate good. In an effort to concentrate on host country issues we assume constant marginal costs in the production of the intermediate good and internationally segregated markets for the final good. These assumptions completely isolate the two markets and enable us to abstract from any secondary cross effects which might exist between the two markets.

The analysis is separated into two distinct sections, one devoted to the case for a "high desired transfer price" and the second to the case for the low desired transfer price. In the first case the multinational enterprise tries to lower the transfer price as much as possible and is constrained by an anti-dumping law in the host country, which prevents the multinational firm from lowering the price of the intermediate input below its marginal cost of production. In the second case the multinational enterprise tries to charge as high a transfer price as possible and is confronted by local content legislation which imposes an upper limit on the value of intra-firm trade and hence defines a maximum allowable transfer price.

In the low transfer price case the exogeneity of the transfer price implies that the transfer pricing motive of the multinational does not impinge upon the pre-tax profit maximizing objectives of the multinational. Consequently, in equilibrium the marginal revenue product of the intermediate input and labor are equal to their respective prices. On the other hand, with an endogenous transfer price, as in the case of the high desired transfer price, a divergence emerges between the marginal revenue product and the marginal cost of each of the inputs. The equilibrium level of input use declines with an increase in the ad-valorem tariff on the intermediate input. The comparative-static responses are the same across the two different cases.

The welfare analysis consists of decomposing the various elements of host-country welfare and analyzing their response to changes in the level of the ad-valorem tariff on intra-firm trade. It is observed that the consumer surplus effect, the welfare impacts of changes in the level of host country employment, and the welfare impacts of changes in total revenue of the multinational in its host country operations are the same in the low transfer price case and the high transfer price case. While the consumer surplus and the revenue effect suggest that a decrease in the tariff rate would increase host country welfare, the welfare influence of the employment effect is ambiguous and depends on the relative values of the wage-differential and the host-country tax rate. The influence of a marginal increase in the tariff rate is an increase in total revenues at the given transfer price and volume of trade. This effect has a positive influence on welfare and is qualitatively the same in the two cases. Whereas in the low transfer price case this impact is greater when the marginal cost of production of the intermediate division is higher, in the case of the high transfer price it was seen that this impact is stronger when the local content legislation is weaker. The value of trade effect unambiguously implies that an increase in the value of the tariff would raise host-country welfare under the high transfer price scenario. However, the welfare impact of the value of trade effect is ambiguous in the low transfer price scenario.

In each scenario the welfare maximizing tariff on the intermediate product is expected to be directly related to the price elasticity of demand for the final good. The low transfer price case reveals that the relationship between the marginal cost of production of the intermediate good and the optimal ad-valorem tariff on the intermediate good is ambiguous and is influenced by the direction of the value of trade effect. In the high transfer price case the optimal ad-valorem tariff depends inversely on the strictness of the local content legislation. Hence, in the event that the multinational firm desires to charge with a high transfer price, the use of local content legislation and ad-valorem tariffs would run counter to each other in their effect on the welfare of the host country.

ENDNOTES

1. There would also be second order effects of changes in the exogenous variables however, our conclusions would still be valid as long as the direct effects dominate the second order changes.

2. The sign of the employment effect depends inversely on the sign of $[1-g^h)w^h-w_a]$. Therefore, we have,

   $(III) > 0$ as $[(1-g^h)w^h-w_a] < 0$ (E.1)

   After some manipulation we can see that,

   $[(1-g^h)w^h-w_a]<0$ as $(g^h-w_a)/w^h$ (E.2)

   From (E.1) and (E.2) we have,

   $(III) > 0$ as $g^h > (w^h-w_a)/w^h$ (E.3)

3. For the analysis of this section $(1-GT)<0$ and incorporating the definitions of G ant T this implies

   $t>(g^h-g^f)/(1-g^h)$ (E.4)

   On further simplifications we obtain

   $t(1-g^h)>g^h-g^f$ (E.5)

   From E.5 it is clear that $(1-GT)<0$ is consistent with both $t(1-g^h)>g^h$ and $t(1-g^h)<g^h$

   Since,

   $[t-g^h(1+t)] = [t(1-g^h)-g^h]$,

   it is clear that $(1-GT)<0$ is consistent with both

   $[t-g^h(1+t)]>0$ and $[t-g^h(1+t)]<0$

4. Collecting the terms in the first order condition for Z_h we have:

   $vL_h^u Z_h^{v-1}[G+(1-GT)q]=r^c$ (E.6)

   Our formulation assumes that $g^h>g^f$ and this implies that $G<1$ and that G gets smaller as the tax differential between the two countries increases. In the limit, as G gets close to zero, the expression above simplifies to,

   $(vL_h^u Z_h^{v-1})q=r^c$ (E.7)

Since q is less than one by definition, we have,

$$vL_h^u Z_h^{v-1} > r^c \qquad \text{(E.8)}$$

5. Similar to endpoint 3 we can show that,

(1-GT)>0 implies

$$t(1-g^h) < g^h - g^f \qquad \text{(E.9)}$$

For any positive level of g^f this means that

$$t(1-g^h) < g^h \qquad \text{(E.10)}$$

Hence, it is clear that (1-GT)>0 always implies

$$[t-g^h(1+t)] < 0$$

CHAPTER IV

MULTINATIONAL FIRMS AND MARKET DISRUPTION

I. Introduction

The term "market disruption" is used to describe a situation in which an "unacceptable" level of imports leads to the advent of protectionism and the consequent disruption of free trade. Bhagwati and Srinivasan (1976) analyzed a situation in which an exporting country faces the threat of future protection from the importing country, and is able to endogenize the probability of protection via its choice of export levels in the current period. This analysis captures a central tenet of policy formulation in a democratic society: given all the "relevant" economic recommendations, the final act of implementation is often governed by influences lying outside the conventional "economic sphere", such as political lobbies and pressure groups. Hence, the issue of probability rather than certainty, or randomness rather than predictability, come into play when one considers policy decisions within an international trade environment.

The allusion here is to the important role played by political economy considerations in trade policy. One cannot underplay the importance of lobbying, not only as an influence on policy, but as a determinant of the form of protectionist policy (Cassing and Hillman 1985). The basic issues of the political economy of protectionism are contained in a

comprehensive survey by Baldwin (1982). Other important theoretical contributions in the area of trade policy and political economy are Bhagwati and Feenstra (1982). The basic idea of market disruption was rekindled recently in papers by Bhagwati, Brecher, Dinopoulos and Srinivasan (1987) and Dinopoulos (1987). These papers look at the influence of a potential threat of protection, on the trade and production location decisions under alternative market settings. They mark a departure from the original work on market disruption in that they include the influence of foreign direct investment on the probability of future protection. Our analysis is similar in nature to these two studies in that an underlying lobbying mechanism, which influences protectionist policy, is assumed to be in place. However, for the purpose of our analysis an explicit model of lobbying behavior is not mandatory. For an explicit model of lobbying decisions within a duopolistic market setting see Das (1986).

Two central features of a potential protectionist threat are (a) the perceived magnitude of protection if it is invoked and (b) the existence of an element of exogeneity in the probability of protection, which exists over and above the influence of the firm's decisions. This exogeneity can be seen in terms of an anti-import lobby lying outside the realm of the firm's influence, or alternatively as an inherent pro-import or anti-import bias within policy circles. An exogenous change in the probability can be captured as a change in the perceived threshold level of import penetration

beyond which the expected tariff becomes a certainty. The threshold level can be seen as an index of the importing country's sensitivity to anti-trade sentiments. A lower threshold level in general would imply a higher probability of protection given nothing else changes. The main thrust of this paper is to examine the impacts of changes in the expected rate of protection and the threshold level on the production location and intra-firm trade decisions of a multinational enterprise in a monopoly setting.

In section II we look at a model of a horizontally integrated multinational operating as a monopoly in the host country and analyze its comparative-static responses. The probability of future protection is taken to be a positive function of the proportion of intra-firm trade to total host country sales of the multinational. The total host country sales comprise of intra-firm trade and production by the multinational's subsidiary in the host country. In the third section we analyze the importance of the multinational's perception as regards the functional form of the probability of tariff imposition. In the fourth section the scale of the multinational's operations are incorporated as a determinant of the probability of protection, and the results are compared to those in section three. The analysis is summarized and concluded in section five.

II. The Model

Consider a horizontally integrated multinational firm which has production operations in the host country and the source (parent) country. Furthermore, assume that there is intra-firm trade in the final good, wherein the parent firm sells to the subsidiary operating in the host country. The total sales of the subsidiary are a sum of its domestic production and the level of intra-firm trade. While the firm does not encounter any form of explicit protection in the current period, it encounters the threat of a tariff in the future. Moreover, the probability of a future tariff is seen to increase as the proportion of imports to total host country sales approaches a perceived "threshold" level, beyond which the imposition of a tariff becomes a certainty. This randomness as regards the threat of future protection is justifiable in terms of an anti-import lobby. A plausible scenario is one in which there is a labor union which has obvious interests in lobbying against imports which can be substituted by domestic production. As stated earlier in this paper I do not model the lobbying mechanism but assume that its effectiveness in terms of generating anti-import sentiments is greater when the proportion of intra-firm trade to total sales in the host country is larger.

Another feature of our analysis is that the multinational's current period decisions do not constrain the future values of its endogenous variables. Hence, in the event that the firm encounters a tariff it can re-optimize its

decision variables without facing any internal constraints. In other words we are looking at a situation in which there are no adjustment costs.

Stating the problem formally, the multinational enterprise operates as a monopolist in both countries and maximizes its global profits by choosing the level of sales in the parent country, the level of sales in the host country and the level of intra-firm trade. Hence, in this formulation the output levels are determined residually. The problem would be identical if we modelled the firm as choosing the output levels instead of sales levels. To keep the analysis tractable we assume a linear demand structure and the inverse demand curves are given by,

$$p^f = a^f - b^f x^f;\ a^f > 0,\ b^f > 0 \qquad (1)$$

$$p^h = a^h - b^h x^h;\ a^h > 0,\ b^h > 0 \qquad (2)$$

where,

p^f = the price of the final good in the source (foreign) country

p^h = the price of the final good in the host (home) country

x^f = total level of sales in the source country

x^h = total level of sales in the host country

We assume that the subsidiary has linearly increasing marginal costs of production whereas the marginal costs of

production are assumed to be constant in the source country. This is an analytical simplification which enables us to isolate the two markets. The total cost curves are given by,

$$TC^f = C^f(x^f+m); \quad C^f > 0 \tag{3}$$

$$TC^h = c^h(x^h-m)^2/2; \; c^h > 0 \tag{4}$$

where,

TC^f = total cost of production in the source country

TC^h = total cost of production in the host country

m = the level of intra-firm trade

C^f = marginal cost of production in the source country

c^h = slope of the marginal cost of production in the host country

The multinational encounters some protectionist sentiments whose efficacy in invoking a tariff on intra-firm trade increase as the import component of total domestic sales becomes larger. The expected level of protection is given by t.[1] Beyond a perceived threshold level of the import to sales ratio, protection is no longer a threat but a certainty. One could extend the analysis to include a situation where the host government actually imposes an upper limit g on the proportion of imports to total sales in the host country. However, in order to keep the analysis tractable and to sharpen the focus on the problem of a protectionist threat we

assume that the threshold level is the same as the upper limit given by g. If one took the threshold level to be greater than g then one would never reach the "perceived" threshold level, however, the positive relationship between the probability of protection and the import component of total sales would still be valid and the analysis would not be qualitatively different. On the other hand, if the threshold level were below g then some interesting possibilities do arise, but these are outside the realm of this paper.[2] In this paper we restrict ourselves to a situation in which the MNE faces a perceived upper limit of g on the import component of total host-country sales and faces the threat of a tariff t, whose probability is related positively to the import composition of total host country sales. In the present study we do not delve into the issues behind the determination of the precise values of g and t but do look at the impacts of varying these levels on the decisions of the firm.

The probability of protection can be described formally by the following representation where G is the probability of tariff imposition in the future.

$$G = G(d); \text{ where } d = g - m/x^h,$$

$$0 < G < 1 \text{ for } d > 0$$

$$G = 1 \text{ for } d < 0$$

(5)

$G' < 0$ for $d > 0$

$G' = 0$ for $d < 0$

$$G_x^h = G'm/(x^h)^2 < 0$$

$$G_m = -G'/x^h > 0$$

$G' < 0$ indicates that an increase in m or a decrease in x^h results in a higher probability of protection. As regards the slope of the probability function we assume that $G'' = 0$.[3] The implication of the linear probability of imposition is that the rate at which the probability increases with an increase in m/x^h does not change with the value of m/x^h. One might argue that as the value of m/x^h gets closer to g, the probability response to a marginal change in m/x^h becomes larger and then one would observe that $G'' > 0$.

Given the probabilistic nature of protection, the future periods might or might not be characterized by a tariff. In either event the expected value of future profits, appropriately discounted, can be calculated. In the event that the tariff is imposed, the multinational reoptimizes its decision variables. The reduced form of the losses it suffers from being in the protectionist regime are given by L. It must be kept in mind that L is a measure of the reduced profits the multinational encounters if it operates in a tariff-ridden environment as compared to a free-trade situation. To highlight the details of L one would need an explicit multi-period model, however, the reduced form suffices for the purposes of our analysis.[4] One must

reiterate here that L does not depend on the values of the endogenous variables in the first period and is seen purely as a function of the expected tariff rate t. Furthermore, one can assert that the expected losses will be greater if, **ceteris paribus**, the expected rate of protection was higher. Therefore the equilibrium configuration is influenced by the value of L, for a given expected tariff, but does not depend on the curvature of the L function.[5]

The losses in the event of a future tariff t on intra-firm trade are given by,

$$L=L(t);\ L'>0 \tag{6}$$

The multinational firm is assumed to maximize global profits and the maximization problem can be written as,

$$\text{Max } M = p^h(x^h)x^h+p^f(x^f)x^f-C^f(x^f+m)-c^h(x^h-m)^2/2-G(g-m/x^h)L(t) \tag{7}$$

Accounting for the linearity assumptions of our formulation the first order conditions of the maximization problem are,

$$M_x^h = a^h-2b^hx^h-c^h(x^h-m)-mG'L/(x^h)^2=0 \tag{8}$$

$$M_x^f = a^f-2b^fx^f-C^f=0 \tag{9}$$

$$M_m = c^h(x^h-m)-C^f+G'L/x^h=0 \tag{10}$$

The linear demand and the quadratic cost structure ensure that the second order conditions for profit maximization are satisfied and a simultaneous solution of the first order conditions would yield the equilibrium values of m^*, x^{h*} and, x^{f*}. It should be noted here that if the optimal values of m and x^h are such that $m^*/x^{h*}>g$, then (7) would be modified to incorporate the fact that G=1. Then the problem would be one of maximizing expected discounted profits where tariffs are a certainty. In the event that $m^*/x^{h*}<g$ then the probabilistic element of the problem is highlighted and present specification is the relevant one.

The impact of the uncertainty as regards tariff imposition and the fact that the probability of a tariff is endogenous to the firm's decisions, is clearly brought out in the first-order conditions. Rewriting (8) one can get,

$$a^h - 2b^h x^h = c^h(x^h - m) + G'Lm/(x^h)^2 \qquad (8')$$

Given that G'<0 (from 5), it is quite clear that in equilibrium,

$$a^h - 2b^h x^h < c^h(x^h - m) \qquad (11)$$

Equation (11) tells us that in equilibrium the marginal revenue of x^h is smaller than the marginal cost of x^h. This wedge between the marginal revenue and the marginal cost comes about because the multinational "oversells" in the host

country in an attempt to reduce the expected losses through a decrease in the probability of imposition. The multinational is able to do so by increasing sales through increased production in its host country facilities. If the multinational was supplying the host country market solely through imports then one would not encounter this divergence.

Rewriting equation (10) one can get,

$$c^h(x^h-m)-C^f=-G'L/x^h \qquad (10')$$

Given that $G' < 0$ (from 5), in equilibrium we have

$$c^h(x^h-m) > C^f \qquad (12)$$

It is quite clear from (12) that in equilibrium the marginal cost of production in the parent firm is lower than the marginal cost of production in the host country and we get this result despite the fact that we do not assume any kind of transportation cost or an explicit tariff cost in the current period. The difference between the two marginal costs is given by $-G'L/x^h$, which is the marginal change in expected losses due to a change in the level of intra-firm trade.

Comparative statics

In this section we will look at the influence of changing the expected level of protection t, and the upper limit of the import component of total host country sales given by g, on

the endogenous variables of the multinational firm. The comparative static effects can be derived by totally differentiating the system of first order conditions with respect to x^h, x^f, m, g and t and by applying Cramer's rule. The assumption of constant marginal cost in the parent country ensures that the equilibrium value of x^{f*} is not disturbed by changes in g and t. This enables us to concentrate on the changes in x^{h*} and m^*, and after some manipulation we get,

$$dx^{h*}/dt = \{2b^f c^h G'L'(m/x^h-1)/x^h + (2b^f LG'L'G'/x(^h)^3)\}/D < 0 \quad (13)$$

$$dm^*/dt = 2b^f\{c^h G'L'(m/x^h-1)/x^h+LG'L'G'm/(x^h)^4-2b^h L'G'/x^h\}/D<0 \quad (14)$$

where D<0 by profit maximization, G'<0 from (5) and L'>0 from (6).

Thus, with a rise in the expected tariff rate there is a decline in the equilibrium level of intra-firm trade and a decline in the total level of host country sales. At a cursory level, relation (13) would seem counterintuitive because a rise in the expected rate of protection would increase the level of expected losses at the given level of host country sales and one would expect the firm to counter this rise in expected losses by increasing its level of host country sales. While this effect does exist, it is overshadowed by the indirect impacts of a downward movement in m. Moreover, one must also account for the fact that there

is a disincentive to increasing x^h as that would increase the divergence between the marginal revenue and the marginal cost of production in the host country. The exact intuition behind (13) and (14) can be grasped by taking a close look at the first order conditions and going through the direct and indirect impacts of a change in t on the equilibrium conditions. The first-order conditions are essentially marginal profitability conditions and in equilibrium the marginal profitability of each of the endogenous variables is equal to zero.

Direct effects

Looking at (8) we can see that a rise in t raises L and this increases the value of the last term, $L-G'Lm/(x^h)^2$ is positive, a larger L makes the marginal profitability of x^h positive. This induces the multinational to raise x^h till the marginal profitability of x^h goes back to zero. Thus, the initial impact of a higher t on the level of host country sales is positive. From relation (10) it is clear that a higher value of t makes $G'L/x^h$ larger. G'L represents the marginal change in expected losses due to a change in the level of intra-firm trade. As this term is negative, a higher t makes the marginal profitability of intra-firm trade negative and the multinational is induced to lower the equilibrium value of intra-firm trade.

Indirect effects

Looking at (10) it is clear that a higher value of x^h makes the marginal profitability of m positive and induces an upward movement in the level of intra-firm trade m. At the same time relation (8) reveals that a lower value of m, as implied by the direct effect, reduces the marginal profitability of x^h and induces a downward movement in the level of sales in the host country.

It is evident from this analysis that the direct and indirect impacts of a change in the expected rate of protection run counter to each other and the final comparative-static effect depends on the relative strength of the two effects. Looking at the first-order conditions it is clear that a change in x^h in (8) is multiplied by $2b^h$ and c^h, while a change in m in (10) is multiplied only by c^h. The first-order conditions also reveal that the impact of a marginal change in L, due to a change in t, is greater on the marginal change in L, due to a change in t, is greater on the marginal profitability of m. This is evident from the fact that in (10) L is multiplied by G'/x^h and in (8) L is multiplied by $G'm/(x^h)^2$ and as m/x^h is less than one, by definition, the direct impact of a change in t is relatively stronger on m. This implies that the changes required in x^h in order to counter the direct impacts of a change in the expected rate of protection t are smaller in magnitude as compared to the required response of m in order to ensure that the marginal profitability of m goes back to zero.

Furthermore, a fall in m reduces the marginal profitability of x^h, inducing a decline in x^h, while a rise in x^h increases the marginal profitability of m, inducing a rise in the level of intra-firm trade. The magnitude of the direct effects, reveal that the cross effect of m on x^h will be larger than the cross effect of x^h on m. Consequently, one sees that in the final outcome both the level of host-country sales and the level of intra-firm trade will decrease in response to an increase in the level of expected tariffs.

Changes in the "threshold" level

From the system of first-order conditions one can see that the firm's decisions are distorted not only by the potential losses due to expected tariffs, but by the existence of the threshold level g. Whereas the former can be looked upon as "explicit expected protection", the latter is essentially a form "implicit protection". Consequently, the host country government has the choice of two policy options and it would be interesting to compare results of exercising the different options.

However, the interpretation of the threshold level as a policy option is a subtle one. Unlike the expected tariff which can conceivably be pre-specified, the threshold level would be more of a reflection of the existing (pro-import) anti-import sentiments and lie in the realm of "reputation".

The comparative statics of the system can be derived by totally differentiating the system of first-order conditions and applying Cramer's rule.

$$dx^h/dg=2b^f\{c^hLG''(m/x^h-1)/(x^h)^2 + L^2G'G''/(x^h)^3\}/\}D>0 \qquad (15)$$

$$dm/dg = 2b^f\{c^hLG''(m/x^h-1)/x^h+L^2G'G''m/(x^h)^4 - 2b^hLG''/x^h\}/D > 0 \qquad (16)$$

where $D<0$ by profit maximization and we assume that $G''> 0$. A rise in the value of g means that the threshold level of the imports to total sales ratio beyond which the future threat of explicit protection becomes a certainty is higher. This implies that for any given level of intra-firm trade and total host country sales the total expected losses are lower. Thus, a larger g implies lower implicit protection and a smaller g implies higher implicit protection. Relations (17) and (18) tell us that as implicit protection rises (the value of g falls) the level of intra-firm trade declines and the total level of sales in the host country is lowered in order to restore equilibrium.

The underlying analysis for this case parallels the analysis in the earlier section where we looked at changes in the expected tariff level. A lower g (higher implicit protection) implies that the probability of tariff imposition increases for any given level of m and x^h. Thus, a lower g makes the marginal profitability of x^h positive and the

marginal profitability of intra-firm trade becomes negative. This induces an initial upward movement in x^h and a decline in the level of m. Upon working through the direct and indirect effects of a change in g on the system, it appears that in the final outcome a decrease in the threshold level leads to a decline in the levels of intra-firm trade and total sales by the multinational's subsidiary in the host country.

As noted earlier, our analysis is based on the assumption that the probability of tariff imposition is represented by a convex function, i.e., $G'' > 0$. This assumption implies that the marginal probability of tariff imposition increases with the degree of import penetration. Relations (15) and (16) are crucially dependent on this assumption, and are completely reversed if we assume $G'' < 0$. Therefore, if the firms perceive that the marginal probability of tariff imposition decreases with the level of import penetration, then an increase in the level of implicit protection will cause an increase in the level of host-country sales and intra-firm trade.[6]

Subsidiary production

We have noticed that in their final outcome the comparative-static response of host country sales and intra-firm trade due to changes in the expected tariff rate, are qualitatively similar to the standard results one encounters in the context of actual current-period tariff distortions and the associated comparative static responses. It would be

interesting to evaluate if a similar symmetry exists in the case of host-country production. In our formulation subsidiary production is defined as the difference between total host-country sales, and the level of intra-firm trade, i.e., x^h-m. Therefore, the comparative-static response of host-country production due to a change in the expected tariff rate can be determined from equations (13) and (14):

$$dx^h/dt-dm/dt = \{(L'G'/x^h)[(LG'(1-m/x^h)/(x^h)^2+2b^h]\}/D \qquad (17)$$

The traditional result as regards foreign direct investment falls in the realm of "tariff jumping", wherein an increase in the level of the trade distortion induces the multinational to increase production in the host country and thereby jump the tariff.

On the other hand, it is clear from relation (17) that the response of subsidiary production to changes in the expected tariff are uncertain. In order to analyze this uncertainty we must keep in mind that in our formulation the multinational chooses the optimal level of sales and intra-firm trade, and the production levels are determined residually. As one would expect, the analysis is qualitatively identical and the same uncertainty exists if we model the multinational as directly choosing production levels. In the present context the change in host country production is best analyzed by identifying the various changes in x^h and m due to a change in the expected tariff level. The

comparative static effects can basically be split up into the "strategic effects" and the "efficiency effects". An increase in the expected tariff has the following responses: A higher expected tariff has the strategic impact of increasing the level of sales in the host country and causing a strategic decline in the level of intra-firm trade. As the first-order conditions indicate the initial changes in x^h and m have cross effects on each other and the efficiency response in order to restore zero marginal profitability is a decline in the sales level and a rise in the level of intra-firm trade. The comparative static analysis reveals that in the case of intra-firm trade the strategic effect dominates and the final impact is a decline in m. On the other hand, in the case of total host-country sales the efficiency effect must be the dominant influence as the final impact is a decline in x^h.

In the event of a rise in host country output in response to higher expected tariffs, it must be true that the downward impact in m is larger than the downward impact in the x^h when t rises. The comparative static analysis reveals that the dominant effect is the strategic effect on m, and this would in all likelihood ensure a rise in the level of host-country production in response to a higher expected tariff. However, it is evident that in general, and as indicated by relation (17), the level of host-country production might go up or down in response to a higher expected tariff. This marks a departure in terms of symmetry with the traditional analysis of tariff jumping, wherein the level of foreign direct

investment always rises if the tariff on current period trade goes up.

III. The Role of Perceptions

This section compares the impacts of a change in t and g on the endogenous variables of the multinational firm. The comparative static analysis reveals that in qualitative terms the influence of a change in the expected tariff level is symmetric to changes in the perceived threshold level. It was noted that a higher t (higher expected protection) decreases the equilibrium values of x^h and m, and lower values of g (higher implicit protection) also results in lower values of intra-firm trade and host-country sales.

In terms of their magnitudinal influence changes in g and t need not be identical and will indeed depend on the values of t and g themselves. The model reveals that t and g influence the system through the functions L and G respectively. Hence, the magnitudinal impacts of changes in t and g are linked to the specific structure of the loss function L and the probability of imposition function G which one chooses to incorporate. For the purpose of our analysis we have used a general functional form for G and a reduced form for the loss function L. Thus, it would seem that we would be unable to make a quantitative comparison, however, even at the level of generalized functions a statement can be made about the relative magnitude of the two effects.

Upon looking at the absolute difference between the comparative-static effects of g and t on x^h and m it is clear that changes in t will dominate the influence of changes in g if the following condition is satisfied.

$$L'G' + LG'' < 0 \qquad (17')$$

Under the general assumptions of $L' > 0$, $G' < 0$ the sign of relation (17') will be ambiguous and one can not make a general statement about the magnitudinal dominance of one effect over the other. If we assume that $G''=0$, then the values of (13) and (14) are exactly the same as in our analysis. In the event that $G''=0$ for the entire analysis, relation (17') will be satisfied and a change in the expected tariff level will always dominate the impact of changes in the perceived threshold level denoted by g. In a pure mathematical sense this assertion is almost trivial as under the assumption of a linear probability of imposition the comparative static analysis reveals that $dx^h/dg = dm/dg=0$. However, the intuition behind this is still interesting and can be deciphered from the first-order conditions. The equilibrium conditions (8) and (10) show that the equilibrium values depend on G'. $G''=0$ implies that the value of G' is constant, i.e., the **marginal change** in the probability of imposition G due to a change in its argument $g-m/x^h$ is constant and does not depend on the values of g, m or x^h. Thus, a change in g does not influence the marginal change in

expected losses due to change in m or x^h. In fact, it is clear that the equilibrium conditions are not at all disturbed by changes in g. On the other hand, a change in t has an impact on the **marginal changes** in the expected losses due to a change in m and x^h. A change in t changes the value of L and this in turn has a clear impact on the equilibrium conditions (8) and (10), thus invoking a non-zero comparative-static response in the level of intra-firm trade and host-country sales by the multinational enterprise.

This analysis enables us to highlight a counter-intuitive element of the scenario wherein the multinational **perceives** the probability of imposition function to be linear: although a rise in t and a fall in g both imply an increase in the expected losses at any given level of m and x^h, only in the event of a change in the expected tariff rate t does one see a response in the equilibrium values of intra-firm trade m and host country sales x^h. This result is a direct consequence of a basic postulate of neo-classical economics wherein economic agents are seen to optimize through equation of marginal changes, and are not directly concerned with values of the variables themselves.

IV. Market visibility as a strategic variable

The analysis thus far has taken the probability of future protection to depend purely on the level of import penetration, i.e., the ratio of intra-firm trade to the total sales of the multinational subsidiary in the host country.

The obvious omission in this formulation is the scale of the multinational's operations. In particular, if we look at two situations where the ratio of intra-firm trade to total sales is the same, but the level of imports is twice as large in the second case. Then it would seem plausible to assert that the multinational is more vulnerable to protectionist pressure in the second case. The basic notion is one of visibility within an environment and the strategic impacts of such visibility. It would seem worthwhile to see what the equilibrium response to a change in the expected tariff would be in this setting. In formal terms the probability of imposition function (5) can be modified as follows:

$$G = G(g-m/x^h,\ m^*-m);G_1 < 0 \text{ and } G_2 < 0 \qquad (5')$$

The subscripts represent the partial derivatives of the probability of imposition function and these indicate that the probability of imposition depends directly on the level of import penetration and the absolute level of intra-firm trade. As before g is the perceived threshold level of import penetration beyond which future protection becomes a certainty. m^* is similarly defined as a threshold level of total imports beyond which future protection is no longer uncertain. One would expect that the value of m^* would be larger in a relatively larger economy. Thus while g is purely a political-economy parameter in the sense that it reflects the anti(pro)-import attitude in the host country, m^* has pure

economic content to it in that it reflects the visibility of the multinational's operations and increases with the level of economic activity in an economy. In an explicit specification m^* would not only depend on the size of the host economy but, quite naturally, also on the proportion of trade in the country's national income.

As we observed earlier the constancy of the marginal cost of production enables us to isolate the two markets and in the ensuing analysis we will deal only with the first-order conditions associated with x^h and m. Upon incorporating (5') in the original profit function (7) and taking the partial derivatives with respect to x^h and m we get the following first-order conditions.,

$$M_x^h = a^h - 2b^h x^h - c^h(x^h - m) - mLG_1/(x^h)^2 = 0 \qquad (18)$$

$$M_m = c^h(x^h - m) - c^f + L(G_1/x^h + G_2) = 0 \qquad (19)$$

On comparing (18) and (19) with (8) and (10) we can see that the same strategic factors come into play in the equilibrium condition for x^h. However, the equilibrium condition form incorporates the additional strategic element which comes into play due to the scale effect. The comparative-static effects can be calculated by totally differentiating the first-order conditions and applying Cramer's rule,

$$dx^h/dt = \{(c^h L' G_1/x^h)(1 - m/x^h) - (LL' G_1 G_2/(x^h)^2)$$

$$+c^hG_2L'-LL'(G_1)^2\}/D < 0 \qquad (20)$$

$$dm/dt = \{(c^hL'G_1/x^h)(1-m/x^h)-(LL'G_1G_{2m}/(x^h)^3$$
$$-LL'(G_1)^2/(x^h)^4 + c^hG_2L'+2b^hL'(G_1/x^h+G_2)\}/D < 0 \qquad (21)$$

Equations (20) and (21) show us that the level of host-country sales and the level of intra-firm trade decline in response to an increase in the level of the expected tariff. Thus, in qualitative terms the inclusion of the scale factor does not alter the results of the previous section. This is not surprising as in specific terms the addition here is a strategic effect on m which reinforces the already dominant strategic effect of m.

Host-country production

In keeping with the previous analysis we can arrive at the comparative static response of the production level in the host country by using equations (20) and (21),

$$dx^h/dt-dm/dt = \{mLL'G_1G_2/(x^h)^3$$
$$-L'(G_1/x^h+G_2)(2b^h+(LG_1/(x^h)^2(1-m/x^h))\}/D \qquad (22)$$

As in the earlier case it is clear that in general and as indicated by (22) the response of host country production to a change in the level of the expected tariff is uncertain. For the level of foreign direct investment to increase in response to a higher level of expected tariff the decline in m must outweigh the decline in x^h. It is quite clear that

the probability of this occurrence is even larger when we incorporate the scale effect as the same results in an additional strategic decline in the level of intra-firm trade in the event of an increase in the expected tariff.

V. Summary and Conclusions

This study analyzed two central issues associated with the threat of potential protectionism. First, we looked at the impact of changes in the level of the tariff which the firms might potentially face in the future. This is refereed to in the paper as expected "explicit protection". Second, we looked at the impacts of changes in the perceived threshold level of the imports to total host-country sales ratio beyond which future protection becomes a certainty. This threshold level is looked upon as a form of "implicit protection" and reflects the underlying attitude of the host country towards the multinationals importing decisions.

We began with a model of a horizontally integrated multinational and analyzed the impacts of changing the expected explicit rate of protection and the implicit rate of protection on the level of total host-country sales and intra-firm trade. It is posited that the probability of tariff imposition increases, for a given level of implicit protection, as the actual proportion of imports to total domestic sales rises. As the multinational faces potential losses from future protection a strategic element comes into play when the firm makes its optimal decisions. It is seen

that in equilibrium the multinational tends to "oversell" in the host country in an attempt to reduce the probability of tariff imposition. Thus, in equilibrium one sees a divergence between the marginal cost of production and the marginal revenue from sales for the multinational firm. The optimal sales levels are characterized by the equalization of the marginal benefits from influencing the probability of protection and the marginal costs of increasing the divergence. This factor plays an important part in influencing some of the comparative static responses.

The analysis reveals that all the results vis a vis expected explicit protection are valid even if the tariff is never really invoked.[7] We observed that a higher expected tariff results in a decline in the level of host-country sales in the present period and in a downward movement in the current-period intra-firm trade. Hence, the comparative-static responses of sales and trade are exactly like they would be if we were dealing with actual current-period distortions. However, the symmetry is not carried over to the response of foreign direct investment, as host country production is in general seen to respond in an uncertain manner to changes the level of expected protection. This is a reflection of the interplay between the **strategic** and the **efficiency** elements in the comparative-static response of the level of sales and intra-firm trade to changes in the exogenous variables. It should be noted that although the text of this paper does not look at the response of foreign

direct investment to changes in implicit protection, it is seen to be identical to the response to a change in t as long as we do not assume a linear probability of imposition. A rise in implicit protection, characterized by a lower threshold level g, also results in a decline in the total sales of the multinational in the host country and a reduction in the level of intra-firm trade. It was also noted that the inclusion of the scale of the multinational's operations as a determinant of the probability of protection does not change any of the results. However, it does increase the likelihood of tariff jumping in the face of higher expected tariffs. An important lesson here from the point of view of lobbying interests is that an employment lobby aiming at higher domestic employment, through increased domestic production by the multinational in response to increased tariffs on intra-firm trade, might not evoke the desired response even if it is able to generate greater anti-import sentiments.

Finally, this analysis also highlights the fact that the symmetry between the impacts of changes in "implicit protection" and "expected explicit protection" hinges critically on the firm's perception as regards the nature of the host government's marginal response to changes in the level of import penetration. When the probability of tariff imposition is perceived to be non-linear then changes in the expected tariff and the threshold level of import penetration have an identical impact on the multinational's endogenous variables. On the other hand, if the probability of

imposition function is linear then the multinational's decisions do not change when the threshold level of import penetration changes. Under the linear specification the marginal expected losses change only if the level of expected tariff changes.

ENDNOTES

1. An alternative specification could be one in which the expected tariff level is itself a variable wherein it is influenced by the firms sales and trade decisions. The implications of this feature are examined in a somewhat different context by Bhagwati and Srinivasan (1976).

2. In the event that the threshold level, beyond which the tariff becomes a certainty, is lower than the upper limit of the import to total sales ratio, the cost (benefit) function of a change in the level of imports would have a kink at the threshold level.

3. One could also use specific forms for the probability of imposition. However, there is no simple way of introducing a specific linear form and introducing a specific non-linear form does not give us more mileage in terms of intuition or tractability.

4. Ethier and Fischer (1987) use a similar formulation in the context of future anti-dumping possibilities in an international oligopoly model.

5. In a model with an explicit specification for the loss function the slope of L would reflect the firm's attitude towards risk, and would influence the equilibrium configuration of the endogenous variables.

6. Kant (1988), in his paper on transfer price manipulation used a similar specification where the probability of penalty was represented by a convex function. Although there is not a **priori** reason as to why the probability function should be convex rather than concave, the former specification seems more plausible in terms of the implied perceptions of the multinational firm.

7. In an explicit multi-period model there could be an additional wrinkle to the analysis in terms of credibility problem the host government might face if it never actually invokes the tariff.

CHAPTER V

SUMMARY AND CONCLUSIONS

This dissertation deals with two issues: (a) host country commercial policy in the presence of transfer pricing (first two essays) and (b) the phenomenon of market disruption and its impact on the decisions of multinational firms (third essay). These are summarized respectively in the next two sections.

I. Commercial Policy and Transfer Pricing

In keeping with the theoretical antecedents of this thesis, the analysis is developed along two distinct lines: First, we look at a model of a horizontally integrated multinational which engages in the transfer pricing of a final good. Secondly, we develop a model of a vertically integrated multinational, which sets a transfer price on an intermediate good being exported from the source country to the host country.

In the horizontal-integration model, we work with a structure where the parent firm, located in the source country, produces the final good for the purposes of domestic sales and export to its subsidiary in the host country. The final goods sales of the host-country subsidiary consist of intra-firm imports from its parent and domestic production in the host country. It is further assumed that both the

divisions of the multinational face increasing marginal costs of production. In the vertical-integration model the multinational enterprise operates three divisions: the parent firm selling the final good in the source country, a final-good subsidiary operating in the host country, and an intermediate-product division located in the source country. The intermediate-product division sells its output to the two final-good divisions and does not sell its product outside the multinational organization. The multinational is assumed to have monopoly power in the final-good market in both the host country and the source country. The monopoly assumption is common to both the models. Furthermore, in each of the two formulations we assume that the multinational faces a proportionate profit-tax in both the countries and confronts a host-country ad-valorem tariff on intra-firm trade.

The transfer pricing motive in both the papers is pecuniary, where the transfer price is used as a profit-shifting instrument. Given this formulation, profit-maximizing behavior requires the firm to charge either the lowest possible transfer price or the highest possible transfer price depending on the relative tax structures and the host-country tariff rate (Horst 1971). It is assumed that the host-country tax rate is higher than the source-country tax rate. If the host-country tax rate is lower, then the transfer price choice becomes trivial and the multinational always sets the price at the lower limit in order to minimize its global tax and tariff payments.

In practice the multinational firm's ability to manipulate its transfer prices is constrained by the fiscal authorities of the trading countries. An example of a legislation directly regulating transfer prices is the U.S. Tax Regulation 1.482-2(e), which stipulates the guidelines for monitoring transfer price manipulation by firms. Even if the governments do not impose direct restrictions, transfer price manipulation is invariably subject to indirect restraints. These restraints can arise from legislation not directly aimed at regulating transfer prices, e.g., anti-dumping laws or local content legislation.

In the final-good model we assume that the multinational faces "arm's length" constraints on its transfer prices. Following Samuelson (1982), we assume that, under "arm's length" restraints, the upper limit of the transfer price is equal to the price of the final good in the source country, and the lower limit of the transfer price is equal to the marginal cost of production in the source country. Given our assumptions of monopoly power and increasing marginal costs, the actual values of the transfer price limits are endogenous to the multinational firm's decision process, and depend on the level of total production and sales in the source country.

In the intermediate-good model the lower limit of the transfer price is taken to be the marginal cost of production in the intermediate-good division. We further assume that the multinational subsidiary faces local content legislation which requires the total value of the imported input to be less than

a given percentage of the total value of final good sales in the host country. Such legislation indirectly establishes an upper limit on the transfer price. Given constant marginal costs in the intermediate good division the lower transfer price limit is exogenous to the firm's decisions. On the other hand, the upper limit, derived from the local content restriction, is endogenous and depends on the value of final goods sales in the host country.

Since these analyses model transfer prices as a medium for moving profits between the different fiscal jurisdictions, the multinational firm always sets its transfer price at one of the two limits. In the final-good model, under the high transfer price regime, the transfer price is equal to the price of the final commodity in the source-country market. In the low transfer price regime, the transfer price on the final good is equal to the marginal cost of producing the good in the source country. On the other hand, in the intermediate-good model, under the high transfer price regime the upper limit is determined indirectly by local content legislation. In the low transfer price regime, the transfer price on the intermediate good is equal to the marginal cost of producing the good in the source country.

The analysis reveals that whenever there is endogeneity of transfer price limits, the equilibrium conditions give rise to a wedge between marginal costs and marginal revenues. Consequently, the low transfer price regime in the intermediate-good model, is the only case in which we

encounter the "traditional" marginal equivalence. Under all other scenarios the transfer pricing motives cause a divergence between the marginal cost of production and the marginal revenue of final-good sales in the host country.

In the horizontal-integration model we analyze the equilibrium responses of host-country sales, intra-firm trade and source-country sales to changes in the ad-valorem tariff rate. Under the high transfer price regime, a higher tariff rate causes a decline in the marginal profitability of host-country sales and intra-firm trade, and an increase in the marginal profitability of source-country sales. Consequently, there is a decline in the level of intra-firm trade and host-country sales, and the equilibrium level of source-country sales rises. For the low transfer price case it is shown that, as long as the direct impacts of a change in the tariff rate dominate the indirect impacts, the equilibrium responses are the same as in the high transfer price regime. The analysis reveals that the decline in intra-firm trade and host-country sales, and the equilibrium level of source-country sales rises. For the low transfer price case it is shown that, as long as the direct impacts of a change in the tariff rate dominate the indirect impacts, the equilibrium responses are the same as in the high transfer price regime. The analysis reveals that the decline in intra-firm trade, in both formulations, is proportionately larger than the decline in host-country sales, hence higher tariffs entail an increase in the level of host-country production.

In the intermediate-good model an increase in the tariff rate causes a decline in the total amount of intra-firm trade in the intermediate good. This causes a decline in the marginal productivity of labor in the subsidiary operations, resulting in a reduction in the total amount of host-country labor employed by the multinational. A reduction in the amount of both inputs employed leads to a decline in the level of subsidiary production. Hence, in complete contrast to the final-good scenario, higher tariffs on the intermediate input result in an unambiguous decline in the level of host-country production. The comparative-static responses in this formulation are identical across the "low" and the "high" transfer price regimes.

Welfare Analysis

In this thesis we abstract from the distributional issues of host-country welfare. Therefore, the welfare function for the host country is specified as a linear sum of the different welfare components. The host-country welfare, in the final good paper, is a sum of tax revenues from the subsidiary's operations, tariff revenues from intra-firm trade and consumer surplus. In the intermediate-good model, we incorporate an additional factor market element in host-country welfare. It is assumed that the multinational subsidiary employs host-country workers, along with the intermediate good, at a wage rate which is higher than the average host-country wage. Thus, the multinational's operations give rise to a welfare

enhancing employment effect in the host country. The explicit specification of the production function, in the intermediate-good formulation, readily enables us to isolate the employment effect.

In each essay we analyze the impact of a marginal change in the ad-valorem tariff on host-country welfare, under the different transfer price regimes. The methodology adopted is identical, wherein the welfare change is broken down into separate components, which are analyzed individually.

The welfare effects analyzed in the final-good model are: the "consumer surplus effect", the "total revenue effect", the "direct tariff effect", the "import substitution effect", the "volume of trade effect", and the "transfer price effect". In the intermediate-good model the analysis considers the "consumer surplus effect", the "total revenue effect", the "direct tariff effect", the "employment effect", and the "value of trade effect." The transfer price effect and the volume of trade effect are captured simultaneously by the value of trade effect in the intermediate-good model.

Within an environment of transfer pricing by multinational firms, host-country commercial policy decisions invariably involve a tradeoff in terms of lower (higher) tariff revenues and higher (lower) tax revenues. Thus, the relative values of host-country tax and tariff rates are an important consideration in determining the direction of welfare effects. The welfare tradeoffs come into play when we consider the "volume of trade effect" and the "transfer

price effect" in the final-good model. In the intermediate-good model, this interaction becomes evident when we consider the "value of trade effect". The analysis reveals that in the low transfer price case, there is an element of uncertainty as regards the welfare dominance of these changes vis-a-vis each other. Although, the changes in tariff revenues are likely to dominate over most of the range, the possibility of a dominant tax revenue change arises if the tariff rate is close to the "critical tariff"; namely the tariff rate at which the multinational is indifferent between a "high" and "low" transfer price. On the other hand, in the high transfer price case, changes in tax revenues always dominate the changes in tariff revenues. This reflects the fact that in the high transfer price case, the host country tariff is relatively low, i.e., below the "critical tariff."

The "volume of trade effect" captures the change in total tax and tariff revenues caused by a decline in the level of intra-firm trade, in response to higher tariffs, for a given transfer price. This effect always has a positive welfare impact under the high transfer price regime. In the low transfer price regime, given the welfare dominance of changes in the tariff revenues, this effect is expected to have a negative impact on host-country welfare.

The "transfer price effect" reflects the change in total host-country revenues caused by changes in the transfer price, for a given volume of trade, in the event of changes in the tariff rate. The final-good model shows that with an increase

in the tariff on intra-firm trade the total production in the source country falls. Given increasing marginal cost this implies a decline in source-country marginal costs. Since in the low transfer price a regime the transfer price is equal to the source-country marginal cost of production, higher host-country tariffs on intra-firm trade result in a decline in the transfer price. In the high transfer price regime the upper limit of transfer price is equal to the source-country price of the final good. The comparative-static analysis shows us that higher tariffs on intra-firm trade cause the multinational firm to sell more in the source country. The firm's monopoly power in the source-country market ensures that the price of the final good in the source country falls with an increase in the tariff. Hence, under the high transfer price regime, an increase in the host-country tariff on intra-firm trade results in a decline in the transfer price. Since a lower transfer price has a downward impact on tariff revenues and a positive impact on the host country tax revenues, the "transfer price effect", has a positive welfare impact in the high transfer price regime and a negative welfare impact, given dominant tariff effects, in the low transfer price regime when the tariff rate rises.

The "value of trade effect", in the intermediate-good model, captures the influence of a change in the total value of intra-firm trade, in response to a change in the tariff rate, on total host-country revenues. In the high transfer price regime higher tariffs cause a decline inn the value of

intra-firm trade, resulting in lower tariff revenues and higher tax revenues. The value of intra-firm trade is also lower for higher tariff rates within the low transfer price regime. Since the changes in tax revenues dominate the welfare outcome in the high transfer price regime, this effect has a positive welfare impact if the firm is charging a high transfer price and the host country raises its tariff rate. On the other hand, the "value of trade effect" has a negative welfare impact, given the welfare dominance of changes in the tariff revenues, when the multinational is charging a high transfer price and the host-country government decides to raise the ad-valorem tariff on intra-firm trade.

In the event of an increase in the host-country tariff rate, the multinational firm reduces its sales and charges a higher price for the final good in the host country. The higher prices and lower sales cause a decline in the host-country consumer surplus. Thus, the consumer surplus effect has a negative impact on host-country welfare in the event of a higher tariff rate.

As the demand elasticity of the final good is greater than one, due to the monopolistic nature of the market, the decline in sales, due to higher tariffs, results in a commensurate decline in the total revenues of the subsidiary. The lower revenues have a, **ceteris paribus**, downward impact on the multinational subsidiary's profits, thereby resulting in lower tax revenues for the host country. Our analysis refers to this as the total revenue effect.

The "consumer surplus effect" and the "total revenue effect" are identical in the two models and have a negative impact on host-country welfare in the event of an increase in the ad-valorem tariff. Furthermore, these effects are insensitive to changes in the transfer price regimes.

The "direct tariff effect" is the change in total tariff revenues, at the given transfer price and volume of trade, due to a marginal change in the tariff rate. This effect is also identical across the analyses. An increase in the tariff rate, all else constant, increases the total tariff revenues and has a positive impact on host-country welfare.

The "import substitution effect", in the final-good model, captures the downward impact on host-country welfare caused by an increase in the production costs of the multinational subsidiary. An increase in the host-country tariff on intra-firm trade results in an increase in the level of host-country production by the multinational subsidiary. The increase in the production costs causes a, **ceteris paribus**, decline in the profits of the subsidiary, thereby causing a decline in the tax revenues of the host country and a concomitant decline in its welfare and is identical across the two transfer price regimes.

The focus on factor markets gives rise to an "employment effect" in the intermediate-good model. This effect captures the overall welfare impact of a change in the amount of host-country labor employment by the multinational, in response to changes in the tariff rate. The analysis reveals that this

effect will in general be ambiguous and depend on the relative values of the host-country tax rate and the relative wage differential. The relative wage differential measures the extra benefit received by host-country workers if they are employed by the multinational i.e., the relative difference between the average host-country wage and the wage offered by the multinational subsidiary. The analysis shows that in the event of a higher tariff the multinational decreases its employment of host country labor. This has a dual impact on host-country welfare: First, a decline in labor costs causes a, **ceteris paribus**, increase in the profits of the subsidiary and a concomitant increase in the tax revenues of the host country. Second, given that the multinational firm offers a wage which is higher than the average wage in the host country, a decline in labor use by the subsidiary causes a reduction in welfare of host-country workers. The marginal increase in welfare is given by the host-country profit-tax rate and the marginal decline in welfare is given by the relative wage differential. Thus, the employment effect is positive if the relative wage differential is less than the profit-tax rate. This analysis has an interesting implication, in that it might not be in the host country's benefit to give preferential treatment, i.e., assess a lower tariff, to a multinational offering a higher wage differential in comparison to another multinational. If the multinational offering the higher wage differential faces a higher profit-tax than the multinational offering the lower wage

differential, then it is possible that the employment effect of an increase in the tariff rate is positive for the former and negative for the latter multinational. In this circumstance the employment effect would call for higher tariffs on the multinational offering the higher wage differential and lower tariffs on the multinational offering the lower wage differential.

The analysis in these essays is couched in a partial-equilibrium framework, where we focus on the impacts of changing tariff rates for a given tax structure. A logical extension would be to relax the assumption of inflexible tax rates, and explore the issue of tax and tariff coordination in the presence of transfer pricing. Another aspect of the analysis is the assumed passivity of the source-country government. An interesting extension could be an explicit consideration of source-country welfare and commercial policy.

II. Multinationals and Market Disruption

This essay develops a two-period model of a horizontally integrated multinational. The parent firm in the source country produces for the source-country market and for export to its subsidiary in the host country. The sales of the subsidiary consist of host-country production and intra-firm imports. Both the divisions of the multinational are assumed to enjoy monopoly power in their respective markets. The multinational attempts to maximize global expected profits and

for the sake of simplicity we ignore the impacts of corporate profit-tax rates.

The multinational encounters a threat of future protection, the probability of which depends on the current-period trade and production-location decisions of the multinational. In particular, the probability of protection depends upon the degree of import penetration, i.e., the ratio of intra-firm trade to total host-country sales. There are no trade distortions in the current period, however, the probability of future protection depends directly on current-period intra-firm trade and inversely on the level of host-country production by the multinational. We look at a situation where there are no costs of adjustment and the choice of endogenous variables in the ensuing periods is not constrained by current-period decisions. Hence, the magnitude of profit reduction experienced in the event of protection depends solely on the rate of protection. The two parameters of expected losses are: the expected tariff rate and a **perceived** threshold level of import penetration beyond which future protection occurs with certainty. The paper refers to the former as "expected explicit protection" and to the latter as "implicit protection".

The endogeneity of the probability of future protection gives rise to a strategic element in the multinational's decision process. The equilibrium conditions show that the multinational has an incentive to "oversell" in the host country, in order to reduce the probability of tariff

imposition. Thus, in equilibrium the marginal cost of production exceeds the marginal revenue from sales. A marginal increase in the level of host-country sales, for a given level of intra-firm trade, reduces the probability of protection. For a given expected tariff rate this implies a reduction in the total expected losses of the multinational firm. At the same time, higher sales imply an efficiency loss due to an increase in the divergence between marginal revenue and marginal cost in the subsidiary operations. Similarly, the equilibrium condition for intra-firm trade reveals that the marginal cost of producing the product in the host country is greater than the marginal cost of producing the product in the source country. Since, higher imports increase the probability of protection, importing the good from the source country involves a strategic cost. In equilibrium the difference in the marginal production costs is equal to the marginal strategic cost. Thus, the optimal trade and sales decisions are characterized by an equalization of the marginal benefits of a lower probability of tariff imposition and the incremental costs of a larger divergence between the marginal cost of production and the marginal revenue of host-country sales.

The interplay of the strategic factors and the efficiency factors is highlighted when we look at changes in the level of host-country production in response to higher expected tariffs. The traditional result, associated with the literature on "tariff jumping", asserts that an increase in

the current-period tariffs will cause the multinational to increase host-country production. However, the inclusion of strategic considerations gives rise to an element of uncertainty in the response of host-country production, to higher expected tariffs. An increase in the level of host-country production, for a given level of imports, increases the level of host-country sales and has a downward impact on the probability of tariff imposition. Thus, an increase in the level of host-country production has a positive strategic impact on the multinational firm's expected profits. On the other hand, given increasing marginal costs and declining marginal revenues, higher host-country production increases the wedge between the marginal cost of production and the marginal revenue of host-country sales. Hence, an increase in the level of host-country production has a negative efficiency impact on the multinational firm. Consequently, if the efficiency impact of higher host-country production outweighs the positive strategic impact of higher host-country production, then higher expected tariffs will result in lower levels of host-country production. This result runs counter to the received theory on "tariff jumping" and has some important implications for interest groups lobbying for greater protection. The analysis implies that a labor lobby, attempting to increase host-country employment by generating anti-import sentiments, might actually hurt its own cause by engaging in such lobbying.

In the latter part of the analysis, an additional strategic element is considered: An attempt is made to capture the influence of the multinational's "visibility" on the probability of protection. We incorporate this element by postulating a positive relationship between the probability of protection and the absolute level of imports, while maintaining the import penetration assumption. Including the "visibility" factor increases the likelihood of an increase in host-country production in response to higher tariffs on intra-firm trade.

It is observed that a change in the level of "implicit protection" has an impact on the equilibrium values only if the perceived probability of tariff imposition is non-linear. A linear probability implies that the marginal impact of a change in the level of import penetration on the probability of tariff imposition is constant and does not depend on the level of import penetration. Consequently, if the probability function is perceived to be linear, a change in the threshold level does not have an impact on the marginal probability. As the equilibrium values of the endogenous variables are dependent on the marginal probability, the multinational's optimal decisions are not altered by changes in the level of implicit protection. On the other hand, if the probability function is non-linear then changes in the level of implicit protection do cause changes in the marginal probability of protection for given levels of intra-firm trade and host-country sales. Under this specification changes in the

threshold level of import penetration and changes in the expected tariff have identical comparative-static impacts on multinational firm's endogenous variables.

Thus, the choice of a particular functional form for the probability function carries with it specific assumptions about the firm's perceptions, and this analysis reveals the importance of the nature these perceptions in situations of "strategic conflict".

APPENDICES

APPENDIX A

High desired transfer price (final-good model)

The multinational firm with $(1-GT)>0$ and $p=P^F$:

The profit function

$$M=(a^F-b^FX^F)X^F-C^F(X^F+E)^2/2+G[(a^H-b^HX^H)X^H-C^H(X^H-E)^2]+(1-GT)(a^F-b^FX^F)E$$

The first order conditions

$$M_X^F=a^F-2b^FX^F-C^F(X^F+E)-(1-GT)b^FE=0$$

$$M_X^H=G[a^H-2b^HX^H-C^H(X^H-E)]=0$$

$$M_E=GC^H(X^H-E)+(1-GT)(a^F-b^FX^F)-C^F(X^F+E)=0$$

Comparative statics

$$\begin{bmatrix} -[2b^F+C^F] & 0 & -[C^F+(1-GT)b^F] \\ 0 & -G[2b^H+C^H] & GC^H \\ -[C^F+(1-GT)b^F] & GC^H & -[C^F+GC^H] \end{bmatrix} \begin{bmatrix} dX^F \\ dX^H \\ dE \end{bmatrix} = \begin{bmatrix} -Gb^FE \\ 0 \\ G(a^F-b^FX^F) \end{bmatrix} dT$$

Changes in the endogenous variables in response to a change in the tariff rate:

$$dX^F/dT=-Gb^FE\{G(2b^H+C^H)(C^F+GC^H)-GC^H)^2\}$$
$$-[C^F+(1-GT)b^F]\{G(2b^H+C^H)G(a^F-b^FX^F)\}/D<0$$

$$dX^H/dT=-[2b^F+C^F]\{-GC^H[G(a^F-b^FX^F)]\}+Gb^FE\{GC^H[C^F+(1-GT)b^F]\}/D<0$$

$$dE/dT=-[2b^F+C^F]\{-G(2b^H+C^H)G(a^F-b^FX^F)\}$$
$$-Gb^FE\{-G(2b^HC^H)(C^F+(1-GT)b^F\}/d<0$$

$D<0$ by the second order condition for profit maximization

APPENDIX B

Low desired transfer price (final-good model)

The multinational firm with $(1-GT) < 0$ and $p=C^F(X^F+E)$

The profit function

$$M=(a^F-b^FX^F)X^F-C^F(/X^F+E)^2/2+G[(a^H-b^HX^H)X^H-C^H(X^H-E)^2/2]+(1-GT)C^F(X^F+E)E$$

The first order conditions

$$M_X^F=a^F-2b^FX^F-C^F(X^F+E)+(1-GT)C^FE=0$$

$$M_X^H=G[a^H-2b^HX^H-C^H(X^H-E)]=0$$

$$M_E=G(C^H(X^H-E)]+(1-GT)C^F(X^F+2E)-C^F(X^F+E)=0$$

Comparative statics

$$\begin{bmatrix} -[2b^F+C^F] & 0 & -[C^F-(1-GT)C^F] \\ 0 & -G[2b^H+C^H] & GC^H \\ -[C^F-(1-GT)C^F] & GC^H & -[C^F+GC^H-(1-GT)2C^F] \end{bmatrix} \begin{bmatrix} dX^F \\ dX^H \\ dE \end{bmatrix} = \begin{bmatrix} C^FEG \\ 0 \\ GC^F(X^F+2E) \end{bmatrix} dT$$

Changes in the level of the tariff in response to a change in the tariff rate:

$$dX^F/dT=GEC^F\{G(2b^H+C^H)(C^F+GC^H-(1-GT)2C^F)-(G^H)^2\} -GTC^F\{G^2(2B^H+C^H)C^F(X^F+2E)\}/D$$

$$dX^H/dT=[2b^F+C^F]\{GC^HGC^F(2E+X^F)\}-GC^FE\{GC^HGTC^F\}/D$$

$$dE/dT=[2b^F+C^F]\{GC^F(X^F+2E)G(2b^H+C^H)\} +GEC^F\{-G^2(2b^H+C^H)TC^F\}/D$$

$D<0$ by the second order for profit maximization

APPENDIX C

Low desired transfer price (intermediate-good model)

The multinational firm with (1-GT) < 0 and $p = r^c$

Totaly differentiating the first order conditions with respect to the endogenous variables and the tariff rate and setting them in matrix form we have:

$$\begin{bmatrix} u(u-1)Lf_f^{u-2}Z_f^{u-2}Z_f^{v} & uvL_f^{u-1}Z_f^{v-1} & 0 & 0 \\ uvL_f^{u-1}Z_f^{v-1} & v(v-1)L_f^{u}Z_f^{v-2} & 0 & 0 \\ 0 & 0 & u(u-1)L_h^{u-2}Z_h^{v} & uvL_h^{u-1}Z_h^{v-1} \\ 0 & 0 & uvL_h^{u-1}Z_h^{v-1} & v(v-1)L_h^{u}Z_h^{v-2} \end{bmatrix} \begin{bmatrix} dL^f \\ dZ_f \\ dL_h \\ dZ_h \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ r^c \end{bmatrix} dt$$

The concavity assumptions on the production function ensures that the Hessian matrix is negative semi-definite and the determinant of the coefficient matrix above is positive.

The comparative statics with respect to the tariff can be arrived at with the use of Cramer's rule:

$$dL_h/dt = \frac{-uvL_h^{u-1}Z_h^{v-1}}{D} < 0$$

$$dZ_h/dt = \frac{u(u-1)L_h^{u-2}Z_h^{v}r^c}{D} < 0$$

APPENDIX D

High desired transfer price (intermediate-good model):

The multinational firm with (1-GT) > 0 and $p=qL_h^{u}Z_hH^{v-1}$

Totally differentiating the first order conditions with respect to the endogenous variables and the tariff rate we have,

$$\begin{bmatrix} u(u-1)L_f^{u-2}Z_f^{v} & uvL_fu^{u-1}Z_f^{v-1} & 0 & 0 \\ uvL_f^{u-1}Z_f^{v-1} & v(v-1)L_f^{u}Z_f^{v-2} & 0 & 0 \\ 0 & 0 & G(uvL_h^{u-2}Z_h^{v}) + u(u-1)q(1-GT)L_h^{u-2}Z_h^{v} & G(uvL_h^{u-1}Z_h^{v-1}) + uvq(1-GT)L_h^{u-1}Z_h^{v-1} \\ 0 & 0 & G9uvL_h^{u-1}Z_h^{v-1}) + uvq(1-GT)L_h^{u-1}Z_h^{v-1} & G(v(v-1)L_h^{u}Z_h^{v-2}) + v(v-1)q(1-GT)l_h^{u}Z_h^{v-2} \end{bmatrix} \begin{bmatrix} dL_f \\ dz_f \\ dl_h \\ dZ_h \end{bmatrix}$$

$$= \begin{matrix} 0 \\ 0 \end{matrix} \qquad dt$$

$$\begin{matrix} GuqL_h^{u-1}Z_h^{v} \\ GvqL_h^{u}Z_h^{v-1} \end{matrix}$$

The comparative statics of the system can be derived with the use of Cramer's rule,

$$dL_h/dt = \frac{-L_h^{2u-1}Z_h^{2v-2}Guvq[G+q(1-GT)]}{D} < 0$$

$$dZ_h/dt = \frac{-L_h^{2u-2}Z_h^{2v-1}Guvq[G+q(1-GT)]}{D} < 0$$

where D is positive

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