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Economic and Policy Analysis Directorate  
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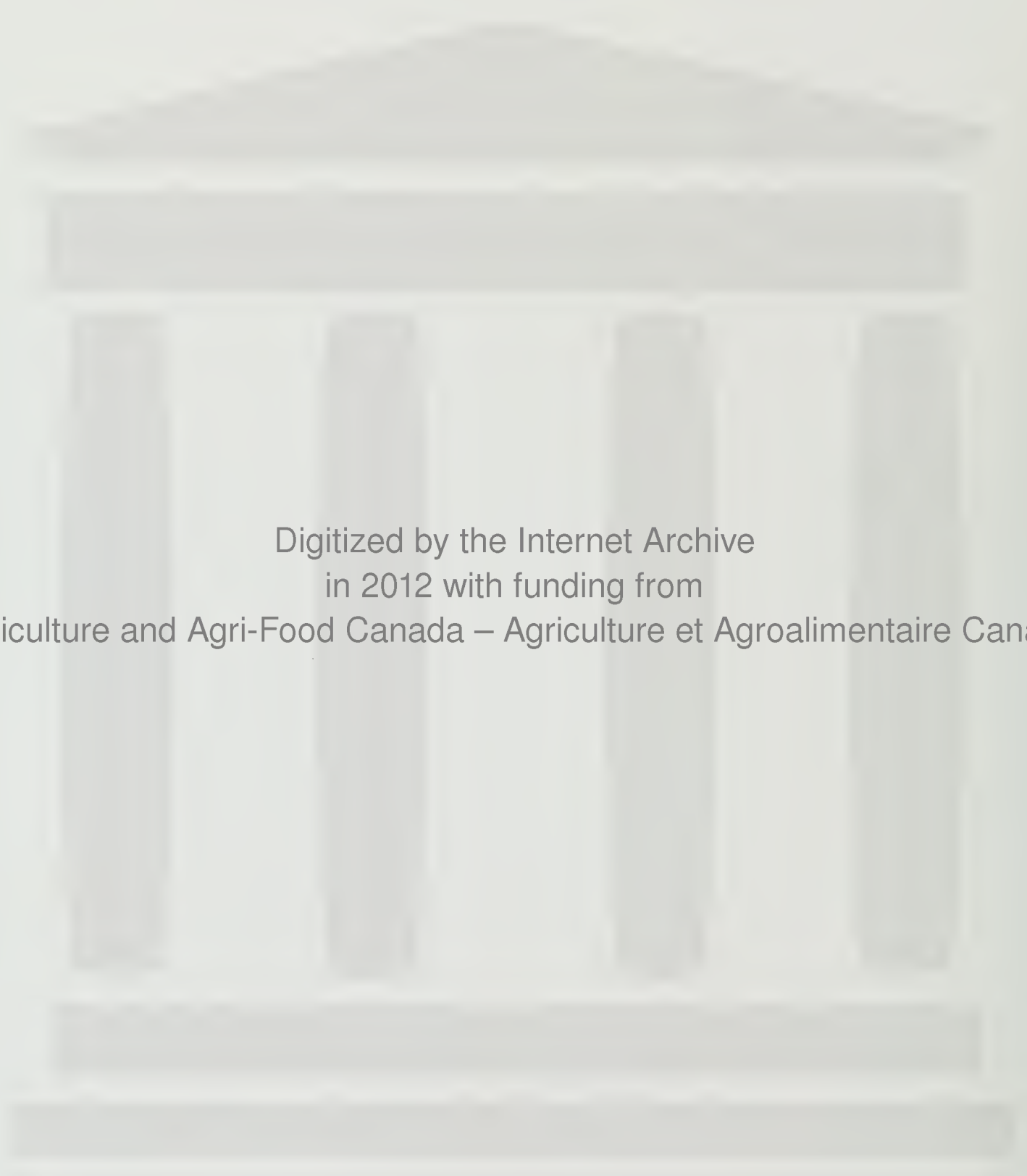
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# **INTERNATIONAL TRADE IN AGRICULTURAL AND FOOD PRODUCTS: THE ROLE OF STATE TRADING ENTERPRISES**

**Agriculture and Agri-Food Canada**

**April 1999**

# INTERNATIONAL TRADE IN AGRICULTURAL AND FOOD PRODUCTS: THE ROLE OF STATE TRADING ENTERPRISES\*

*Dr. Michelle Veeman  
University of Alberta, Edmonton*

*Dr. Murray Fulton  
University of Saskatchewan, Saskatoon*

*Dr. Bruno Larue  
Laval University, Quebec*

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Economic and Policy Analysis Directorate  
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Agriculture and Agri-Food Canada  
Ottawa, Ontario  
K1A 0C5  
Tel: (613) 759-7443  
Fax: (613) 759-7034  
E-mail: [ipp@em.agr.ca](mailto:ipp@em.agr.ca)

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# Preface

This report is part of the Trade Research Series that Agriculture and Agri-Food Canada (AAFC) is undertaking to support discussions in connection with multilateral and bilateral trade negotiations. The purpose of the series is to create an inventory of research that will make it easier for stakeholders to identify concerns, issues and opportunities associated with such discussions. The research is for the most part directed to areas in which little or no information has been circulated rather than to areas in which a broad base of literature already exists. More information on the Trade Research Series is available on the AAFC website at [www.agr.ca/policy/epad](http://www.agr.ca/policy/epad), or by contacting Brian Paddock, Director of the Policy Analysis Division, Policy Branch (e-mail: [Paddobr.em.agr.ca](mailto:Paddobr.em.agr.ca), phone: (613) 759-7439).

This report is a joint undertaking by the Policy Branch and the Market and Industry Services Branch of AAFC. Dr. Michelle Veeman from the University of Alberta, Dr. Murray Fulton from the University of Saskatchewan, and Dr. Bruno Larue from Laval University were engaged to do the analysis. The report focuses on state trading enterprises (STE) that deal with agricultural and agri-food products. The first part of the report provides a literature review with respect to STE. The second part develops theoretical frameworks of imperfect competition for assessing the operations of STE. The final part proposes criteria for building a classification system for STE, presents some case studies, and assesses these case studies according to the criteria.



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# Executive Summary

State trading enterprises (STE) are one of many different types of institutions that are involved in or otherwise influence international trade. Although STE operate for several industrial and resource products in a variety of different countries, they are most prevalent for agriculture and food products. Interest in STE has recently been heightened, in part because the United States has indicated that it will focus attention on these institutions during the next round of multilateral trade negotiations through the World Trade Organization (WTO), and in part because many of the former or current centrally planned nations who have applied for WTO membership have STE. There is concern that STE in these nations may operate in ways that conflict with the principles and rules of the WTO.

## Definition of State Trading Enterprises

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There is no commonly accepted definition of STE. The problem is that STE can vary widely in terms of structure, operation, power, and function, and societies have different values and beliefs concerning state involvement in matters of trade. This lack of a clear definition for STE has hampered effective analysis of these institutions. In order to identify all state-authorized interventions that may distort world trade, an all inclusive approach should be used in defining STE. For example, STE could be defined as *state sanctioned-institutions and associated activities that influence the quantities, prices, or the direction of trade in internationally traded goods*. For purposes of WTO administration of STE provisions, this inclusive definition could be limited by excluding state-sanctioned practices, like tariffs or phytosanitary standards, that are comprehensively covered elsewhere in the provisions of the WTO. To ensure that all STE are identified, an illustrative list of STE needs to be drawn up to show the wide variety of form they can take. As well, it may be necessary to develop a process of notification challenges since some countries are

reluctant to self-identify institutions/activities. For example, such a process might be needed to determine whether institutions like the European Union's Cereal Management Committee or United States marketing orders should be classified as STE.

## **State Trading Enterprises and Market Power**

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Literature to date generally assumes that the state-based nature or the grant of an "exclusive or special privilege" to STE automatically confers to them monopoly power, or at the least gives them considerable market power. Based on this presumption, STE are shown to result in poor market performance, cause undesirable trade outcomes or to be unfair competition to other world market traders. Although this presumption holds for some STE, it does not for others. For example, the market power of export marketing boards is often overstated. The ability of any marketing entity to affect export market prices, i.e., to exhibit market power, reflects the nature of competition in the market in question, not whether that entity is the sole seller of product from a particular nation. Export STE typically compete with other state traders and with multinational private traders in some or all of the commodities which they trade.

Conceptual models are developed to analyse the impact on trade flows and price formation of export STE that operate in an oligopolistic market structure (i.e., a market structure resembling the world grain market which is composed of multinational trading enterprises - MNE, and STE). These models, along with an associated numerical simulation, demonstrate the importance of market structure and behaviour on potential market outcomes that would arise in the absence of the export STE. The analysis shows that introducing a STE in an industry where trading firms possess some market power has the effect of redistributing MNE profits to farmers in the domestic market. This redistribution leads to higher levels of output, and consequently lower levels of prices in foreign countries. If processing demand in the domestic market is small relative to total output, and/or the domestic processing sector is reasonably contestable, then the introduction of the STE will produce less distortion in the domestic market than was the case when private traders were the only firms operating. Less distortions in the domestic market result in less distortions in the world market.

Although export STE which operate in competitive domestic and world markets tend to have little impact on trade flows, import STE which have monopoly power on domestic production and which have some control/ownership of imports can distort trade. Conceptual models are developed to show that in these cases, a reduction in tariffs or an

increase in market access commitments will not necessarily reduce domestic production and increase imports but may lead to STE exports. These anomalous responses to trade liberalisation are particularly likely to occur if there are prohibitive tariffs on imports. It is shown that in such a situation tariff reductions will be more effective than increasing minimum access commitments.

## **Classification Scheme for State Trading Enterprises**

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Criteria are developed for classifying STE into three different types. The classification scheme is based on the principle that as long as markets are reasonably contestable, an oligopolistic market structure can produce market outcomes and welfare properties similar to those that would be achieved under perfect competition. Contestability is the concept that if firms can unrestrictedly enter and exit the market, the threat of potential competition will cause oligopolistic firms to behave competitively, and not to exercise their market power. Criteria used to measure market contestability includes market concentration, trade shares, price differences, and rents. Other, more subsidiary criteria for classification is whether the relationship between the STE and government/politicians is at arms length and whether the STE operates with an appropriate level of transparency.

Type I STEs have little if any effect on contestability and their potential to distort trade is low. They include export STEs such as the Canadian Wheat Board, the Australian Wheat Board, and the New Zealand Dairy Board. In contrast, Type III STEs have clear adverse impacts on contestability, and consequently have the potential to distort trade. They include import STEs such as the Japanese Food Agency, and Korean State Mandated Imports. Type II STEs do not fall in either of the more clear-cut cases of Types I and III but operate in circumstances in which contestability may be compromised and consequently trade flows may be distorted. An example is Indonesian BULOG's operations for rice. The activities of these STEs need to be closely monitored to ensure that trade flows do not become distorted. The typology can be viewed as a "green" (Type I), "amber" (Type II) and "red" (Type III) categorization. Type III (red) STE should be phased out or converted to less distorting operations. Type I (green) STE should be subject only to reporting and periodic monitoring. In contrast, Type II (amber) STE should be required to do more intensive reporting and to undergo more stringent monitoring on a case-by-case basis. To determine whether STE are Type I, Type II or Type III standardized information needs to be collected on each notified STE so that they can be assessed according to the criteria. This information could be collected through a revision of the questionnaire currently used in notifications of STE to the WTO.



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# Glossary of Abbreviations

AWB	Australian Wheat Board
BULOG	Badan Urusan Logistik
CCC	Commodity Credit Corporation
CUSTA	Canada-US Trade Agreement
CWB	Canadian Wheat Board
EC	European Community
EEP	Export Enhancement Plan (of the United States Government)
GATT	General Agreement on Tariffs and Trade
MAC	Minimum access commitment(s)
MAFF	Ministry of Agriculture, Forestry and Fisheries
MNE	Multinational enterprise(s)
NLCF	National Livestock Federation
NZDB	New Zealand Dairy Board
OECD	Organisation for Economic Co-operation and Development
ROW	(the) Rest of the world
SPS	Sanitary and phytosanitary standards
STE	state trading enterprise(s)
TRQ	tariff rate quota(s)
US	United States
USGAO	US General Accounting Office
VER	Voluntary export restriction
VIE	Voluntary import expansion
WTO	World Trade Organisation



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# Part I: Literature and Concept Review

## 1. Introduction

There are two major focal points of interest in state trading. At the broad level, there is much interest in the potential membership of countries like China and Russia in the multilateral trading system of the General Agreement on Tariffs and Trade (GATT), which is now administered by the World Trade Organization (WTO). However, the more specific focus of the current interest in state trading in agricultural and food products arises from a second focal point, the concern of some nations about the provisions for state trading in the international trade agreement of the GATT/WTO. In particular, it is the intention of the United States government to focus attention on state trading in agricultural products in this next round of international trade negotiations. The concern of the United States on this issue is directed primarily at export marketing boards of Australia, Canada and New Zealand [USGAO, 1996], while in turn these nations are concerned that such a targeted focus ignores state-based institutions and practices of the United States and the European Union. This has contributed to the increased interest and debate on state trading. The purpose of this first part of the three part report is to survey economic literature on state trading in agricultural and food products and to overview economic theory and concepts that may be of assistance in developing a framework to analyse the effects of this practice and a method of classifying these. In the second part of the report, two analytical models of state trading enterprises (STE henceforth) are presented; two appendices, relating to these models, are attached to this document and numbers of figures that relate to the two models are provided following the text of the entire document. The third part of the report presents several short case studies of STE and outlines some criteria that may be used in classifying STE.

STE are one of many different types of institutions that participate in or otherwise influence international trade in agricultural and food products. These different institutions include privately owned firms, publicly listed companies, co-operatives, and various forms of state-sanctioned enterprises and institutions. There are many variants of these broad institutional categories. Numbers of privately owned and publicly listed corporations are based in one nation and trade beyond that nation's borders. Other such firms have enterprises that are based in many nations and operate as multinational corporations. Some co-operatives exhibit a traditional form of open membership; the membership of other co-operatives is closed. There is also great variety in STE. Some of these operate in a manner comparable to

commercial firms, while others do not. The ownership and control of such varied forms of organization of economic activity does not in itself predetermine the conduct and performance of these different institutions. As the study of industrial organization indicates, market conduct and performance is influenced by a variety of features of the market environment, and this is considerably influenced by the social, economic and political culture of particular nations. The various forms of public policy and public intervention that are seen in different nations reflect the history of this culture. In some nations, STE are long-established mechanisms of public policy for agriculture and food.

There are numbers of diverse opinions on the economics of state trading, as indicated below.

Sir Leon Brittan, vice-president of the European Commission<sup>1</sup>:

*"I should at this point raise a related issue concerning state trading, in other words cases where a government has given a special right to a designated corporation to import or export or to distribute certain current goods...I think that, if we are to look at international competition rules seriously, the time is ripe to consider whether this antiquated form of monopoly trading can be phased out altogether."*

Phillip Abbott and Linda Young, economic researchers<sup>2</sup>:

*"It may well be the case that many aspects of trading behaviour would not change after reform or elimination of a state trading enterprise."*

James Smith and Tony Scriven, Australian grain growers<sup>3</sup>:

*"If the export market were deregulated we would lose a great deal of our clout. The world market is not a level playing field and without the single desk we would be de-powering a valuable marketing arm." and "export market deregulation would give a dangerous amount of market influence to large multi-national traders. They could force the market price down to suit their own means"*

As indicated by the preceding quotes, state trading is a contentious issue. Part of this controversy reflects different perceptions of the benefits and costs of this form of government intervention. And there evidently is a lack of agreement as to the structure and performance of world markets in the absence of this type of intervention.

Some of the disagreements about STE might be attributed to the lack of consensus on an acceptable definition of these bodies. STEs may have a wide range of powers that may apply to either or both imports and exports. The lack of a clear and widely-accepted definition for state trading may be one reason why not all member countries of the GATT, and its administering body, the WTO, have reported information about the activities of their STE, even though Article XVII of the General Agreement of the GATT/WTO obligates them to do this.

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1. Quoted from a speech entitled "Competition policy and the trading system: towards international rules in the WTO" given at the Institute for International Economics, Washington D.C., November 20, 1997.

2. Quoted from Abbott and Young, [1997, p. 10].

3. Reported in the Australian periodical, *The Land*, November 27, 1997.

The major reason for the opposition to STE has to do with the concern that these bodies may have the ability to escape constraints imposed by international and national regulations on trade and competition. It is also sometimes argued [for example, Dixit, 1996] that the operations of STE are less transparent than is the case for private traders, giving STE an ability to engage in illegal practices. It is alleged that, combined with the special powers granted by a state, this gives these organisations an unfair advantage over private traders. Critics have dismissed some STE as highly inefficient enterprises run by corrupt bureaucrats. There may have been instances where this was the case, but most such STE have not survived, due to internal and external pressures favouring deregulation, structural adjustment and institutional reform. The STE that are more likely to be a continuing concern to critics of this type of policy intervention are those that are an “effective, flexible, direct, yet simple means of policy implementation and management” [Simonot, [1997 p.10].

Much focus on STE has involved agricultural markets, in part because there are several agricultural commodities for which a sizeable portion of world trade involves a STE at one or both ends of trading transactions. However, the proportion of trade that involves STE appears to be declining<sup>4</sup> and only 29 countries submitted STE notifications to the GATT/WTO Secretariat between 1980 and 1994 [WTO, 1996]. Even so, the length and composition of the list of government observers to the WTO, the procedure that normally indicates interest in joining this organization, suggests that the STE issue is not likely to fade away.<sup>5</sup>

This first part of the report is organised as follows. The next section, Section 2, outlines the major justifications provided for the use of STE and other policy interventions for agriculture. In Section 3, issues associated with arriving at a definition of STE are addressed. Key elements of commonly used definitions are noted and the current provisions of the GATT/WTO for STE are outlined and discussed. One reason for the difficulty in arriving at a single widely accepted definition of STE is the wide variety in the powers and functions of these institutions. The diversity in these institutions and in their activities is discussed in a subsequent section of the paper, as is the variety in possible effects that they may have. In the fourth and fifth sections of this first part of the report, we investigate some economic literature that relates to inter-relationships between international trade, firm and industry behaviour and government intervention, with and without STE. Since some arguments for and criticisms of STE are framed in terms of the possible use of these institutions as means of government intervening in trade in a strategic manner, emphasis is also directed at an overview of literature on strategic trade policy. In addition, concepts from literature on industrial organisation are overviewed in order to isolate key concepts and issues to be applied in the subsequent analysis of the consequences of STE activities and for purposes of classification of various types of STE. These latter two features are pursued in Parts II and III of this report.

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4. For example, an earlier assessment by Schmitz *et al* [1981] estimated that in 1973-1977 some 91% of world wheat imports were by countries using STE. In contrast by 1996, about 40% of imports were by countries using STE [Abbott and Young, 1997].

5. As of October 31, 1997, there were 32 observer governments. These include a large proportion of centrally planned and transition economies: Albania, Algeria, Andorra, Armenia, Azerbaijan, Belarus, Cambodia, China, Croatia, Estonia, Ethiopia, Former Yugoslav Rep. of Macedonia, Georgia, Vatican, Jordan, Kazakhstan, Kyrgyz Rep., Latvia, Lithuania, Moldova, Nepal, Oman, Russian Federation, Saudi Arabia, Seychelles, Sudan, Chinese Taipei, Tonga, Ukraine, Uzbekistan, Vanuatu, Vietnam.

## 2. Reasons for STEs and Related Policy Interventions in Agriculture

STE are one of many different forms of public policy, which may be pursued for a variety of reasons. In a perfect world, good market performance should arise from proper market structure and the conduct that arises from this [Scherer and Ross, 1990]. However, markets may fail for a number of plausible reasons, leading to policy interventions that may take many forms, including the establishment and operation of STE. Policy interventions may also be directed at concerns of income distribution, particularly in situations in which market structures and processes are such that there may be considerable disparities in the market power held by different economic agents.

The market structure that typically applies for agriculture involves relatively large numbers of small primary producers. Individually, each of these lacks the ability to influence the prices that are received from the sale of their undifferentiated farm products. In contrast, the product handling, processing and trading sectors, for which agricultural products are raw material inputs, typically consist of relatively small numbers of much larger industrial firms which often process and sell differentiated consumer products and thus have at least some ability to influence selling prices. In most high income nations, concern with the consequent disparity in market power held by individual small farmers vis-à-vis larger traders and processors has underlain public policies to encourage farmers' group marketing endeavours. This has been the primary rationale for public policies that have encouraged farmers' cooperatives, marketing boards, marketing orders and similar institutions that are intended to bolster individual farmer's bargaining power.

The early development of export marketing boards in Australia and New Zealand provided farmers in those nations with an opportunity to negotiate, as a group, freight rates with groupings of international shippers, offsetting the market power exerted by such groupings (or conferences) within an imperfectly competitive international shipping industry. Application of group bargaining power by primary producers in transactions associated with agricultural exports, in a manner that prevents free riding, continues to be the major function of most exporting STEs for food and agricultural products. The capture of economies of scale in transportation and handling of agricultural exports is a related objective for numbers of STE.<sup>6</sup>

The market structure in primary agriculture, as compared to the more concentrated market structures in the downstream sectors that handle, process, or trade in farm products, may contribute to considerable asymmetries in market information between individual farmers and downstream processors and traders. An example is provided by the world grains market, in which access to reliable market information is believed to confer a major advantage on large privately-owned trading institutions [Caves, 1977]. Such information is unavailable for individual farmers, since much relevant information on markets and prices is not generally available, or is not in the public domain. Export marketing boards may give associations of farmers the ability to overcome such information disparities.

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6. For example, Abbott and Young [1997, p.23] contend that there are "substantial economies of scale in shipping grain" and consequently, private firms replacing a STE might have incentives to collaborate to exploit such economies of scale by hiring a large vessel.

Associated rationales for regulation of agricultural markets arise from the inherent variability that affects farm output for many agricultural products. In the face of the relatively inelastic demand that characterises markets for most foods, unplanned variations in supply that arise from the influence of weather or pest problems lead to considerable variability in market prices for many farm products. This variability, allied with the lack of complete markets for farmers to offset risks, provides a justification for a variety of policy interventions that reduce or otherwise offset price and output risk. This has been one of the motivations underlying establishment of some STE.

Quality variations that arise from the vagaries of weather, pests and disease are also evident for many agricultural products and have been a long-standing rationale for policies to establish grading programs and product quality specifications for farm products. In some nations, these have been pursued through STE. Some quality improvements in farm and food products may result from investments in animal or plant breeding programs or quality improvement programs in processing and product handling. If the quality enhancement is not evident on simple inspection, there can be incentives for traders to misrepresent supplies from other sources, which do not possess the enhanced quality, as the high quality product. With consequent lack of performance, the reputation of the quality-enhanced product may be adversely affected, with detrimental effects on producer-level prices and revenues. Loss of quality reputation for particular foods is expected to be persistent and not easily reversed. Exportation through a STE, such as an export marketing board, may be chosen as a means to maintain quality reputation that might otherwise be lost, due to asymmetric information on product quality.

With increasing recognition of the potential product value creation that may be associated with product development and marketing strategies involving successful differentiation of food products, some STE have provided a mechanism for associations of farmers to capture such returns through group marketing. Pursuit of marketing strategies involving value creation through forward (downstream) integration into handling and processing on a group basis avoids the barriers to entry, from economies of scale and associated capital requirements, that prevent individual small scale primary producers from pursuing this marketing strategy. In situations where markets outside the country are important for such commodities, and where history and culture have favoured public policies that provide for group marketing by farmers, export marketing boards can provide a mechanism of achieving this, in a form that prevents free riding. The increasing tendency for STE to follow a group marketing strategy of forward integration along the “value chain” based on product development and product differentiation represents somewhat of an adaptation of these institutions. They are following a very similar marketing strategy to that pursued by many large corporations. An example of a STE that appears to have been successful in applying this marketing strategy is the New Zealand Dairy Board. Export marketing boards can also provide a mechanism for the capture of rents, on behalf of groups of farmers, from the sale of their products to distorted import markets; these would otherwise accrue to private traders or importers. This is one objective of both the Australian Wheat Board and the Canadian Wheat Board in their respective sales to markets like Japan.

In sum, existence of imperfect competition, information asymmetries, and the lack of complete markets to manage risk are some of the motivations for STE that focus on exportation of agricultural commodities. They are organised in a manner that prevents free riding. These institutions have also been developed because of the public desire, in some nations, to bolster the market power of individual farmers in their transactions with large

powerful firms in concentrated food handling, processing and trading industries. A related significant objective of some export marketing boards has also been to capture for farmers the income benefits of successful forward integration and rents associated with market distortions in import markets. The latter two types of activities should not be viewed as efficiency-based arguments/interventions, but as issues of potential income distribution, i.e., equity.

A somewhat different set of rationales appears to have underlain the establishment of numbers of the STE that operate primarily for imported farm products. Where these institutions exist in high-income nations and in some rapidly industrialising nations, they have typically been associated with the maintenance of national policies of food self-sufficiency and food price stability. These policies, which are sometimes rationalised as programs to achieve security of supplies of food, have emphasised protection and support of domestic production. To this end, regulation of imports has served the purpose of restricting imports that would otherwise be attracted by the relatively high level of domestic prices. In some cases, importing STE have also been used as the means to capture at least some portion of the rents that would otherwise accrue to foreign exporters or domestic importers from sales to the relatively high priced domestic market. Consequently, these have been available to support domestic producers. The Japanese Food Agency is an example.

In contrast, in lower income countries, in which food policy is often oriented more to the concerns and interests of urban people, rather than farmers, policies are sometimes followed that use STE to tax farmers to provide relatively cheap food for urban consumers, or some segments of these. Import STE may also be directed at maintenance of food stocks, or other facets of food security. These types of policy have been supported in some nations by import STE that either import or control the importation of basic foodstuffs, such as rice or grains. Example of import STE are the Food Corporation of India and the Indonesian state trading organization, Badan Urusan Logistik, commonly referred to as BULOG.

### **3. STEs: What Are They and Why Are They of Concern?**

#### **3.1 Defining State Trading**

Two aspects of state trading tend to underlie the differences in the variety of definitions that can be found in the literature on STE. One of these is institutional in focus and concerns the nature of the involvement of the state in international trade. The other aspect of the various definitions of state trading is the functional focus on the nature of the activity of the state in this trade. It is not clear that there is any universally adopted or self-evident definition of these institutions and activities. However, there is a clear tendency for some definitions and views of state trading and state-trading enterprises to reflect perceptions associated with value judgements that underlie beliefs about the appropriate role of public policy and state intervention. Consequently, the attempt to define such institutions should explicitly recognise the purpose for which the definition will be applied.

In this paper, it is assumed that the purpose of arriving at a definition of state trading and STE is to identify state-based institutions and associated practices that may serve as a means of protection of domestic production and distortion of international trade, other than tariffs and similar specific practices that are explicitly covered by other provisions of the GATT, which is administered by the WTO. A broad definition will best suit this purpose.

Early references to state trading in the literature on international economic relationships refer to this as the direct participation of national governments as importers or exporters, mainly since at the time when GATT rules were drafted, much foreign trade was in the hands of governments [van Meerhaeghe, 1971]. A related over-narrow definition is that a STE is a body that is either wholly or partly owned by the state [Ghai, cited by Lloyd, 1982]. Matejka [1982] views state trading as the activities carried out by enterprises that involve the state in ownership, control or management. A more general view of the institutional aspect is that a STE is a state-sanctioned, i.e., a state-authorised, institution.

Some definitions of state trading and STE appear to be targeted at certain types of institutions and functions. For example, one proposed definition of state trading is that this exists when "...an institution granted [an] exclusive right by government controls or materially affects the conditions of trade on a transaction by transaction basis." [Sorenson, 1991]. The restriction of this definition to influences that occur on a transaction by transaction basis is rationalised by this author as excluding forms of government intervention under which private trade occurs. This definition focuses on only a subset of state-sanctioned institutions and interventions. This does not seem to be consistent with interpretative notes to the GATT/WTO article that deals with STE (Article XVIII). It is hard to escape the conclusion that the focus is on institutions and interventions that have generally not been used by the United States, but have been used by some other nations.

One frequent tendency in the literature on state trading is the incorrect assumption that state-sanctioned institutions necessarily exert considerable market power. Kostecki [1982] offers a fairly general statement of the institutional aspect of state traders as "government or government-backed agencies..." but adds to this the restrictive functional component "exporting and importing occur on government-determined terms of transaction." The view of considerable market power is also embedded in the definition proposed by Lloyd [1982] of "a trading organisation for which the prices and/or quantities of international transactions in commodities are determined as an instrument in the pursuit of objectives of government policies." These are certainly considerable overstatements of the ability of export marketing boards to determine, i.e., to establish, export market prices. In fact, the extent to which any exporter can influence market prices reflects the degree of competition that exists in that market. In most if not in all cases, export agencies such as export marketing boards do compete with several other suppliers in world markets.

Another view of state trading is that in the operation of these bodies, political considerations may dominate over commercial considerations. Thus Josling [1996] suggests that there may be a fundamental inconsistency in the Article XVII requirement for STE to apply commercial considerations in their operations, stating that "the essence of a state trader is that political considerations are given precedence over commercial (or profitability) concerns." Again, while this may be true of some state trading institutions, it is certainly not true of all. It may well be a correct depiction of a body like the Commodity Credit Corporation of the US, which was created to stabilise, protect and support farm income; political considerations do dominate over commercial concerns in pursuing such a purpose. This is not a true statement for those export marketing boards that operate for the purpose of marketing particular farm products, to best advantage, on behalf of farmers.

Examination of the provisions of GATT relating to state trading indicates that this body has taken a broad but not very clear view of this activity. The major provisions of the Agreement concerning state trading are provided by Article XVII. The view initially adopted by GATT in identifying state trading was to describe this as existing when a contracting party “establishes or maintains a State enterprise, wherever located, or grants to any enterprise, formally or in effect, exclusive or special privileges,”[XVII:1(a)]<sup>7</sup>. (This definition has not subsequently been changed, although the 1994 memorandum “Understanding on the Interpretation of Article XVII” has provided a supplementary definition for purposes of notification, i.e., for reporting on STE). There are no restrictions on the rights of nations to establish state enterprises or to grant any enterprise an “exclusive or special privilege”. However, no definition of these terms was given.<sup>8</sup> Instead the approach taken was to provide for GATT members to self-identify their STE, based on the preceding description, and to enjoin these to follow certain forms of conduct. Since different nations have taken different views of the meaning of “state enterprise” and “exclusive and special privilege”, it is not surprising that the provisions of GATT have been viewed to be unclear. Nonetheless, it is clear that Article XVII and the “Understanding” related to this involve a fairly general view of a STE as a state-sanctioned, i.e., state-authorised, institution.

The major rule of GATT for the conduct of STE requires these to “...make any such purchases or sales solely in accordance with commercial considerations, including price, quality, availability, marketability, transportation and other conditions of purchase and sale...”[XVII:1(b)]<sup>9</sup>. Article XVII:1(c) requires that members shall not prevent any STE from acting in accord with the specified principles of most-favoured-nation treatment and commercial behaviour.<sup>10</sup>

The early provisions for STE, encompassed in Articles XVII:1 and XVII:2, were supplemented in 1955 by the addition of a recommendation for negotiations among concerned member countries. This was viewed to have opened the way for membership in GATT of states with collectivist economic systems [van Meerhaeghe, 1971]. However, there was a subsequent view that the provisions of Article XVII were not pertinent to states with collectivist economic systems, or to low-income nations [Bernier, 1982]. This view appears to have changed for low-income nations.<sup>11</sup> Article II.4 specifies that an import STE may not be used to increase the protection given to any product beyond that provided by the tariff scheduled

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7. Article XVII:1(a) also specifies that “such enterprise shall, in its purchases or sales involving either exports or imports, act in a manner consistent with the general principles of non-discriminatory treatment described in this Agreement for governmental measures affecting imports or by private traders.” It is clear that this non-discrimination obligation requires MFN treatment [Article I] but whether this also requires national treatment, as in all clauses of Article III, is viewed to be unclear [Hoekman and Mavroidis, 1994].
  8. Some light is provided by the interpretative notes to the article which do clarify that “exclusive or special privileges” are not conferred by governmental measures to ensure standards of quality or efficiency in the operation of external trade, or the exploitation of national natural resources (but do not empower the government to exercise control over the trading activities of the enterprise in question).
  9. XVII:1(b) also specifies that the enterprises of other GATT members be afforded the opportunity, in accordance with customary business practice, to compete for participation in such purchases or sales.
  10. However, these rules of conduct do not apply to imports of products for governmental use [XVII:2].
  11. This is currently unclear for nations that have had (or continue to have) collectivist economic systems. The lack of clarity as to whether the foreign trade enterprises or foreign trade organisations of some former and current non-market economies are covered by the recent memorandum of understanding is recognised in the recent WTO background paper on operations of STE [WTO, 1996].

for the commodity. The other provisions of Article XVII include the obligation for members to notify, to the GATT/WTO, products exported into or imported into their territories by STE [XVII:4(a)]<sup>12</sup>. Member countries that authorise an import monopoly are required to provide information to GATT on the mark-up on such imports; this information may be requested by a member with a substantial trade in the product in question [XVII:4(b)]. GATT/WTO may request any nations with STE to supply information on the operations of these institutions [XVII:4(c)], but there is no obligation for any member to disclose confidential information that might prejudice the legitimate commercial interests of any enterprise [XVII:4(d)].

In addition, Article II:4 requires that import monopolies not provide a higher level of protection than given by that nation's bound tariff schedules. Thus import STE are required to maintain a "mark-up" (the difference between purchasing and selling prices of the STE), at a level that is lower than the tariff on imports.<sup>13</sup> (During the last round, mark-ups of some import STE were bound. Japan and Korea are in this category.)

There has been much criticism of the long-established process of self-reporting of state trading. As expressed by Bernier [1982], self notification "suffered inherently from the common defect of all self-incriminating procedure, that is the lack of goodwill of those most immediately concerned." The process of notification involves the response of members, for the products and institutions that they recognise to be STE, to a questionnaire, unchanged since 1960, which is intended to provide information on the operations of STE. Unfortunately the questionnaire provides little information that would be helpful in assessing the economic effects of particular institutions. To assess this, information on the nature and extent of competition in the markets in which the STE operates would be necessary. Instead, the questionnaire, which gives effect to Article XVII:4, "reflected the typical bureaucratic approach which seeks to cover all petty details." [Bernier, 1982].

Article XVII was not changed in the Uruguay round of GATT negotiations, but the memorandum: "Understanding on the Interpretation of Article XVII" was developed. This provides a working definition of STE, for purposes of notification of these, as follows. "Governmental and non-governmental enterprises, including marketing boards, which have been granted special rights and privileges, including statutory or constitutional powers, in the exercise of which they influence through their purchases or sales, the level or direction of imports or exports". The previous provisions of Article XVII are not changed, but it is clear that government-sanctioned institutions that influence the direction, as well as the level, of trade are to be included in notifications as STE. The 1994 memorandum of understanding on

12. The wording of this clause could be read to imply that STE are bodies that import and export—as opposed to bodies that have been given an exclusive or special privilege to regulate imports and exports—whereas the descriptive definition of STE of XVII:1(a), as outlined above, is broader than this. The interpretative notes to Article XVII add weight to the broad interpretation of the Article in that the definition of a marketing board is specified to include these bodies that regulate private trade as well as those that buy and sell. Even so, several US authors have queried whether only state-based institutions that actually trade should be considered as STE [e.g. ERS, 1997; Dixit and Josling, 1997]. However, the wording in Article XVII does not limit the definition of STE in this way and a limited view of STE is inconsistent with the interpretative notes to the Article.
13. This has had an interesting effect on the recent importation of some commodities, previously imported only by national STE, but where importation has been liberalised, so that private traders may now engage in this activity, after paying the appropriate tariff. With mark-ups maintained at less than the tariff, private traders have had no incentive to import but have instead purchased supplies from the STE which has increased the level of its purchases to accommodate this. This effect has been reported for importation of wheat and barley into Japan, where a similar effect is also seen for raw silk imports [IATRC, 1997].

Article XVII also provides for establishment of a working group to review notifications, as well as any counter-notifications that may be raised by members. The working group will also review the questionnaire used for notification and develop an illustrative list of STE.

The development of an illustrative list of state-sanctioned institutions and associated activities has merit in overcoming some of the flaws in the self-reporting process of Article XVII [Bernier, 1982]. The memorandum of understanding cites marketing boards as one such institution. This specification is not surprising, since countries in which export marketing boards are long-established elements of agricultural policy have for many years notified these institutions to GATT. The United States had earlier notified its Commodity Credit Corporation to be a STE within the GATT/WTO specifications and has recently again given notification of this institution.<sup>14</sup> However, the United States has not declared marketing orders for agricultural products to be in this category, despite their apparent consistency with the GATT/WTO specifications and their essential similarity to marketing boards. Other institutions and activities that should be assessed for possible listing and notification are associated with the export restitution activities of the European Union.<sup>15</sup>

In summary, if the purpose of definition of STE is to identify state-authorised interventions that may protect domestic production and distort world trade, the definition should be sufficiently broad to fulfil this purpose. This would be served by following an inclusive approach, as in the following:

*STE are state sanctioned-institutions [i.e., state-authorised institutions] and associated activities that influence the quantities, prices or the direction of trade in internationally-traded goods.*

However, for purposes of GATT/WTO administration of STE provisions, it is suggested that this inclusive definition be limited by excluding particular policy instruments and activities, like tariffs or phytosanitary standards, that are comprehensively covered elsewhere in the provisions of the GATT/WTO. In view of the wide variety of existing state-sanctioned institutions and activities, the development of an illustrative list of STE should be pursued.

### **3.2 Overview of Purpose, Functions, Powers and Effects of STE**

STE may be authorised to perform a wide variety of activities in pursuit of diverse goals of government policy. As was discussed in Section 2, these goals include the use of STE to address market failures associated with imperfect competition, information asymmetries, and the lack of complete markets to handle risk. They may also be used to provide farm groups with bargaining power to offset that held by large traders and processors and as a means to enable farm groups to capture rents associated with distorted markets. These institutions can be directly or indirectly involved in the importing and/or exporting of products. Policy goals pursued with state trading may include protecting local industry from

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14. Thus it has been noted by Dixit and Josling [1997, p. 5] that the export enhancement supported shipments of the US, administered by the CCC, "could" be regarded as state trading.

15. So-called "voluntary" export and import restrictions should also be assessed and monitored in this context; these state-sanctioned trade restrictions were subject to negotiation in the Uruguay round and with the conclusion of the round, officially sanctioned voluntary export restraints are prohibited. However, it has been recognised that this could be undermined by private action [OECD, 1996a]. If these were to be implicitly [as opposed to officially] sanctioned by government, they would still be considered to be STE under the provisions of Article XVII.

import competition, pursuing domestic price or income stabilisation goals or pursuing foreign exchange goals. Other possible uses could include discriminating among buyers/sellers, improving terms of trade (if market circumstances make this possible), or achieving import or consumption targets, such as may arise from shortage phobia or the control of “bad” goods such as alcohol and tobacco.

Another feature of the heterogeneity of STE is seen in the wide differences in the extent of control exerted by the state over its STE. Some such bodies may, in effect, be government departments, administered by government employees. Consequently, they are subject to considerable government control and management. Other STE are agricultural producers’ marketing institutions which have been established under state authority, i.e., under enabling legislation, that provides for very specific powers and activities of the institution, such as the grant of an exclusive “right”. This could be, for example, the right to negotiate terms of sale of specified products. Such institutions may operate independently from government, except in satisfying periodic reporting and accountability requirements.

The agricultural commodities and related products most commonly state traded are grains, dairy products, rice, sugar, fuel, salt, alcoholic beverages and tobacco. The largest importing STE are found in Japan, Indonesia, Korea, Pakistan, Mexico, Turkey, Tunisia, Morocco and Malaysia [Ackerman, 1997]. Many of these countries are notorious for the protection of their agricultural sector.<sup>16</sup> On the export side, the largest STE are found in Canada, New Zealand, Australia, China, South Africa and Turkey [Ackerman, Dixit and Simone, 1997]. In contrast to the list of major STE importers, the list of large STE exporters includes the two countries, Australia and New Zealand that are, perhaps, the world’s most liberal trading nations.

Some STE have the exclusive right to import and/or export to/from the nation in question. In some cases, these bodies may use private traders as agents to carry out specific tasks. Other STE do not directly engage in trade but regulate the conduct of private traders by various means, as by licensing exporters or importers. Others directly engage in trade but compete with private traders.

The involvement of exporting STE in purchasing, handling, storing, processing, selling and shipping to foreign and local customers varies from one STE to another. This is also the case for the possible negotiation by STE of the charges and the services performed by other marketing agents that may insure, finance, ship, process, store or perform other functions. The largest exporting STE have powers to engage in or control exports and are called single-desk exporters. The tools used by exporting STE may include marketing contracts and price pooling. If authorised and funded for this purpose, STE could apply price support subsidies, export subsidies, or credit guarantees. These types of policies or programs are often applied through other mechanisms than STE.<sup>17</sup>

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16. Tyers and Anderson [1986] note that many countries justify protection on the grounds that they need to insulate their domestic markets from the instability of the world market. Not surprisingly, this discourse appears in STE notifications. There is evidence that some STE do stabilise the internal market (see for example, the discussion of BULOG by Barichello [1996]). However, there is also empirical evidence supporting an inverse causal relation in the aggregate: domestic market insulation may exacerbate the volatility of world markets.

17. Subsidies applied by marketing boards are notifiable to GATT/WTO under the Agreement on Agriculture provisions and are subject to the reduction provisions of that Agreement.

In addition to controlling imports, some import STE may have various powers to regulate domestic markets. Some handle the products themselves while others use private traders. Import STE may be authorised to use trade and domestic policy instruments to achieve their goals. Tariff-rate quotas are policy instruments that may be administered by STE. These bodies may also be able to use controls on supply and associated regulation or setting of prices at various levels in the domestic marketing chain.

As was noted previously, the major basis for concern about the influence of STE is that such institutions may have undesirable effects on the conduct and outcomes of international trade. There is a tendency for some authors and commentators to assume that the state-related basis of such institutions and activities necessarily leads to poor performance. However, where markets have failed, intervention through this means may be justified to improve efficiency. Alternatively, this intervention may have been chosen for reasons of income distribution, or in pursuit of other national objectives. The tendency for the automatic assumption of poor performance, undesirable trade outcomes or unfair competition for other traders arising from STE operations primarily seems to be associated with the presumption that their state-based nature or the grant of an “exclusive or special privilege” automatically confers monopoly power, or at the least, that this confers considerable market power. This may be so for some STE, but is quite inaccurate for others. The overstatement of market power has often been applied to export marketing boards.

The ability of any marketing entity to affect export market prices, i.e., the extent of its market power, reflects the nature of competition in the export market in question, not whether that entity is the sole seller of product from a particular nation. State traders typically compete with other state traders and with private traders in some or all of the commodities that they trade in export markets. Thus, as pointed out by Lloyd [1982], “while the assumption of monopoly or an element of monopoly is frequent in the literature on state trading, this implies nothing about the absence or restriction of competition.” This is recognised by the Directorate for Food, Agriculture and Fisheries of the Organisation for Economic Co-operation and Development (OECD). That organisation recently reported on competition policy and the agro-food sector, pointing out:

*“The extent to which the continuing [STE] arrangements have the potential to affect market access and foreign competition depends on the existence of market power and prevalence of market distortions (e.g., limitations on market access, tariff rates, export subsidies). Where market power under the arrangement in question is relatively weak, and/or markets are already highly distorted due to government intervention, the marginal impact of such arrangements on competition may not be large and is difficult to assess.” [OECD, 1996a p. 20].*

It is also noted that:

*“Where market power is relatively weak, STE and private export cartels are limited in their ability to act as true monopoly suppliers.”*

The Directorate notes three export marketing boards for which this appears to be the case:

*“The New Zealand Dairy Board, for example, would argue that, while it is a significant supplier on international dairy markets, it is essentially a price taker. With the EU by far the most significant trader, world dairy prices are essentially set by the level of EU export restitution and any differential returns to the Board reflect the*

*different levels of support prices set by government intervention in the countries to which the Dairy Board is exporting, rather than its actions as a statutory export monopoly. The Canadian Wheat Board and the Australian Wheat Board also have relatively small market shares relative to the US and EU exports and see themselves as price takers in the international grain market..” [OECD, 1996a p.20].*

The issue of whether the Canadian Wheat Board does indeed have sufficient market power to allocate supplies to markets in a manner that yields price premiums that would otherwise be bid away by competition between many traders has been the topic of recent debate in Canada. A similar debate has also occurred in Australia relative to the Australian Wheat Board. Even if this is a correct depiction of the market power of these bodies, as the recent OECD report notes:

*“Some industry observers, however, would argue that state agencies behave no differently than large private traders in the world grain trade and that the grain market is characterised by routine price discrimination and market segmentation. To the extent that this is true, elimination or reform of state monopolies would not in itself improve the competitive behaviour in export markets without complementary measures directed at private traders under competition legislation.” [OECD, 1996a, p.20].*

Most experts agree that STE offer potential advantages and disadvantages. The debate over the benefits and costs of having institutions like the Canadian Wheat Board and the Australian Wheat Board has focused attention in these two countries on the merits and demerits of STE in general. On one hand, STE can be associated with cost inefficiencies. Carter and Loyns [1997] blamed the Canadian Wheat Board for added costs of marketing grain, (as in storage, handling and shipping) in Canada, as compared to the US. The level of unit marketing costs of the New Zealand Dairy Board, relative to Nestle, a private trader of about the same size, has been questioned.<sup>18</sup> It could be that the lack of competition faced by STE in at least some of their activities encourages inefficient use of their resources so that they do not operate efficiently. Alternatively, some STE may operate on too large a scale to be cost competitive. One can also wonder whether they have the right product mix (are there diseconomies of scope?) or whether they are involved at too many levels in the marketing chain.

Applying the same line of reasoning, in the situation in which the creation of an STE was motivated by one or several market failures, it can be queried whether these failures are a continuing concern, whether these have been overcome by other changes, and whether a STE is the best way to address these failures. There are other persuasive criticisms of STE. Krueger [1993] argues that the concept of a “benevolent social guardian” state whose interventions are strictly motivated by economic efficiency considerations is reflective of utopia, and not realistic. Bureaucratic capture by private interests occurs in practice and this is costly. The existence of an STE is not a required condition for capture of rents by special interests, but the greater the government involvement, the greater the expected capture.<sup>19</sup> Rent seeking may well explain the development and maintenance of some STE.

18. Personal communication by Professor Ralph Lattimore, Lincoln University, New Zealand.

19. Krueger’s analysis [1993] is directed at developing countries. A recent paper by Gawande [1998] in which endogenous protection models are compared suggests that US protection is best explained by special interest models.

Despite these varied objections, STE may be effective instruments to conduct domestic and trade policy through the application of controls over production, marketing and/or trade activities. One component of the literature on trade policy focuses on the possible exertion of market power through trade policy. A potential advantage of some STE may be an ability to influence the terms of trade. This is not to say that terms of trade could only be manipulated through STE. After all, it is well known that a large country (whose trade may involve a large number of small firms unaware of their joint market power) can improve its terms of trade by imposing an “optimal” (export or import) tariff. A single firm eliminates the need for a tariff [Corden, 1984 p.83] and hence could be seen as more practical or flexible.<sup>20</sup> Even so, the ability to shift the terms of trade requires large country attributes for the single firm or the STE, i.e., it must hold market power. However, even small countries may benefit from a tariff. Katrak [1977] has shown that a small country can gain by using a tariff to shift rents, from a large foreign exporting firm that enjoys a monopoly position on the domestic market, to domestic taxpayers.<sup>21</sup> The common elements in these two cases are the presence of market power (held respectively by the home country or the foreign firm) and a fixed tariff. With some exceptions for regional trade arrangements like customs unions and common markets, the rules of GATT/WTO disallow the use of discriminatory tariffs, (i.e., through adherence to the most favoured nation principle). Hence other instruments than tariffs must be used if it is a nation’s policy to discriminate across trade partners.

Discriminatory manipulations of the terms of trade on the import side could be pursued by a nation possessing market power through such means as voluntary export restrictions (VER), minimum access management, technical barriers and sanitary and phytosanitary regulations. The potential for such distortions may be more evident for agricultural trade than for some other products since “effective discriminatory quotas” are ubiquitous in agricultural trade. Of course, these types of protectionist tools could be used by STE, but a country does not have to have STE to apply protectionist measures to restrict trade in a discriminatory manner across trade partners. And, it should also be recognised that discrimination across trade partners is particularly likely to trigger retaliation by trading partners.

What are the ways in which STE may be used as instruments of national trade policy? Their use for this purpose presumes that they possess market power. Some STE are large and might have market power<sup>22</sup> and this has led to some arguments for and criticisms of STE that are framed in terms of strategic trade policy. Consequently, it is of interest to overview the body of literature that relates to strategic trade policy; this is pursued in the next section.

Oligopoly trade models like Brander’s [1981] model of intra-industry trade in identical products and Brander and Krugman’s [1983] models of reciprocal dumping set the stage for the new area in trade literature that is termed strategic trade policy. This literature focuses on

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20. The benefits of having a single firm extend to the case where product quality is unknown and importers rely on the reputation of the exporters to value quality. Larue and Lapan [1992] developed a Cournot trade model in which reputation has country-specific and firm-specific components. The quality of agricultural products often depends on country-specific factors such as weather and regulations. It is shown that an exporting country with a single firm prevents a free-riding effect that leads to an inefficient reduction in quality and lower prices.

21. This paper anticipated the rent-shifting arguments developed by Brander and Spencer [1981, 1984] who considered two cases: 1) a duopolistic domestic market with a local and a foreign firm and, 2) a domestic market served by a foreign firm that must decide between allowing a tariff-induced entry by a local firm or fighting this off. In both cases, a tariff can raise welfare. In the second case, the best tariff is the maximum tariff that supports entry deterrence.

strategic trade interventions by governments. The early models from which this literature evolved are oligopoly trade models with a domestic and a foreign firm competing in each other's market. In essence these begged the question of whether governments could intervene to profitably alter the strategic interactions between firms. In the following section, the main results of this literature are presented. The intent is not to provide an exhaustive literature review but to expose as clearly as possible the intricacies and difficulties of government interventions when markets are imperfectly competitive. The difficulties in implementing strategic trade policy are enormous but they do not necessarily justify the existence of STE as we will demonstrate in a subsequent section. Nevertheless, we show that the existence of STE is easier to justify in a world in which the actions of large private traders can influence market outcomes.

#### 4. Strategic Trade Policy

Strategic trade policy has been a fast growing area of the literature on international trade for the last fifteen years. In this literature, the term "strategic" is used in a game theoretic sense and has no direct political or military connotations [Brander, 1995]. The context of strategic interventions is necessarily one in which there are strategic interactions between local and foreign firms. Thus many examples are presented in a duopoly setting. The concept of strategic trade policy is for governments to influence or manipulate, in a credible manner, the strategic interactions between firms. For instance, an import tariff can be regarded as a credible increase in the cost of foreign firms. By the same token, the local government can use a production or export subsidy to signal to the foreign firm that the average cost of local firms has been reduced and that the increased output that is to follow is sustainable. Of course, in this context, the attainment of a dominant position need not be restricted to government intervention. Firms can take actions to achieve a credible dominant position by themselves. For example, they can invest in research or they can attempt to improve their positions on spot markets by strategically using/not using futures markets [Newbery, 1984; Allaz, 1992; Allaz and Vila, 1993; Yapo, 1998].

In the first generation of strategic trade policy models, it was assumed that governments would pre-commit to a policy action in the first stage of a game and local and foreign firms with Cournot conjectures (i.e., their strategic variables are quantities) would simultaneously commit to quantities in the second stage of the game. To keep the presentation of the rent-shifting argument as simple as possible, it was common in these models to assume a duopoly setting in which a home firm and a foreign firm would compete, either in a third-country market or in each others' markets. It was assumed that firms had linear total cost curves and hence constant average costs applied. The assumptions of linear cost and segmented markets allowed the separate analysis of the home and foreign markets. The game is then solved backwards. The second stage of the game, involving the firms' optimisation problem, is solved by assuming that the governments have already chosen the level of their strategic

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22. However, this is a very contentious issue. Evidence about the nature of agricultural markets is mixed. There is disagreement over which markets might be imperfectly competitive. When there seems to be near-consensus that a particular market is imperfect, there can be debate over whether the balance of market power favours importers or exporters. Market power has been claimed for the Canadian Wheat Board [for example, by Kraft, Furtan and Tyrchniewicz, 1996] and the Australian Wheat Board [Ryan, 1994] but these claims have been disputed (for example, for Canada, by Carter and Loynes [1996] and for Australia by Piggott [1992]). Market power has also been claimed for import STE but a recent empirical study does not support this [Abbott and Young, 1997].

variable (e.g., tariff, quota or subsidy). Best response or reaction functions for both firms are derived from the maximisation of profits.<sup>23</sup> An equilibrium is attained when both best response functions are satisfied. With the assumptions above and the condition that the demand curve not be too convex,<sup>24</sup> the best response functions are downward-sloping and cross only once to yield a unique Cournot equilibrium. Because the best response functions are negatively sloped, the strategic output variables of both firms are said to be strategic substitutes (i.e., when the output of one firm increases, the output of the other falls). This gives rise to the first mover advantage which states that if instead of moving simultaneously, firms were to move sequentially, the first one to commit to an output level would gain. The first firm to commit chooses a point on its rival's best response function to establish a Stackelberg leadership. In this case though, firms move simultaneously and the first mover advantage requires government intervention to be attained. To recognise this, recall that the firms' problem is solved conditionally on the government's action in the first stage. The governments' optimisation problem can then be solved by introducing the results of the firms' optimisation into the government's objective function. Governments are assumed to maximise a welfare function which takes into account the profits of the local firm, the cost or revenue derived from its intervention and the surplus of resident consumers when relevant.<sup>25</sup>

This simple setting has produced very interesting results. In the case in which a local firm and a foreign firm sell all of their output in a third country, a government can use a subsidy to manipulate the strategic interactions between the firms such that the increase in the profits of the home firm exceeds the cost of financing the subsidy.<sup>26</sup> From the STE perspective, four results warrant discussion. First, the subsidy is positively related to the cost advantage of the home firm, relative to the foreign firm. Thus, firms that are not "competitive" should not be receiving much assistance [Neary, 1994]. This result adds support to Hillman's [1982] prediction (derived from a pressure group model of protection) that a declining industry will continue to decline. Thus the invisible hand pushes the government's hand which through reforms can increase, decrease or terminate STE activities. Second, the impact of the subsidy is reduced as the number of local firms increases [Dixit, 1984; Brander, 1995]. When the number of local firms is large relative to the number of foreign firms, the subsidy will induce an increase in production by all domestic firms and will lead to lower profits and welfare. In such a case, the standard "optimal tariff" argument applies and the policy prescription is reversed. As the number of foreign firms becomes large relative to the number of home firms, the subsidy again becomes attractive. Clearly, rent-shifting under constant or decreasing average costs is most efficient with a single firm. Third, STE can be involved in many oligopolistic markets and given that some resources are in fixed supply (i.e., land), subsidies in some sectors will injure other sectors. The general equilibrium considerations of strategic trade policy have been analysed by Dixit and Grossman [1986] and tend to

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- 23. The term reaction function is misleading when firms move simultaneously in a one-shot game like the one described here because no dynamics are involved.
  - 24. This condition, commonly referred to as Hahn's stability condition, forces the marginal revenue of a firm to fall as the output of its rival rises.
  - 25. Consumer surplus is not relevant when local and foreign firms do not sell anything at home but compete in a third country market. Also, there are tax collection costs and deadweight losses for a government that needs to finance a subsidy. This cost reduces the appeal of strategic subsidies but does not alter the basic rent-shifting argument.
  - 26. Because there is no home consumption, the use of a tariff is de facto ruled out.

depreciate the value of strategic trade interventions. The intuition is that when oligopolistic industries compete for the same scarce resources (i.e., land, labour or capital), subsidies for all the industries cannot increase the output in all of them. Fourth, we have demonstrated that in the duopoly case an active government facing a passive government can increase its welfare by intervening. However, intervention is a dominant strategy for both governments (i.e., when the foreign government is passive, the home government's payoff is higher under intervention and likewise when the foreign government is active). In equilibrium, both countries can end up worse off as a result of their respective interventions. Retaliation issues, such as the choice of instruments, are discussed more fully below.

Tariffs can be used when local firms compete with foreign firms in the home market. The impact of the tariff is to raise credibly the costs of foreign firms. In the duopoly case, the best response function of the foreign firm shifts down along the best response function of the home firm. The output of the home firm increases but the output of its foreign rival falls by a greater amount which means that the domestic price must rise. However, the increase in the profits of the home firm, combined with the tariff revenue, more than makes up for the consumption loss. If the home firm also exports, the tariff has no impact on its sales abroad given the constant average cost assumption. However, Krugman [1984] has shown that under increasing returns, the import protection afforded the local firm also acts to promote exports. The intuition is that the increase in local production caused by the tariff lowers the unit cost of production of the local firm and makes it more competitive abroad. Of course the reverse holds when the local firm is facing diseconomies of scale.

One of the most devastating criticisms of strategic trade policy is that the policy prescriptions are not robust across the types of conjectures that firms might have [for example, Bhagwati, 1988]. If instead of Cournot conjectures about the quantities of their rivals, firms held Bertrand conjectures about the prices of their rivals, it has been shown by Eaton and Grossman [1986] that an export tax would raise welfare and a subsidy would the opposite. In a Bertrand game, the best response functions are upward sloping, the prices of the firms are strategic complements and the second-mover advantage applies. If firms were to announce their prices sequentially, as opposed to simultaneously, the firm that would play second could undersell the other and increase its market share and profits. However, if firms move simultaneously, the second mover advantage can be achieved through the assistance of the government. In a game in which local and foreign firms compete in a third market, an export tax by the home government signals the foreign firm that the price of the home firm will be higher. This induces the foreign firm also to raise its price.

An interesting result with Bertrand games is derived when the foreign firm competes with the local firm in the home market and a voluntary export restriction [VER], or an import quota, is used by the home government. Krishna [1989] has shown that introduction of a VER of the size of the free trade level of exports by the foreign firm would bring about a mixed equilibrium characterised by higher prices of both the home and the foreign firms.<sup>27</sup> The VER signals the local firm that its foreign rival cannot use a low price to flood the domestic market with foreign goods. The home firm responds by setting a higher price to maximise its profits. Because the home price is higher, the foreign price is also higher and both firms see their profits rise. In contrast, in a Cournot game, a VER at the free trade level of exports creates a flat segment in the reaction function of the foreign firm and therefore has no effect [Hwang and Mai, 1988]. This outcome is explained by the equivalence of tariffs and quotas under static Cournot competition.<sup>28</sup> Harris [1985] contends that a VER enables the home firm to establish Stackelberg leadership when it plays a Bertrand game with a foreign firm under laissez-faire. Like Krishna [1989], he shows that a VER facilitates the attainment of higher prices and profits by both firms and this is why a VER could be truly voluntary (when it is not too restrictive) and why it is sometimes viewed as a collusion-facilitating device.

Similarly, a negotiated or targeted market share, better known as voluntary import expansion (VIE), intended to increase the market share of imports, may lead to increased domestic prices. Greaney [1996] uses a Bertrand duopoly model to show that a domestic firm coerced by its government into giving up market share to its foreign rival responds by increasing prices. This leads to an equilibrium in which both firms end up selling at higher prices. Furthermore, both firms can see their profits rise as long as the market share concession is not too large; hence the counterintuitive result that VIE do not promote competition.

Which of the Cournot and Bertrand conjectures make the most sense? In the Cournot model, firms simultaneously supply quantities to the market and an auctioneer ensures that a market-clearing price is discovered. The Bertrand conjectures seem to correspond more to the way firms make their decisions in practice. However, Cournot models yield rather appealing results. Furthermore, these results could be duplicated by a two-stage Bertrand game in which firms must commit to a capacity choice prior to setting their prices. Kreps and Sheinkman [1983] have shown that if the cost to adjust output beyond the set capacity is infinite, the resulting equilibrium devolves to the Cournot equilibrium. Maggi [1996] builds on this equivalence to address the Cournot vs Bertrand criticism against strategic trade policy by building a model with a capacity cost-flexibility parameter. This allows Maggi to encompass different degrees of competition without having to appeal to the controversial conjectural variation elasticity.

Sophistication in the decision process of governments could be added by separating the decisions about the choice of instrument and the level of the instrument. In Hwang and Shulman's [1992] third-country strategic trade policy model, two governments have to choose simultaneously between no-intervention, a subsidy and an export quota before some uncertainty is resolved. In the second stage of the game, the uncertainty is resolved and the governments must choose the level of their instrument, which might be zero. The third stage

27. The mixed equilibrium is the result of a discontinuity in the home firm reaction function. The VER also changes the reaction function of the foreign firm by making it steeper, starting at the free trade equilibrium. The discontinuity makes the home firm set two prices with probability  $a$  and  $1-a$ .

28. Dockner and Haug [1990] have shown that this equivalence breaks down in a dynamic framework.

of the game is about the competition between the firms. The key result of this model is that the modelling of the governments' problem in two stages, instead of one, increases the likelihood of no-intervention as the best policy course.

To this point, it was assumed that governments pre-commit to a policy before the firms set prices or quantities. Carmichael [1987] and Gruenspecht [1988] have developed models in which a local firm and a foreign firm must set prices for their differentiated product to be sold in a third market prior to government action. It turns out that this inverse sequence of events reverses Eaton and Grossman's [1986] result. The local firm has an incentive to raise its price knowing that the government will use a subsidy to keep the local firm competitive. Brander [1995, p.1419] rightly points out that the government in this case is "trapped by its own good intentions" and that the subsidy program is of no value since the government would not lose anything by not having it. Hwang et al [1993] use a three-stage game to show that an export subsidy can reduce welfare. In their model, the local firm must choose a technology in the first stage of the game before the government commits itself to a set export subsidy. The local and foreign firms play a Cournot game in a third country market in the last stage of the game. The profit-shifting effect of the subsidy is still present but may not be sufficient to overcome the inefficient choice of technology by the local firm which simply takes into account that the government sets its subsidy in relation to its marginal cost.

A few recent studies have started investigating the effects of relaxing the assumption that firms and governments are fully informed about the cost structure of firms and that each player knows that other players know. In general, strategic trade policy becomes less attractive when information constraints are imposed. Unobservable outcomes, moral hazard and adverse selection are sources of imperfect information [Dixit, 1990]. Perhaps the problem is best illustrated in the principal-agent framework commonly used in literature on the economics of regulation. In this case, the government is the principal and the local firms are the agents.<sup>29</sup> The government has a policy objective (i.e., rent-shifting) and must use the firms as its agents to achieve this. The problem faced by the government is that it does not have as much information as the firms. Therefore, the firms can use this asymmetry to obtain larger subsidies that, in the end, may very well reduce their country's welfare [e.g., Wong, 1995].

Qiu [1994] specified a model in which the government is aware that domestic firms have the incentive to misrepresent their costs. It is assumed that the costs of the foreign firm are known to all. The government offers a menu/list of possible interventions to force the local firms to reveal information about their costs (i.e., high versus low). This second-degree discrimination/screening<sup>30</sup> device is potentially useful because it can provide information to the uninformed government while at the same time sending a signal to the foreign firm. When the firms play a Cournot game, a separating equilibrium is achieved and the government takes the same actions as it would under perfect information. This occurs because the gains from signaling the foreign firm that the local firm is of the low cost type exceed the losses associated with signaling the high cost structure of the local firm. As a

29. As Brainard and Mortimort [1997] put it, the principal-agent problem in trade policy differs from the regulatory policy problem in three important ways. First, market power in trade policy is not bad, especially when it is used to obtain surpluses from foreign consumers. Second, trade interventions can bring about retaliation from other governments. Third, in regulation problems, firms typically suffer from government-imposed interventions. In trade policy problems, firms often invite government intervention (e.g., anti-dumping actions) which implies that firms have the (so-called) residual right of control.

30. In game theory, the term "screening" refers to an action taken by the uninformed player. "Signalling" refers to an action taken by an informed player.

result, the expected payoff for the government is higher under a separating equilibrium. However, if the firms are involved in a Bertrand game, a pooling equilibrium is preferred by the government and a uniform subsidy will be provided to the local firms regardless of their types. In this case, it is best not to signal the foreign firm(s) about the costs of the local firm(s).<sup>31</sup>

Brainard and Mortimort's [1997] model is similar to that of Qiu [1994], except that the government is the only uninformed player. Since by construction the foreign firm knows the cost structure of the local firm, potential benefits from signaling are absent. The fear that the local firm will get an unnecessarily large subsidy reduces the pre-commitment value of the subsidy and thus induces the government to use a smaller subsidy (potentially negative for the least efficient firms) than under full information. Under asymmetry of information, the choice of policy instrument is very important because the government must credibly commit to expand the local firm's output and address informational rent seeking. Accordingly, the optimal policy has two elements: a (publicly announced) subsidy and a lump sum tax calculated from the local firm's reported cost. The second element is a screening device aimed at the adverse selection problem.<sup>32</sup> Interestingly enough, the local firm's incentive to misrepresent its costs is reduced when the foreign government is using a subsidy and this alignment of incentives between the local firm and its government tends to raise the subsidy for the local firm. Finally, if government intervention comes at the request of the firms and government intervention for the least efficient firms involves taxes, it follows that only efficient firms will request government intervention, which in turn means that only positive subsidies should be observed. If size and efficiency are correlated, this model predicts that only large firms will receive subsidies.

In Preszler, Wilson and Johnson [1992], exporting firms compete for a third-country market. Exporting firms maximize the expected value of profits by bidding to supply a product (assumed to be wheat) to the importing country. The importing country accepts the lowest bid. Hence, the exporting firm's expected profits depends on its probability of winning and the spread between its unit cost and its bid. The unit cost of a firm is not observed by other exporting firms and this is assumed to be normally distributed with given mean and variance. It is also assumed that the information about unit costs of STE is not as precise as for private traders. This greater variance, assumed to be brought about by asymmetry in the quality of information, induces less aggressive bidding and thus higher expected profits for all exporters, but more so for the STE. The benefits accruing to exporters through reduced competition are evidently at the expense of the importing country.

Yapo and Larue [1998] found results along the same lines by investigating the effects of asymmetries in risk perception and risk attitudes in a duopoly Cournot-like model. Through its effect on the best response functions of the firms (i.e., inward rotation), risk tends to temper the aggressive/non-cooperative nature of the firms. Thus the direct effect of risk on the firm's output is to depress it. However, because both firms are affected by risk and because the best response functions are negatively sloped, it is possible for a firm that is much less risk averse than its rival to end up producing more under uncertainty than under

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31. Under Bertrand competition, signalling a high cost (low cost) local industry is beneficial (harmful) because the foreign firm will respond with a higher (lower) price. Because signalling low costs does more harm than signalling high costs does good, the government chooses not to signal.

32. The adverse selection problem is due to the assumption that the government is uninformed about the firms' cost structures. Hence it might over or under subsidize because of a wrong inference about the firms' costs.

certainty. This highlights the importance of an indirect effect of risk that results from the strategic interactions of the firms. Such an outcome cannot be achieved by firms operating under perfect competition. In this model, it is advantageous for firms to face less risk and to be less risk averse. The implications for STE are evident. Firstly, operating in a non-transparent way may not be undesirable for STE as long as this translates into asymmetries in risk faced by STE and private traders. Secondly, financial backing of STE by government may profitably alter the rivalry between STE and their private rivals as long as it makes STE less risk averse.<sup>33</sup> In contrast, a self-financing STE can be at a distinct disadvantage in the event of a subsidy war if private traders in competing nations are provided government-financed subsidies (like EEP), regardless of the assumption made about market structure.

Retaliation is a big issue in strategic policy.<sup>34</sup> We stated earlier that two countries subsidizing the sales of their exporting firms might end up worse off than under free trade. Wong [1995] shows that in the “one-shot” game in which governments simultaneously impose production/export subsidies, at least one country is made worse off by the “subsidy-subsidy” trade war but not necessarily both. Thus, the trade war game is not quite like the Prisoners’ Dilemma game. Let us consider the case in which a local firm and a foreign firm compete in the local market. We further assume that their output decisions are made after governments have announced their policies. The activist foreign government uses an export subsidy while the activist local government uses a tariff and a production subsidy. This leads to a higher tariff than when the home government deals with a non-interventionist foreign government and to a lower foreign subsidy than in the absence of a tariff. Such an outcome simply reflects the fact that the tariff revenue is positively correlated with the size of the foreign subsidy. If governments move sequentially, i.e., if the foreign government must announce its export subsidy prior to the announcement of the (countervailing) tariff and the subsidy by the home firm, it is found that the optimal foreign subsidy is zero when the demand curve is linear [Collie, 1991].

The models involving “one-shot” non-cooperative games (i.e., government moves first and the game ends when the firms move) that are commonly used to analyse strategic trade policy, predict a relatively aggressive stance by countries. Once we allow for a large (voire infinite) number of repetitions in a dynamic framework and the rate of time preference is assumed to be small, different equilibria (including free trade and collusion) can arise. For instance, in the case in which a local firm and a foreign firm compete in a third country market, the governments may opt to implement the collusion solution through export taxes

33. The financial backing of a STE by government may be criticized because taxpayers’ money is at stake. This argument may also be applied to any diversified multinational corporation that uses shareholders’ money to back up a company division operating in a risky environment.
34. The analysis of retaliation under perfect competition was pioneered by Johnson [1953-54]. In this setting, governments impose so-called optimal tariffs to exploit the joint market power of the numerous (importing or exporting) local firms. With his two-country/two-good model, Johnson showed that at least one country is worse off than under free trade at the Nash equilibrium and that both countries are likely to end up worse off. Rodriguez [1974] has shown that if countries use optimal quotas instead of tariffs, the outcome is the elimination of trade. Syropoulos [1994] revisited Johnson and Rodriguez’s results by allowing the timing of government moves to be endogenized. If governments are involved in a trade war and use quotas, the equilibrium involves sequential play, the second country to move wins, trade is not eliminated and Rodriguez’s dire prediction is rejected. If governments fight with tariffs, the best-response functions in tariff space need not be downward-sloping everywhere. This raises the possibility of a Stackelberg equilibrium in which one country uses a negative tariff and both countries end up better off than under the Cournot equilibrium. When the choice of instrument is endogenized, it is shown that governments are more likely to use tariffs than quotas.

[Collie, 1993]. The intuition behind this result is that if there is a sufficiently long period of time remaining in the game, it might pay to suffer a short term loss and punish a rival that has deviant behavior in order eventually to get a long stream of higher collusion profits. Governments play cooperatively and rely on threats of punishment to deter changes in behavior. As long as the planning horizon is still sufficiently long, the threat of punishment is credible.<sup>35</sup>

In the case of a local firm competing with a foreign firm in a third-country market, the results from one-shot games are that the size of the optimal subsidy depends on the cost advantage of the local firm over its foreign rival and the ability of the government to finance the subsidy cheaply (i.e., it might cost \$1.10 or \$2.10 to finance a \$1 subsidy). The government has an incentive to back “winners” in order to shift as much rent as possible from the foreign rival. If we extrapolate to a finitely repeated game framework, a firm must try to keep a cost advantage over its rival if it wants to keep its subsidy. Thus, a country practicing laissez-faire might opt for intervention if its local firm develops a cost advantage, as through success in research and development. As mentioned previously, the size of the subsidy also depends on the cost of financing the subsidy by the government. If a government is disadvantaged in terms of its ability to collect cheaply the funds required to finance its firm's subsidy, it might decide to stay out of a subsidy war. This line of argument is a version of the “long purse/deep pockets” hypothesis of predatory behavior by firms in the presence of imperfect capital markets [see Tirole, 1988 chap. 9]. Over an infinite horizon, countries might consider colluding and taxing exports and sharing the collusion profits.

#### **4.1 How Effective is Strategic Trade Policy?**

Following the wave of theoretical studies on strategic trade policy in the early 1980s, numbers of empirical studies were published. Most studies suggest rather modest gains for interventionist governments [for example, see Dixit, 1988; Thursby and Thursby, 1990; Krishna, Hogan and Swagel, 1994]. However, data availability has limited the quality of empirical studies in two ways. First, it is often the case that data series are not long enough to support econometric estimation. Calibration techniques are often used. Second, the data series and elasticities required for a sophisticated calibrated model specification may not exist. Hence it is hard to say whether the small estimated gains derived from strategic trade policy are biased upward or downward.

The clearest result to emerge from the empirical literature on strategic trade policy mirrors the theoretical objections to strategic trade policy: the size of the gains is very sensitive to the choice and setting of policy instruments. Using the wrong policy instrument can have disastrous effects. Another result worth mentioning is that the number of players in the market need not be very small for strategic trade policy to matter [e.g., Panagariya and Schiff, 1992].<sup>36</sup>

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35. Rotemberg and Saloner [1987] use this same line of reasoning to compare tariffs and quotas when foreign and domestic firms might be tempted to collude. It turns out that a tacit collusion equilibrium is more easily supported by a tariff because the quota imposes too strong a constraint on the ability of foreign firms to flood the domestic market and hence punish domestic firms when the latter overproduce.

36. As argued earlier, strategic trade policy loses its appeal when a government must deal with a large number of domestic firms competing with a large number of foreign firms. It is common to refer to a number between 2 and 5 when talking about a “small” number of firms. However the simulations of Panagariya and Schiff [1992] for the cocoa market show that strategic interactions may matter, even when there are as many as nine exporting countries competing in a market.

Most experts find strategic trade policy unworkable on the ground that it requires too much information [e.g., Brander, 1995; Karp, 1996]. In practice, there are not many opportunities for countries to use subsidies and tariffs to shift rent. In essence, local firms, acting either individually or jointly, may not have market power and the government need not maximize the sort of welfare function usually assumed in the strategic trade policy literature. Political economy motives are likely to be important in explaining the behavior of state trading institutions, especially the STE involved mostly with import activities. Unlike the case of trade policy with competitive firms, governments need firm-specific information to implement efficiently strategic trade policy [Wong, 1995]. Furthermore, governments often depend on firms for their information. This is particularly worrisome in light of the incentive compatibility problem and potential regulatory capture that might result [Gasmi, Hansen and Laffont, 1995]. Governments are informationally-challenged and, even if they were not, one might wonder if they are able to respond quickly to new market developments. One way to circumvent this problem could be for a government to be directly involved in trade through state trading. By being directly involved in trade, STE may have information about the nature of the rivalry between the firms in the market and the home technology. By having monopoly rights to import or export and financial backing, STE may not need explicit policy instruments to harness whatever market power they might have in world markets.<sup>37</sup> Camouflage through self-imposed quantitative restrictions/expansions might provide an advantage of not eliciting as much retaliation.

## 4.2 Illustrating Strategic Trade Policy by Some Simple Examples

In this last section on strategic trade policy, simple examples are constructed to analyze the possible behavior of governments involved in strategic trade policies. These illustrate two issues, (i) the importance of timing, and (ii) the importance of the choice of instrument. In all cases, we assume that there are two exporters competing in a third country market. In the first two games, firms use prices as their strategies. They face a demand function:  $q_i = A - \beta p_i + \beta \delta p_j$ . Governments move first by setting a subsidy/tax that maximizes their welfare, defined as the difference between the local firm's profit and the cost of the subsidy. In the first game, governments move simultaneously, while in the second, they move sequentially. The firms set prices simultaneously in both cases. The games are solved backward. The firms maximize profits and set optimal conditional prices  $(p_i(s_i, s_j))$ . This yields conditional quantities and profits which are then used in the optimization problem of the governments.

In the third and fourth games, firms play Cournot (i.e., quantities are the strategies and the firms move simultaneously). The demand functions above  $q_i(p_i, p_j)$ , are inverted and take the form:  $p_i(q_i, q_j)$ . Governments set optimal subsidies simultaneously in the third game and play sequentially in the fourth game. The fifth game can be explained in two ways. The first explanation follows: government i moves first by setting a binding marketing quota. Government j moves second by setting a subsidy/tax. In the third stage, firm i whose output is constrained is a follower (i.e., its price is set based on  $p_j$  and the marketing quota/voluntary export restraint) and firm j is a price leader. The same results are also obtained by a different explanation. In this case government i sets its optimal quota in the first stage,

37. Having "deep pockets/long purse" and firm-level market power are not advantages restricted to STE. More often than not, such advantages are presented to explain predatory pricing behavior by multinational enterprises.

government *j* sets an optimal subsidy in the second stage, and in the third stage firm *j* is a quantity leader and firm *i* is a follower whose pre-determined output is equal to the optimal quota set in the first stage.

Regarding Table 1, from games 1 and 2, it turns out that moving sequentially in the tax game is Pareto optimal. The leader ends up with a lower market share but with higher profits. These results confirm the conclusion from the literature concerning optimal forms of interventions: when firms use prices as their strategies, the optimal intervention is a tax, however, subsidies are optimal when firms play Cournot. In the subsidy/tax games, the first mover advantage prevails. Game 5 is based on Harris's [1985] argument about whether voluntary export restraints are truly voluntary. In this case, government *j* is allowed to respond to the marketing/export quota by setting an optimal tax/subsidy. As it turns out, this is zero, due to the fact that firm *j* is the de facto leader and its government cannot improve on this. The interesting feature here is that the commitment to a fixed level of output is the best possible move for government *i*.

**Table 1: First Illustration of Strategic Trade Policy Outcomes<sup>1</sup>**

	Game 1	Game 2	Game 3	Game 4	Game 5
<b>Firms instr.</b>	Price	Price	Output	Output	Output/ Price
<b>Firms move</b>	Simult.	Simult.	Simult.	Simult.	Leader/ Follower
<b>Gov. instr.</b>	Subs/tax	Subs./tax	Subs./tax	Subs./tax	Quota, Subs
<b>Gov. move</b>	Simult.	Leader/ Follower	Simult.	Leader/ Follower	Leader/ Follower
<b>Welfare i</b>	468.595	470.068	471.191	471.202	488.17
<b>Welfare j</b>	468.595	469.825	471.191	469.984	468.798
<b>Profits i</b>	410.021	407.393	538.504	543.695	488.17
<b>Profits j</b>	410.021	411.097	538.504	537.124	468.798
<b>Output i</b>	28.6364	28.5444	28.4211	28.5577	28.9286
<b>Output j</b>	28.6364	28.6739	28.4211	28.3846	26.5179
<b>Price i</b>	21.3636	21.4441	21.5789	21.5	21.875
<b>Price j</b>	21.3636	21.3851	21.5789	21.5577	22.6786
<b>Subs./tax i</b>	-2.04545	-2.19573	2.36842	2.53846	n.a.
<b>Subs./tax j</b>	-2.04545	-2.04814	2.36842	2.36538	0

<sup>1</sup> Constant average costs are assumed. The table gives results for  $c_i = c_j = 5$ ,  $A = 50$ ,  $\beta = 2$ ,  $\delta = 0.5$ . For comparison purposes, the symmetric Bertrand game without government intervention yields: price=20, output=30, profit=welfare=450. The less competitive symmetric Cournot equilibrium without government intervention has: price=23, output=27, profit= welfare =486.

Regarding Table 2, as noted in the preceding review of strategic trade literature, the optimal subsidies for firm *i* in games 3 and 4 became larger as the firms' cost advantage widens. The underlying intuition is that government *i*'s subsidy can shift more rents from firm *j* when firm *i* is more efficient. The same can be said about the level of taxes in games 1 and 2. In real

life, the government does not know the cost structure of the firms unless it is itself directly involved in the production and export business. As demonstrated by Brainard and Mortimort [1997], the uncertainty surrounding the cost structure of the local firm is problematic, because the local firm may be tempted to mislead its government about its cost advantage and in so doing might be successful in shifting rents from both its government and its foreign rival. Taking the case of US export subsidies, it could be argued that the EEP bidding system tends to mitigate this “cost under reporting” problem (as long as the firms do not collude) but in so doing, it ties the hands of the government which cannot provide the optimal subsidy (i.e., the one derived from its optimization problem).<sup>38</sup> Thus, a STE with controls on production and export might be a natural way of dealing with such an informational deficiency.

**Table 2: Second Illustration of Strategic Trade Policy Outcomes<sup>1</sup>**

	Game 1	Game 2	Game 3	Game 4	Game 5
<b>Firms instr.</b>	Price	Price	Output	Output	Output/ Price
<b>Firms move</b>	Simult.	Simult.	Simult.	Simult.	Leader/ Follower
<b>Gov. instr.</b>	Subs./tax	Subs./tax	Subs./tax	Subs./tax	Quota, Subs
<b>Gov. move</b>	Simult.	Leader/ Follower	Simult.	Leader/ Follower	Leader/ Follower
<b>Welfare i</b>	484.066	486.159	486.545	486.556	502.741
<b>Welfare j</b>	413.33	414.514	415.808	414.655	413.696
<b>Profits i</b>	423.558	421.338	556.051	561.411	502.741
<b>Profits j</b>	361.663	362.7	475.209	473.892	413.696
<b>Output i</b>	29.1053	29.0289	28.8804	29.0192	29.3571
<b>Output j</b>	26.8947	26.9332	26.6986	26.6615	24.9107
<b>Price i</b>	21.6316	21.7141	21.8469	21.7667	22.125
<b>Price j</b>	22.3684	22.3904	22.5742	22.5526	23.6071
<b>Subs./tax i</b>	-2.07895	-2.23299	2.4067	2.57949	n.a.
<b>Subs./tax j</b>	-1.92105	-1.9238	2.22488	2.22179	0

<sup>1</sup> To gauge how asymmetry in cost can affect the results, these calculations are based on the same parameters as in Table 1, except for  $c_j$ , which is set at 7 instead of 5.

The games illustrate the necessity for flexibility in timing and the importance of choice of instrument if governments are to be successful in application of strategic trade policies. If STE are to be successful as instruments of the application of strategic trade policy by governments, they will also need to have the ability to apply and be flexible in the timing of subsidies/taxes as well as the quantity they commit to market, as though the control of domestic supply, either through explicit marketing quotas or (arguably less precisely) by

38. This objection to EEP is strongest if it is assumed that firms play the more aggressive Bertrand game. In this case, the optimal subsidy is negative!

controlling domestic prices. This supposes that the market structure in which STE operate is conducive to strategic play and that STE have the resources and authority that is required to play competently. Overall, however, the literature pertaining to strategic trade policy certainly does not suggest that the existence of an STE necessarily provides for either market power or the ability to operate strategically to the detriment of other nations or other traders.

## **5. Industrial Organisation Theory, Competition Policy, International Trade and State Trading**

### **5.1 Competition Policy and State Trading**

Competition or antitrust policy and legislation reflects the facts that most markets are characterised by varying degrees of imperfect competition and that these often exhibit characteristics of market structure and firm behaviour, known as market conduct, that lead to less-than-desired performance. Consequently, market failures that harm economic efficiency as well as affecting income distribution in a socially unacceptable manner are not uncommon. Competition policy typically involves government intervention directed at certain forms of business conduct that may harm market performance. One feature of state trading institutions is that these institutions are often exempted from national competition legislation. However, this exemption is not restricted to STE. Full or partial exemption from competition legislation, or special rules, are often applied to the agricultural sector and to other institutions associated with agriculture, such as co-operatives [OECD, 1996b].

The focus of national competition policy is on the conduct of firms in domestic markets, rather than on their behaviour in international markets. However, relationships between international trade, trade policy, and competition policy are evident and there has been periodic discussion of the benefits of international action to link trade policy and competition policy. A history of attempts to develop these linkages is outlined by Lloyd and Sampson [1995]. These authors attribute the increasing attention directed at the interface between trade policies and competition policies to the greater economic integration of markets across countries which has directly arisen from multilateral and unilateral reductions in border barriers to trade.

Codes of conduct for multinational enterprises have been developed under the auspices of the Organisation for Economic Co-operation and Development (OECD), but these are voluntary and not legally enforceable. Ways in which competition policy could be incorporated into the negotiating agenda of the WTO are discussed by Hoekman [1997]. This author concludes that an option that should enhance market access, improve efficiency and strengthen the world trading system would be the incorporation of anti-trust principles into anti-dumping; the most beneficial outcome would be abolition of anti-dumping measures, but this may be unlikely to be achieved, as shown by the unsuccessful efforts of Canadian negotiators to incorporate this change into the Canada-US Trade Agreement.

### **5.2 Insights from the Literature on Industrial Organisation**

What are the conduct requirements for STEs to follow the Article XVII specification that STE make “any purchases and sales solely in accordance with commercial considerations”? Concern about the effects of STE on market conduct and performance in international markets necessarily raises the question of the appropriate framework to analyse these features. The heterogeneity in STE operations and potential outcomes has also led to the

question of whether a useful classification scheme for STE can be developed. The economic theory of the impact of firm behaviour on industry outcomes, known as industrial organisation theory, provides some insights that may be useful in answering these questions. We now turn to these issues.

The classical paradigm of industrial organisation analysis relates market structure and the behaviour of firms that operate in a particular market to market performance. The parameters of market structure involve the number and size distribution of competitors; the barriers that may limit entry and exit; whether the product is homogenous or differentiated and whether there are substitutes for the product. Other structural factors relate to the existence and extent of vertical integration; the availability of information; and the nature and extent of risk that confronts economic agents in this market. The conduct dimensions of the paradigm relate to the behaviour of economic agents in this industry, specifically whether firms act independently or interdependently in their output, pricing and product (i.e., non-price) decisions and the nature of these decisions. The nature of the interdependence between firms that applies in actual markets is of importance. This may involve different forms of rivalry, or different forms of co-operation. Some of these types of behaviour may in turn influence structure, while market structure and conduct influence industry performance. Market performance, reflecting resource allocation at the industry level, is assessed in terms of measures of profitability, whether economies of scale are exhausted and other efficiencies are achieved, whether innovation is stimulated and in terms of the nature of product choice that confronts consumers. [Green, 1990; Jacquemin, 1987; Scherer and Ross, 1990].

Recognition that the concept of perfect or "pure" competition is a useful conceptual abstraction, rather than a description of real world markets, led to the concept of "workable competition". This was considered to apply when there is rivalry among sellers, sellers try to maximise profits and price discretion is limited by the option of buyers to purchase from rival sellers [Clark, 1940]. Thus, when there are several sellers of a particular product, driven by the goal of profits, and when easy entry conditions for new sellers keep established firms honest, workable competition ensues [Green, 1990].

The crucial importance of conditions of entry to firm conduct and industry performance is also recognised by a more recent concept of industrial organisation, contestable markets. Baumol and others argue that the welfare properties of perfect competition can be achieved under conditions of oligopolistic markets as long as there are no impediments to firm entry and exit. For a market to be perfectly contestable, potential entrants must not be at a cost disadvantage to existing firms and entry and exit must be costless. Firms must be able to exit without the loss of sunk capital costs, either by selling assets without loss or by transferring these to another production activity. In these circumstances potential entry forces established firms to set price equal to average cost, since any above-normal rate of return on assets would induce entry. Thus, in a perfectly contestable market, cost minimization for the industry is achieved, prices reflect average costs and the traditional distinction between long and short run analysis is blurred.

In practice, market contestability is always a matter of degree. Cost advantages may accrue to incumbents because of economies of scale, learning by doing, or customer loyalty. Incumbents may also have an advantage because of experience with local culture, customs or language. Natural barriers to entry due to geography may only be partially overcome by transportation and communication, thus allowing existing firms to raise prices above

average cost. Governments may also create barriers to entry. Examples include quotas, permits, preferential purchasing, and patents. Finally, the strategic actions of private firms may create barriers to entry [OECD, 1996c, d].

Although the concept of contestability is easy to understand, the measurement of contestability is difficult. Measurement of contestability must generally be based on an assessment of outcome indicators. Indicators such as concentration measures, trade shares, price differences and the existence of sustained rents (profitability measures) have been suggested in this regard [OECD, 1996c, d].

As Graham and Lawrence point out in their paper for the OECD, there are a number of ways to achieve contestability [OECD, 1996c, d]. One way that has attracted considerable attention is economic integration and harmonization. However, a single international governing body may not be able to respond to local needs and problems. What is important is that industry and markets remain open to new entrants, not that market rules and institutions are the same.

How may the concepts above aid in developing a subsequent framework for analysis of STE? From this literature, it is clear that the existence of a relatively concentrated market does not necessarily indicate imperfect market conduct if the entry/potential entry of new competitors is likely to have a major impact on firms' conduct and performance. One lesson from this literature is that the basis of comparison in analysing the impact of a STE must focus on the behavioural characteristics that would be expected in the absence of a STE. Would the removal of the STE appreciably improve either market "workability" or contestability? Would changes in the operations of some STE change market "workability" or contestability? These questions must be asked on a case by case basis and may not always be easily answered.

A second lesson is that typically there is a fundamental potential difference between those STE that are provided sole-seller privileges in the exportation of agricultural products (single-desk export marketing boards) and those STE given sole-importer status. In the former case, in most if not all instances, other suppliers that source product elsewhere exist and can compete in world markets; their structure of costs is not affected by the existence of a competing STE. In fact, the deletion of an existing export STE in the world grain market, for instance, might increase the level of seller concentration in that market. However, this is not the case for a sole importer STE; the power to act as the sole importer directly limits the access of other traders to that market. Thus the issue of whether other importers or traders may supply the import market, and the associated issue of whether any minimum access commitments are binding, or exceeded, can provide indicators of the potential market power of import STE.

A third lesson is that any classification framework or typology of STE that is developed needs to be based on the likely impact of various STE on market performance. This will necessitate the identification of measures, which may necessarily be proxy or "rule of thumb" indicators, of the impact of different types of STE on market structure, conduct and performance, rather than the characteristics per se of the STE. One attempt to develop a classification scheme for STE proposed the following characteristics: the trade balance for the product; the range of marketing activities subject to a degree of market control by the STE; the type of policy regime within which the STE operates; the product range of the STE; and the ownership and management structure of the STE [Dixit and Josling, 1997]. This list omits the important feature of the nature of the contestability or competitiveness of the market in

which the STE operates. In particular, whether market conduct would differ and whether market performance would be improved or worsened in the absence of the cited STE is not considered by Dixit and Josling. Another criticism of the characteristics viewed to be of importance by Dixit and Josling and the classification scheme that they propose is that the relationship of the cited characteristics to the typology that they also propose is not very clear. These authors seem to conclude that an apparent ability to apply market power (e.g., through the holding of sole-seller status in a domestic market) automatically leads to the exertion of market power against domestic consumers. As previously noted, this is, however, not necessarily the case. For example, government policy may explicitly constrain the behaviour of some import STE (such as BULOG or the Food Corporation of India). Government policy constrains current practices concerning the pricing of domestic sales that are made by the Canadian Wheat Board.

Finally, it should be recognized that differences among countries in their approaches to achieving contestability may reflect legitimate differences based on differences in history and culture. Attempts to harmonize policies and institutions are not necessarily desirable on their own account, nor are they necessarily likely to result in fewer entry barriers in international markets. While there is a need for some multilateral decisions on the requirements for transparency, minimum rules, and operating procedures [see OECD, 1996c, d], countries do have the right to develop their own mechanisms to encourage contestability.

### **5.3 What is Normal Commercial Practice for State Trading Institutions? The Issues of Price Discrimination and Transparency**

A question posed for consideration in this review of literature concerns the behaviour that is implied by the performance obligation of commercial behaviour for STE in Article XVII. As noted earlier, STE have been criticised as being insufficiently transparent. They have also been criticised for possible “hidden” subsidies arising from cross-subsidisation in pricing policies, i.e., for price discrimination.<sup>39</sup> The literature on industrial organisation theory and competition policy does provide some guidance on this issue. Price discrimination involves the sale or purchase of a good at price differentials not directly corresponding to differences in supply cost [Scherer and Ross, 1990, p. 498]. Scherer and Ross note that for a seller to practice (third degree) price discrimination profitably, three conditions must apply.<sup>40</sup> The seller must have some control over price; the seller must be able to segregate its customers into groups with different elasticities of demand, or different reservation prices; and the opportunities for arbitrage, i.e., the resale by low priced customers to high price customers,

39. Another criticism of STE such as the Australian and Canadian Wheat Boards has been expressed by the US [US GAO, 1992, 1996, US, 1997]. This relates to price pooling. This is not an activity conducted only by STE -- many cooperatives pool producers' prices. It is not at all clear that the formal price pooling arrangements of the CWB and AWB give these STE an advantage over “informal” price pooling procedures that might be pursued by private traders. In fact, legislated price pooling can reduce the pricing flexibility of STE, relative to private traders. Nor is it at all clear that price pooling keeps more producers and land in farming than would otherwise be the case, as alleged by the US [US, 1997].

40. Economic theory recognises three types of price discrimination schemes. In the first type, the firm charges different prices to consumers according to their different willingness to pay. This requires knowledge about the willingness to pay of all consumers and is, therefore, unrealistic in practice. In second degree price discrimination, the firm sells different units for different prices but each consumer buying the same quantity pays the same price. With third degree price discrimination, different groups of consumers pay different prices for the same good. Consumer segregation may be based on geography (e.g., domestic vs foreign), age (e.g., elderly discounts) etc.

must be constrained. Despite the popular view that price discrimination is bad, it has been pointed out that this practice is widespread, usually innocuous, and sometimes pro-competitive [Green, 1990 p. 494]. This is in fact recognized in the interpretative notes to Article XVII of the GATT/WTO. This spells out that STE may charge different prices for sales in different markets, provided that this is done to meet conditions of supply and demand in export markets.

Price discrimination is sometimes condemned because it is symptomatic of monopoly and the exploitation of monopoly power implies a misallocation of resources. However, this criticism is not appropriate if monopoly power would be present whether or not price discrimination were practised [Scherer and Ross, 1990 p. 494]. Scherer and Ross [1990] and Varian [1996] point out that price discrimination can improve the performance of industries that are unavoidable monopolies, by reducing the inefficiencies that arise from output restriction. Price discrimination can enhance competition by facilitating experimentation in pricing. Unsystematic price discrimination can have an important pro-competitive effect in undermining oligopoly discipline. In some circumstances, as when a firm faces increasing returns to scale over a large range, certain types of systematic price discrimination, such as "Ramsey pricing", can enhance economic efficiency.<sup>41</sup> However, price discrimination will be anti-competitive if it enables a firm to entrench its market power by creating strong seller-buyer relationships, providing barriers to entry of new competitors. Systematic predatory discrimination that is directed to "killing the rival" is clearly undesirable.

The competition legislation of some nations has restricted price discrimination, as through the US Robinson-Patman Act, which was passed to help small businesses but is recognised to have harmed competition by restricting price competition [Scherer and Ross, 1990 p. 509-516]. A review of the provisions of this Act in 1977 by the US Department of Justice condemned this legislation for harming competition by imposing rigid pricing in oligopolistic markets, where firms have used this law to prevent competitors from price-cutting [Hilmer *et al*, 1993 p. 78-79]. A recommendation to repeal the more limited restriction on price discrimination that had been included in Australian anti-trust legislation was made by a recent committee of inquiry into national competition policy in that nation. That committee concluded that price discrimination generally enhances economic efficiency, and that exceptions to this would be adequately covered in the anti-trust provisions that deal with anti-competitive agreements and misuse of market power. The committee considered that the restriction of price discrimination otherwise should not form part of a national competition policy [Hilmer *et al.*, 1993 p. 74-80]. These recommendations of the Hilmer committee were adopted in the subsequent revision of Australia's Trade Practices Act.

Review of literature on firm behaviour and industry performance clearly indicates that in general, price discrimination is a normal expression of price competition and thus a normal commercial practice. Exceptions occur when this practice harms contestability of markets by restricting or excluding new competitors. There is no indication that this has been the case in the pricing practices of export marketing boards. However, it is also clear that the impact on contestability of some import STE is deleterious when access of competing traders to that market is restricted i.e., if the STE is effectively given "sole importer" or "preferred

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41. Pricing according to marginal cost, as is desired to achieve an efficient outcome, will provide losses for a firm/enterprise in a "natural monopoly" situation of extensive economies of scale, relative to market size. However, pricing differentially, according to a Ramsey formula, retains profitability and prices efficiently [Scherer, 1990, p. 496-499].

importer", status or if it operates in a highly protected market, as when imports are effectively limited by restrictive tariff-rate quotas. Under these circumstances, an import STE may be able to exert considerable market power in pricing on the protected domestic market.

A further issue to be considered is the question of the transparency of STE operations. Dixit and Josling [1997 p. 4] pose the question: "is there a time limit on how long any information can be held as proprietary?" The answer must depend on the particular characteristics of the industry. It would not seem to be in the spirit of GATT/WTO to impose higher reporting standards on a STE than those that are customarily applicable to its competitors in any market. Such a requirement would place the STE at a competitive disadvantage. This would be of particular concern in those export markets where the exclusion of STE could harm, rather than aid, the competitive environment (i.e., when industry concentration would be expected to increase, and thus the extent of competition would be expected to decline, with the elimination of STE). This situation could be expected, for example, if some export STE were to be eliminated.

#### **5.4 Some Issues Concerning Price Asymmetry and Procurement Advantages of Export STE**

Issues of information asymmetry have been noted in several instances in this part of the report. Specifically, it was noted in Section 2 that asymmetry in knowledge of market conditions held by traders, relative to that held by primary producers, has been one major motivation for the involvement of STE in marketing of agricultural products. Similarly, asymmetries in the availability of information about product quality that could lead to loss of quality reputation has been noted as another rationale for STE operations. However, Preszler, Wilson and Johnson [1992] have postulated that more market information may be available to grain-marketing STE such as the CWB and AWB than to US-based private grain traders since there are "highly competitive public transaction mechanisms in the United States (and, to some extent the EC) in which all terms of trade are revealed" (p. 2). The preceding statement is highly debatable. Most international grain trading companies are private companies and do not release details of their trading operations. The data series on US prices are typically constructed series and do not reflect individual transactions. Data on individual US grain transactions have only been released relative to price support/export subsidy operations of the US STE, the CCC. Overall, there is little evidence supporting the argument that there is preferential access of export STE to market information.

The other aspect of the US-based arguments that export STE like the CWB and AWB possess an unfair advantage relative to private traders is the contention that these STE face less uncertainty about procurement prices, due to the specification, say, of CWB initial payments, while private traders may face a greater risk that prices may change during the time period between forward sales commitments and grain procurement. In addition, private traders are viewed to face greater search or transactions costs in acquiring appropriate supplies [Wilson et al, 1995]. However, risks facing private traders from variations in grain purchase costs can be readily offset by hedging, while costs of search for supplies can also be offset by contracting between producers and traders. The fact that the latter is not a widespread practice by US-based grain traders suggests that such traders do not face significant problems of grain acquisition, relative to STE.

In practice, the possible advantage to STE like the CWB from general knowledge of the levels of initial payments seems to be more imagined than real. Offsetting any advantages to the STE of assured procurement are the features that MNE exporters which compete in wheat

sales with STE like the CWB know the CWB's acquisition costs, while the reverse is not the case. And long-standing procedures relating to the system of initial payments for CWB grains, in particular, have meant that this institution has had the disadvantage of lack of flexibility in procurement pricing, a restriction that does not apply to private traders.

## 5.5 Overview

This first part of the full report has provided a review of selected literature relating to STE for agricultural and food products. It constitutes the first stage of the full report on STE; the second and third stages of the full report outline, in addition to this literature review, two theory-based analyses of STE operations, a classification scheme for STE and several brief case studies of actual STE. The STE issue that is expected to be the focus of the next round of multinational trade negotiations is not the concern that excess market power might be held and exerted by export boards. Instead, the alleged use of covert subsidisation by export boards has been the major issue of concern, sparked by pressure on the US Government by farm interests that are concerned that they are harmed by subsidisation and a lack of transparency of export board operations [Josling, 1996]. In turn, these boards, and those knowledgeable about their operations, point out that subsidisation requires financial transfers from government, that such transfers must be documented in national accounts, and that any such assistance to boards is explicitly included as an export subsidy in the Uruguay Round Agreement on Agriculture. The issue of "implicit" subsidization, which necessarily would require the STE to apply price discrimination practices, was discussed above in Section 5.3.

We believe that concerns over export STE are probably exaggerated. The evidence available indicates that most export STE receive little assistance from their government. The most effective way of ensuring that STE do not subsidise exports is to ensure that these are self financing institutions that are insulated from government. However, the most effective means of ensuring that export subsidies do not distort world markets for agricultural products would be for the complete prohibition of all agricultural export subsidies.

The concern about import STE is more generalised in nature and is focussed mainly on issues of access. One way to meet concerns about import STE could be to reduce the level of protection that is implicit in tariff rate quotas and to increase the associated minimum access commitments. However, concern has also been expressed about administration of minimum access commitments and whether these commitments can be subverted when they are administered by the STE. Thus there are concerns that administration of tariff rate quotas may lead these to represent potential access rather than actual access. For example, there are concerns that the manner in which tariff rate quotas are administered may cause importation to be restricted to low quality versions of the product that are not preferred by local consumers. Similarly there are concerns that the markups applied by STE on imported product might be used in a way that deters consumption of the imported product in favour of the local product. These issues are taken up again in Parts II and III of this report.

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# Part II: Analyzing the Impact of STE Operating in International Trade

## 1. Introduction

STE are important features in the international trade of many agricultural commodities. To examine the impact of STE on international trade, a comparative organizational approach is taken in this section of the report. The basis of this approach is that different types of trading enterprises, such as STE and privately-owned firms, operate in international markets. Each of these organizational forms has strengths and weaknesses. The impact of an STE operating in the international market can be determined by answering the following question. What is the outcome (e.g., in terms of prices, output, exports, imports, economic surplus) if an STE is assumed to operate in the international market, and what is the effect on this outcome if the STE is removed and replaced by privately-owned traders?

The assumptions used in answering this question are very important. Previous models of STE typically assume that STE removal will result in the formation of a competitive trading sector in that country or for that commodity. This assumption is simplistic and can have important consequences for the results of analyses that employ it. In reality, although the removal of an STE could potentially result in a competitive trading sector, in many instances the more likely impact of STE removal is the replacement of one oligopolistic structure with another. This is particularly likely for many export STE. As discussed below, the replacements to an export STE are often likely to be multinational enterprises (MNE); these MNE are large, may be vertically integrated, and often are privately owned firms that provide very little public information.

The assumption that a competitive trading sector will replace the STE has important consequences for the question posed above. If the alternative to the STE is a perfectly competitive trading industry, removal of the STE always has the effect of potentially improving the operation of the trading sector and the international market. However, this conclusion is not automatic if the STE is replaced by an oligopolistic trading sector. The replacement of the STE by oligopolistic private traders can be expected to have both benefits and costs. A comparative analysis approach is one way to determine these.

The purpose of this second part of the full report is to develop theoretically-based models of international trade in farm products that incorporate export and import STE. The initial focus is on export STE, and this is modelled in the context of an oligopolistic world market, as in the world market for grain. Thus, the next section of this part of the report draws on work by Caves to develop the theoretical reasoning as to why an oligopolistic trade sector is likely to emerge as an alternative to export STE. The various industrial configurations that might emerge when STE no longer operate in an industry are then examined. These configurations serve as the basis for a number of theoretical models that are developed to examine the impact of STE. The results of numerical simulations follow the theoretical model. The focus then turns to theory-based considerations of import STE. This section of the paper focuses on the practice of price discrimination by an import STE in the situation where the STE has the power to control domestic production. A summary concludes Part II of the report.

## **2. Oligopolistic Trade Sectors — Evidence and Theory**

There are strong empirical and theoretical reasons to believe the international agricultural trading sector is oligopolistic in nature. The purpose of this section is to describe the oligopolistic structure of one segment of agricultural trade, namely the grain trade, and to link this oligopolistic structure to the nature of the assets owned by trading companies.

### **2.1 The Structure of the World Grain Trade**

Grains represent one of the more important sectors in agriculture, particularly in the context of international trade. The major actors in the world grain trading system are governments and MNE [Davies]. Governments play a role through domestic commodity programs, export subsidies, trade barriers, and the operation of STE. MNE play a role by virtue of the fact that they account for roughly 75 per cent of the total grain shipped internationally [Atkin]. The relationship between MNE and government is complex. At times the relationship is one of conflict, while at other times the relationship involves pursuing mutual interests. Because of the strong interrelationship between governments and MNE, these two actors have to be examined together [Davies].

While recent estimates are not obtainable, Davies estimates that in the mid-1970s the five largest MNE handled about 85 to 90 per cent of US grain exports, 80 per cent of Argentina's grain exports, 90 per cent of Australia's sorghum exports, 90 per cent of the wheat and corn exports from the (then) EC, and 90 per cent of Canada's canola exports.

The five largest grain handling MNE are Cargill, Continental, Bunge and Born, Louis Dreyfus, and André Garnac (see Sewell for a description of these five companies). These MNE are privately owned and are thus not required to publish financial data on their operations.

One reason for MNE being privately owned is that corporate success in the grain trade depends heavily on market intelligence and on the development of proprietary assets that are based on the collection and use of market intelligence. All the MNE operate extensive networks that collect and collate information. They also operate extensive networks of storage, handling, and transportation facilities that allow them to co-ordinate various aspects of grain distribution and handling [Davies]. MNE have links with financial and shipping firms, provide farm inputs to farmers through country elevators, and operate an extensive

set of processing and manufacturing facilities [Sewell]. Their information and distribution networks provide the MNE with economies of scale that are the source of their advantage in the world grain trade [Davies].

While MNE source a considerable amount of grain themselves, they also handle grain on behalf of other grain companies, most notably STE and co-operatives. For instance, in the US, several large co-operatives provide grain and oilseeds for export. They arrange for delivery of the product to the port, where it is sold to one of the MNE for sale to foreign purchasers [Cramer, Davies]. MNE also handle a substantial amount of grain on behalf of STE. For instance, while the majority of sales are carried out directly, the Canadian Wheat Board (CWB) also uses accredited exporters. Accredited exporters are national and multinational companies authorized to purchase grain from the CWB for resale to customers and other exporters. The CWB works with over 20 accredited exporters [Canadian Wheat Board, 1998]. MNE play this role because of the information and distribution networks at their disposal.

Although MNE, along with a few STE, dominate international markets, they compete in national markets with co-operatives, national trading companies, and on occasion, STE [Hill, Davies]. The result is that at the country elevator level, competition ranges from very high to very low [Hill].

In summary, the international agricultural trading sector is oligopolistic in nature, with vertically integrated MNE playing a dominant role. As the next section outlines, this particular market structure arises because trading firms possess significant proprietary assets. These assets provide trading firms with significant economies of scale and scope and create cost advantages for the incumbents. The result is that contestability is reduced, providing trading firms with some degree of oligopoly power and the potential and incentive to price discriminate. As well, since proprietary assets are difficult to license to others, vertically integrated MNE become the dominant organizational forms for trading firms.

## **2.2 Proprietary Assets and Oligopolistic Structure**

The international trading sector for agricultural products is likely to be oligopolistic because of the nature of the assets used in the trading of these products. Firms engaged in the international trading of agricultural products are likely to possess proprietary assets such as networks for gathering market intelligence, personnel with specialized knowledge of the international market, and logistic systems for ensuring product is efficiently moved from where it is produced to where it is demanded [Davies].

Proprietary assets—or intangible assets—are different from the other assets used by firms in that they are nonrival goods that have a high degree of excludability. While rival goods can only be used by one firm or person at any one time, nonrival goods can be used by different people, in different locations, at the same time. The fact that a proprietary asset can be used in many different locations at the same time means the firm possessing that asset will enjoy increasing returns to scale in production [Romer].

Firms that possess increasing returns to scale cannot function as price takers in their industry unless the nonrival assets that give rise to the returns to scale can be obtained free of charge. The reasoning is simple. With increasing returns to scale, marginal cost is less than average

cost unless the nonrival assets are obtained without cost. If obtaining nonrival assets involves a cost, firms with these assets will lose money if they act as price-takers. Consequently, firms with nonrival assets must price above marginal cost if they are to remain successful [Romer].

Proprietary assets also restrict contestability. These assets provide incumbents with cost advantages, thus providing an opportunity for prices to be raised above average cost without attracting entry. They also create barriers to entry and exit. Because the market for proprietary assets is prone to failure (see the discussion below), the acquisition cost of proprietary assets is often greater than the resale price. The result is that firms cannot costlessly enter and exit the trading industry.

Applying the results of the discussion above to agricultural trading firms suggests that the international agricultural trading sector is oligopolistic in nature and contestability is limited. Proprietary assets such as information networks and personnel with specialized knowledge of the international market are some of the most important assets owned by trading firms. These assets lead incumbent trading firms to possess economies of scale and cost advantages, which in turn implies that these firms also possess some degree of market power.

### **2.3 Proprietary Assets and Multinational Enterprises**

Proprietary assets have another important implication for the structure of the international trading sector: firms for which proprietary assets are important are much more likely to be multinational enterprises (MNE). The reasoning is as follows. Because proprietary assets are nonrival, they can be used in different locations at the same time. However, attempts to make these assets available to other firms through such means as licensing agreements are often prone to market failures, arising from factors such as opportunistic behaviour. For example, the intangibility of proprietary assets makes it difficult for firms to arrive at a price for their exchange in advance of the assets actually being exchanged. After the assets are exchanged, however, it is difficult for the holders of these assets to obtain their full value, since the receiving firm can claim the assets did not perform as was expected. In addition, proprietary assets may be difficult to transfer because their effectiveness depends on the other assets that are present. For example, an information collection network is more valuable if a distribution network is also in place. If these other assets are missing, the proprietary assets may have little value [Caves, 1996].

As a consequence of these factors, firms with proprietary assets often find it more advantageous to start new operations themselves (i.e., to expand their operations to new locations) in order to obtain the benefit of their assets, rather than leasing the assets to others. In short, firms for which proprietary assets are important are likely to establish multi-plant sites within a country and to expand their operations to other countries through MNE. The empirical evidence supports this hypothesis, and foreign investment by grain-trading MNE is evidently strongly influenced by investments in proprietary assets. Proprietary assets also play a similar role in decisions to vertically integrate [Caves, 1996].

### **2.4 Proprietary Assets and Price Discrimination**

The existence of trading firms with proprietary assets and consequent market power raises the possibility of price discrimination. As Varian [1996] notes, firms with high fixed costs and low marginal costs—the kind of cost structure associated with proprietary assets—either have to charge a single price and restrict sales or they have to use differential pricing. The first of these outcomes may be followed by firms with market power. However, differential

pricing is the preferred option for such firms since, if this can be implemented, firms will earn larger profits. As was noted earlier in the discussion of price discrimination, differential pricing can reduce resource misallocation in these circumstances.

Price discrimination is possible when: (1) different markets have different demand elasticities; (2) firms practicing price discrimination have sufficient control over product movement to limit the supply of product to certain markets; and (3) barriers exist to purchasers in one market reselling to purchasers in another market [Scherer and Ross, 1990]. The first of these conditions is likely to exist in the world market for agricultural goods. There are wide variations in income levels associated with differences in development in different countries. As well, the differences in preferences for many foods and the presence of quotas and tariffs in many countries will have the effect of producing different demand elasticities in these countries. In addition, recent surveys of grain importers conducted by Mercier [1993] and Stephens and Rowan [1996] demonstrate that grain quality is an important factor in procurement decisions. Intrinsic quality, quality consistency and price are given the highest priority by grain buyers.

The degree to which the second condition is met depends on the nature of the commodity being sold, the type of strategic behaviour chosen by the trading firms, and capacity constraints of the trading firms. If the commodity being sold is completely homogeneous and if the trading firms have no capacity constraints, these trading firms can be expected to engage in price competition and/or arbitrage, and price discrimination will not be possible. Simply put, if firms compete solely on price—i.e., if they engage in Bertrand competition—each firm always finds it profitable to undercut the others, with the result that price is driven down to marginal cost.

The introduction of product heterogeneity and/or capacity constraints changes these results. If all the trading firms have limits on the amount they can supply to a market—particularly the high-priced ones—over a particular time period then the resulting price can be set above marginal cost even if the firms engage in price competition. Examples of such limits include processing, storage or transportation constraints. The standard theoretical framework that examines the choice of capacity constraints is the Cournot model. As Kreps and Scheinkman [1983] show, the introduction of capacity constraints or other types of quantity precommitment results in a Cournot-type solution.

In addition, if the product from one trading firm is viewed differently from the product supplied by another trading firm (e.g., because of the type of service provided), then each firm may possess some degree of market power, even if capacity constraints are not present.<sup>42</sup> Firms may also be able to raise price above marginal cost if the products they sell have brand name advantages or if there are costs associated with customers shifting their purchases to the product supplied by another firm [Klemperer, 1996].

Product differentiation is likely to be important in the export of those agricultural products for which trading companies are providing something more than just the basic product to their customers. In reality, trading firms must be recognized as not only supplying a physical product, but also the service that derives from their proprietary assets. Differences, perceived

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42. Salop [1979] provides a theoretical framework that forms the basis for virtually all models of product differentiation. Although Salop's framework was specifically developed for monopolistic competition, the basic structure applies to all oligopoly models with differentiated products. This structure is also used by Greenhut et al.

or real, in the services provided by different trading companies will allow each firm to price its product above marginal cost, to some degree. Indeed, since the marginal costs of providing these services are likely to be very low, while the fixed costs associated with providing them are high, trading firms have to charge a price above marginal cost to survive economically.

The extent to which the purchasers in one market are constrained from reselling to purchasers in another market depends on many of the same factors that determine the degree to which traders can control output. In particular, the issue of product heterogeneity is again important. If traders are selling the physical good and a set of associated services, the ability of a purchaser in one market to resell the product to a purchaser in another market is severely restricted. Even a difference in product specifications from those that the purchaser is familiar with may be enough to restrict the reselling of a product.

Other factors are also important. If trading transactions are confidential, for instance, opportunities for reselling may go unnoticed. More importantly, however, widespread arbitrage by purchasers can only occur if the purchasers effectively become trading companies. However, as was discussed above, proprietary assets create a barrier to new firms entering the trading industry.

Although the conditions that are necessary for some sort of price discrimination appear to be present in the trading of many agricultural products, the mere presence of these conditions does not mean that price discrimination is actually practiced. As would be expected, evidence on price discrimination is difficult to obtain.

### **3. Analysing Export STE: Industrial Configurations in the Trade Sector**

The dominant presence of large multinational firms in the international agricultural trading sector suggests that an oligopolistic market structure that is dominated by MNE is likely if STE are removed from an industry. The purpose of this section is to outline a few of the possible industrial configurations that are possible.

Before the industrial structure of the trading sector is examined, it is necessary to take a look at the nature of the theoretical and simulation models that will be built in the next section. When considering the effect of an export STE, at least three broad national groups must be considered. The first is the country in which the STE is operating, the second group involves competitors, that is, other countries that compete in the export market with the country that has the STE, and the third group contains countries that import the traded product. To accommodate these, the model developed in this paper has three regions—a domestic country, a foreign country, and the rest-of-the-world (ROW)—each of which corresponds to the three groups outlined above. In the model, the domestic country is the one that is replacing the STE, the foreign country is the competing export country, while ROW represents the import countries.

Within each of these broad groups, sub-groups exist. In both the domestic and foreign countries, three sub-groups can be identified—the producers of the agricultural products at the farm level, the traders of the agricultural products (this group includes traders selling internationally, plus those selling only within the country), and the processing firms that purchase the agricultural products. In the ROW, only two groups are identified, the traders and the processors.

Agricultural products are purchased from the farm production sector and sold to the processing sector by traders. While some of the traders may only operate in the domestic and/or foreign country, other traders will operate internationally, purchasing farm product from the farm sector in both the domestic and foreign country and selling it to ROW. Traders operating only in the domestic or foreign market are termed local traders, while the international traders will be termed MNE.

### **3.1 A Comparative Analysis of Alternative Organizational Structures**

To examine the impact of STE on the prices of the products in the various markets and the quantity of product produced and traded, the theoretical and simulation models are set up as follows. Privately-owned traders are assumed to operate in the foreign country at all times. In the domestic country, two scenarios are examined and compared. In the first scenario, the trading firm operating in the domestic country is assumed to be a STE. In the second scenario, the STE is replaced by private traders. MNE are assumed to carry out the export and import trade, while some combination of MNE and national traders carry out the domestic trade.

Within this broad model, a large number of different organizational structures are possible. To keep the analysis as simple as possible, the structure of the farm production sector and the processing sector is assumed to be given. The farm production sector is assumed to be competitive, with a large number of price-taking producers operating in both the domestic and foreign country. The behaviour of the farm production sector is summarized by a farm product supply curve which shows the quantity of the agricultural product that will be produced for any given price established by the traders.

Although vertical integration is important for many agricultural commodities, this aspect is not considered so that the model is more manageable. The actions of the processing sector in the domestic, foreign, and ROW countries are represented by demand curves in each of these countries. These demand curves are assumed to be consistent with either a perfectly competitive processing sector or an oligopolistic processing sector. In the latter case, the demand curves represent the quantity the processing firms are perceived to be willing to purchase at any given price set by the traders. These perceived demand curves would apply in a situation where the traders move first and set a price that the processors take as given when making their purchase decision (see Waterson [1980,1982] and Abiru [1988] for examples of this framework). Although neither the competitive nor oligopolistic interpretation of the processors' demand curve is entirely satisfactory, the notion that demand curves exist for the product supplied by traders is maintained to allow attention to be focused on the trading sector.

### **3.2 Structure of the Trading Sector**

The structure of the trading sector has a number of potential variations. Trading firms operate as both buyers and sellers, buying from the farm supply sector and selling to the processing firms. From a theoretical perspective, the structure of the buying market may be different than the structure of the selling market. For instance, traders may be price takers when they purchase product from the farm supply sector, but have market power when they sell the product to processors in ROW. Or, traders may operate in an oligopolistic market when they are buying farm product in a particular country, but sell their product into a relatively competitive market in ROW.

Table 1 shows a number of the potential market structures for the trading sector in the model used in this paper. As Table 1 indicates, the competitive market structure (Structure 1) is one of the many possible market structures that could govern the trading of agricultural products. Other market structures that could exist include: (1) competitive markets in both the domestic and foreign country, but an oligopolistic market in ROW (Structure 2); (2) competitive markets in one of either the domestic or foreign market, combined with either a competitive or an oligopolistic market in ROW (Structures 3 to 6); (3) oligopolistic markets in both the domestic and foreign market and a competitive market in ROW (Structure 7); and (4) oligopolistic markets in the domestic, foreign and ROW markets (Structure 8)

**Table 1: Potential Private Trader Market Structures**

Market Structure	Domestic Country		Foreign Country		ROW
	Buying	Selling	Buying	Selling	Selling
Structure 1	C	C	C	C	C
Structure 2	C	C	C	C	O
Structure 3	C	C	O	O	C
Structure 4	C	C	O	O	O
Structure 5	O	O	C	C	C
Structure 6	O	O	C	C	O
Structure 7	O	O	O	O	C
Structure 8	O	O	O	O	O

Key: C - Competitive; O - Oligopoly.

Market structures 2 to 6 emerge when only a few of the trading firms operating in the domestic and foreign countries have sufficient size and expertise to operate internationally. These structures could also occur when domestic and foreign oligopolies compete vigorously in their home countries, but not in the ROW. Structure 7 occurs when the domestic and foreign oligopolies compete vigorously in ROW, but are sheltered from competition in their home markets.

The market structures outlined in Table 1 are much richer than the preceding discussion would indicate. For instance, the traders operating in the domestic country may be different firms from those operating in the foreign country. Alternatively, some or all of the firms operating in the domestic country may also be operating in the foreign country. The latter situation occurs when one or more of the trading firms are MNE.

In addition to specifying whether the firms are competitive or oligopolistic, it is necessary to specify the type of oligopolistic behaviour in which the firms engage. The possibilities include price competition with homogeneous goods [Bertrand], price competition where consumers have switching costs [Klemperer], price competition with differentiated goods, and quantity competition with homogenous goods [Cournot]. Stackelberg behaviour can also be modeled if one of the firms is a price or quantity leader.

To analyze the impact of a STE on international trade, it is necessary to specify the appropriate market structure both before and after the STE is removed from the domestic country and replaced with private traders. Table 2 presents some of the market structures that are possible when a STE operates in the domestic country and private traders operate in the foreign country. The analysis of the economic impact of a STE involves a comparison of the prices, quantities and economic surplus that emerge from the appropriate market structure in Table 2 with the prices, quantities and economic surplus that emerge from the appropriate market structure in Table 1. The appropriate market structure is defined as the market structure that corresponds best to the market structure in a particular industry when a STE is present (Table 2) and the market structure that is expected to emerge once the STE is removed (Table 1). Note that there is no requirement that Structure A (Table 2) will be replaced with Structure 1 (Table 1), and so on.

**Table 2: Potential STE and Private Trader Market Structures**

Market Structure	Domestic Country		Foreign Country		ROW
	Buying	Selling	Buying	Selling	Selling
Structure A	S	S	C	C	C
Structure B	S	S	C	C	O
Structure C	S	S	O	O	C
Structure D	S	S	O	O	O
Structure E	S	S	C	C	C
Structure F	S	S	C	C	O
Structure G	S	S	O	O	C
Structure H	S	S	O	O	O

Key: C - Competitive; O - Oligopoly; S - STE

To further complicate matters, STE may pursue other objectives besides maximum profits. For instance, STE may be formed with the intent of maximizing export earnings. Or STE may be formed with the objective of maximizing the returns to producers in the domestic country, or its objectives may relate to reducing price variability to consumers and/or producers in the domestic country. Although the range of possible STE behaviour is very large, one STE objective is selected for analysis in this section of the report: maximization of producer welfare with transfer to producers via pooling (see discussion below).

### 3.3 Analysing Export STE: The Structure of the Theoretical and Simulation Models

The next section develops a theoretical model and a numerical simulation to examine the effect of a particular STE on agricultural trade. The theoretical model establishes the framework for examining oligopolistic traders and the impact of STE, as well as showing some conclusions that can be drawn from the analysis. The simulation model shows results that cannot otherwise be obtained with a theoretical model.

As was outlined earlier, most authors agree that the export trade for grain is dominated by an oligopolistic market structure involving MNE. The MNE face competition, however, in the sourcing of agricultural products at the farm level from firms that operate exclusively in

the local market. These local firms buy from the local farm supply sector and supply the local processing sector. In some cases these firms provide extensive competition to the MNE, while in other cases the competition is muted because of spatial factors and increasing consolidation of the local firms. In some cases this consolidation is occurring because MNE are purchasing or investing in local trading firms.

To reflect this structure, the base case for the simulation model assumes that MNE operate alongside local traders in sourcing the agricultural product from the farm sector. Both local traders and MNE sell to the processing sector in the home country. However, only MNE export to ROW, because of cost advantages associated with proprietary assets. Because this particular structure is difficult to model theoretically, two alternative structures that bracket this structure will be examined in the theoretical model. In one case, perfect competition is assumed in the sourcing of products from the farm sector and in the selling of this product to the processing industry. Oligopolistic MNE, however, undertake the export of the product from both the domestic and foreign country. In the other case, MNE are assumed to be the only purchasers of the farm product and the only traders internationally. In this case the MNE thus have oligopsony power in the sourcing of products from the farm sector and oligopoly power in the supplying of products to the processors in both the local and ROW markets. These alternatives are described in detail below.

In both market structures used in the analysis, the assumption is made that all firms adopt Cournot behaviour. Cournot behaviour is used because it results in a relatively simple model that encompasses a range of market behaviours from perfect competition to monopoly. The Cournot model is routinely used as the basic model in most industrial organization contexts where oligopolistic behaviour is assumed. Furthermore, the Cournot results can be duplicated by a two-stage Bertrand game in which firms must commit to a capacity choice prior to setting their prices [Kreps and Sheinkman [1983]; see also the earlier discussion in section I.4]. Single-stage Bertrand behaviour was not assumed because it results in the MNE pricing at marginal cost. Such an outcome is not consistent with the cost structure of the trading industry (i.e., the presence of substantial fixed costs means that marginal cost pricing will lead to operating losses).

The base case scenario where only private traders operate is compared to an alternative scenario in which the STE operates in the domestic country, while private traders continue to operate in the foreign country. As in the base case, MNE operate alongside local traders in sourcing the agricultural product from the farm sector in the foreign country, although only the MNE export product to ROW. Although the range of possible STE behaviour is very large, one is selected for analysis in this paper: maximization of producer welfare with transfer to producers via pooling. The pooling of returns is characteristic of two of the major STE in the international wheat industry—the Canadian Wheat Board and the Australian Wheat Board. Pooling also applies for some other agricultural commodities, such as milk.

## 4. Analysing Export STE: A Model of International Trade with a Trading Sector

### 4.1 A Trade Model with Competitive Traders

To examine the impact of introducing oligopolistic traders into an international trade model, consider Figure 1, which shows the case of perfect competition in the trading sector. The case of perfect competition is examined first because this serves as a comparison point for further analysis.

Panel (a) in Figure 1 shows the supply curve ( $s$ ) and the demand curve ( $d$ ) for the commodity under consideration in the domestic country, while panel (b) shows the supply curve ( $S$ ) and the demand curve ( $D$ ) in the foreign country. Panel (c) shows the demand curve ( $D^*$ ) in ROW. The ROW is assumed to have no domestic production. Curves  $es$  and  $ES$  are the excess supply curves in the domestic and foreign countries, respectively. The construction of  $es$  and  $ES$  is explained below.

In what follows it will be explicitly assumed that the marginal costs of providing the trading function are zero, as are the costs of transporting the product from both the domestic and foreign country to ROW. For ease of exposition, the following notation is used: (1) small letters refer to the domestic country; (2) capital letters refer to the foreign country; and (3) capital letters with stars refer to ROW.

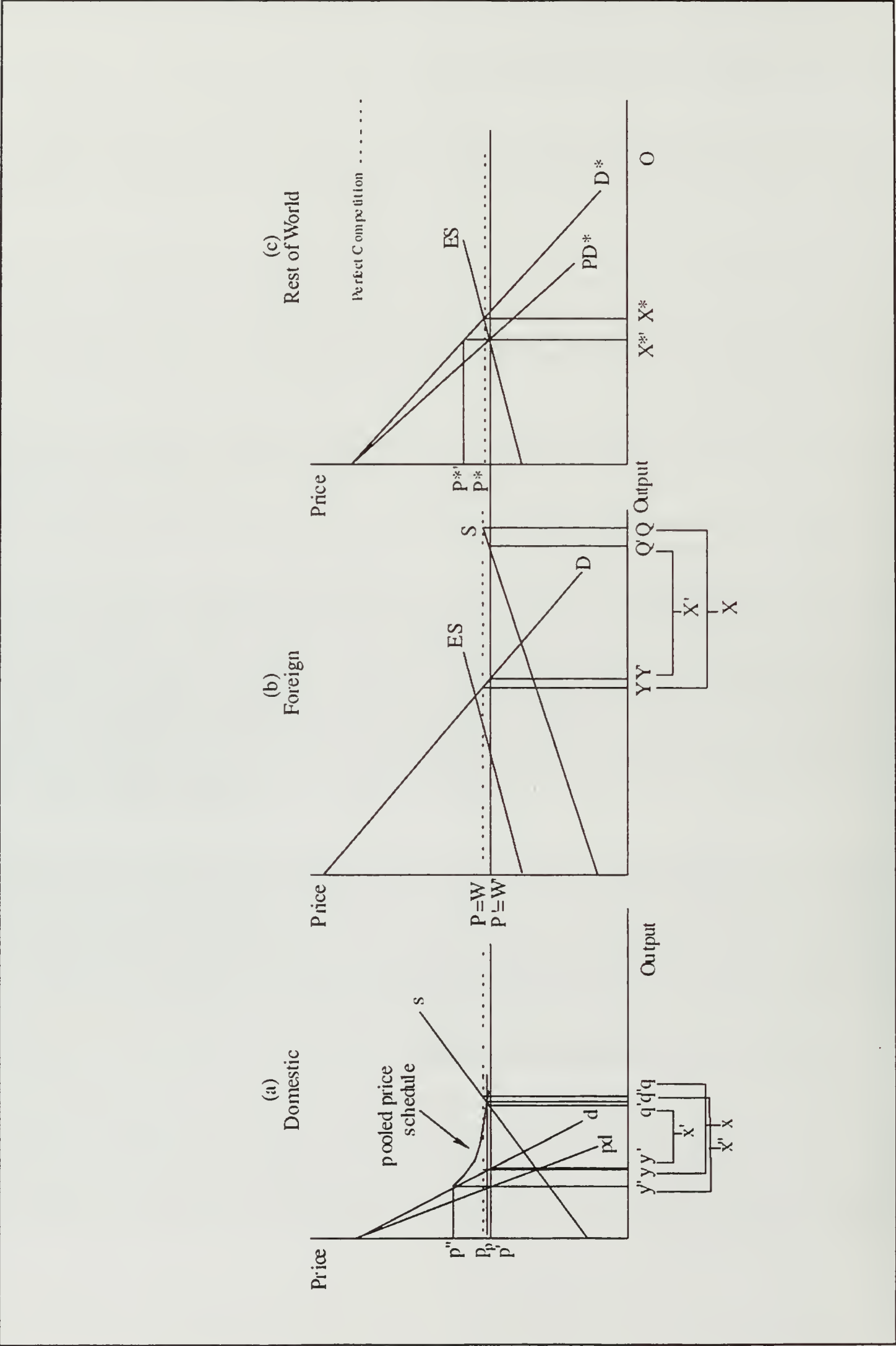
Under perfect competition, both the domestic country and the foreign country are exporting countries. World prices and trade are determined by equating the sum of the excess supply curves in the domestic and foreign countries with the demand curve in ROW. The excess supply curves in the domestic and foreign countries are denoted  $es$  and  $ES$ , respectively. These curves are formed by taking the horizontal difference between the supply and the demand curve in each of the countries; for example,  $es$  in panel (a) is constructed by taking the horizontal difference between  $s$  and  $d$ . The excess supply curves show the amount that traders operating in each country are willing to supply to the world market at any given price.

Panel (c) shows the horizontal summation of  $es$  and  $ES$ . Equating the horizontal summation of  $es$  and  $ES$  with the ROW demand curve  $D^*$  gives the equilibrium price and quantity. Thus, the world price for the commodity is given by  $p = P = P^*$ . Total production in the domestic country is  $q$ . Of this total,  $y$  is consumed locally, with the difference,  $x$ , exported to ROW. In the foreign country, total production is  $Q$ , of which  $Y$  is consumed locally. The difference,  $X$ , is exported to ROW. Total imports by ROW equal  $X^*$ , where  $X^* = x + X$ .

### 4.2 A Trade Model with Oligopolistic Traders

As was noted above, the best description of the industrial structure of the trading sector is that both local traders and MNE sell to the processing sector in the home country, while only MNE export to ROW, presumably because of cost advantages associated with proprietary assets. While this structure can be modeled in the simulation analysis, it cannot be easily examined in the theoretical model. However, two alternative structures that bracket this structure can be examined.

Figure 1: International Trade Model With Oligopolistic MNE in Export Trade: Small Country Domestic Market



The two structures that are examined graphically are based on Structure 2 and Structure 8 in Table 1. The first structure examined below is characterized by perfect competition in the sourcing of products from the farm sector and in the selling of this product to the domestic processing industry for the trading sectors in both the domestic and foreign countries. However, oligopolistic firms undertake the export of the product from both the domestic and foreign country. These oligopolistic firms are assumed to be MNE, i.e., they operate in both the domestic and foreign countries. Figure 2 illustrates the determination of quantities and prices under this structure.

The second structure examined below assumes only MNE operate in each of the local and export markets in both the domestic and foreign countries. As a result, the trading firms are assumed to have some oligopsony power in the sourcing of products from the farm sector and some oligopoly power in the supplying of products to the processors in both the local and ROW markets. Figure 3 illustrates the determination of quantities and prices under this structure.

#### 4.2.1 Perfect Competition in the Local Market

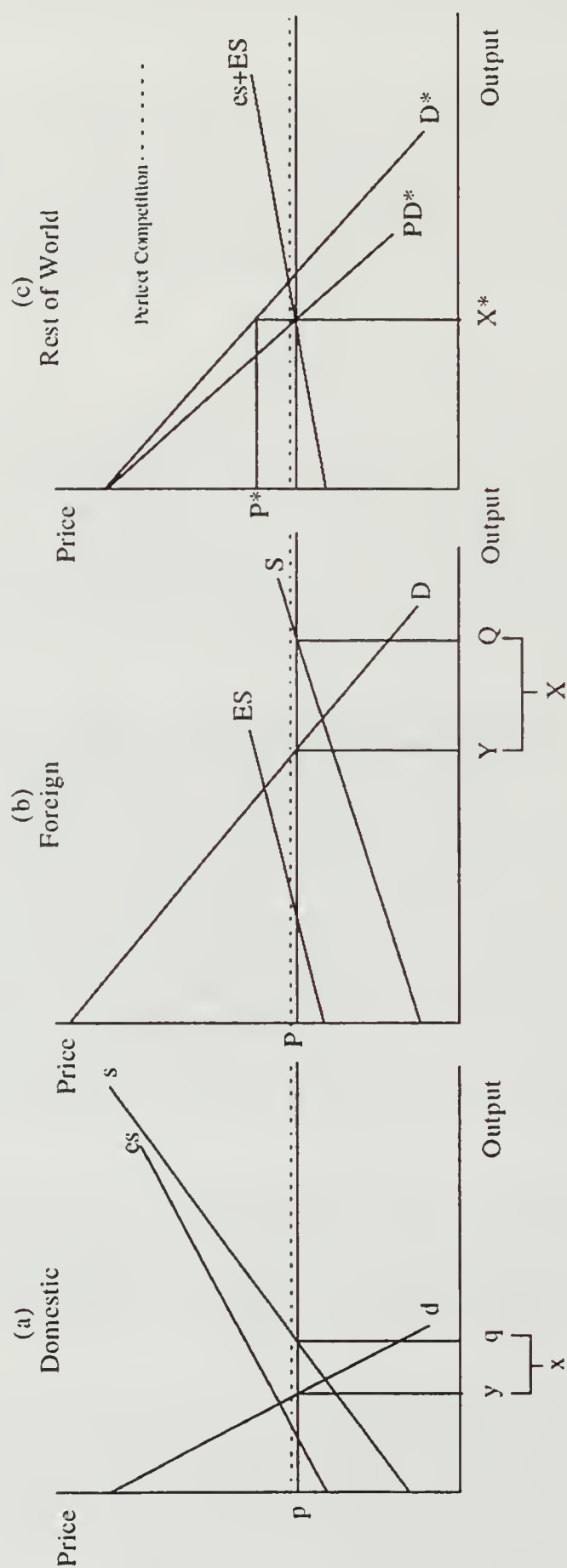
Figure 2 shows the determination of prices and quantities for the case where there is perfect competition in the local markets and oligopoly in the export market. Because the sourcing and selling of products in the domestic and foreign countries is competitive, the excess supply curves in these two countries show the quantities that are available for export to ROW at any given price (see Figure 2, panels (a) and (b)). The horizontal summation of the excess supply curves in Figure 2 (see panel (c)) shows the total quantity available for export to ROW at a given price.

Since the trading firms are oligopolistic, each trading firm will choose the amount to export that maximizes its profits. At an industry level, the behaviour of the trading firms can be summarized by the curve  $PD^*$  in Figure 2, panel (c). Curve  $PD^*$  is the perceived demand curve facing the oligopolistic traders. Intuitively, the  $PD^*$  curve represents the schedule of prices at which the traders are willing to purchase given quantities of the farm product before turning around and selling the product to the ROW processors. The position of  $PD^*$  shows the oligopoly power possessed by the traders. If the traders act as a monopolist, then  $PD^*$  would be the marginal revenue curve (not shown). In contrast, if the traders are perfectly competitive, the demand curve  $D^*$  would represent  $PD^*$ . When the traders have a degree of market power that lies between monopoly and perfect competition, curve  $PD^*$  lies between  $D^*$  and the monopolist's marginal revenue curve. Appendix I shows the derivation of the  $PD^*$  curve.

Equating the horizontal summation of the excess supply curves with the perceived demand curve  $PD^*$  gives the equilibrium import,  $X^*$ , by ROW. The import price is  $P^*$ . The trading firms purchase the product in the domestic and foreign countries at farm price  $w = W$ . The price paid by domestic and foreign processors is given by  $p$  and  $P$ , respectively, where  $p = P = w = W$ .

Compared to the case of perfect competition (see the dotted line in Figure 2), the presence of oligopolistic trading firms in the export market raises the price in ROW, lowers exports from both the domestic and foreign country, and lowers farm and processor prices in both the domestic and foreign country. As a result of these lower prices, consumption rises and production falls in both exporting countries.

Figure 2: International Trade Model With Oligopolistic MNE in Export Trade Only



### 4.2.2 MNE in the Local Market

Figure 3 shows the determination of prices and quantities for the case where oligopolistic MNE are the sole traders in both the local and export markets. Unlike in Figure 1, the horizontal difference between the supply curve ( $s$ ) and the demand curve ( $d$ ) does not show the quantity that the oligopolistic MNE are willing to export. To find the quantity the traders are willing to export, the perceived excess supply curve ( $pes$ ) must be obtained. The curve  $pes$  is constructed by taking the horizontal difference between the perceived demand curve ( $pd$ ) and the perceived supply curve ( $ps$ ) in the domestic country. Intuitively, the  $pd$  curve represents the schedule of prices at which the traders are willing to purchase given quantities of the farm product before turning around and selling the product to the processors. The  $ps$  curve represents the schedule of prices at which the traders are willing to sell any given quantity of the farm product they obtain from the farm sector. Appendix I shows the derivation of the  $pd$  and  $ps$  curve. Similarly, for the foreign country, the perceived excess supply curve ( $PES$ ) shows the quantity the traders from that country will make available to ROW (see Horst [1971] for a similar derivation).

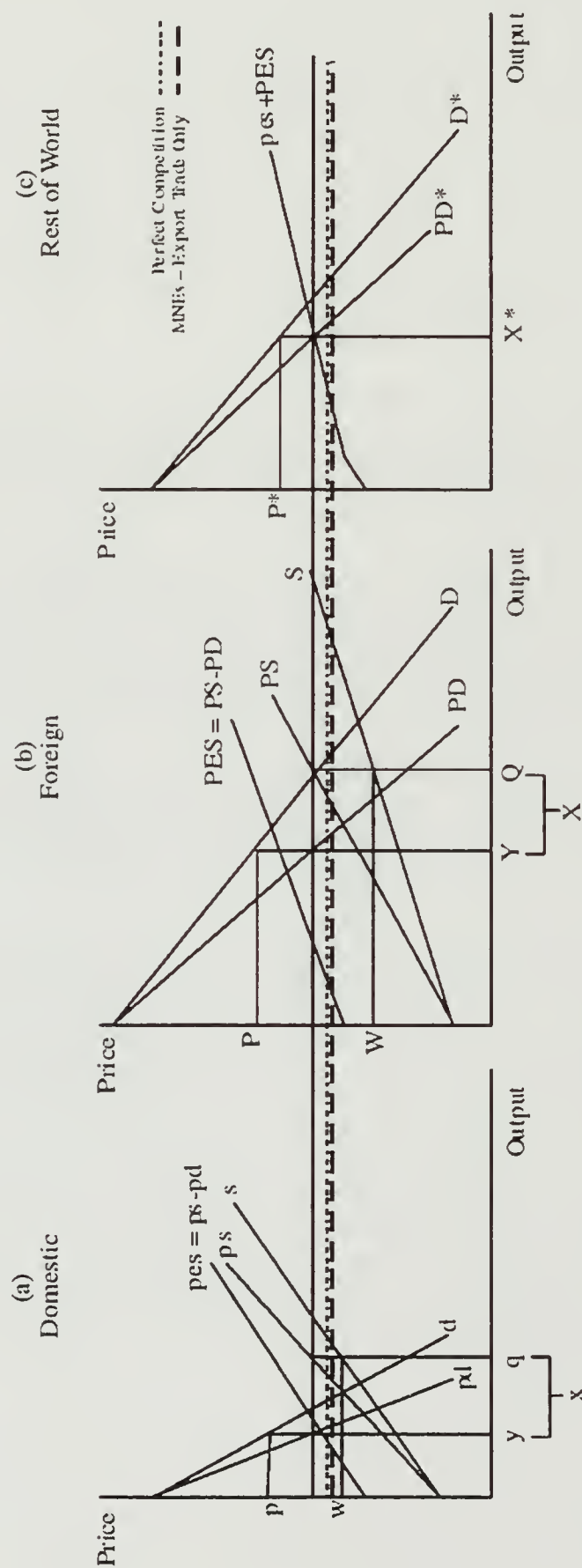
The perceived demand curve is the market demand curve rotated downwards, with the magnitude of the downward rotation given by the degree of oligopoly power possessed by the MNE. If the traders have complete monopoly power, the  $pd$  curve would be the marginal revenue curve, while if the traders are competitive, the  $pd$  curve is the demand curve  $d$ .

In a similar fashion, the perceived supply curve is the market supply curve rotated upwards, with the magnitude of the upward rotation given by the degree of oligopsony power possessed by the MNE. If the traders have complete monopsony power, the  $ps$  curve is the marginal outlay curve; if the traders are competitive, the  $ps$  curve is the supply curve  $s$ .

Panel (c) in Figure 3 shows the horizontal summation of  $pes$  and  $PES$ . Equating the horizontal summation of  $pes$  and  $PES$  with the ROW perceived demand curve  $PD^*$  gives the equilibrium imports,  $X^*$ , by ROW. The price paid for these imports is given by  $P^*$ . Note that the perceived demand curve lies below the demand curve in ROW.

With oligopolistic traders, processors in the domestic and foreign countries no longer pay price  $P^*$ . In addition, the purchase price and the selling price of the commodity are no longer the same in each of the regions. Farm production in the domestic country is determined by extending a line from the intersection of  $PD^*$  and  $pes+PES$  in panel (c) back to panel (a) (the solid line in Figure 3). Production  $q$  is given by the intersection of this line and the  $ps$  curve. The farm price is the price  $w$  on the supply curve  $s$  that gives rise to production  $q$ . Consumption  $y$  by the domestic processor can be determined in a similar fashion. The price paid by domestic processors is  $p$ . The difference between  $q$  and  $y$ , namely  $x$ , is exported to ROW. In the foreign country, total production is  $Q$ , of which  $Y$  is consumed locally. The farm supply price is  $W$ , while the processor price is  $P$ . Exports by the foreign country are  $X=Q-Y$ . Total imports by ROW equal  $X^*$ , where  $X^* = x + X$ .

Figure 3: International Trade Model With Oligopolistic MNE in Local and Export Trade



Compared to the case of perfect competition (see the dotted line in Figure 3), the presence of MNE in both the local and export market has the following effects: (a) raising the price in ROW; (b) lowering exports from both the domestic and foreign country; (c) lowering farm prices in both exporting countries; (d) raising the processor price in both countries; and (e) raising the processor price in ROW. As a result of these price changes, consumption and production falls in both the exporting countries and ROW. The direction of these effects is the same when the case of MNE in both the local and export market is compared to the case where MNE are engaged in export trade only (see the long dashed line in Figure 3).

Compared to the case of perfect competition, the welfare effects of introducing MNE into the local and export market are straightforward. Processors in all three regions and the farm sector in the domestic and foreign country are worse off, while traders are better off.

## 5. A Model of International Trade with Export STE and Oligopolistic Traders

To examine the impact of a STE on the international market, the behaviour of the STE must be modeled. There are many objectives that STE may pursue and many ways in which STE can affect trade. As a result, no one analysis can be undertaken that will cover all STE. Rather, each STE must be modeled separately. The following analysis examines the situation of a STE that maximizes producer welfare and transfers the income generated from sales to producers via pooling.

Inherent in most price pooling schemes is some form of price discrimination. Price discrimination requires the existence of at least two different markets. In the model developed below, the two markets are the domestic processors and the ROW processors. While a more complete model would consider a number of different markets in the ROW, adding additional ROW markets would excessively complicate the analysis. Thus, the modeling of price discrimination in the domestic market should be viewed as a way of illustrating the pooling effect and not as a policy that is followed by all STE. As is noted elsewhere in this report, the domestic pricing policy of a STE is often the subject of regulation by its home country.

In this situation, two scenarios are examined. In the first scenario, the domestic country is a small country—i.e., its actions do not affect the world price of the commodity under examination. In the second scenario, the domestic country is a large country.

### 5.1 Small Country Case

Figure 4 illustrates the situation in which the domestic country is a small country in the world market. As a small country, exports from the domestic country are so small that changes in these have no discernible impact on world prices. Thus, world price is determined solely by the quantity from the foreign country. If the world market is perfectly competitive, the ROW price,  $P^*$ , is determined by equating the excess supply from the foreign country (ES) with the demand curve in ROW ( $D^*$ ). This world price is also the farm level and processor price in both the foreign country and the domestic country. Thus,  $P^* = P = W = p = w$ . At these prices, domestic processor demand is  $y$ , domestic output is  $q$ , and domestic exports are  $x$ . These quantities must be interpreted as being very small relative to the quantities produced in the foreign country. In the foreign country, processor demand is  $Y$ ,

farm output is  $Q$ , and exports are  $X$ . Total imports by ROW are  $X^* = X$ . Although the domestic country is exporting  $x$ , the amount is negligible compared to the quantity being exported by the foreign country.

Now assume the traders engaged in international trade are oligopolistic in nature, while the local traders in both the domestic and foreign countries are perfect competitors. The quantity exported to ROW is determined by equating the excess supply from the foreign country (ES) with the perceived demand in ROW ( $PD^*$ ) (see Figure 5). Exports from the foreign country are thus  $X' = X^*$  and the ROW price is  $P^*$ . The farm and processor price in the foreign and domestic country fall to  $p' = w' = P' = W'$ . This fall in price leads to a reduction in domestic output ( $q$  to  $q'$ ), an increase in domestic processing ( $y$  to  $y'$ ), and a fall in domestic exports ( $x$  to  $x'$ ). Similarly, the fall in the price in the foreign country leads to a reduction in domestic output ( $Q$  to  $Q'$ ), an increase in domestic processing ( $Y$  to  $Y'$ ), and a fall in domestic exports ( $X$  to  $X'$ ).

Now consider the introduction of the STE in the domestic country. Two conditions have to hold when the STE maximizes producer welfare and returns all revenues net of marketing costs to producers through a pooling mechanism. First, since the STE wishes to maximize producer welfare, it equates marginal revenue in the domestic market with marginal revenue in ROW. Second, the prices that emerge from the domestic and foreign markets are averaged (the weights are the sales to each of these respective markets) and this average price must equal the producer price that causes the farm sector to produce the total amount of production sold to the two markets.

The marginal revenue in the domestic market is given by the perceived demand curve  $pd$ . The position of  $pd$  depends on the degree of competition faced by the STE in the domestic market. In the case of perfect competition, the  $pd$  curve corresponds to the demand curve  $d$ . If the STE must compete with other local traders for product to supply to the domestic processors, then  $pd$  lies between the marginal revenue curve and the industry demand curve. Curve  $pd$  may also lie between demand curve  $d$  and the marginal revenue curve if the STE is given a regulatory constraint under which to operate. Ramsey pricing rules such as those developed by Baumol and Bradford [1970] are one example of this type of regulatory constraint. Finally, if the STE is the only firm operating nationally in the domestic country and its monopoly power is not curtailed by regulation, then  $pd$  is the marginal revenue curve.

Since the domestic country is a small country, the STE will not have the scale economies necessary to trade internationally on its own account. Thus, the STE will have to contract with one or more MNE to undertake export trading. The price at which the STE will be able to sell to the MNE is  $p' = P'$ . Thus, price  $p'$  represents the marginal revenue of the STE in selling product to the export market.

Equating  $pd$  with  $p'$  results in sales of  $y''$  to the domestic market. The price paid by domestic processors is  $p''$ . The line "pooled price schedule" shows the average price that can be returned to the farm sector as a function of total output,  $q$ . This price schedule declines with an increase in total output because any output over and above  $y''$  must be sold to the MNE at price  $p'$ . The equilibrium level of output produced in the domestic country is given by  $q''$  and is determined by the intersection of the line "pooled price schedule" with the farm supply curve (see Alston and Gray for a similar derivation). The pooled price paid to the farm sector is  $p_p$ . The price-output combination ( $p_p, q''$ ) is an equilibrium combination because  $p_p$  is such that it just gives rise to output  $q''$ , and  $q''$  is the output that when sold gives rise to an average

price  $p_p$ . Since the quantities sold to the domestic and ROW market are chosen so that the marginal revenue in each of these markets is equal, the solution also maximizes the total revenue generated by the STE.

The welfare impacts of the introduction of the STE are examined in Figure 6. Compared to the competitive case (price  $p$ ), processors gain area  $pcdp'$  and the farm sector loses area  $pfhp'$  when the STE is absent. The non-competitive behaviour by the MNE results in a deadweight loss to the domestic country equal to area  $cfhd$ . When the STE is present, processors lose area  $p''acp$  and the farm sector loses area  $pfgp_p$  relative to the competitive situation. The loss to the domestic country is the sum of these two areas.

When the domestic country is a small country, the introduction of the STE always results in a loss of welfare. Since area  $p''acfgp_p$  exceeds area  $cfhd$ , the loss to the domestic country with the STE in place exceeds the loss to the country when the STE is not in place. This loss in welfare occurs because the STE raises processor prices in the domestic country. Because the introduction of the STE in the domestic country has no impact on the foreign country or ROW, the introduction of the STE also results in a loss of welfare to the entire world.

The conclusion that the STE results in a loss of economic surplus need not hold if the trading firms in the domestic country prior to the introduction of the STE are oligopolistic or if the domestic country is a large country. Consider first the case where the trading firms in the domestic country are oligopolistic.

When the trading firms in the domestic country are oligopolistic, the farm level price and the processor price are no longer equal. Assuming that the trading firms in the foreign country are still perfectly competitive, the farm price and processor price in the domestic country are determined by equating  $p'$  with the perceived demand curve ( $pd$ ) and the perceived supply curve ( $ps$ ). The resulting farm and processor prices are  $p''$  and  $w''$ , respectively (see Figure 6). The corresponding quantities are  $y''$  and  $\hat{q}$ .

In the example shown in Figure 6, the introduction of a price pooling STE improves the welfare of the farm sector, while leaving the welfare of the processors unchanged. Processor welfare is unchanged because it is assumed that the STE has the same degree of market power as do the MNE. Farm sector welfare is improved because the STE is able to raise the farm price above  $w''$ . The degree to which the farm price is raised above  $w''$  depends on the degree of STE bargaining power. If the STE has limited bargaining power vis-à-vis the MNE, the export price of farm output will remain at  $w''$ . However, the farm sector will receive a price higher than  $w''$  because primary producers receive a pooled price that reflects both the export price and the domestic processor price ( $p''$ ). Greater bargaining power by the STE will raise the export price above  $w''$ , thus raising the pooled price. For example, if the STE is able to negotiate an export price equal to  $p'$ , primary producers will receive a pooled price of  $p_p$ .

Figure 4: International Trade Model with Oligopolistic MNE in Export Trade: Small Country Domestic Market

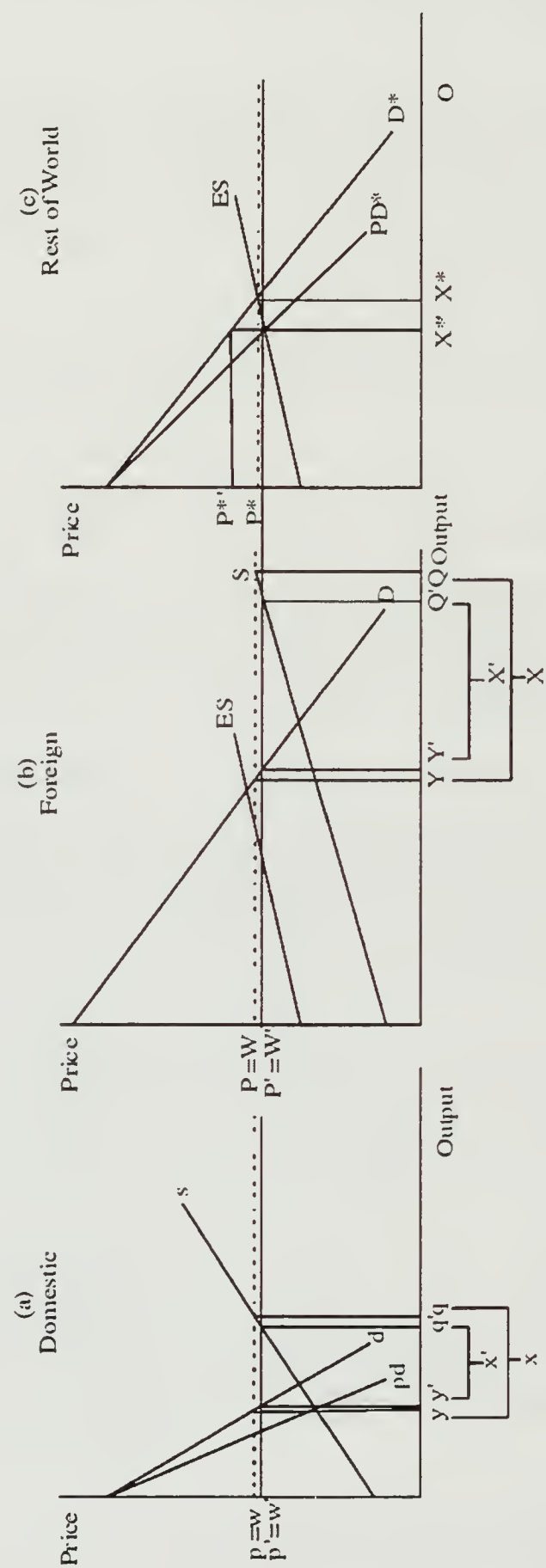


Figure 5: International Trade Model With Oligopolistic MNE in Export Trade: Small Country Domestic Market with STE

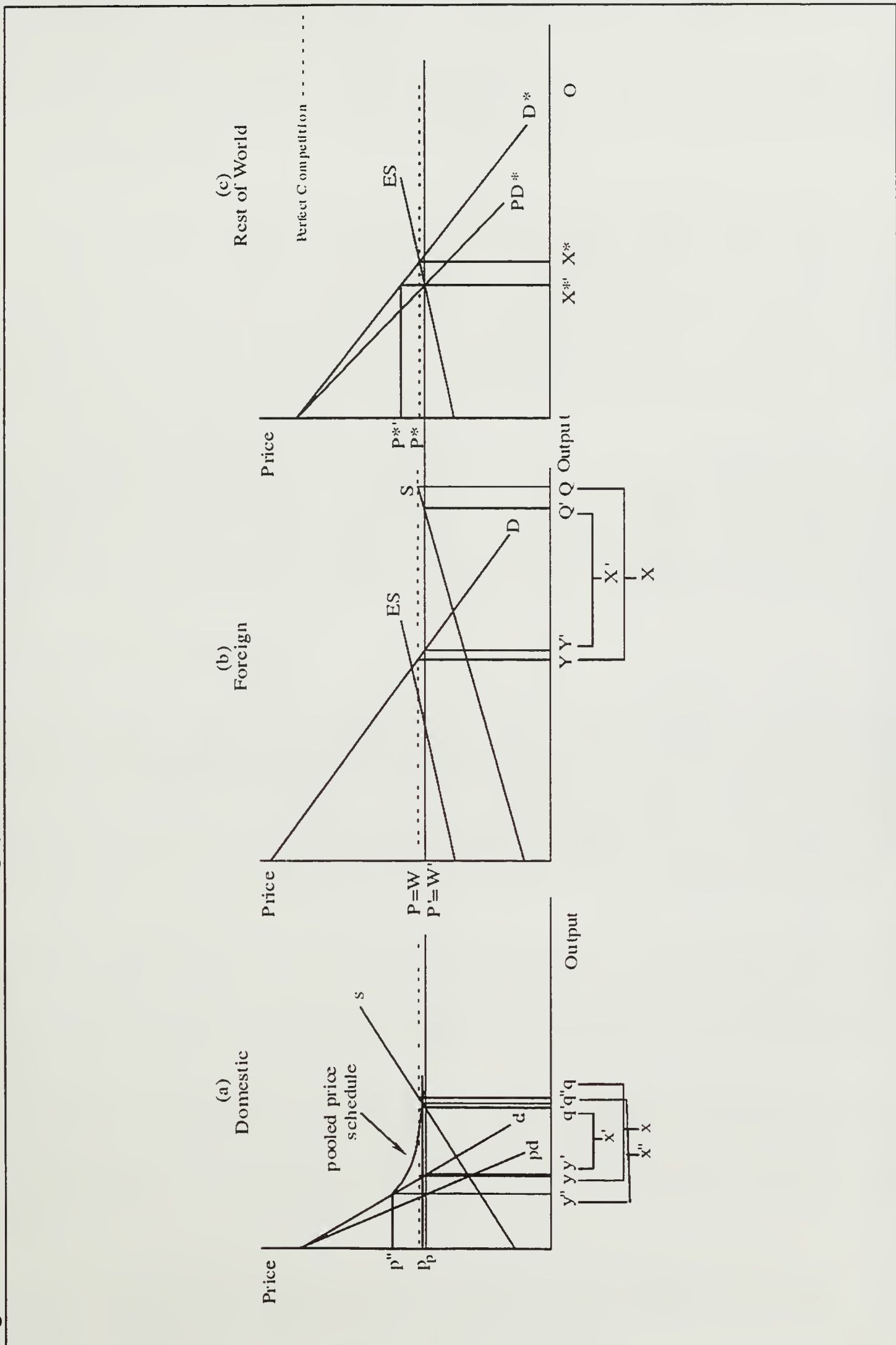
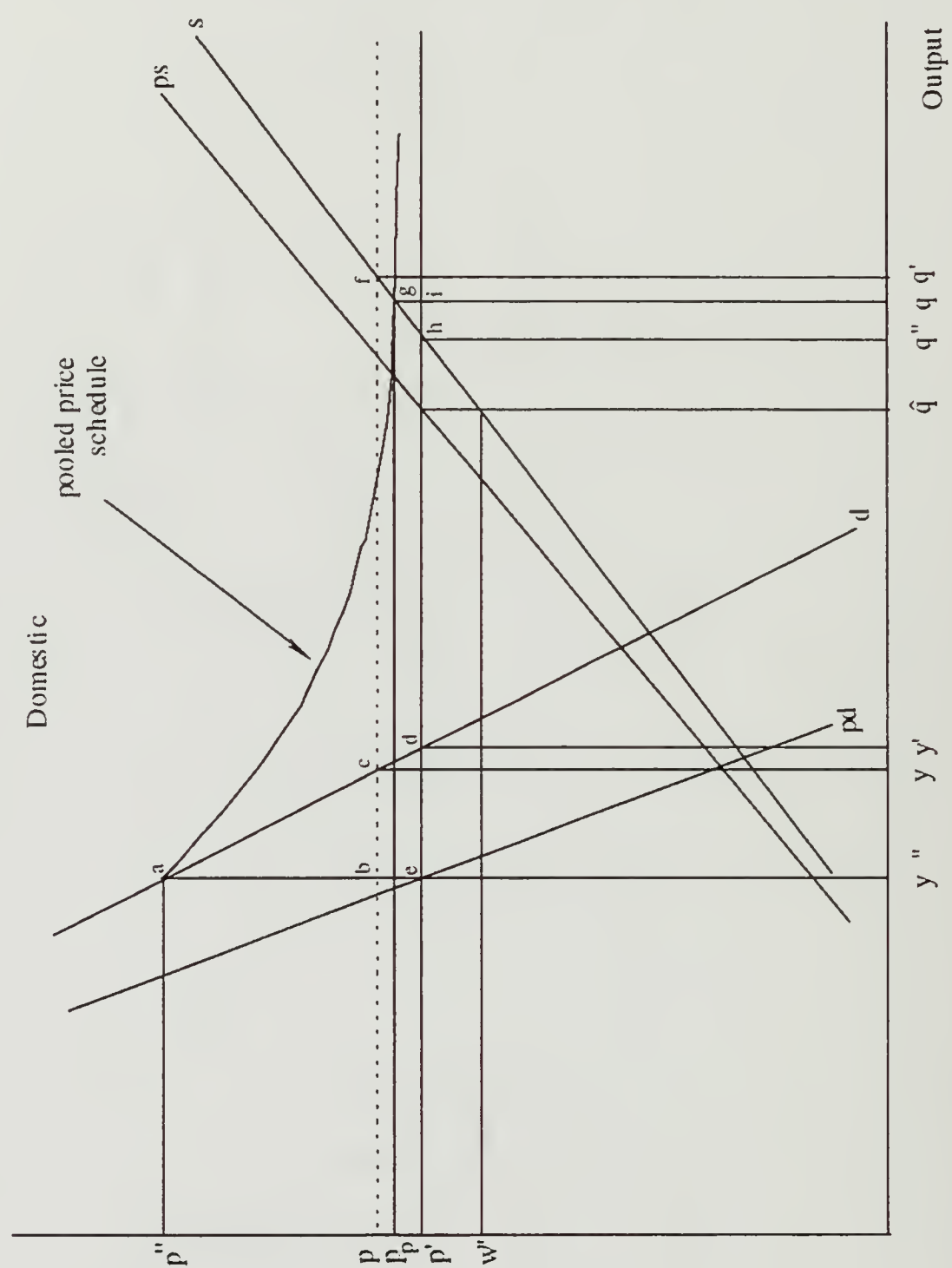


Figure 6: Welfare Effects of a Domestic STE: Small Country Case



The introduction of the STE is unlikely to result in the same level of market power as in the case of oligopolistic MNE. Obviously, if the introduction of the STE results in a lower processor price, welfare of both producers and processors will increase. However, if the introduction of the STE results in a higher processor price, processors will lose while primary producers will gain. The gain to producers will be greater than the loss to processors when the processor price increase is small and when exports are large relative to domestic processor demand.

Now consider the large country case. The introduction of the STE in this situation can both raise and lower welfare, both domestically and in the other regions of the world. To the degree that the STE raises domestic processor prices, welfare is lowered. Welfare is also increased through another mechanism, however. The introduction of the STE leads to additional competition among traders selling to the ROW, which lowers the price paid by processors in the foreign country and ROW, thus increasing welfare. As well, because the STE returns the revenues earned in ROW to the domestic farm sector, the presence of the STE leads to increased domestic output, which results in increased welfare for the farm sector.

In general, the introduction of the STE improves welfare when the STE has relatively little market power in the domestic market and/or when the processing demand is relatively small relative to total production. Conversely, if the STE has substantial market power in the domestic market and/or processing demand is a large component of total output, then the introduction of the STE results in lower welfare. To consider these outcomes in more detail, the next section examines the case of a large domestic country that introduces a price-pooling STE.

## **5.2 Large Country Case**

To examine the case of the introduction of the STE by a large country, consider Figure 7. Recall from above that two conditions have to hold when the STE maximizes producer welfare and returns all revenues net of marketing costs to producers through a pooling mechanism. First, the STE equates marginal revenue in the domestic market with marginal revenue in ROW. Second, the prices that emerge from the domestic and foreign markets are averaged (the weights are the sales to each of these respective markets) and this average price must equal the producer price that causes the farm sector to produce the total amount of production sold to the two markets.

The graphical analysis of this scenario is much more difficult to depict than in the previous scenario. As well, while the graphical analysis in the previous case could provide a precise outcome, graphical analysis in this case can only provide outcomes that are close to the real outcome.<sup>43</sup> Nevertheless, the graphical analysis does give the flavour of how prices and output are determined in this scenario.

One final observation needs to be made. In contrast to the small country case, the STE in the large country case is assumed to be able to enter the world market and compete with the MNE. That is, the STE does not use MNE as agents. Modifying the model to allow for the case where the STE uses MNE to handle all or part of its export sales is a project for future research.

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43. Mathematically, the large country case does have a unique solution. This solution can be obtained numerically (see the simulation model results below).

Figure 1 consists of three graphs labeled (a), (b), and (c), illustrating the effects of a tariff on the domestic market for a small country.

(a) Domestic Market: The vertical axis is Price and the horizontal axis is Output. The supply curve is labeled  $s$  and the demand curve is labeled  $d$ . A horizontal line represents the world price  $w$ . The domestic price is  $p$  and the world price is  $w$ . The domestic output is  $y$  and the world output is  $x$ . The domestic price is  $p$  and the world price is  $w$ . The domestic output is  $y$  and the world output is  $x$ .

(b) Foreign Market: The vertical axis is Price and the horizontal axis is Output. The supply curve is labeled  $S$  and the demand curve is labeled  $D$ . A horizontal line represents the world price  $w$ . The foreign price is  $P$  and the world price is  $w$ . The foreign output is  $Y$  and the world output is  $X$ . The foreign price is  $P$  and the world price is  $w$ . The foreign output is  $Y$  and the world output is  $X$ .

(c) Rest of World Market: The vertical axis is Price and the horizontal axis is Output. The supply curve is labeled  $PES$  and the demand curve is labeled  $D^*$ . A horizontal line represents the world price  $w$ . The rest of the world price is  $P^*$  and the world price is  $w$ . The rest of the world output is  $X^*$  and the world output is  $X$ . The rest of the world price is  $P^*$  and the world price is  $w$ . The rest of the world output is  $X^*$  and the world output is  $X$ .

The analysis starts in panel (c) with the construction of the curve PD\*-PES. In the analysis above, the curve PD\* was interpreted as the perceived demand curve. An alternative interpretation of PD\* is that this shows the marginal revenue seen by exporters to ROW at any given level of total exports. The curve PES shows the marginal cost used by foreign exporters in determining their exports to ROW. Taking the horizontal difference between PD\* and PES (i.e., curve PD\*-PES) gives a curve that shows the marginal revenue that the domestic STE can expect to see for any given level of exports from the domestic country to ROW.

In panel (a), the curve PD\*-PES is summed horizontally with curve pd to give curve pd+(PD\*-PES). This latter curve shows the combination of sales to the domestic market (y) and the sales to ROW (x) that provides any given marginal revenue. Put differently, curve pd+(PD\*-PES) shows the marginal revenue that can be obtained for any given level of total production.<sup>44</sup>

To solve for the level of output that satisfies the two conditions outlined above, the following exercise must be undertaken. For any given level of q, determine the implied marginal revenue that will exist in each of the domestic and ROW markets. Thus, for total output q, the implied marginal revenue is mr. To obtain this marginal revenue it is necessary to sell amount y to the domestic processors and amount x to the ROW. The resulting prices in these two markets are p and P\*, respectively. Finally, determine if the weighted average of these prices equals the farm level price, w, that would result in output q (i.e., the price-quantity combination (w, q) must be a point on the supply curve s, where

$$w = p \frac{y}{q} + P^* \frac{x}{q}$$

Finding the solution to this problem is straightforward mathematically. Graphically, however, the solution can only be obtained by trial and error.

Once the price-quantity combination (w, q) is found, foreign market sales to the local processors and to the export market are determined by equating the marginal revenue with the PD and PS curves in the foreign country. In Figure 7, panel (b), the foreign country produces total output Q and has sales to the local processors equal to Y. Exports to ROW equal X. Local processors pay price P, while the local farm supply sector receives price W.

In comparison to the case in which the STE is not present, there are a number of impacts, some of which are unambiguous and some are ambiguous. The unambiguous impacts are that total production in the domestic market rises and exports from the domestic country increase. The ambiguous effects are on total exports to ROW, production and processor use in the foreign country, the processor price in ROW, and the processor price in the domestic country. These effects are ambiguous because they depend on the relative elasticities of demand in the domestic country and the ROW. Generally speaking, prices will be higher in the less elastic market and lower in the more elastic market. Figure 7 illustrates the case in which the domestic processing market is more elastic than the ROW market.

44. The construction of the pd+(PD\*-PS) curve implies that all trading firms, whether STE or private, choose their output simultaneously. If the STE were to act as the leader, it would take the marginal curve to the curve PD\*-PS and equate this new curve with pd. Alternatively, one or more of the MNE could act as leaders by recognizing the objective and behaviour of the STE and by choosing a level of sales that takes this information into account. Both of these leader models are subjects for future research.

As a consequence of these changes, the unambiguous welfare impacts of introducing a price-pooling STE in this scenario are: (1) the welfare of the domestic farm sector increases and (2) the welfare of the trading firms falls. To be able to determine other impacts of introducing an STE, a simulation model must be used.

## 6. Export STE Simulation Model

The simulation model presented in this section has the same basic structure as in the graphical models. The farm supply curves and processor demand curves are assumed to be linear. Linear supply and demand curves results in linear excess supply and demand curves, as well as linear perceived demand and supply curves. As in the analysis above, the marginal costs of providing the trading function are assumed to be zero, as are the costs of transporting the product from both the domestic and foreign country to the ROW. All firms are assumed to choose output simultaneously and Cournot-Nash conjectures are assumed. The result is a Nash equilibrium in quantity.

Table 3 presents the values of the parameters that underlie the simulation model. The model is calibrated using the prices, quantities, and elasticities presented in Table 3. The slopes and intercepts of the demand and supply curves in the simulation model are calculated from these prices, quantities and elasticities. Table 3 also presents the numbers of local traders and MNE assumed in the analysis, as well as the fixed costs that are associated with the MNE and the local traders. The assumption of zero marginal costs and positive fixed costs means that the trading firms implicitly have economies of scale.

As Table 3 shows, two sets of prices and quantities are used in the simulation — these sets are labeled Model I and Model II. In both models the domestic and foreign countries each export 25 units; ROW imports 50. In Model I, both the domestic and foreign country produce and process the same quantity. In Model II, however, the domestic country only processes 5 units and produces 30 units. Thus, in Model II, exports for the domestic country are a much larger fraction of total output than for the foreign country.

Table 3: Parameter Values for the Simulation Model

	Domestic Country		Foreign Country		ROW
	Farm Sector	Processing	Farm Sector	Processing	Processing
<b>MODEL I</b>					
Calibration Quantity	50	25	50	25	50
Calibration Price	100	100	100	100	100
Elasticity	1.00	-0.50	1.00	-0.50	-10.00
Intercept	0	300	0	300	110
Slope	2.00	8.00	2.00	8.00	0.20
Number of Local Traders Before STE	20	20	20	20	na
Number of Local Traders After STE	20	20	20	20	na
Number of MNE	5	5	5	5	5
<b>MODEL II</b>					
Calibration Quantity	30	5	50	25	50
Calibration Price	100	100	100	100	100
Elasticity	1.00	-0.50	1.00	-0.50	-10.00
Intercept	0	300	0	300	110
Slope	3.33	40.00	2.00	8.00	0.20
Number of Local Traders	20	20	20	20	na
Number of MNE	5	5	5	5	5
<b>Other Assumptions</b>					
Fixed Costs for Each MNE & STE					25.0
Fixed Costs for Each Local Trader					5.0

Table 4 presents the results of the analysis. The “Perfect Competition” column replicates the prices and quantities used for calibration, as well as showing the economic surplus associated with these prices and quantities. Note that under perfect competition, the traders lose money because of the fixed costs they must incur. Although perfect competition is not sustainable when the firms have economies of scale, it is presented as a benchmark for the rest of the analysis.

Table 4: Simulation Model Results: Comparison of Private Traders and Domestic Pooling STE

	Model I			Model II		
	Perfect Competition	Private Traders	Domestic Pooling STE	Perfect Competition	Private Traders	Domestic Pooling STE
p	100.00	102.56	104.94	100.00	97.83	105.43
P	100.00	102.56	102.31	100.00	102.56	102.51
P*	100.00	101.67	100.53	100.00	101.67	100.77
w	100.00	91.03	102.14	100.00	86.29	100.69
W	100.00	91.03	90.78	100.00	91.03	90.97
x	25.00	20.83	17.91	25.00	20.83	17.91
y	25.00	24.68	24.38	5.00	5.05	4.86
q	50.00	45.51	51.07	30.00	25.89	30.21
X	25.00	20.83	20.68	25.00	20.83	20.80
Y	25.00	24.68	24.71	25.00	24.68	24.69
Q	50.00	45.51	45.39	50.00	45.51	45.49
X*	50.00	41.67	47.37	50.00	41.67	46.15
<b>WELFARE EFFECTS</b>						
<b>Domestic</b>						
Consumer	2500	2436	2378	500	511	473
Producer	2500	2071	2608	1500	1117	1521
Traders	-100	406	-100	-100	279	-100
Government	0	0	0	0	0	0
Total	4900	4914	4886	1900	1906	1894
<b>Foreign</b>						
Consumer	2500	2436	2442	2500	2436	2438
Producer	2500	2071	2060	2500	2071	2069
Traders	-225	281	262	-225	281	264
Government	0	0	0	0	0	0
Total	4775	4789	4764	4775	4789	4770
<b>ROW</b>						
Consumer	250	174	224	250	174	213
Total Traders	-325	688	162			
Total Welfare	9925	9877	9875	6925	6869	6877

The next column to the right, "Private Traders," shows the outcome of introducing private traders with some degree of oligopoly power into the model. Although processor prices rise somewhat, the major impact of introducing market power in the model is to lower the farm supply price in both the domestic and foreign countries. This price reduction occurs even though the overall degree of market power is quite low (recall that the local traders compete with the MNE in the sourcing of the agricultural product at the farm level and in the sale of this product to local processors). In this situation, 25 firms are assumed to be competing in product acquisition and supply. Although total welfare falls from 9,925 to 9,877 units, in percentage terms this decrease is less than half of one percent.

The column "Domestic Pooling STE" shows the outcome when the STE is introduced into the domestic market. The results in this column are obtained by assuming that the STE replaces the private traders in the domestic country. As in the graphical model, the STE is assumed to maximize the welfare of the farm sector, subject to the constraint that the average price received equals the producer price that causes the farm sector to produce the total amount of production that is sold.

As was outlined in the previous discussion of the graphical analysis, the simulation is carried out by equating the marginal revenue in the domestic market with the marginal revenue in the ROW, while at the same time ensuring that

$$w = p \frac{\tilde{y}}{\tilde{x} + \tilde{y}} + P^* \frac{\tilde{x}}{\tilde{x} + \tilde{y}} + \frac{\tilde{f}}{\tilde{x} + \tilde{y}}$$

where  $\tilde{x}$  and  $\tilde{y}$  are respectively, the quantities exported and sold to domestic processors by the STE. The fixed cost of the STE is  $\tilde{f}$ .

Two points need to be mentioned with respect to this analysis. First, the introduction of the STE in the domestic country raises the number of trading firms supplying the ROW from five to six. This increase in the number of traders in the international market affects the marginal revenue seen by the STE in ROW. Second, the STE is assumed to have some competition in selling to the processors in the domestic country. The degree of competition is assumed to be similar to that which existed prior to the STE being formed. As will be seen, this assumption is important.

Quantitatively, the introduction of the price pooling STE leads to a small decrease in total welfare compared to the "Private Trader" case under Model I. Under Model II, the introduction of the STE leads to a small increase in total welfare. Thus, the results of the simulation model indicate that the conclusion derived in the small country case also holds in the large country case. An improvement in welfare can occur when the STE is introduced in countries with exports that are relatively large compared to total production. As will be seen from the results of the sensitivity analysis given below, improvements in welfare can also occur when the domestic market is relatively contestable. Thus, there are some fairly clear conditions under which STE are welfare improving.

The total welfare impacts mask the welfare effects that occur in each of the sectors. The introduction of the STE leads to small decreases in the prices in the foreign country (and hence a decrease in production, an increase in consumption, and a decrease in exports) when compared to the "Private Trader" case. The most important impact of the STE, however, is the redistribution of economic surplus from traders that were operating in the domestic country, to the farm sector in that country.

The sensitivity analysis reported in Table 5 shows the impact of combining the domestic processing market and the foreign processing market. This type of market integration is modeled by constraining the market power of the STE so that the processor price in both the domestic country and the foreign country are equal. The main result of this analysis is that integrating the domestic and foreign processing markets leads to an increase in total welfare. In both Model I and Model II, the "Domestic Pooling STE" scenario results in greater total output than does the "Private Trader" case. As would be expected, increased contestability results in a decrease in the farm sector price in the domestic market and an increase in the farm sector price in the foreign market, although these changes are relatively small.

In summary, the introduction of the STE into an industry where trading firms possess some market power has the effect of redistributing MNE profits to the farm sector in the country where the STE is introduced. This redistribution of profits leads to higher output by the farm sector in the domestic country and consequent lower prices to the farm sector and processors in the foreign country and processors in ROW. If processing demand in the domestic market is small relative to total output, and/or if the domestic processing market is reasonably contestable, then the overall impact of the STE is to provide less distortion in the domestic market than was the case when private traders were the only firms operating. Less distortions in the domestic market result in less distortion in the world market.

## **7. Trade Distortions and Import STEs**

It is widely believed that importing STE have ways of escaping the disciplines imposed on private firms by multilateral and bilateral trade agreements. This belief can be rationalized on several grounds. Not much is known about STE and their operations. Even though member countries are supposed to notify the GATT about the activities of their STE, compliance is problematic and the information provided by the notifications is sketchy. This lack of transparency may make it difficult to monitor STE and may encourage speculation about anti-competitive behavior. Along the same lines, it could be argued that the lack of knowledge about domestic policies and about the other firms and institutions involved in local production, distribution, wholesaling and retailing is equally problematic. Lower trade barriers do not automatically guarantee improved market access if domestic policy instruments are highly trade distorting. Similarly, anti-competitive behavior by local private firms (in the absence of an effective competition policy) can distort markets. Are STE unfairly blamed for market access problems? This is a difficult question to answer because most of the available empirical evidence consists of narrowly focused case studies relying on different methodologies and covering different time periods. The most recent evidence is provided by Abbott and Young's broad study [1998] of wheat importing countries. Their main conclusion is that "there is no clear correlation between the existence of an STE and the level of protection in a country" [Abbott and Young, p.24]. This result should be interpreted carefully even though it is a major blow to the traditional view that STE use unfair advantages to raise the level of protection afforded national producers. The evidence in the case of the wheat trade indicates that on average, countries with importing STE are no more protectionistic than countries without STE; however, this does not imply that importing countries with and without STE have the same ability to curb market access. Scrutinizing the practices of STE remains a worthwhile endeavor, but it is obvious that market access investigations must be extended to include careful examination of domestic policy and the marketing chain.

Table 5: Simulation Model Sensitivity Results: Contestability

	Model I with Market Integration			Model II with Market Integration		
	Perfect Competition	Private Traders	Domestic Pooling STE	Perfect Competition	Private Traders	Domestic Pooling STE
P	100.00	102.56	102.44	100.00	97.83	102.54
P	100.00	102.56	102.44	100.00	102.56	102.54
P*	100.00	101.67	100.68	100.00	101.67	100.81
W	100.00	91.03	101.05	100.00	86.29	100.26
W	100.00	91.03	90.90	100.00	91.03	91.00
X	25.00	20.83	17.91	25.00	20.83	17.91
Y	25.00	24.68	24.69	5.00	5.05	4.94
Q	50.00	45.51	50.52	30.00	25.89	30.08
X	25.00	20.83	20.76	25.00	20.83	20.82
Y	25.00	24.68	24.69	25.00	24.68	24.68
Q	50.00	45.51	45.45	50.00	45.51	45.50
X*	50.00	41.67	46.59	50.00	41.67	45.96
<b>WELFARE EFFECTS</b>						
<b>Domestic</b>						
Consumer	2500	2436	2439	500	511	487
Producer	2500	2071	2553	1500	1117	1508
Traders	-100	406	-100	-100	279	-100
Government	0	0	0	0	0	0
Total	4900	4914	4892	1900	1906	1895
<b>Foreign</b>						
Consumer	2500	2436	2439	2500	2436	2437
Producer	2500	2071	2066	2500	2071	2070
Traders	-225	281	263	-225	281	264
Government	0	0	0	0	0	0
Total	4775	4789	4768	4775	4789	4771
<b>ROW</b>						
Consumer	250	174	217	250	174	211
Total Traders	-325	688	163	-325	560	164
Total Welfare	9925	9877	9877	6925	6869	6878

Even if it were always true that importing countries with STE are no more protectionistic than countries without STE, it may be that STE are able to target their protection more narrowly. This is a refinement of the traditional complaint about importing STE. It is possible that a lack of transparency concerning their practices could allow STE to implement targeted protection. An incentive to discriminate across exporters may be influenced as much by economic considerations as by political ones. Abbott and Young [1997] found support for this hypothesis. They found wheat importing STE to be less responsive to market conditions in choosing their sources of supply than private traders. They also concluded that importing STE may discriminate on quality.<sup>45</sup> Love and Murniningtyas [1992] found that the Japanese Food Agency was able to exert monopsony power in its purchases of wheat from abroad. Their evidence points out that the tariff rate is too high to be optimal and thus they concluded that its level must be motivated by the desire to raise revenues to finance production subsidies.

Many import STE are preoccupied by internal price stabilization. This may not be worrisome when importers are small, as long as stabilization is not used as a synonym for subsidization. Concern about domestic stabilization activities may, however, be justified when large importers are involved, since efforts to stabilize domestic prices may lead to increased volatility in world markets. Perverse effects of this nature arising from the variable levies of the Common Agricultural Policy are well-documented [see Vousden, 1990], but a large import STE like BULOG, because of the nature of its interventions, might also have contributed to the instability in the world price for a commodity such as rice, in the course of acting to stabilize domestic rice prices.

Despite the empirical evidence provided by Abbott and Young [1997] that the existence of wheat importing STE is not correlated with higher levels of protection, it could be argued that their potential ability to be protectionist in the future is an issue. One of the accomplishments of the Uruguay Round was the tariffication of non-tariff barriers. Unfortunately, there are cases where countries have traded non-tariff barriers for extremely high tariffs and the "new" quantitative barriers of Minimum Access Commitments (MAC). In these cases, imports in excess of the negotiated MAC are taxed by tariff levels at sufficiently high rates that the tariffs are not binding.<sup>46</sup> Thus, in these cases, until tariffs are drastically reduced, the maximum levels of imports are determined by the MACs.<sup>47</sup> As with the administration of any quantitative barriers, fairness and discrimination issues must be addressed in designing the rules by which the MAC will be filled. An ad hoc rule, such as allocation using historical market shares, is certainly one way of allocating a MAC among exporters but this is unlikely to be either fair or efficient. Such schemes may lead to trade diversion, since importing countries may not be able to shop around to improve their terms

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45. Surprisingly, these researchers found that STE were more likely to buy higher quality wheat than private traders. This is not consistent with the hypothesis that STE buy low quality wheat to satisfy local demand when consumption is heavily subsidized through an artificially low price.

46. Ingco's [1994] estimates show that many countries have raised effective tariff rates for numbers of commodities through a "dirty" tariffication process. In several cases, the high tariff rates yield price ceilings that are not likely to be binding. For example, a 300 percent tariff means that non-MAC imports cannot enter the local market as long as the domestic price is less than four times higher than world prices. We discuss, in the subsequent section, the effects of tariff reductions in the presence of MACs.

47. Imports entering the local market as part of the MAC can be taxed. In practice though, the tariff rates for imports within the MAC are usually very low, relative to the rates that are applied to imports in excess of the MAC.

of trade. Forcing imports to be bought only from specific sources might facilitate the possibility of collusion among exporters.<sup>48</sup> However, the absence of any rules on access allocation could allow an importing country to delay or even reduce market access below MAC levels. What can be done if an importer claims that it was honestly looking for the best deals and that it could not fill its MAC because the price quotes were too high? On the other hand, it is evident that an import STE that controls domestic production has an obvious incentive to control imports in order to consolidate its market power. Depending on the cost structure of the monopolist and on world prices, the profit maximizing level of imports for the monopolist may well fall under the quota level. There are several examples in textiles and agriculture where countries have imposed quotas that have not been completely filled, even when there was a large differential between domestic and world prices. E. Cunha and Santos [1996] have shown that even when quota licences are auctioned off, the monopolist might find it profitable to purchase such licences with the intention of not using them. The intuition behind this pre-emption tactic is that the firm invests in "sleeping quotas" to avoid the lower price that would occur if it had to share the domestic market with importers.

Low tariff rates are not sufficient to insure market access. Impediments in distribution channels may occur in the marketing of agricultural and food products and these could be very restrictive. For example, import duties on alcoholic beverages are relatively low and make up only a small fraction of domestic prices in most countries. However, domestic sales taxes are relatively high and distributors and retailers (whether state-owned or private), have various mechanisms that effectively reduce access to "new" products. Listing practices, volume requirements, infrequent product evaluations, shelving fees and technical barriers are tools that can be used to limit market access. Similarly, imports can be restricted, despite low tariffs, if there is a highly restrictive regime of sanitary and phytosanitary regulations. Of course, if exporters can market their products at a reasonable cost once they clear customs, this problem is reduced. If this is not possible, foreign firms may have to enter into licencing agreements to market their products, a common practice in the beer industry. In this context, an importing STE with control over distribution may have many ways to renege on its GATT/WTO obligations.

## **8. Price Discrimination by an Import STE with Monopolized Production, and Trade Liberalization**

### **8.1 Introduction**

Following the Uruguay Round, numbers of observers have voiced concerns that import STE may be able to bypass national negotiated market access commitments. It is feared that import STE might be able to apply a higher level of protection than provided by the specified tariff reductions and minimum access commitments of the Agreement on Agriculture. In this section, we analyze the behavior of a domestic monopolist/STE when trade liberalization is done through tariff reductions or through the enlargement of minimum access commitments. The case in which import STE compete with many other domestic firms in local production is trivial and will not be analyzed. Instead, we concentrate on cases in which the STE has monopoly power in domestic production and may or may not have control/ownership of imports.

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48. This is based on the argument of Krishna [1990] that a foreign monopolist has an incentive to increase the price of its quota-constrained exports to such a point as to render quota licenses valueless.

In the theoretical models developed below, the STE maximizes profits and can export all it wants at price  $\omega - te$ . Imports are either purchased by private agents or by the STE itself at the constant world price  $\omega$ .<sup>49</sup> Thus, the “small country” assumption prevails and domestic and foreign goods are perfect substitutes. Per unit transport costs,  $te$ , are assumed to be constant and small relative to the world price  $\omega$ . It is common in Bhagwati-like models to assume that the domestic monopolist cannot export under any condition. However, this assumption has not been convincingly rationalized, especially when one considers that transport costs make up only a small fraction of the landed price for a wide range of commodities. In our analysis, the decision to export or not is made endogenously. This is appealing from a modeling standpoint and is interesting because it also allows for price discrimination. Our models demonstrate that exports by a well protected monopolist need not be either “accidental” or the result of bad planning.

We begin the analysis with the case of “dirty tariffication” for a domestic monopolist which may or may not have control/ownership of imports. With tariffs, control/ownership of imports does not matter as long as i) the STE pays duties on imports to another branch of government and, ii) the government does not return the tariff revenue to the STE through internal transfers.<sup>50</sup> The initial “dirty tariff” is set at a very high rate and, for simplicity, it is assumed that the initial MAC is zero. We provide a mapping of the trade liberalization process through tariff reductions. This is illustrated by figures that embody numerical calculations in accord with the assumptions noted above. The consequences of relaxing some assumptions about technology and the way tariff collection is administered are briefly investigated. Subsequently, four cases of liberalization through MAC enlargements are considered. In these cases, the domestic monopolist can be either relatively efficient or inefficient, but it is assumed that the level of efficiency is never sufficient for the STE to be exporting under free trade. We also allow the STE to have control/ownership of imports, a change in assumption that dramatically modifies the trade liberalizing effects of MAC enlargements.

## 8.2 Analysing the Use of Tariffs to Limit Market Access

We define the inverse domestic demand curve as  $p(q+I)$ ,  $p' < 0$  where  $q$  denotes the domestic sales of the monopolist,  $I$  indicates imports and  $q+I = D$ . The tariff-distorted world price is given by  $w(1+\tau)$ .<sup>51</sup> Exports are represented by  $E$  and the cost function of the monopolist is expressed as  $c(q+E)$  with  $c', c'' > 0$ . At this point we make an additional assumption:

**Assumption 1:** The cost structure of the STE is such that imports would be observed at the free trade equilibrium. That is,  $q_{ft} < q_s$ , where  $q_{ft} = qmc(\omega)$ , the quantity at which the marginal cost equals the world price ( $c'(q) = \omega$ ), and the self-sufficiency quantity  $q$  is such that  $c'(q_s) = p(q_s)$ . Relative efficiency is defined in terms of the positioning of the marginal cost curve. A firm is efficient if:  $qmc(\omega - te) > qmr(\omega - te)$  where  $qmr(\omega - te)$  is the quantity at

49. Allowing for an upward sloping world price schedule would not change the nature of the following conclusions which hinge on the capacity of the monopolist to price discriminate.

50. This insures that the marginal cost of imports is the tariff-augmented world price and not the world price.

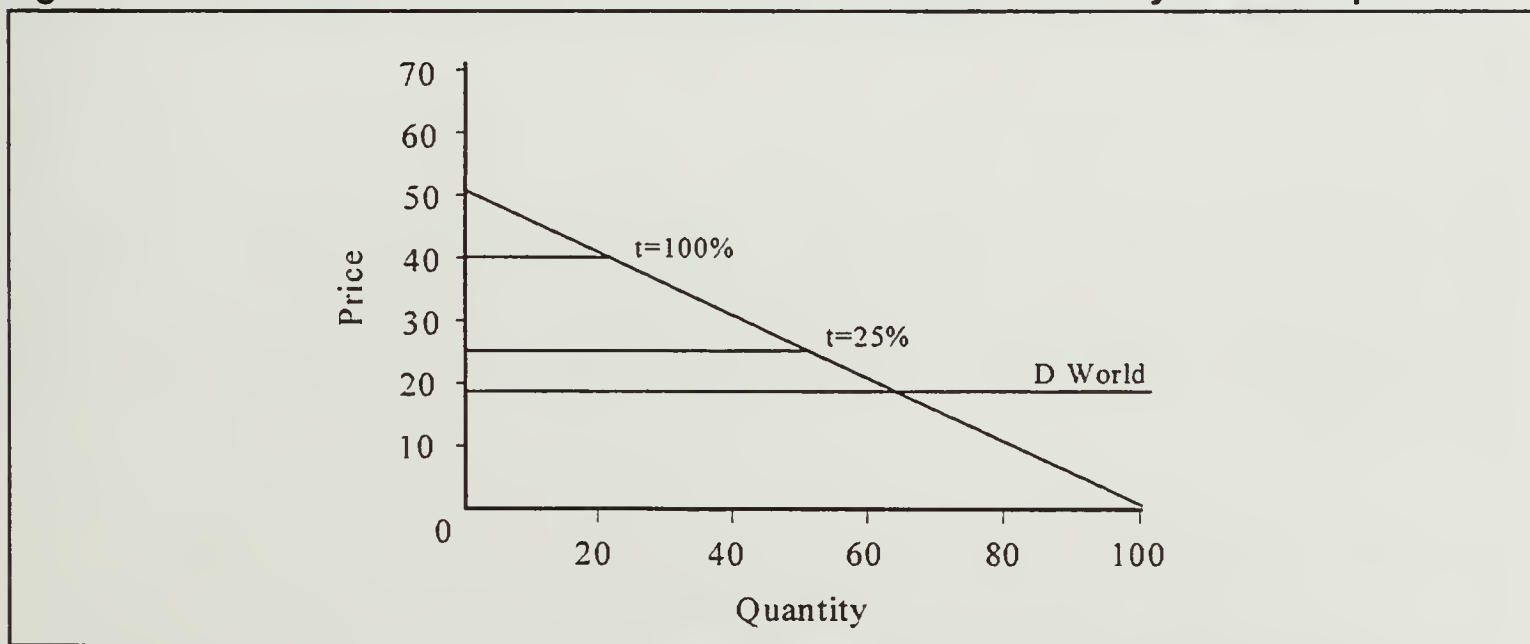
51. We chose an ad valorem tariff without loss of generality, since in this setting, ad valorem and specific tariffs are equivalent.

which the marginal revenue function associated with the undistorted domestic demand is equal to the world price adjusted for transport costs (i.e., the quantity that satisfies  $p + p'q = \omega - te$ ). An inefficient firm is one for which:  $qmr(\omega) > qmc(\omega)$ .

The first assumption simply states that the efficient STE would not completely supply the local market at the free trade price, but would nevertheless have a “relatively large” share of the market. As in Kaempfer, McClure and Willett [1989], it is assumed that a relatively large market share is one in excess of half of the demand under free trade (when  $te = 0$  and the domestic demand is linear).

Before specifying the optimization problem of the monopolist, let us describe the effect of a tariff on the demand faced by the monopolist. Figure 8 displays the undistorted domestic linear demand and the perfectly elastic export demand curves that apply in the numerical example illustrated by this figure. The aggregate demand curve (i.e., the horizontal summation of the domestic and export demand functions) slopes downward to the point where the domestic demand intersects (from above) the export demand (i.e., quantity=62). From that point on, the aggregate demand curve becomes perfectly elastic. Hence  $\omega - te$  (i.e.,  $20 - 1 = 19$  in this numerical example), is the minimum price the monopolist can obtain. The dotted lines show the effect of tariffs on the domestic demand faced by the monopolist. Given the assumption of product homogeneity, the monopolist is constrained to set its price according to the following arbitrage rule:  $p \leq \omega(1 + \tau)$ . The highest line is associated with a 100% tariff rate. This creates a perfectly elastic (flat) segment in the demand curve at  $p = 2\omega = 40$ , because at a price in excess of 40, consumers would buy nothing from the monopolist; instead, consumers' purchases (at  $p=40$ ) would be entirely from foreigners. The second dotted line illustrates the “price ceiling” effect of a 25% tariff. It follows from the particular numerical example illustrated by Figure 8 that a tariff in excess of  $\tau^* = 150\%$  would not modify at all the domestic demand confronting the monopolist. In general, tariff reductions flatten the domestic demand and reduce the downward sloping portion of the aggregate demand. The implication is that equilibria are likely to occur at the kinks (i.e., where the top flat portion and the downward sloping portions of the demand function meet).

**Figure 8: The Effects of Tariff on the Domestic Demand Faced by the Monopolist**



The possibility of selling at an exogenously determined export price creates a flat export demand. No importer would buy anything at a price in excess of the world price and there is no incentive for the monopolist to sell below the world price, adjusted for transport costs.

This "small country" assumption also implies that imports can be purchased on the world market at the fixed price of  $\omega = 20$  in the example. Consequently, in the absence of a tariff, this would be the domestic price. Under the assumption that imports are made by private agents or that the STE actually pays import taxes, the non-prohibitive tariffs raise the marginal cost of imports from  $\omega$  to  $\omega(1 + \tau)$ , which is the domestic price. Thus, the identity of the importer(s) is irrelevant.

Let us now consider the optimization problem of the efficient monopolist/STE when trade liberalization is done through tariff reductions. The STE optimization problem is:

$$\text{Max}\{\text{Min}[p(q + I), \omega(1 + \tau)]q + (\omega - te)E - c(q + E)\} \quad (1)$$

This maximization problem makes explicit the discrimination problem of the STE. In this setting, positive exports are not the result of poor planning that might be caused, for example, by the overestimation of domestic demand or underestimation of supply. The profit equation of (1) above reflects the effect of the tariff rate on the shape of the domestic demand curve faced by the monopolist. When the tariff is non-prohibitive (i.e., when imports  $> 0$ ), the monopolist is confronted with a perfectly elastic domestic demand and must act as a price taker. Under such conditions, the STE is unlikely to export. When the tariff is prohibitive,<sup>52</sup> this may or may not impose an effective price ceiling on the monopolist. Recalling that the tariff-distorted domestic demand curve faced by the monopolist is perfectly elastic up to the quantity at which  $p(q) = \omega(1 + \tau)$ , the quantity  $q_0(\tau)$  that satisfies this equality represents a kink in the demand curve faced by the monopolist. It should be emphasized that this quantity is generally decreasing with the tariff rate, except when  $\tau \geq \tau^u$ . At  $\tau^u = (p(0) - \omega)/\omega$ , the kink occurs at a zero level of demand and the "price ceiling" effect of the tariff is obviously ineffective.<sup>53</sup> We show later this is also true for some tariff rates below  $\tau^u$ .

From (1) and the discussion above, it is clear that the marginal revenue function associated with domestic demand can take different shapes and will be discontinuous for many tariff rates. For very high and prohibitive tariff rates (i.e., if  $\tau > \tau^u$ ), the marginal revenue function associated with the demand curve faced by the monopolist is continuous and is simply:  $p + p'q$ . At lower prohibitive tariff rates that generate an effective price ceiling effect, the marginal revenue function will have three components: i)  $\omega(1 + \tau)$ , for  $q < q_0$ , where as previously defined,  $q_0$  solves  $p(q) = \omega(1 + \tau)$ , ii)  $p + p'q$  for  $q > q_0$  and iii) a discontinuous segment at  $q = q_0$ . Thus the domestic marginal revenue curve is flat up to  $q_0$ , at which point marginal revenue drops down to a segment that exhibits the usual downward slope. Finally, Assumption 1 tells us that the cost structure of the monopolist is such that "low" tariffs are not prohibitive. In this case, the marginal revenue function is the constant  $\omega(1 + \tau)$ . Because the export demand is perfectly elastic, it follows that its corresponding marginal revenue function is also perfectly elastic. Thus the aggregate marginal revenue function becomes perfectly flat at  $\omega - te$ .

52. The minimum prohibitive tariff is defined as:  $\tau^s = \frac{p(q_s) - \omega}{\omega}$ , where  $q_s$  solves  $p(q) = c'(q)$ , that is, the quantity at which the local demand is equal to marginal cost. Alternatively,  $\tau^s$  can be thought of as the maximum tariff rate that will support an equilibrium with imports.

53. Intuitively, an infinite price will generate no sales and will not be chosen by the monopolist even if the tariff rate allows it ( $\tau \rightarrow \infty$ ). By continuity, the same can be said about "very high" prices.

Recalling that  $\tau^u$  is the tariff rate for which the identity  $p(0) = \omega(1 + \tau)$  holds, and defining  $\tau^s$  as the minimum prohibitive tariff rate

$$\tau^s = \frac{p(q_s) - \omega}{\omega}, \text{ and } q_s$$

such that  $p(q_s) = c'(q_s)$ , the first order conditions associated with (1) can be written as follows:

$$p + p'q - c' = 0, \quad \text{for } \tau \in \{\tau^u, \infty\} \quad (2')$$

$$p + p'q - c' = 0, \quad \text{for } \tau \in \{\tau^M, \tau^u\} \quad (2'')$$

$$\omega(1 + \tau) - c' = 0, \quad \text{for } \tau \in \{0, \tau^s\} \quad (2''')$$

$$\omega - te - c' \leq 0 \quad (3)$$

The second order condition is met given the assumption of increasing marginal cost in production. For an interior solution to be observed (i.e., for  $q > 0$ ,  $E > 0$ ), the first order conditions that apply to domestic sales and exports must hold with equality. By construction, the most lucrative market for the STE in the allocation of its sales is the domestic market and exporting might be a money-losing proposition, hence the inequality that applies in (3). More specifically, it is obvious that (2''') and (3) cannot hold simultaneously. Consequently, exports cannot be observed at low tariff rates. It is also obvious that the monopolist will choose to price below the tariff-distorted world price when the tariff rate is very high. Let  $q_M$  be the solution to  $p + p'q = \omega - te$ . This is the quantity that would be sold on the domestic market by the monopolist if the domestic market was protected by a prohibitive import quota. Then  $\tau^M$  can be defined as the minimum tariff rate that allows the monopolist to replicate the most profitable equilibrium, hence  $\tau^M = (p(q^M) - \omega) / \omega$ .<sup>54</sup> Recalling that  $qmc(\omega - te)$  and  $qmr(\omega - te)$  are the respective quantities from evaluation of the marginal cost and marginal revenue curves, at the export price, and recalling also that from the efficiency condition defined in Assumption 1,  $qmc(\omega - te) > qmr(\omega - te)$ , it follows that (3) must hold with equality for any  $\tau \geq \tau^M$ . In fact, as long as  $q_0(\tau) < qmc(\omega - te)$ , the level of tariff protection is sufficient for exports to take place if the firm is relatively efficient. From this framework of analysis several results can be stated, as follows.

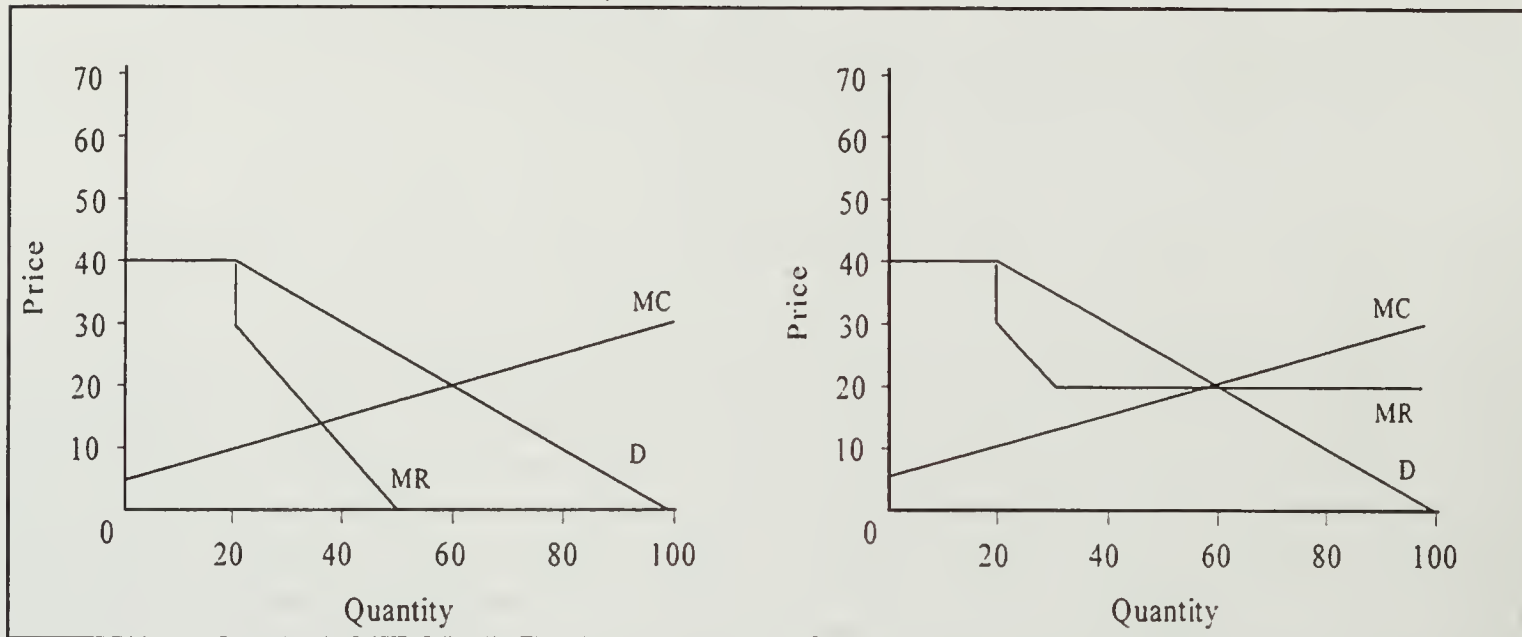
**Result 1:** Only a (relatively) efficient firm can export and this only if it is sufficiently protected.

To understand this result, let us suppose that the efficient firm is protected by a tariff in excess of  $\tau^M$  and that it decides not to export. It will then set its quantity such that  $qmr(.) = qmc(.)$ , as shown by the left panel of Figure 9. Note that by definition  $qmr(.)$  and  $qmc(.)$  are respectively decreasing and increasing in price. Thus the equilibrium at  $qmr(.) = qmc(.) < qmc(\omega - te)$  is characterized by a lower output and lower marginal revenue than the profit maximizing equilibrium with endogeneous exports (see the right hand panel of Figure 9). Thus the efficient firm that does not export could increase its profit by moving up its marginal cost curve until  $mc(.) = \omega - te$ , the marginal revenue from exporting. From the right hand panel of Figure 9, it is obvious that if the marginal cost curve were to cut the

54. Even in cases where government agencies do not maximize profit, there is evidence that these agencies do not tend to use fully the protective shield provided by tariffs. That is, tariffs of x% have not resulted in domestic prices  $1+x$  times higher than border prices. The excesses in the tariffification process were meant to maintain the status quo as long as possible [Larue, 1994].

aggregate marginal revenue curve when it is downward sloping (i.e., if  $qmc(\omega - te) < qmr(\omega - te)$ ), then exporting would not be profitable regardless of the tariff rate protecting the domestic market.

**Figure 9: The Tariff-distorted Domestic Demand and Marginal Revenue Curves Without and With an Export Market**



The following results summarize the effects of trade liberalization through tariff reductions. Parts of these results have appeared explicitly or implicitly elsewhere [e.g., Bhagwati, 1965; Kaempfer, McClure and Willett, 1989; Vousden, 1990; Lapan and Larue, 1995]. The results are as follows :

**Result 2:**

- A) In the interval  $\{\tau^M, \infty\}$ , tariff reductions will bring about no change in local and export sales. The domestic price remains at  $p(q_M)$ .
- B) In the interval  $\{\tau^E, \tau^M\}$ , tariff reductions will leave the firm's output level unchanged; decreases in exports are just offset by increases in local sales which means that the domestic price must fall.
- C) In the interval  $\{\tau^S, \tau^E\}$ , tariff reductions lead the monopolist to increase output which is entirely sold on the local market at reduced prices.
- D) In the interval  $\{0, \tau^S\}$ , tariff reductions lead to a contraction of domestic output and lower levels of local price.

Result 2: A) is a restatement of the result of Fishelson and Hillman [1979], that beyond a certain tariff rate, there is "water in the tariff" or redundant protection. The monopolist rightly chooses not to raise its price beyond the profit maximizing level. The monopolist's profit maximizing solution can be supported by a tariff rate  $\tau \geq \tau^M$ . In that domain, the price arbitrage constraint is not binding. Result 2: B) simply reflects that with movement down the schedule of prohibitive tariffs that allow exports, the marginal revenue function for the local market becomes more elastic (i.e.,  $q_0$ , the quantity at which the discontinuity in the marginal revenue function occurs, increases). Result 2: C) might appear somewhat counter-intuitive, but makes considerable sense when it is realized that (3) does not hold with equality in this

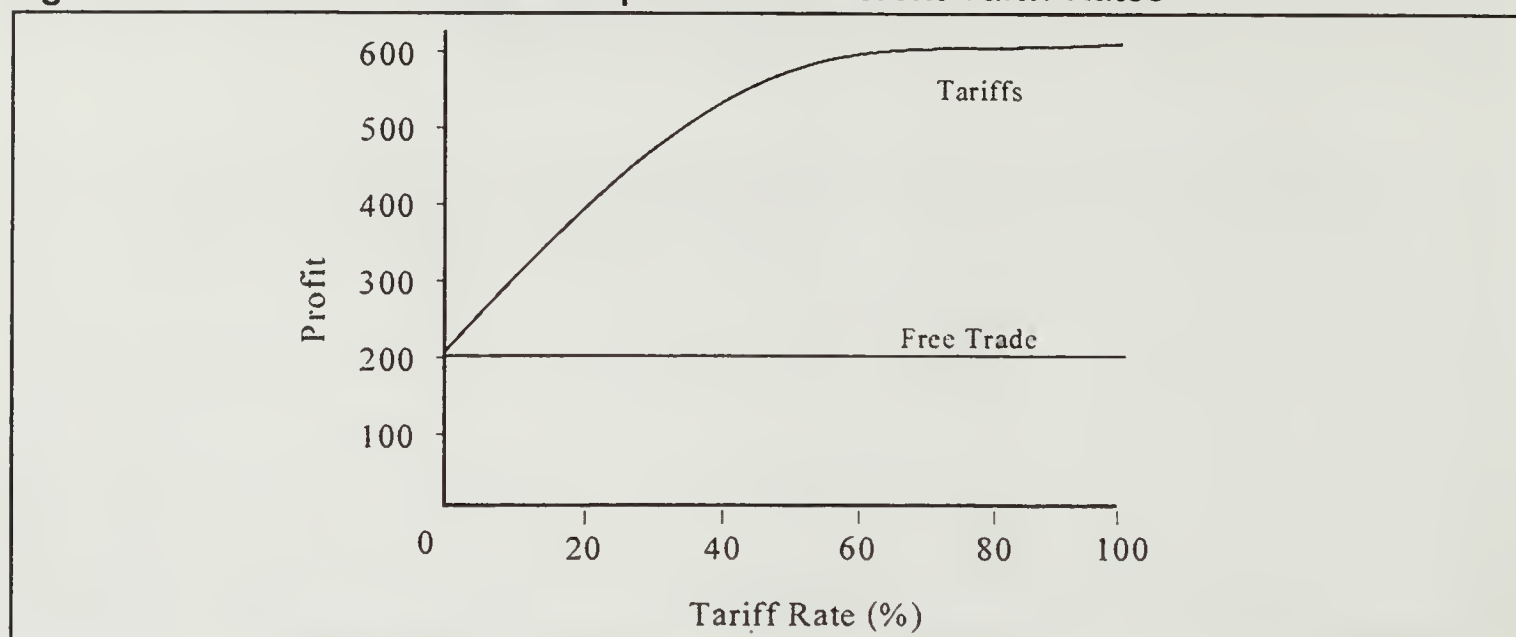
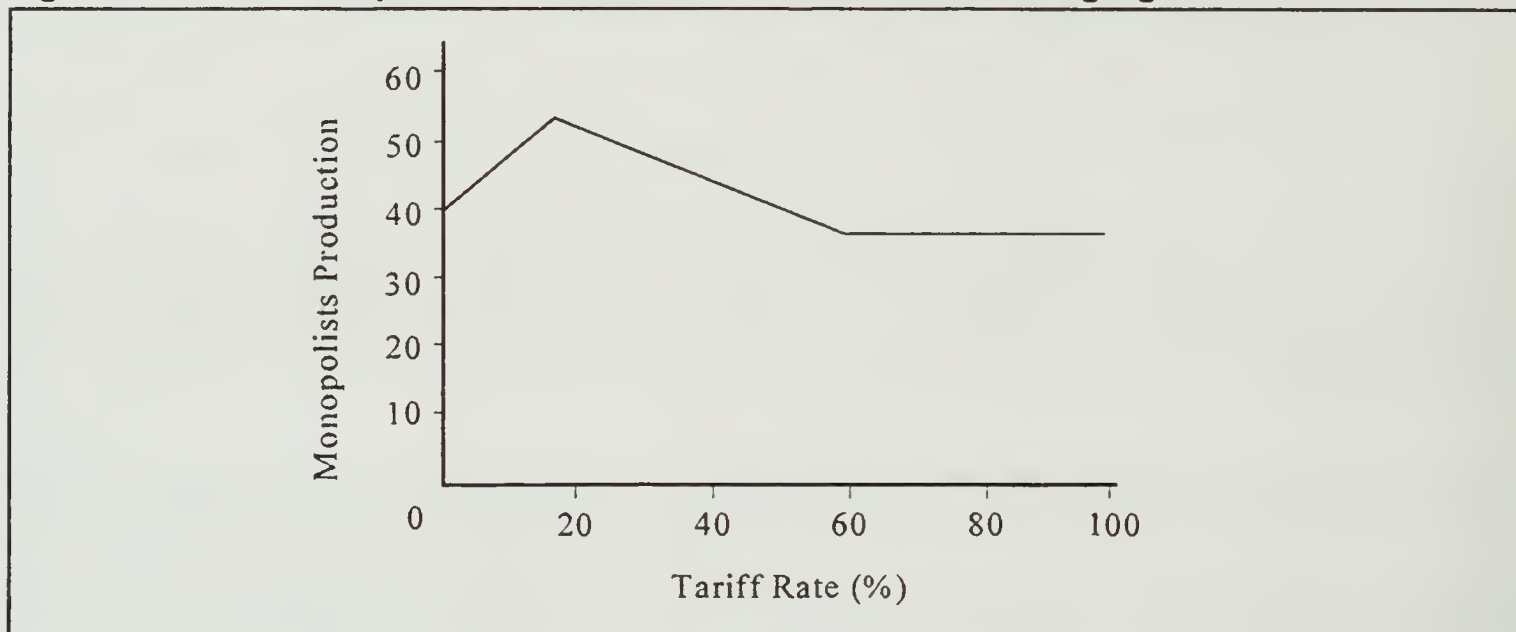
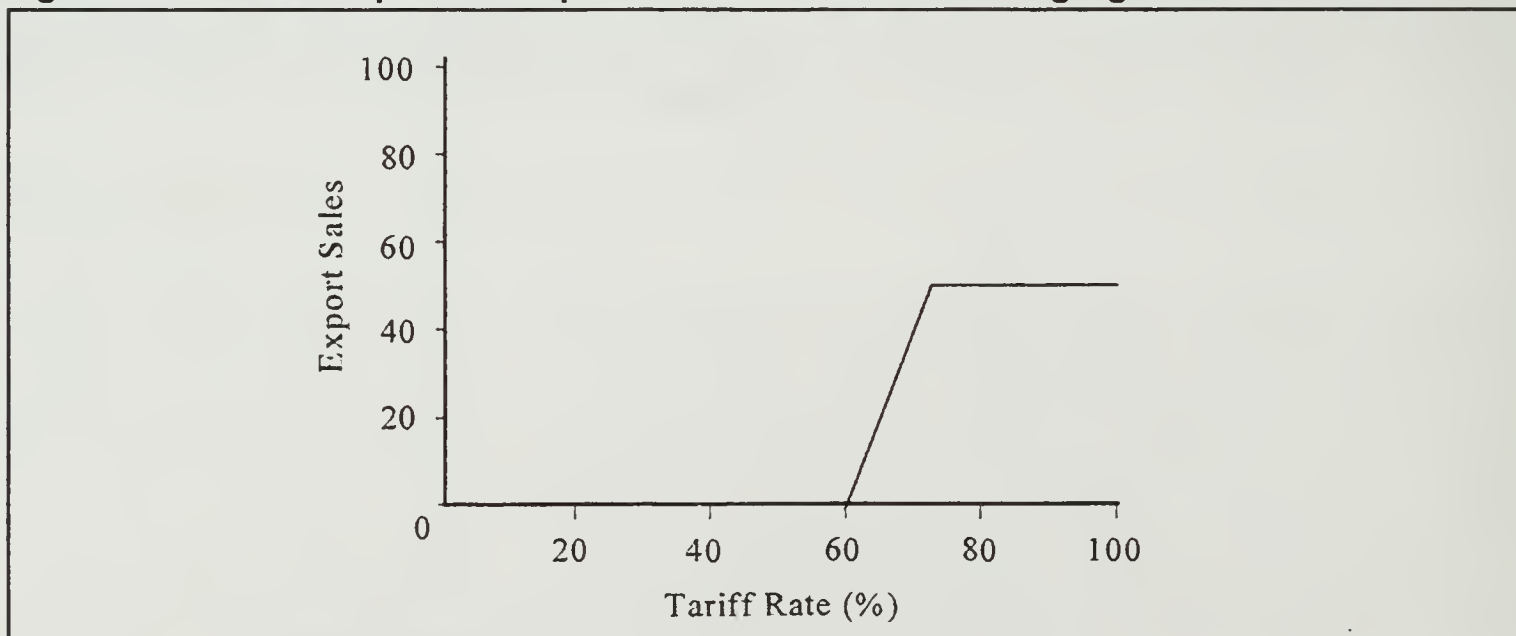
tariff domain. Hence, the STE prefers to move up its marginal cost curve to serve only the local market. Result 2: D) is the competitive firm's reaction to a price decrease. In this domain, the STE has no market power and reacts accordingly.

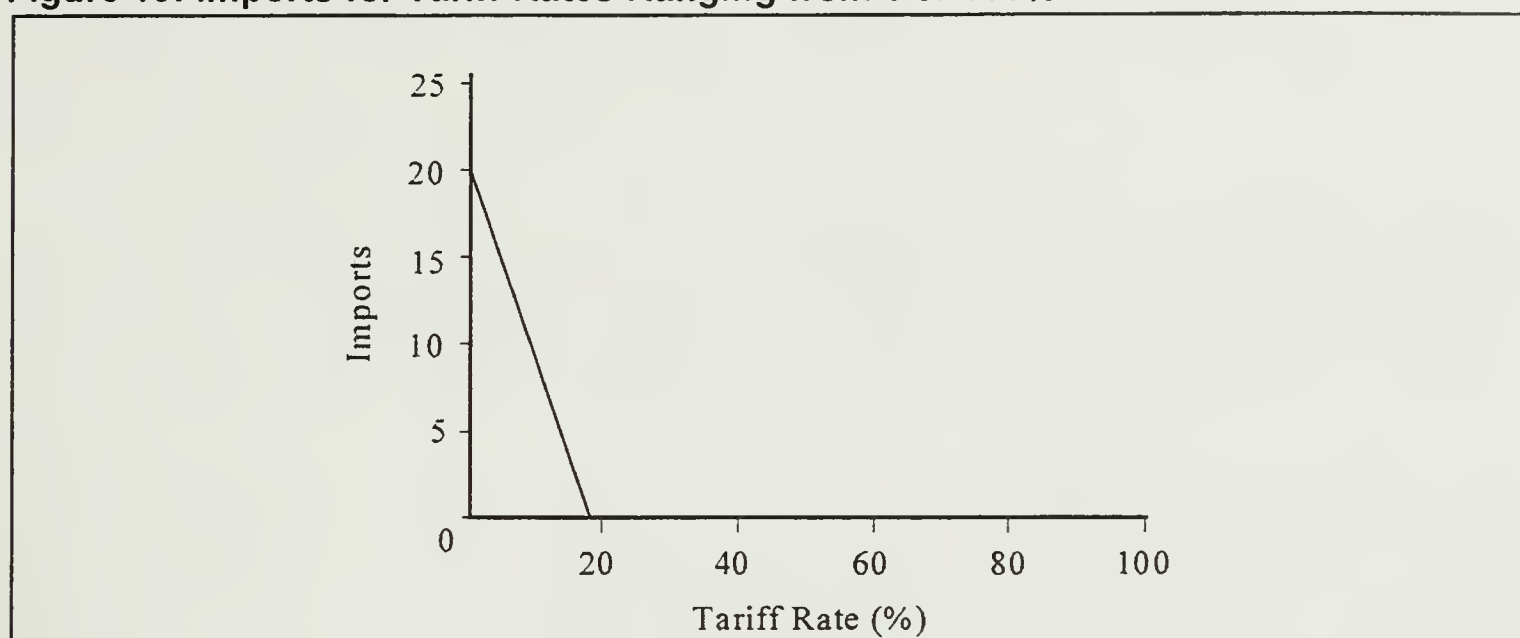
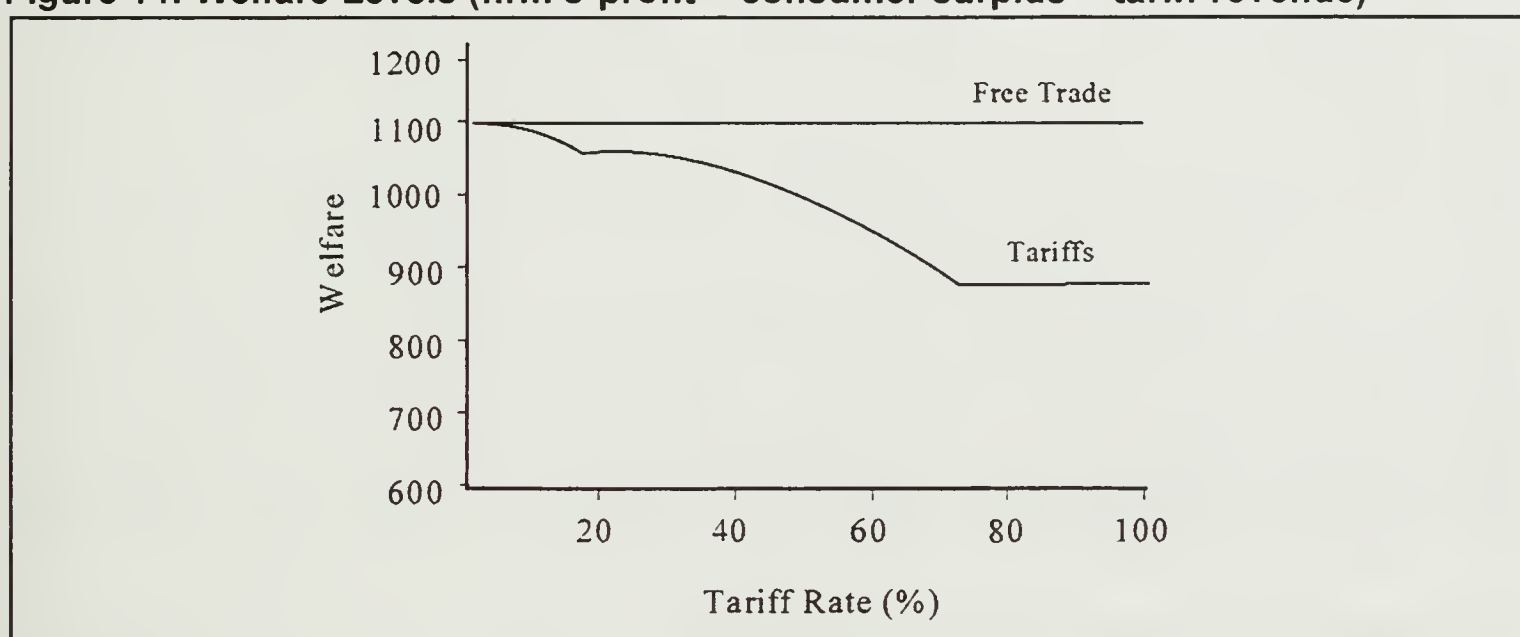
Figure 10 and those that follow map the trade liberalization process described by Result 2 for a linear domestic demand ( $Q=100-2p$ ), a linear marginal cost curve ( $mc=10+0.25Q$ ) and  $\omega = 20$ . For this case,  $\tau^s = 16.67\%$ ,  $\tau^E = 60\%$ ,  $\tau^M = 72.5\%$ . Figure 10 shows the profit of the monopolist at tariff rates ranging from 0 to 100 percent. The straight line is the monopolist's profit under free trade. The flat segment starts at  $\tau^M = 72.5\%$ , the rate at which increases in protection are redundant. Figure 11 illustrates the monopolist's production path. As mentioned earlier, there is no adjustment in production for  $\tau \in \{\tau^E, \infty\}$ . This is because of the redundant protection beyond  $\tau^M$  and because of the offsetting changes in domestic and export sales when  $\tau \in \{\tau^E, \tau^M\}$ . It is only when imports start at  $\tau = \tau^s$  that tariff reductions bring about decreases in production. Figures 12 and 13 show the export and import paths. Exports are possible/profitable only when tariffs are high,  $\tau \geq \tau^E = 60\%$ , in the numeric example in question. Because the firm is relatively efficient, import equilibria involve tariff rates below  $\tau \leq \tau^s = 16.67\%$ .

The domestic price reaches a maximum at  $\tau \geq \tau^M$  and decreases linearly until it reaches its minimum under free trade. The welfare path does the opposite, as shown in Figure 14. The straight line in this figure is the free trade welfare level; this corresponds to the maximum level of welfare since, by assumption, tariff increases cannot improve the country's terms of trade.

These results demonstrate that the STE that would import under free trade can export if it is sufficiently efficient and sufficiently protected. This occurs because high tariffs allow the profit maximizing STE to price discriminate. Exporting does not occur as an outcome of poor planning, nor does this necessarily involve dumping.

As a corollary to the second set of results, let the STE be efficient enough to be able to export under free trade. In practice, it might be difficult to assert whether a firm can or cannot export under free trade because state monopolies are usually well protected. For this very efficient firm, Result 2: A) still applies; the domestic price is  $p(q_M)$  whether the tariff rate is infinite or  $\tau^M$ . However, regardless of the height of the tariff at which the trade liberalization process starts, total output is not affected by tariff reductions. Consequently, output-neutral tariff reductions increase domestic sales at the expense of exports. It is interesting to note that if tariff reductions are also implemented in other (larger) countries, and if as a result, the world price rises, the exports of the STE need not fall!

**Figure 10: The Profits of the Monopolist for Different Tariff Rates****Figure 11: The Monopolist's Production for Tariff Rates Ranging from 0 to 100%****Figure 12: The Monopolist's export sales at tariff rates ranging from 0 to 100%**

**Figure 13: Imports for Tariff Rates Ranging from 0 to 100%****Figure 14: Welfare Levels (firm's profit + consumer surplus + tariff revenue)**

The case of the inefficient firm that operates in a small market under free trade is also straightforward. In this particular instance, the marginal cost curve cuts the aggregate marginal revenue curve before the latter reaches its plateau at  $\omega - te$ , regardless of the tariff rate. Consequently exports are never profitable. Tariff rates high enough to provide redundant protection yield a higher maximum domestic price than for the case of the efficient firm. As a result, the firm's output is also smaller than in the case of the efficient firm. Assuming that there is "water" in the initial prohibitive tariff rate, tariff reductions have no effect at first, as in Result 2 :A. Further tariff reductions induce increases in output as the monopolist finds it profitable to deter the entry of imports, however, sufficiently large tariff reductions end up forcing the monopolist to contract output, as import penetration of the domestic market intensifies. Thus the output adjustment pattern is very much like the one described for the efficient firm. The gains from trade liberalization are higher in this case because redundant protection starts at a higher tariff rate.

It is often alleged that STE may have "unfair" advantages. In the following discussion, we analyse a hypothetical situation where this could be the case. This is an unlikely and illegal case which nonetheless is of interest in the analysis of discrimination. In this case tariffs are

levied in a discriminatory manner such that STE is given the tariff revenue through an internal government transfer. (Alternatively, it could be assumed that custom officers never actually collect the customs duties from the STE). In such a case, the tariffs still impose price ceilings that may or may not be binding, but they do not raise the marginal cost of imports, which remain at  $\omega$ , for the STE/monopolist. For the efficient monopolist, this does not greatly change Result 2. The minimum profit maximizing tariff  $\tau^M$  is unaffected by whether or not the STE pays duties. Thus redundant protection starts at the same tariff rate as before. The minimum tariff required to support an equilibrium with exports ( $\tau^E$ ) is also unaffected. However, imports start entering the domestic market at a higher tariff rate than  $\tau^S$ , the maximum tariff that supported equilibrium with imports in Result 2. This happens because the marginal cost of imports is constant at  $\omega$ , while the marginal cost of domestically produced goods is increasing (i.e.,  $c'' > 0$ ). As a result,  $c'(\cdot)$  never exceeds  $\omega$  and the maximum level of domestic production under tariff protection is lower when the STE does not pay duties. The tariff domain in which imports are observed is enlarged to  $\tau \in \{0, \tau^I\}$  where  $\tau^I = (p(q_I) - \omega)/\omega > \tau^S$ , where  $q_I$  is the quantity that satisfies  $\omega = c'(q)$ . This is an outcome that exporters should not disapprove of. In the case of the inefficient monopolist (i.e., when exports are always zero and there is no  $\tau^E$ ), the invariance of the marginal cost of imports to tariff variations is much more beneficial, and consequently discriminatory tariffs have a larger impact on the behavior of the inefficient firm than on the efficient one. As in Result 2, there is a range of tariffs that grants redundant protection (i.e.,  $\tau \in (\tau^M, \infty)$ ). The difference from Result 2 is that the inefficient monopolist minimises cost by supplying the local market with domestically produced goods and by importing, just as a two-plant monopolist would do. Thus, imports enter the market even when there is redundant protection ( $I > 0 \forall \tau \geq \tau^M$  but  $\partial I / \partial \tau = 0$ ). Because the discriminatory administration of the tariffs lowers the aggregate marginal cost of the monopolist, the minimum profit maximising tariff rate,  $\tau^M$ , will be lower than when the monopolist must pay import taxes. Furthermore, the fact that the monopolist can exploit cheap imports means that the level of domestic production is at its free trade level, regardless of the rate of the (discriminatory) tariff. This in turn implies that tariff reductions will increase imports in the domain  $\{0, \tau^M\}$ . Thus discriminatory tariffs provide more market access to exporters when the monopolist/STE is inefficient.

### 8.3 Analysing Minimum Access Commitments

We now introduce a minimum access commitment (MAC), of  $R$  units of imports, as a means to improve market access. For the moment, we suppose that there is no tariff. Unless otherwise indicated, the following assumption will be maintained throughout this segment of the analysis.

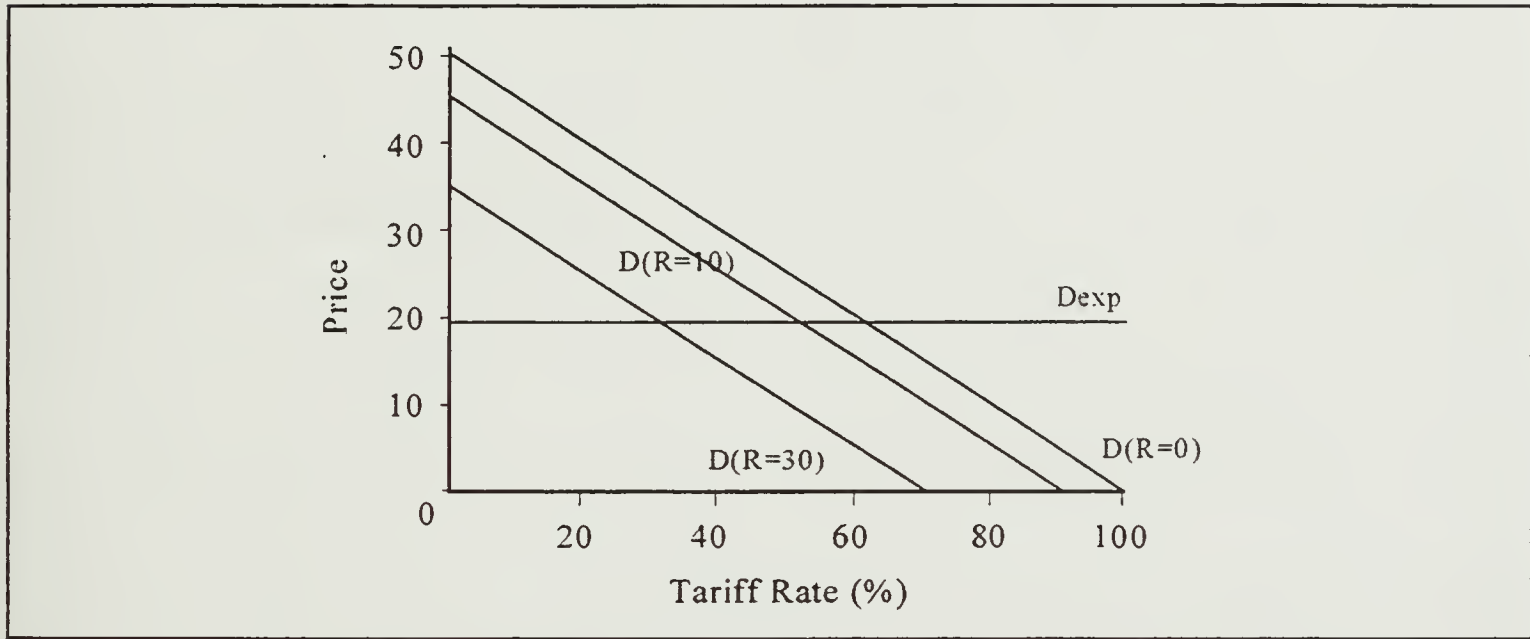
**Assumption 2:** A minimum access commitment (MAC) of  $R$  units has been negotiated in a previous stage of the trade game.  $R$  is perceived as exogenous in the second stage of the game when the monopolist makes its production decision. The monopolist imports at least  $R$  units as long as its profits exceed the free trade benchmark. When profits reach that level, the game goes back to stage one and the MAC agreement is terminated. The game ends as a free trade equilibrium emerges.

It is implicit in the assumption above that the trade partners of the importing country are capable of inflicting sufficient punishment to eliminate any temptation the importing country might have of importing less than  $R$  units. The assumption about the efficiency of the domestic monopolist (i.e., assumption 1) is maintained. Two investigations of market access improvements are conducted under this set of assumptions. Our objective is to isolate

the effect of import control by the domestic monopolist. Thus, in the first investigation, the firm does not have control/ownership of imports. In the second investigation, private agents are prevented from importing and the STE has perfect control. A third case combining inefficiency in production and import control is also analysed.

When the domestic monopolist competes with imports purchased by private agents, we assume that importers follow the price leadership of the domestic monopolist. Hence the monopolist optimizes domestic sales from a residual demand curve defined as the difference between the domestic demand and the MAC (i.e.,  $D(p)-R$ ). Figure 15 illustrates this effect for different values of  $R$ , while also displaying the perfectly elastic export demand which is unaffected by the MAC.

**Figure 15: Residual Domestic Demand Curves for  $R=0, 10, 30$  and the export demand curve**



**Result 3 :**

A) Increases in  $R$  have pro-competitive effects. At  $R=0$ , the efficient monopolist sells on both the domestic and export markets. As the minimum level of imports grows, export sales increase, but less than proportionately to imports. The country that was originally a net exporter eventually becomes a net importer as market access is liberalized.

B) There is a level of minimum forced imports  $R^{max}$  at which the profits of the monopolist under the MAC regime are equal to profits under free trade. At that point, the monopolist will request that its government abandon the MAC regime to adopt a free trade position.

Given our assumptions, the monopolist implements the following optimization problem:

$$Max \pi = p(q + R)q + (\omega - te)E - c(q + E) \quad (4)$$

where  $q+E$  is the monopolist's output,  $p$  is the domestic price and  $\omega - te$  is the export price. The first order conditions derived from maximizing over domestic sales  $q$  and export sales  $E$  are:

$$p(.) + p'(. )q - c'(. ) = 0 \quad (5)$$

$$\omega - te - c'(. ) = 0, \forall R < R^{max} \quad (6)$$

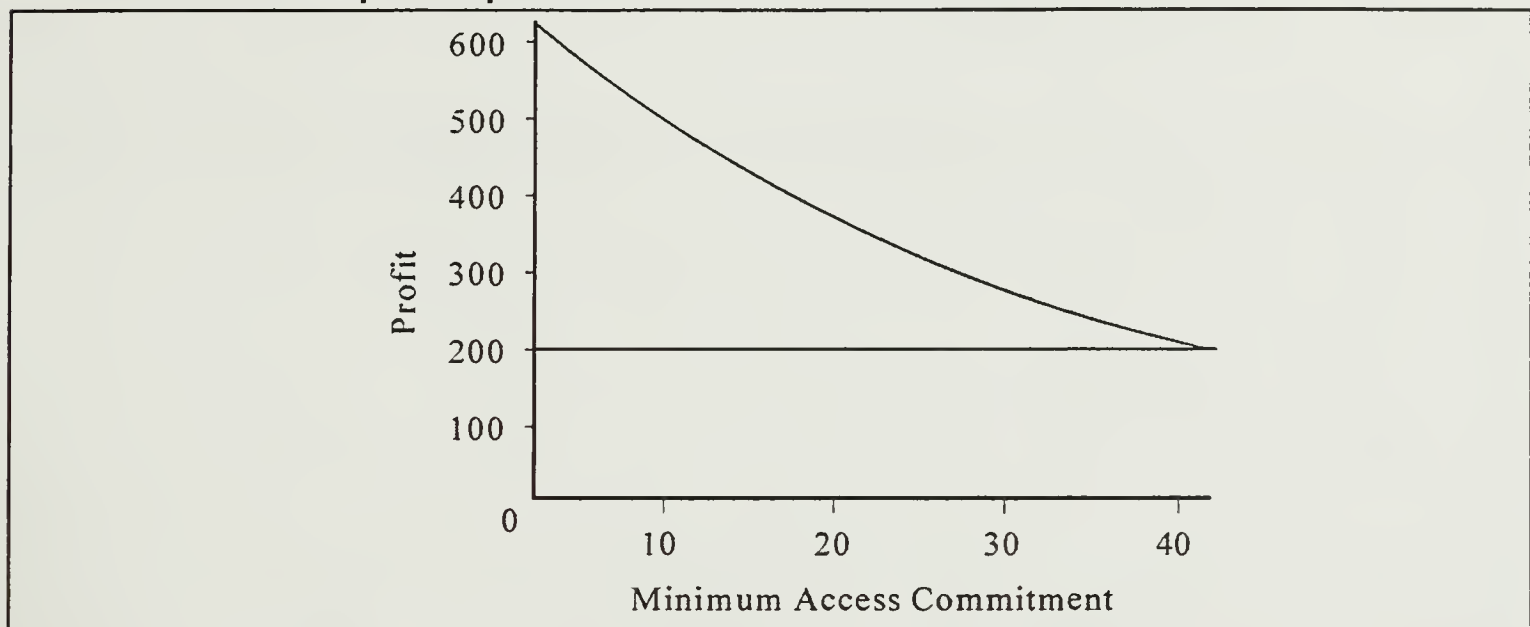
Notice that both equations hold with equality as long as the MAC is not too large. This arises from the efficiency assumption (i.e.,  $qmr(\omega - te) < qmc(w - te)$ ) which implies that the marginal cost curve cuts (from below) the perfectly elastic segment of the aggregate marginal revenue curve. This, in turn, implies that total production ( $q+E$ ) is fixed as long as  $R < R^{max}$ . Hence, MAC enlargements trigger offsetting changes in domestic and export sales. However, export sales grow at a slower rate than the MAC, and consequently, MAC enlargements induce growth in net imports. Accordingly, the domestic price falls as  $R$  increases (i.e., domestic demand,  $Q(R)+R$ , increases with  $R$ ). The domestic price exceeds the world price for all  $R < R^{max}$ . At  $R = R^{max}$ , the MAC has forced a sufficient contraction in both domestic sales and the domestic price that profits are equal to the profit that would prevail under free trade. At that point, the firm would prefer free trade to a further MAC enlargement. Welfare also increases with a move to free trade. Because MAC no longer serve any domestic interest, MAC equilibria do not exist beyond  $R^{max}$ . This outcome was first uncovered by Kaempfer, McClure and Willett [1989] who showed that it is impossible to find "domestic price equivalent" tariffs and quotas at low domestic prices. Because enlargements in MAC lower the domestic price, increase consumption and make the profit of the domestic firm converge toward its free trade level of profit, it follows that MAC enlargements are welfare-improving.

In Figure 16 the straight line depicts the profit of the firm under free trade. In this case the maximum MAC is well over the free trade level of imports ( $R^{max} = 44.56 > I_{ft} = 20$ ). Production is constant as long as  $R < R^{max}$ , but trade negotiations seeking an enlargement of the MAC beyond its maximum level would lead the importing country to adopt a free trade position. From the numeric example depicted in the figures, in this situation the output of the firm would then jump from 36 under the MAC regime to 40 under free trade. Exports grow with  $R$  as long as the maximum MAC has not been reached. Exports are depicted by the flatter path in Figure 17. Moving to free trade makes exports drop abruptly from their maximum level to zero. The country is a net exporter at low MAC levels but eventually becomes a net importer as market access improves. In our example, exports are linear in  $R$  and it is easy to verify that the turning point in the trade position occurs at  $R=10$ . The 45° line represents the growth in forced imports ( $R$ ).

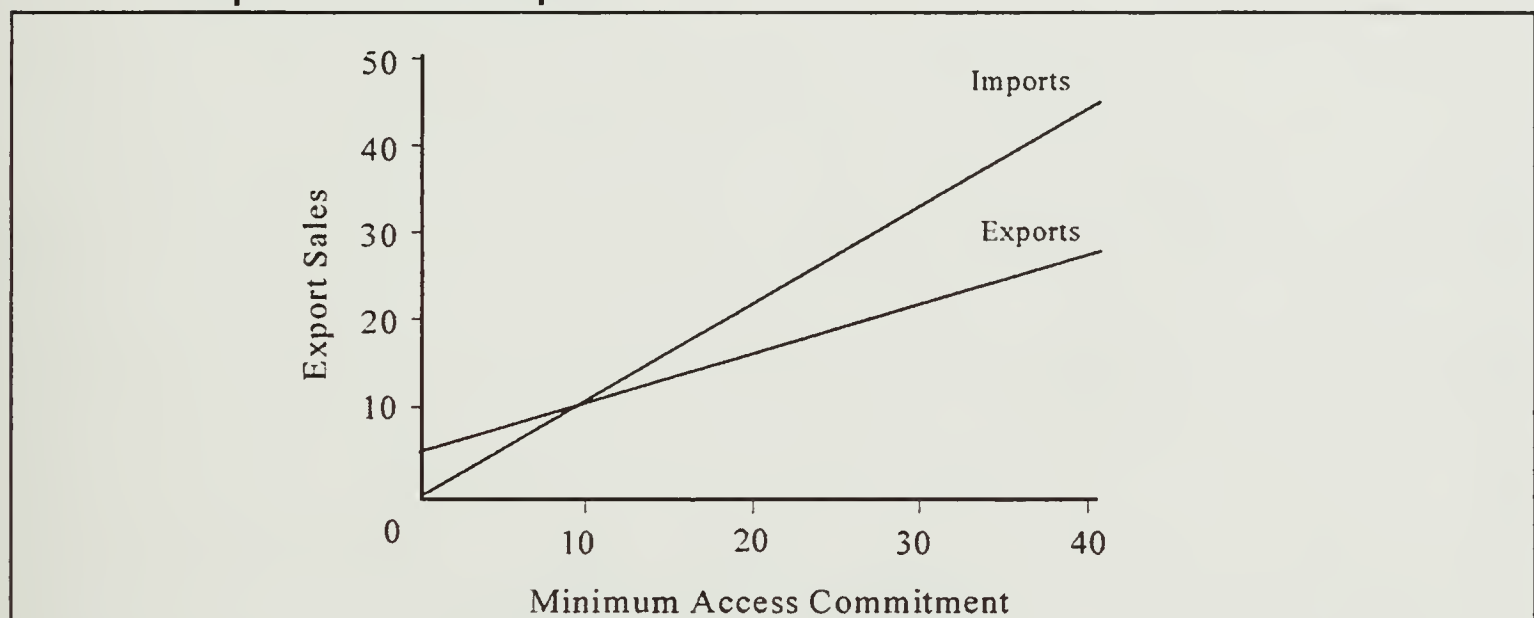
The trade liberalization path of the domestic price also shows a discontinuity as the importing country abandons the MAC regime for free trade. For  $R < R^{max}$ , the price declines smoothly as  $R$  increases. Once the maximum MAC is reached, the domestic price falls to  $p(.) = \omega = 20$ . On the other hand, domestic sales decline steadily as  $R \rightarrow R^{max}$  and jump to their free trade level once the trade liberalization process is complete. Figure 19 illustrates the path of gradually increasing welfare for  $R < R^{max}$  and the free trade reference level of welfare. At the maximum level of MAC, the country moves to free trade and this involves a small welfare jump in the numerical example that is depicted.

We now focus attention on the more germane case of the domestic monopolist/STE that controls imports. The efficiency condition is maintained.

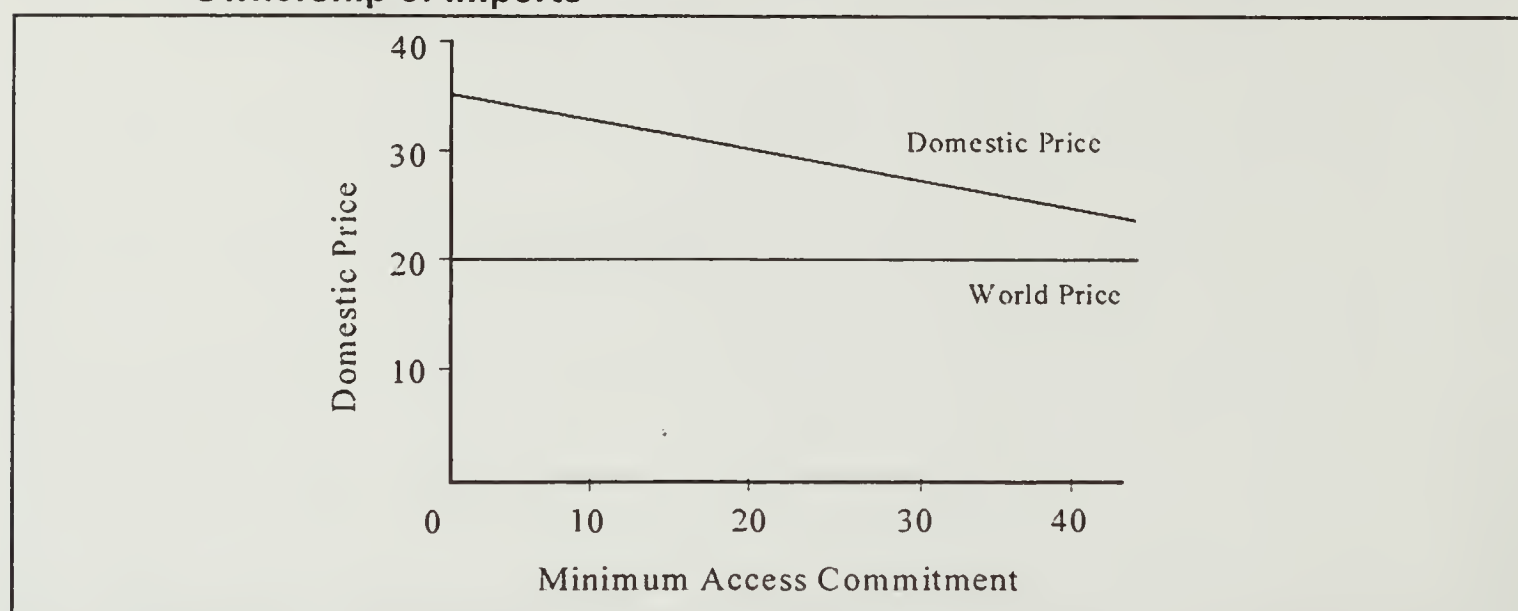
**Figure 16: The Profits of the Efficient Monopolist who does not Control/have Ownership of Imports**



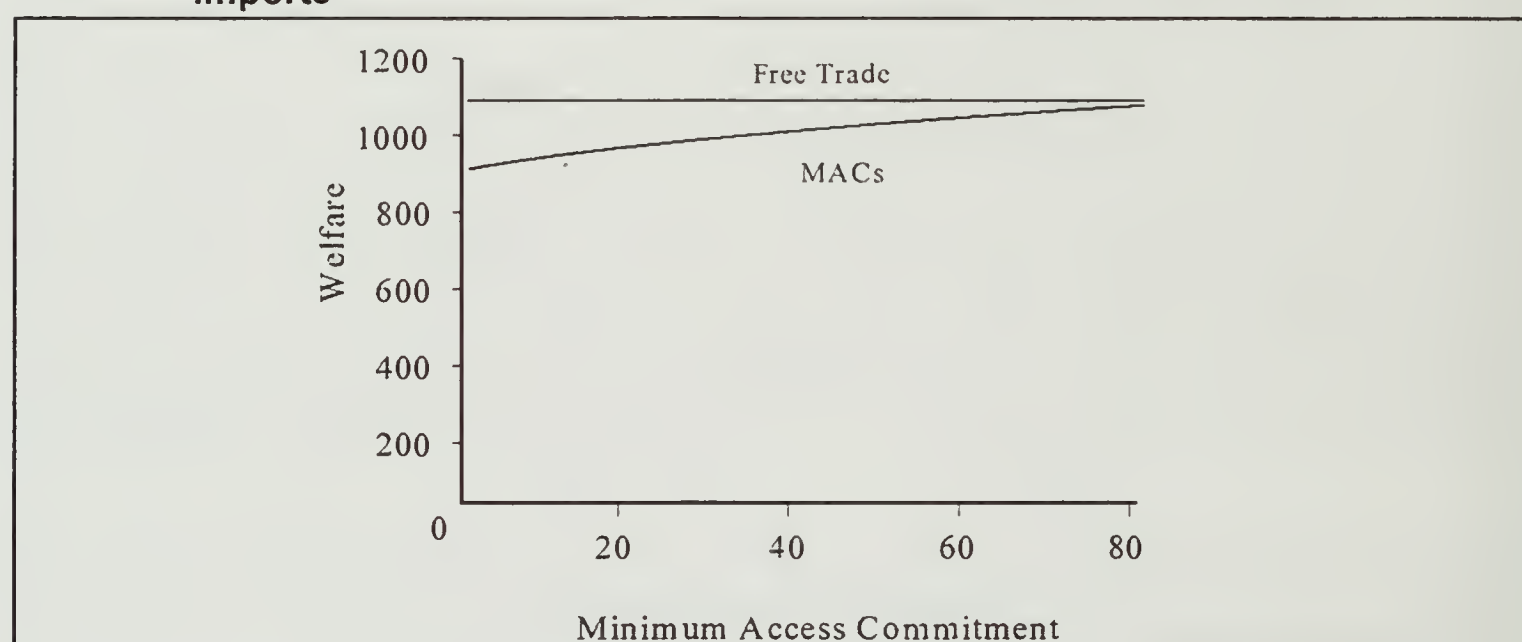
**Figure 17: Exports When the Efficient Monopolist does not have Control/Ownership of Imports 45° line=imports**



**Figure 18: The Domestic Price when the Efficient Monopolist does not have Control/Ownership of Imports**



**Figure 19: Welfare when the Efficient Monopolist does not Control/Ownership of Imports**



**Result 4 :**  $R$  is always binding when the monopolist is efficient. Thus the monopolist with control over imports maximizes its profit at  $R=0$  by practicing price discrimination (i.e., domestic and exports sales  $> 0$ , imports  $= 0$ ). As long as  $R < R^{max}$ , the country continues to be a net exporter as exports and imports grow at the same pace. Increases in the MAC reduce welfare and the net import position is observed only when the country abandons the MAC regime for free trade.

Some intuition is provided by considering the effect of control over import licenses on the marginal cost of the firm. Recall that the firm is committed to buy at least  $R$  units of imports at the world price. Such a commitment creates a fixed cost of  $\omega R$  for the firm, but it also gives the firm a stock of goods with zero marginal cost. Figure 20 shows the shifts in the marginal cost curve caused by MAC of 8 and 20 units. The efficiency assumption (i.e.,  $q_{mc}(\omega - t_e) > q_{mr}(\omega - t_e)$ ) states that the upper marginal cost curve cuts the flat segment of the aggregate marginal revenue curve from below, which results in positive export sales. Given that increases in  $R$  shift the marginal cost curve to the right, it follows that exports are increasing in  $R$ .

Mathematically, the firm's constrained optimization problem can be expressed as:

$$\text{Max } \pi = p(q)q + (\omega - te)E - c(Q) - \omega R + \lambda(Q + R - q - E) \quad (7)$$

where  $\lambda$  is the Lagrange multiplier,  $Q$  is the monopolist's production,  $Q+R$  is the supply at its disposal and domestic and exports sales are  $q$  and  $E$ . The first order conditions are:

$$p(.) + p'(. )q - \lambda = 0 \quad (8)$$

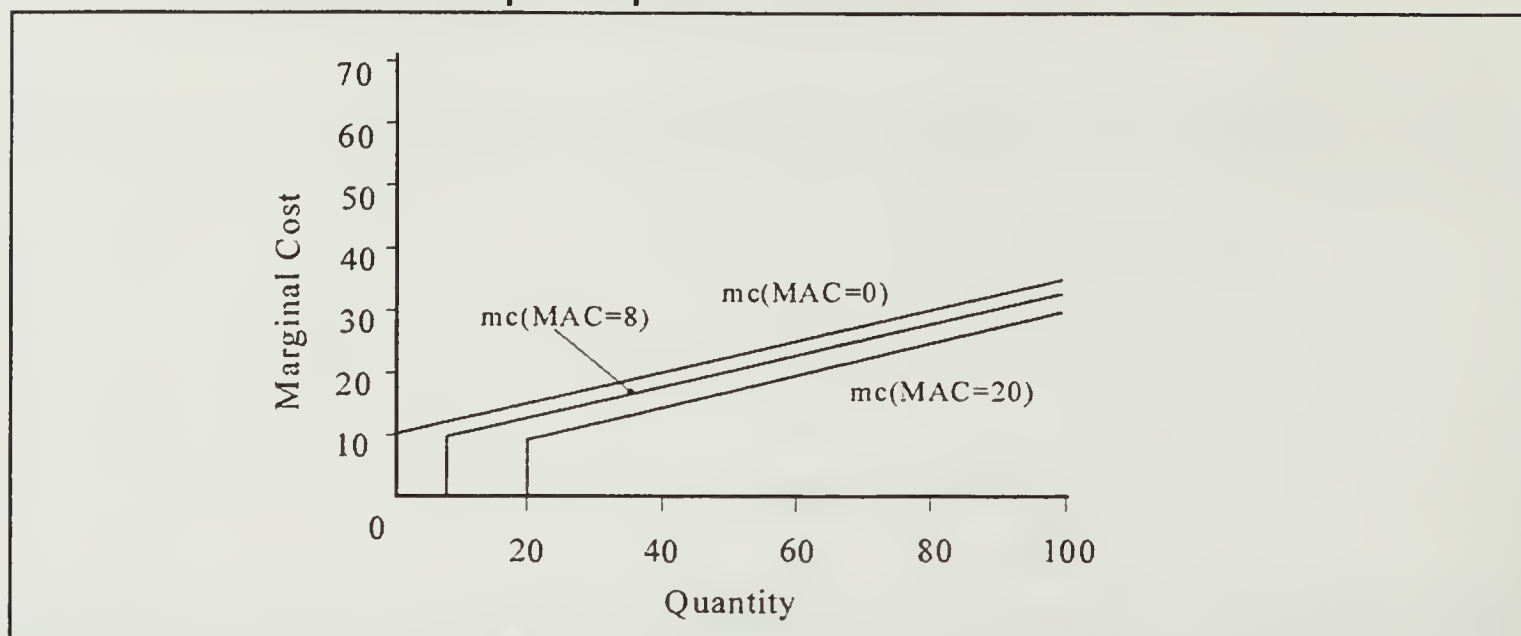
$$\omega - te - \lambda = 0 \quad (9)$$

$$-c'(. ) + \lambda = 0 \quad (10)$$

$$Q + R - q - E = 0 \quad (11)$$

Note that  $R$  is not treated as a choice variable even though it is, by definition, a minimum commitment that could be exceeded, if it were profitable to do so. If  $R$  was a choice variable for the efficient firm,  $R$  would be zero because the firm's marginal revenue from its first unit of import is  $\omega - te$ , which is less than  $\omega$ , the cost of the imported unit. This is, in essence, the basis of the "sleeping quota" result noted earlier, in which a monopolist has an incentive to purchase import licences to insure that these will not be used. In our model, threats of punishment are assumed to be sufficiently credible to deter the monopolist from importing less than the agreed upon minimum access target. Hence, the efficient firm is forced to import its country's minimum commitment of  $R$  units, but it has no incentive to import more. Thus  $R$  is binding. The net trade position of the country does not change as long as  $R < R^{max}$ , the latter being the MAC level at which the profit of the firm is the same as under free trade. As long as  $R < R^{max}$ , the equilibrium on the domestic market is unaffected by increases in market access because an increase in imports is matched by an identical increase in exports. The profit of the firm decreases as  $R$  increases, because every unit imported adds  $\omega$  to the fixed cost while an additional unit exported increases revenue by only  $\omega - te$ . Thus the profit of the firm decreases by  $te$  for every increase in  $R$ , as shown in Figure 21. When transport costs are small, the monopolist can maintain a high domestic price, even for very large  $R$  values. In our numerical examples, transport costs represent 5% of the world price and this explains why the profits of the firm decrease slowly as  $R$  increases, in sharp contrast to the case in which the firm does not have control/ownership of imports. The control of imports consolidates the market power of the firm and this is why MAC increases have very little effect on the profits of the firm. The straight flat line in Figure 21 is the level of profits under free trade. Transport cost being low, the firm's profit under the MAC regime equals the free trade level of profit at  $R^{max} = 442.5$ , which is about ten times higher than when the monopolist does not control imports.

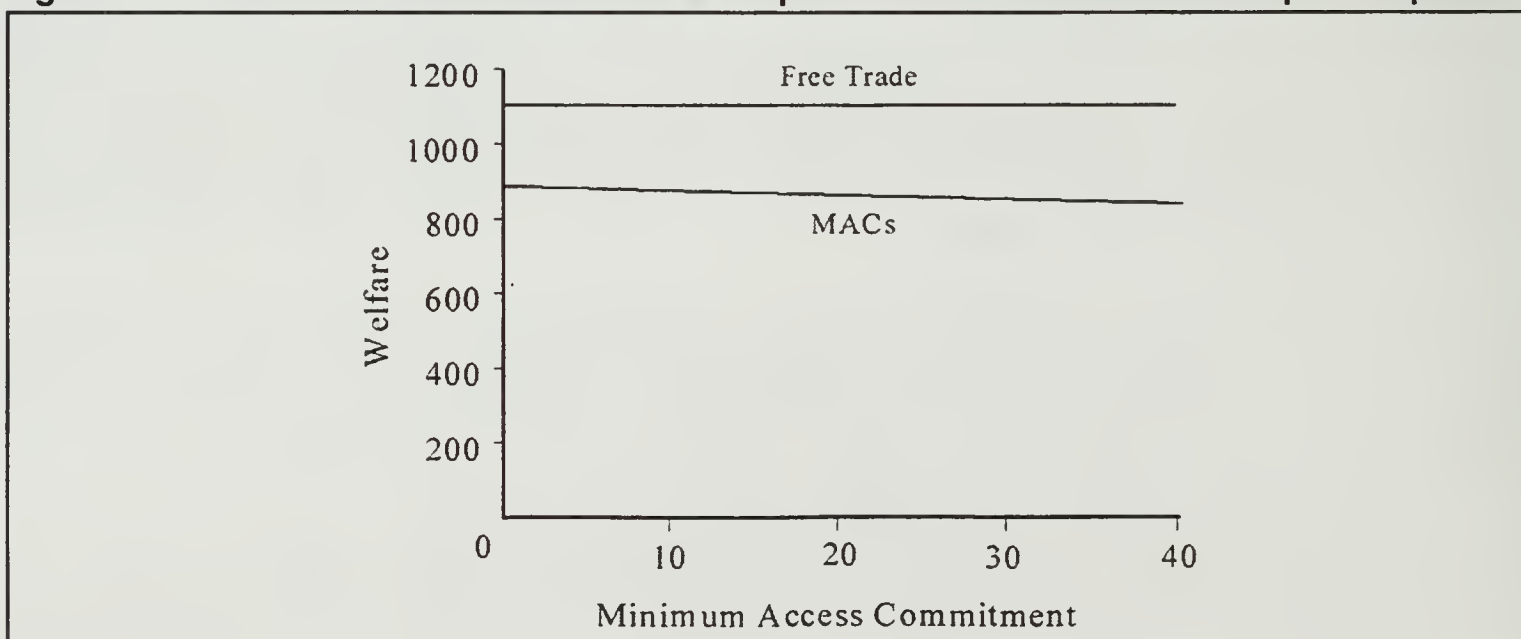
**Figure 20: The Effect of MAC on the Marginal Cost of the Efficient Monopolist who has Control/Ownership of Imports**



**Figure 21: Profits of the Efficient Monopolist who has Control/Ownership of Imports**



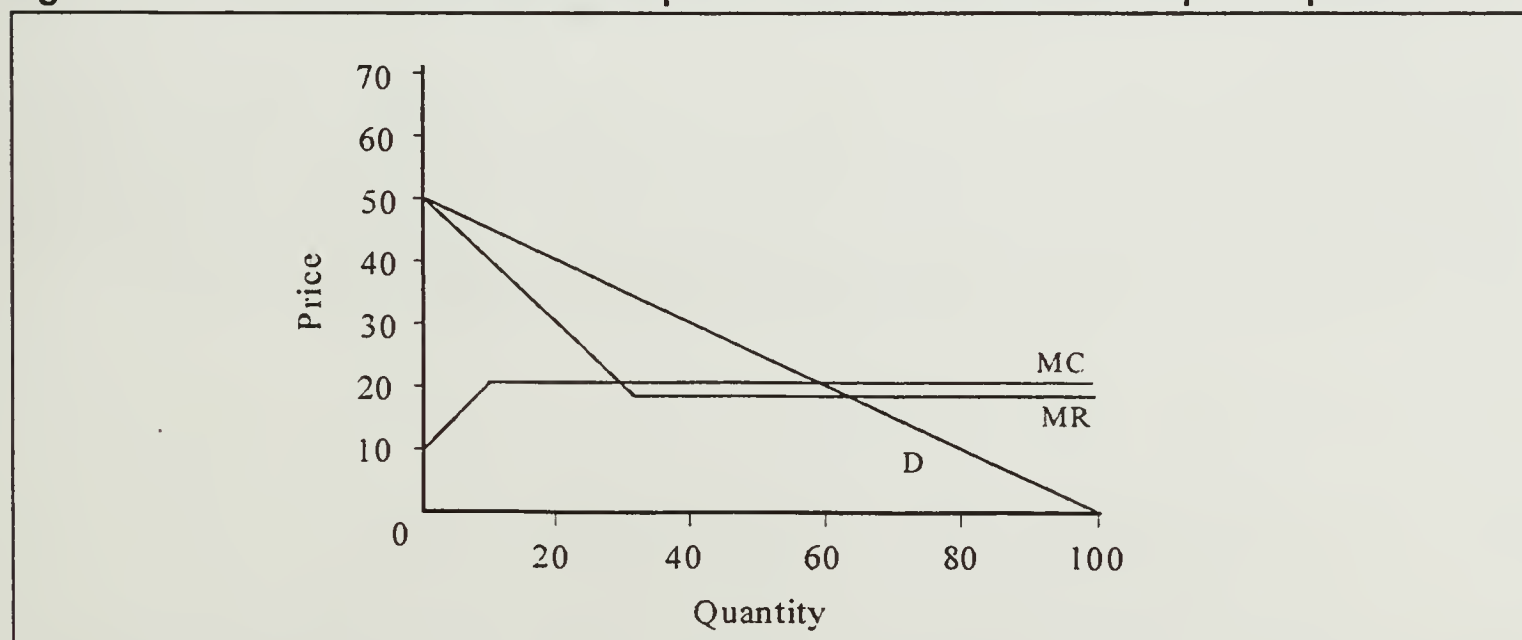
**Figure 22: Welfare when the Efficient Monopolist has Control/Ownership of Imports**



The domestic price, the monopolist's output and the country's net trade position are constant for all MAC equilibria. From the first order conditions, it follows that an interior solution occurs when the marginal revenue from domestic sales equals the marginal revenue from export sales (i.e., when  $p + p'q = \omega - te = c'$ ). Because the export price is a constant,  $c'$ , output is not affected by  $R$ . Similarly,  $p + p'q$  is not affected by  $R$  and hence the domestic price will not be affected by  $R$ . Our efficiency assumption stipulates that  $qmr(\omega - te) < qmc(\omega - te)$ . These quantities are, respectively, the domestic sales and output under the MAC regime. The difference between these quantities is equal to exports when  $R=0$ . When  $R>0$ , this difference is equal to net exports. In our numerical example, domestic sales are optimised at  $q=31$ . When  $R>0$ , the monopolist operates an import-export warehouse to protect the profits derived from the domestic market. Domestic price being constant, consumer surplus is not affected by MAC increases. Given that the profit of the firm is a decreasing function of  $R$ , MAC increases must affect the firm adversely. Figure 22 displays the negative relationship between MAC and welfare, relative to the free trade benchmark.

Relaxing the efficiency condition slightly complicates the problem because it is then in the firm's best interest to purchase a limited quantity of imports. As in the previous case, the monopolist has no foreign competition (i.e., it owns import licenses) and will use this consolidated market power in the domestic market. Unlike the efficient firm, the marginal cost of the inefficient firm rises rapidly; thus it would import in order to take advantage of the constant marginal cost of imports, even in the absence of the MAC. Figure 23 applies the parameter values used previously with one exception; it is assumed that the marginal cost of domestic production rises four times faster than before. This inefficiency in production leads to the intersection of the flat portion of the aggregate marginal cost with the downward portion of the aggregate marginal revenue curve. The existence of transport costs accounts for the difference in the flat portions of the aggregate marginal revenue and aggregate marginal cost curves. In Figure 23, the monopolist chooses to import 20 units to optimize its market power over the domestic market. For  $0 \leq R \leq I^{min}$ ,  $I = I^{min}$ , is the minimum level of imports that can be observed. The MAC are binding only when  $R$  exceeds the minimum level of imports. Even though the monopolist has complete control over trade in Figure 23, it cannot profitably export for the reason given in Result 1. When  $R$  is sufficiently large (i.e., when  $R^{exports} > I^{min}$ ), the monopolist will export because of the effect of forced imports on its aggregate marginal cost curve.

**Figure 23: The Cost-Inefficient Monopolist with Control/Ownership of Imports**



**Result 5 :** For  $R \in \{0, I^{min}\}$ , the inefficient monopolist will find it profitable to import  $I^{min}$  and thus exceed its minimum access commitment until  $R = I^{min}$ . Thus  $R$  is not binding in the domain in question. The monopolist sells all of its production and its imports on the domestic market. In the domain  $\{I^{min}, R^{exports}\}$ , the increase in imports lowers the domestic price but this is not sufficient to trigger exports. However, for  $R \in \{R^{exports}, R^{max}\}$ , exports are observed and the domestic price remains constant. At  $R^{max}$ , the forced imports are sufficiently large that the monopolist is indifferent between the MAC regime and the free trade equilibrium ( $\pi_{R=R^{max}}^{MAC} = \pi^{ft}$ ).

The optimisation problem of the monopolist is similar to that defined by (7). The difference lies in the constraints imposed :

$$Max\pi = p(q)q + (\omega - te)E - c(Q) - \omega I + \lambda_1(Q + I - q - E) + \lambda_2(I - R) \quad (12)$$

The first order conditions with respect to domestic sales  $q$ , export sales  $E$ , imports  $I$ , output  $Q$  and the Lagrangian multipliers  $\lambda_1, \lambda_2$  are given by :

$$p(.) + p'(. )q - \lambda_1 = 0 \quad (13)$$

$$\omega - te - \lambda_1 \leq 0 \quad (14)$$

$$-\omega + \lambda_1 + \lambda_2 = 0 \quad (15)$$

$$-c'(. ) + \lambda_1 = 0 \quad (16)$$

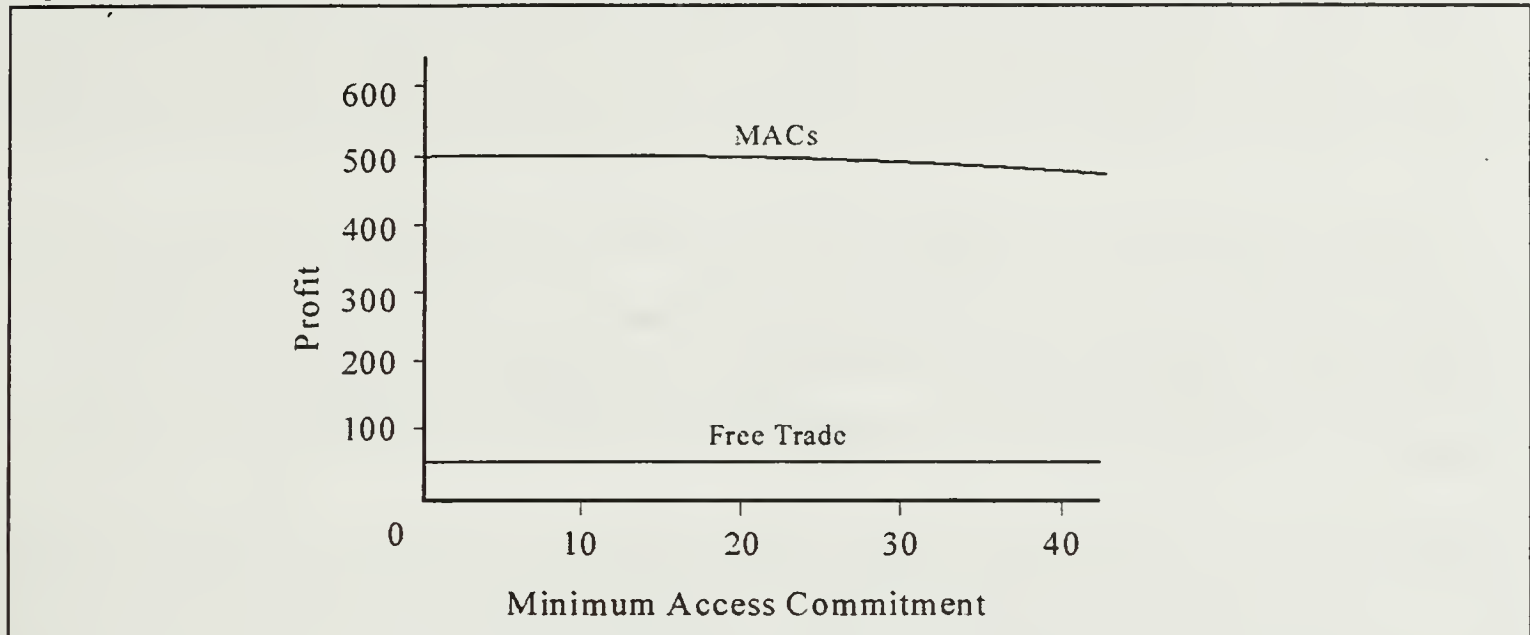
$$Q + I - q - E = 0 \quad (17)$$

$$I - R \geq 0 \quad (18)$$

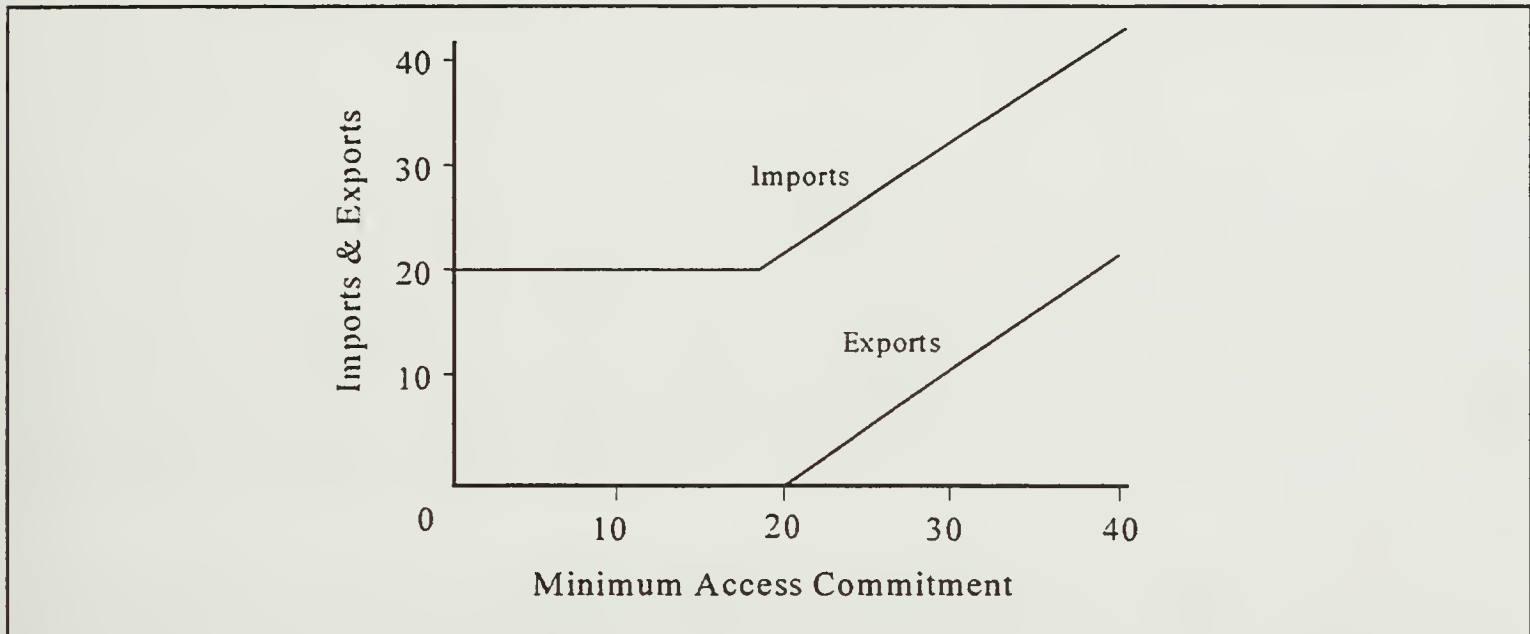
The conditions above tell us that when  $R$  is not binding (i.e., when  $I - R > 0$ ,  $\lambda_2 = 0$ ),  $p + p'q = c' > \omega - te$  and it is not profitable to export. Imports are given by  $I = qmr(\omega) - qmc(\omega) > 0$ . When  $R$  is binding, the first order conditions indicate that:  $\lambda_1 = \omega - \lambda_2 \geq \omega - te$ . When this holds with inequality, exports remain at zero, as when  $R$  is not binding, but domestic sales and output are higher and lower respectively. This confirms that the domestic price decreases over the interval  $\{I^{min}, R^{exports}\}$ . When  $R \in \{R^{exports}, R^{max}\}$ ,  $\lambda_1 = \omega - \lambda_2 = \omega - te = c'$ , exports are profitable and all imports in excess of  $R^{exports}$  are exported.

The straight line in Figure 24 is the profit benchmark under free trade. The profit of the firm starts to decline at  $R = I^{min} = 20$ . MAC below 20 are not binding and thus profits are constant in that domain. Figure 25 displays imports (top line) and exports (bottom line). The import path shows that the MAC are not binding until  $R = I^{min} = 20$  and exports begin at  $R^{exports} = 22$ . Because our numerical example assumes that transport costs constitute only 5% of the world price, exportation of imports can be sustained until  $R = R^{max} = 471$ .

**Figure 24: The Profits of the Inefficient Monopolist with Control/Ownership of Imports**



**Figure 25: Imports and Exports when the Inefficient Monopolist has Control/Ownership of Imports**



**Figure 26: The Domestic Price when the Inefficient Monopolist has Control/Ownership of Imports**

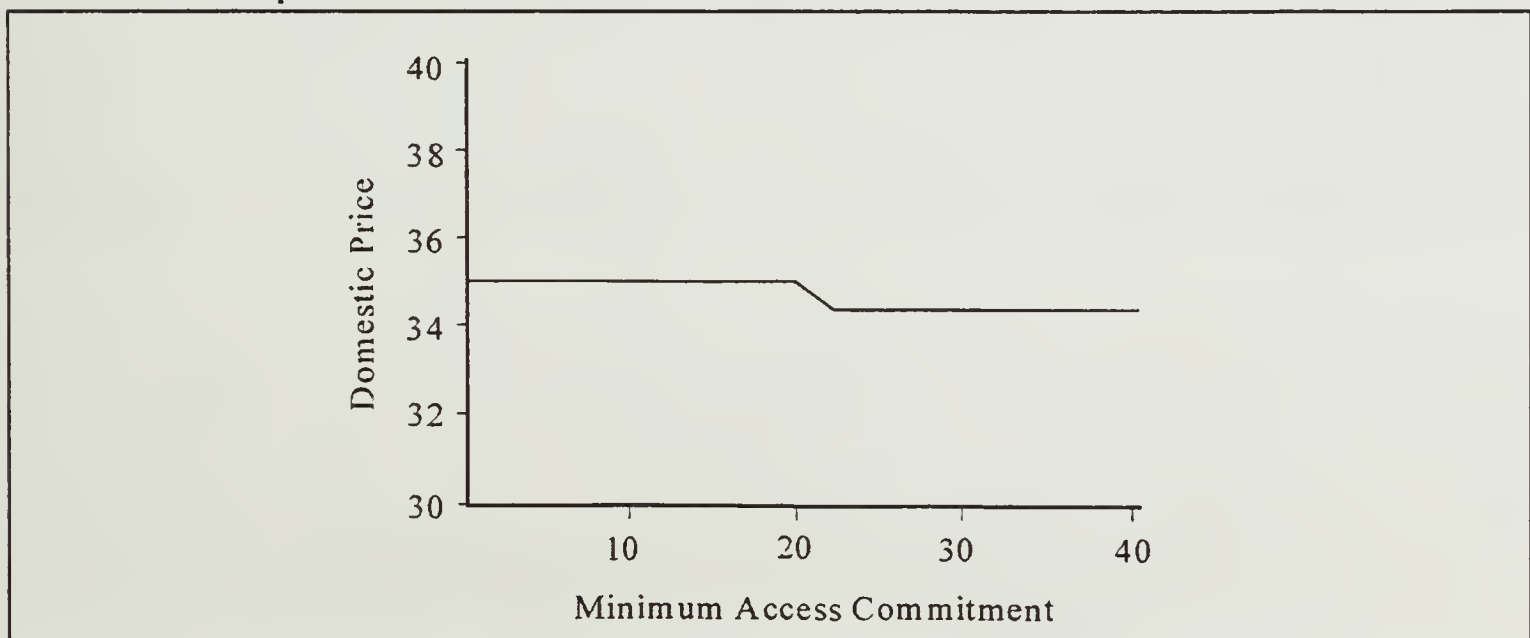
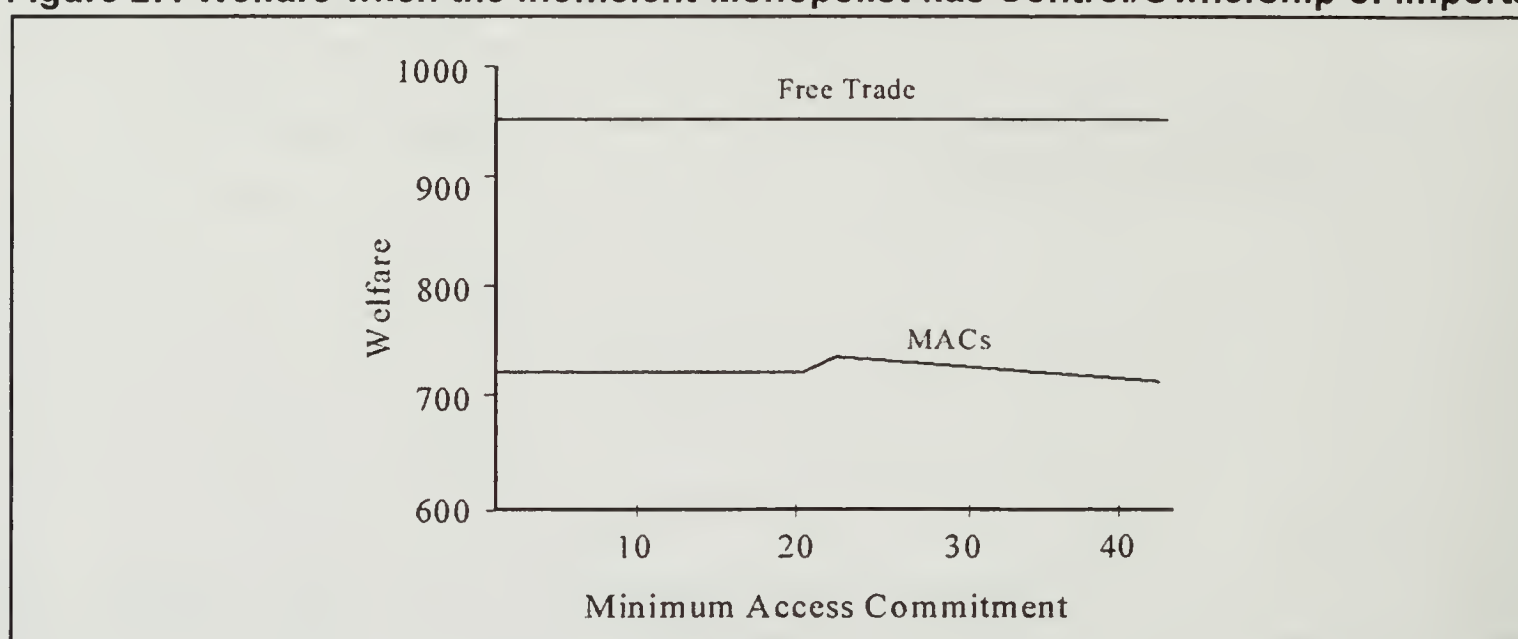


Figure 26 shows that the domestic price is constant as long as the MAC is not binding. In the domain where MAC are binding, but not sufficiently high as to trigger exports, the domestic price falls as  $R$  increases. However, the domestic price is constant when the monopolist exports. At the maximum MAC, the domestic price jumps from the level under the MAC regime with exports ( $p=34.5$ ), to its free trade level ( $p=20$ ).

The welfare implications of increases in MAC are illustrated in Figure 27. Because domestic price and profits are constant for  $R \leq 20$ , it follows that welfare is also constant in that domain. Welfare increases when  $R^{min} < R \leq R^{exports}$  because the domestic price falls in that interval. MAC increases beyond  $R^{exports}$  have adverse impacts on the firm's profits. The decline in welfare is proportional to the transport-based costs of exporting. The straight line is the free trade welfare level.

**Figure 27: Welfare when the Inefficient Monopolist has Control/Ownership of Imports**



## 8.4 Summary

In the analyses given in the preceding section, it was shown that the effects of trade liberalization, in circumstances of monopoly power, will not necessarily bring about a fall in domestic production and a rise in imports. This conclusion contrasts to the situation that involves STE operation in competitive world and domestic markets. It is evident that even if STE do respect national commitments toward trade liberalization, expressed through tariff reductions and increases in MAC, unusual phenomena can take place. Unexpected outcomes are especially likely in the circumstances of "dirty tariffication" of agricultural goods.<sup>55</sup> The analysis above clearly shows that when an import STE has market power in the domestic market, trade liberalisation through MAC is not a desirable alternative to tariff reductions.

55. According to Inco [1998], the conversion of non-tariff barriers into tariff-based quotas has led current tariffs for several products and many countries to be much higher than the calculated implicit tariffs that prevailed prior to "tariffication" of non-tariff barriers.

## **9. Implications of the Theoretical Analyses**

There are a number of implications of the preceding analyses for determining the efficiency of the various types of marketing organizations that might exist in international agricultural markets. Some major implications are:

1. STE are always less efficient than private traders if the private traders are perfectly competitive.
2. If the private traders are not perfectly competitive, the use of a price pooling export STE can increase the total economic surplus available. This result can hold for both the small country and the large country case.
3. The use of a price pooling export STE is more likely to increase the total economic surplus available when:
  - (a) export sales are a relatively large percentage of total production
  - (b) the market power of the STE in the domestic processing market is limited
4. If an import STE has monopoly power in the domestic market and is heavily protected, trade liberalization through provision of market access commitments may have apparently anomalous effects; in the circumstances where an import STE has monopoly power in the domestic market, tariff reductions will provide a more dependable mechanism of trade liberalization.

One of the conclusions to be drawn from these results is that the debate about STE is only partly about economic efficiency criteria. Also of importance in the debate is the distribution of the economic surplus that emerges under various organizational structures. Although the concern about distribution is important when the trading sector is perfectly competitive, the introduction of trading firms with market power introduces another group that has economic surplus that it would like to protect. Thus, the inclusion of oligopolistic trading firms enhances the complexity of the economic redistribution that can occur when different organizational structures are introduced.

The simulation results presented above can be used to determine the groups that benefit and lose under different organizational structures. For instance, MNE clearly lose when a price pooling export STE is introduced. Thus, they can be expected not to be supporters of export STE. This conclusion must be tempered however with the reminder that in the export STE model the STE were assumed to carry out international trade on their own account. In reality, export STE often use MNE for some or all of this function. An analysis of the situation where export or import STE use MNE as their agents may result in different conclusions and is a subject for future research. In situations where import STE hold monopoly power over domestic production, these institutions can be expected to oppose trade liberalization, particularly where this is effected through tariff reductions. Their attitude toward MAC may be ambiguous as reflected by the preceding analysis.

A major conclusion to draw from the research in this part of the report is that the analysis of STE is difficult and must be carried out carefully and thoughtfully. Simple models that assume perfect competition can easily lead to incorrect conclusions. At the same time, the models that incorporate imperfect competition are often complex and require simulation analysis to determine results. And most importantly, the simulation results depend critically on the assumptions concerning market integration and the assumptions about firm and STE

costs that have to be included in the various models. In short, the analysis of STE requires good, solid economic analysis using appropriate theoretical tools and appropriate empirical observations.

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# **Part III: International Trade in Agricultural and Food Products: The Role of STEs: Some Criteria and Cases**

## **1. Introduction**

The first part of this report overviewed literature and concepts relating to state-trading enterprises (STE); the second part presented two analytical models of STE activities. From these overviews and analyses it is evident that STE vary greatly, as do the economic effects that they may have in domestic and export markets. In this third part of the report, the criteria that may be useful in categorizing STE are discussed further and several brief case studies of STE are provided.

## **2. Concepts for Categorizing STEs**

In Part I of this report, the basic concepts of industrial organization that are commonly used in assessing market performance, from a societal viewpoint, were briefly reviewed. Both that review of literature and the analytical models of Part II indicate the crucial importance of developing criteria that relate to the actual market outcomes that would be expected in the absence of an STE, rather than making the assumption that in the absence of a STE, perfect competition would automatically apply. The crucial importance of contestability as a determinant of market outcomes was noted. It was recognized that the use of this concept will necessarily entail proxy measures, or indicators. Indicators such as concentration measures, trade shares, price differences and the existence of sustained rents (profitability measures) have been cited as possible contestability indicators [OECD, 1996c, d]. An additional highly relevant criteria related to the issue of contestability in the context of agricultural STE concerns the availability of competition from imports, i.e., whether or not national borders are open to allow competition from other competitors or nations in the form of imports. Open borders provide for rapid entry and exit of competitors and consequently this is a highly effective means of ensuring contestable markets.

The set of criteria to categorize STE that has been proposed by Dixit and Josling [1997] was also discussed in Part I of this report. The first criteria that they propose is the trade balance for the product, i.e., whether the STE is an importer or exporter. As Dixit and Josling explain, this is necessary information, but it is only a very initial first step to understand the economics of STE. As discussed in the last section of Part I, the major concern about export STE is not the concern that they might hold and exert market power. The major concern about these bodies, heightened by alleged lack of transparency, is the possibility that they may be used as a means of covert export subsidization. It may not be recognized by their critics that many export boards are in fact financially independent from government, and thus unable to apply export subsidies, and that export subsidies, whether applied by STE or otherwise, are in any event, subject to the Agreement on Agriculture provisions concerning export subsidy disciplines. An import STE may have more potential to adversely affect contestability, competition, and trade than does an export STE since if it is specified as the sole importer, or a favoured importer, there is an immediate impact on other importers' ability to supply the domestic market.

A second criteria that is proposed by Dixit and Josling is described as "market control", referring to four specific activities that the STE might be engaged in: importing, exporting, domestic procurement (purchases), and domestic marketing (sales). Dixit and Josling argue that these are measures of potential trade distortion, since the ability of a STE depends, among other things, on the control it exercises over these activities. However, we do not believe that this is a particularly useful criteria. As described by Dixit and Josling, this only involves a listing of STE activities, which just sheds light on the scope of STE operations, rather than providing evidence on the degree of market control that is involved or the extent of potential or actual trade distortion that a particular STE may cause. A more meaningful indicator would focus on the extent to which STE can and do apply market power.

As was discussed in Part I, Section 5.2, the economic theory of industrial organization and market behaviour suggests that the existence of restrictions or limitations to competitors' potential entry or exit may be the most relevant indicator of the extent of market power that may be applied by any firm or by the STE. We propose that categorization of STE should be based on contestability indicators. One highly effective indicator of contestability in a particular market for a traded good is whether or not the border is open to import competition. Proxy indicators may be needed to gauge the extent of import competition, such as whether the import market is completely open, or whether some restraint on importation is involved, such as import licensing, or whether extensive constraints on importation apply, as through the minimum access commitments of tariff rate quotas.

A third criteria suggested by Dixit and Josling is the "policy regime", for example, whether the STE has access to preferential government assistance, such as preferential access to import quotas (and thus to the rents associated with these), or preferential access to tariff revenues or loan guarantees. We consider this to be an appropriate basis for criteria to categorize the possible impacts of STE but note that this criteria is not in fact applied in the tentative typology that is proposed by these authors. This omission is also the case for the other two criteria proposed by Dixit and Josling, namely "product range" and "ownership and management structure". We do not find the reasoning underlying "product range" (that more market power may be exerted if the STE is involved with several products, rather than one product), to be particularly convincing. The listing of "ownership and management structure" as an indicator of the performance of an STE is also debatable since, as we discussed earlier in Part I, STE ownership per se does not necessarily affect market

performance or distort trade patterns. Even so, the issue of whether or not an STE operates at “arms length” from political interference (albeit within any specified policy constraints on its operations<sup>56</sup>), can be interpreted as being consistent with the existing specification of the GATT/WTO Article XVII:1(b). As discussed in Part I Section 3.1 of this report, this Article requires STE to make purchases and sales solely in accordance with “commercial considerations”.

Summing up, we propose that the categorization of STE be based on criteria that will act as indicators of contestability, since this is the crucial indicator of potential market power. Other relevant criteria can be proposed that may also be of interest, such as whether the relationship between the STE and government/politicians is at arms length and whether the STE operates with an appropriate level of transparency. However, we suggest that these should be regarded as subsidiary criteria to indicators of contestability.

Application of these criteria necessitates provision of information on STE and the markets that they operate in; currently, this type of information is not specified in the notifications of STE to the WTO. The type of information that is necessary for effective STE classification is listed below in Table 6 and 7.

The listed information is required for application of an economically relevant typology of STE. We propose such a typology and depict this in Table 8 and 9. We propose that STE that are classified as Type I include those that have little if any effect on contestability and consequently can be concluded to have relatively little impact on trade; their potential to distort trade is low. Type III STE, in contrast, do have the potential to distort trade since they have clear adverse impacts on contestability in the markets in which they operate. The STE classified as Type II do not fall either of the more clear-cut cases of Types I and III but operate in circumstances in which contestability may be compromised and consequently trade flows may be distorted. Case by case analysis of whether distortion actually occurs is necessary. Our typology could be viewed in the context of a “green” (Type I), “amber” (Type II) and “red” (Type III) characterization. Type III (red) STE should be phased out or converted to less distorting operations. Type I (green) STE should be subject only to reporting and periodic monitoring. In contrast, Type II (amber) STE would be required to engage more intensive reporting and to undergo more stringent monitoring on a case-by-case basis.

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56. For example, through a government policy directives or legislative specification that may provide a limitation of the ability to apply monopoly powers against domestic consumers.

**Table 6: List of Information Required to Categorize and Assess STE\***

1.	Basic Nature of STE Activity: Does the STE engage in/apply to a commodity that is exported, imported, or both?
2.	Concentration, question 1: What market share of national imports and/or exports is controlled by the STE?
3.	Concentration, question 2: For an import STE, what share of domestic market sales for each of the products it deals with is controlled by the STE?
4.	Concentration, question 3: For an export STE, what is the market share of world export sales that is controlled by this body?
5.	Import Access, question 1: If the STE relates to imports, is the border open to imports or restricted?
6.	Import Access, question 2: a. If imports are restricted in some way, is this a minor restriction, such as import licensing? b. Is the restriction administered by the STE?
7.	Import Access, question 3: a. If imports are restricted, is this a major restriction, such as through a tariff rate quota (TRQ) and associated minimum access commitment (MAC)? b. Is the TRQ restriction administered by the STE? c. Is the MAC filled? And if not, is there an identifiable reason for this?
8.	Price Comparison: For an import STE, is the price level in the domestic market appreciably in excess of the world market price, as measured in an accepted reference market, during a sustained period of time?
9.	Subsidization, question 2: a. For an import STE, are there preferential arrangements (such as loan guarantees or debt forgiveness) that are equivalent to subsidies? b. If so, are these in accord with the provisions of the Agreement on Agriculture?
10.	Subsidization, question 1: a. Is the export STE or the products it controls the recipient of export subsidies? b. If so, are these in accord with the provisions of the Agreement on Agriculture? c. What are the levels of such subsidies, relative to those applied by major national competitors, as judged by the calculated measure of market price support for the commodity in question?
11.	Appropriate Transparency: Is information regularly made available to the public on the operations of the STE that is equivalent in scope and detail to the information that is made available by the major competitors of the STE?
12.	Nature of Relationship with Government: a. Does the STE operate independently of government from an organizational perspective? b. are the financial operations of the STE independent from government, i.e., is the STE self-financing?

\*Questions 1 to 8 are indicators of contestability and are considered to be necessary for STE categorization. Questions 9 through 12 are supplemental; they do not relate primarily to contestability but they focus mainly on whether the STE in question conform with provisions of the Agreement on Agriculture (9 and 10), and provide additional information on the STE.

**Table 7: Information Required for Categorization and Assessment of STE**

Criterion	Import STE	Export STE
Basic Nature	Is the commodity imported?	Is the commodity exported?
Concentration, questions 1 & 2	What is the market share of national imports controlled by the STE?	What is the market share of national exports of the product in question that is controlled by the STE?
Concentration, question 3	What is the market share of domestic sales that are controlled by the STE for each product it regulates?	What is the market share of world export sales that are controlled by the STE?
Import Access, question 1	Is the border open to imports?	Are domestic sales regulated?
Import Access, question 2	If imports are restricted, is this done in a minor way, as through licensing? Is the import restriction administered by the STE?	If imports are restricted, is this done in a minor way, as through licensing? Is the import restriction administered by the STE?
Import Access, question 3	If imports are restricted, is this done in a major way, as through MAC? Is the restriction administered by the STE?	If imports are restricted, is this done in a major way, as through MAC? Is the restriction administered by the STE?
Price Comparison	What is the level of price in domestic market relative to a specified world market reference price?	If the STE also operates in the domestic market, what is the level of price in the domestic market relative to a specified world market reference price?
Subsidization, questions 2 & 3	Are there preferential arrangements (e.g. loan guarantees or debt forgiveness) equivalent to subsidies? If so, are these in accord with the Agreement on Agriculture?	If so, are these in accord with the Agreement on Agriculture? What are the levels of subsidies relative to those for similar products from major national competitors?
Appropriate Transparency	Is information equivalent to that from private competitors made public?	Is information equivalent to that from private competitors made public?
Nature of Relationship with Government	Are operations independent of government? Is the STE self-financing?	Are operations independent of government? Is the STE self-financing?

**Table 8: The Proposed Typology of STE: Defining the Classifications\***

<b>Type I: The market can be regarded as contestable. This class of STE includes:</b>
<ul style="list-style-type: none"> <li>i) Export STE that face competition in export markets from private traders or other national STE (where the proportion of world export market sales/product controlled by the STE is less than thirty-three percent).</li> <li>ii) As above, and the STE does not have a single desk role in the domestic market.</li> <li>iii) As (i) above, and in addition the STE does have a single desk role in the domestic market, but the border is fully open to imports.</li> <li>iv) Import STE that compete with private importers (i.e. do not have single desk authority) and control sales of less than thirty-three percent of the domestic market.</li> </ul>
<b>Type II: This class of STE relates to market situations and institutions such that contestability may potentially be compromised. Included are:</b>
<ul style="list-style-type: none"> <li>i) Export STE with competition in export markets but control 33% to 49% of world export sales.</li> <li>ii) Export STE with competition in export markets and a single desk role in the domestic market but the border is not open to imports.</li> <li>iii) Import STE that compete with private traders but control sales of more than thirty-three percent of the domestic market.</li> </ul>
<b>Type III: Contestability is contravened by this group of STE. These include:</b>
<ul style="list-style-type: none"> <li>i) Import STE without competition in importation.</li> <li>ii) In addition to (i) immediately above, TRQ and/or MAC are administered by the STE.</li> <li>iii) Export STE that control 50 percent or more of world export sales of the commodity in question.</li> <li>iv) In addition to (iii) immediately above, the STE has a single desk in the domestic market.</li> </ul>

\* The specification of market shares of 33% and 50% is judgemental and based on the industrial organization specification of a dominant firm as one that controls 50% to 90% of market share [Shepherd, 1979].

**Table 9: Classification Typology for STE\***

STE Class	Import STE that:	Export STE that:
Type I (Green) STE		
The market is contestable	i. Face competition in the domestic market and control less than 33% of domestic market sales	i. Face competition in the export market and control less than 33% of export market sales  ii. As i above, and no single desk in the domestic market  iii. As i above, and has a single desk in the domestic market but the border is open to imports
Type II (Amber) STE		
Contestability may be compromised	i. Face competition in the domestic market but control 33% or more of domestic sales	i. Face competition in the export market but control 33% to 49% of world export sales  ii. Face competition in export markets and have a single desk role in the domestic market, but the border is not open to imports
Type III (Red) STE		
Contestability is contravened	i. No competition in importation  ii. As for i, and TRQ and/or MAC are administered by the STE	i. Control 50% or more of world export sales of the commodity  ii. As for i, and has a single desk in the domestic market

\* The specification of market shares of 33% and 50% is judgemental and based on the industrial organization specification of a dominant firm as one that controls 50% to 90% of market share [Shepherd, 1979].

### 3. Case Studies: Some Examples of STE

We turn now to brief outlines of several STE. Where information is available from other sources or from previous assessments, this is drawn on. The case studies also draw on available materials filed as STE notifications by the governments in question.

#### 3.1 Indonesia: Badan Urusan Logistik (BULOG)

BULOG, or Badan Urusan Logistik, is the Indonesian state-owned agency that has been given powers to import and export a variety of agricultural products, including rice, sugar, soybeans, and wheat. During the mid- to late-1960s, a high priority was placed on agricultural development in Indonesia. Funds generated through oil and petroleum sales were used for market intervention, to subsidize and stabilize the prices of selected commodities. One of the instruments used to pursue these objectives was BULOG, which was formed in 1967.

In the case of rice, BULOG had two main objectives when it was formed--the provision of monthly rice rations to certain "budget groups" and the stabilization of rice prices. The weight given to these objectives has changed over the years, with the early emphasis on

ration provision later giving way to price stabilization. Priorities on the stabilization side have also changed, with more attention paid in the early 1970s to maintaining a ceiling price for consumers and more attention in the late 1970s and early 1980s to maintaining a floor price for producers [Barichello, 1996].

The basis of BULOG's stabilization activities is a price band, set without direct reference to the world market, within which domestic prices are maintained. The floor price is set to ensure that real prices of unmilled corn are held constant at approximately \$250 per tonne (1985 prices). The ceiling price is set on the basis of domestic inflation targets and must be set sufficiently above the floor to ensure a margin that will lead the private sector to stock rice between seasons [Barichello, 1996].

Within the season, the domestic market is effectively closed and storage and variable quotas are used to keep prices within the price band. When prices threaten to fall below the floor price, BULOG raises prices by buying and storing rice. BULOG exports rice if stocks become too large or if storage facilities are in short supply. When prices threaten to rise above the ceiling price, BULOG uses stocks to augment supply and hold down price. If stocks are insufficient to keep the price at or below the ceiling, BULOG imports rice from the world market [Barichello, 1996].

While BULOG's objective is price stabilization, it has the policy instruments available to subsidize either production or consumption on a long-term basis. As Barichello points out, there are concerns that BULOG could use these instruments to provide subsidies that would otherwise not be allowed under the WTO. More specifically, the question is whether BULOG engages in price stabilization or acts to maintain rice prices at subsidized levels.

To answer this question, Barichello compares Indonesian rice prices with world prices for the period from the late 1970s to the early 1990s. On the basis of data collected by himself and others, Barichello finds that Indonesian rice prices were less variable than world prices for that period and that, on average, Indonesian rice prices follow the world price. He also finds that BULOG imports rice during periods when the price ceiling is threatened and that exports occur when stocks are relatively high. Thus, the data suggest that in its operations for rice, BULOG has been acting to stabilize prices in Indonesia and that the level of protectionism is small. This does not imply that BULOG is a costless and efficient organization. Its operations, even for rice, have been subject to criticism and it has been suspected of corruption [Economist, 1998]. Despite these suspicions, and in the context of international trade distortions, the available evidence suggests that this agency has stabilized, rather than consistently distorted, the domestic rice market.

Although there is evidence that BULOG is not providing protection to Indonesian rice producers, this is not the case with the other commodities that it handles. Specifically, for sugar, soybean meal, and wheat, the empirical evidence is consistent with provision of protection to the producers of these commodities. Based on the case by case assessments noted above, we classify BULOG operations for rice to be Type II, whereas its operations for sugar, soybeans and wheat appear to be Type III in nature.

### **3.2 New Zealand: The New Zealand Dairy Board (NZDB)**

First established in 1925-27 and reconstituted under the Dairy Board Act of 1961, this is now a producer-owned marketing board that is the long-standing exporter of New Zealand dairy products to world markets. Based on these sales, the Board establishes base milk prices for the 14,000 New Zealand dairy farmers who produce milk that is manufactured into dairy products by dairy processing cooperatives [Dobson, 1998]. Top-ups to the base price are determined by the net revenues of the (cooperative) dairy processing companies. Subsidies that had previously been provided (in the form of interest subsidies and tax advantages) were removed in the mid-1980s, during the deregulation of New Zealand agriculture that occurred at that time. The domestic market for dairy imports is not regulated or controlled in New Zealand. Imports of dairy products into the New Zealand domestic market are not restricted. Tariffs are low or zero. The NZDB has a long history involving subsidiary and joint marketing ventures in various overseas markets. Its emphasis has been on adding value, through vertical integration, a marketing strategy that has been successful, despite the distorted nature of residual world markets for dairy products. The NZDB has sole seller authority over the sale of New Zealand dairy products in export markets, although food manufacturers can request NZDB export consents that allow them to export on their own account and a 1992 amendment of the legislation governing the Board required it to establish criteria for approvals for export marketing to bypass this body. US industry spokesmen have criticized the NZDB, focusing in particular on its ability to extract rents from the US market for cheese (a high priced market which is quota-protected) through the establishment of a subsidiary dairy importing enterprise in the US. Such criticism ignores the fact that this opportunity to extract rent arises from the protection provided to US dairy farmers and cheese processors by US import restrictions, rather than from market power of the NZDB. We conclude that the NZDB is an example of a Type I export STE.

### **3.3 The Japanese Food Agency (JFA)**

Japan's Food Agency (JFA), a part of the Ministry of Agriculture, Forestry and Fisheries, implements the Staple Food Law of this nation. This is directed mainly at Japan's politically sensitive rice farming sector. The JFA applies comprehensive measures over the pricing and distribution of rice, and over the purchase, pricing, import and sale of wheat and barley. The JFA administers Japan's WTO market access provisions for rice, wheat and barley. In the wording of Japanese policy documents the focus of the JFA is viewed to be directed at price stabilization for these staple foods, but most observers outside Japan assess these policies to be directed more at income support of farmers rather than price stabilization per se. The policies have provided domestic prices that have been consistently at considerably higher levels than in world markets. Price support, with border measures, provides significant protection for Japanese producers of these products [Ackerman, 1997]. For wheat, it appears that the tariff policy has been directed mainly with a view to collecting revenues to offset the cost of wheat producer subsidies [Love and Murningtyas, 1992]. Contestability is directly impaired by this STE. We classify the Japanese Food Agency as a Type III import STE.

### 3.4 The Australian Wheat Board (AWB)

This statutory marketing board, a Commonwealth crown corporation run by producers, is expected to become a grower-owned private corporation in 1998; maintenance of its long-standing authority as the single-desk exporter of Australian wheat is expected. Government guarantees of AWB borrowings are scheduled for discontinuance in 1999. AWB initial payments to farmers are not government-guaranteed. Importation of grain into Australia is subject to strict requirements of sanitary and phytosanitary standards (SPS), involving rigorous quarantine standards and procedures. For example, imported feedgrains must be steam treated or cracked at the port, before they can be shipped inland [World Grain, 1998]. Tariffs on imports are relatively low and tariff rate quotas do not apply to imports. Since 1989 the AWB has not had single desk authority over the sales of Australian wheat to the domestic market; it competes with other traders, deals in several grains, and is a relatively large trader in the domestic market, reportedly accounting for about 70 percent of grain sales in this market. The restrictive policy on grain importation, based on strict SPS standards, suggests that in Australia's domestic market for grain, contestability may be compromised. However, in its export operations, we judge the AWB to be a Type I STE.

### 3.5 The Canadian Wheat Board (CWB)

The CWB, a Canadian crown corporation that to this point of time is governed by five government-appointed commissioners, has single-desk sales authority over the sale, to export markets, of Canadian wheat and barley. In addition the Board has sales authority over wheat and barley from Western Canada that is sold for domestic human consumption (i.e., for sales of Western Canadian wheat and barley to Canadian millers, maltsters and food processors). The opportunity to practice "two price systems" involving higher domestic prices than in world markets occurred in much earlier years but now no longer applies. For example, the prices at which wheat is sold to Canadian millers has for some years been constrained by policy to levels equivalent to US futures prices, plus transportation costs, and the border is open to grain imports from the United States and Mexico. However, tariff rate quotas apply to imports of wheat, barley and their products from other origins.<sup>57</sup> These arrangements are not administered by the CWB. The possibility of CWB losses arising from the government-determined initial payments that are applied by the CWB is met by government guarantee of these; subsidies arising from specified credit guarantees of export sales are also, in effect, administered through the CWB, (although it appears that these may be at less concessionary rates than those that apply for US export credit sales of wheat). These Canadian subsidies are in conformity with the commitments of Canada regarding the Agreement on Agriculture of the WTO. An increase in exports of grain from Canada to the United States that followed the Canada-United States Trade Agreement (CUSTA) has stimulated opposition from US producers' associations and politicians. These have accused the CWB of subsidization and unfair trading. Numbers of inquiries have involved assessments of CWB activities and wheat exports to the US. These have involved a US International Trade Commission (USITC) inquiry on durum wheat which reported in 1990, a subsequent binational panel inquiry, convened under the provisions of CUSTA, and a later

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57. Prior to implementation of the Canada-US Trade Agreement (superceded now by the North American Trade Agreement), the CWB controlled importation of Board-regulated grains. However, from 1991 import licensing for US grains was restricted to those grains for which US support levels exceeded those for Canada; this still continues to be the case for wheat. Since 1994, Mexico has been exempted from import licensing. Consequent on the Uruguay Round outcome, in August 1995, import licensing for wheat, barley and products was converted to tariff rate quotas, except for imports from the US and Mexico.

USITC investigation of milling wheat imports from Canada. No evidence of unfair CWB trading practices has been documented. However, there appears to be a continuing US perception that STE are necessarily a cause of increased exports; there has been pressure to restrain exportation of grain to the US<sup>58</sup> and there seems to be a lack of understanding that Canadian grain exports to the US may well have been considerably greater in the absence of the CWB.

The specification of TRQ for wheat and barley imports and the maintenance of CWB sole-seller authority in the Canadian market, at least for wheat and barley for human consumption, could lead to the suspicion that contestability may be potentially impaired within the Canadian market. However, more careful observation indicates that this is not in fact the case, since TRQs do not apply to importation of wheat and barley from the neighbouring grain producing country of the US. With respect to its export market operations, the CWB is a Type I STE.

### **3.6 Korean State Mandated Imports**

The Ministry of Agriculture, Forestry and Fisheries (MAFF) has the exclusive right to import rice and a certain amount of barley; the balance of this nation's barley tariff rate quota may be imported by private traders but such trades have yet to be reported.<sup>59</sup> Large price differences apply between the domestic and world markets for these products; domestic prices are determined by MAFF. The Agricultural and Fisheries Marketing Corporation also acts as the import STE for a variety of vegetable and agricultural products for which tariff rate quotas apply; again, domestic prices exceed those in export markets, but for these products, domestic prices are determined by the system of wholesale market auctions. The Livestock Products Marketing Organization is a more recently established Korean STE. This import agency administers the tariff rate quotas for beef; private traders may directly access a portion of these imports under a "simultaneous buy and sell" program. A fourth import STE, the National Livestock Cooperatives Federation (NLCF), is designated as the importer of the tariff-rate quota-controlled imports of honey. The maintenance of TRQ in each case appears to be oriented toward agricultural price support, rather than price stabilization. The restriction of importation limits contestability in each case. Thus the state mandated import system of Korea is categorized as consisting of Type III STE.

### **3.7 A Summary of Some Lessons from the Case Studies**

The various case studies provide a number of lessons about the analysis required to examine adequately the impact of STEs. We noted one import STE, BULOG, that may be an anomaly, at least in some of its operations--as Barichello points out, this is one of the few agencies to operate a price stabilization scheme effectively. The case study for BULOG shows that an STE can be engaged in price stabilization, for rice in this case, rather than necessarily operating solely to provide protection to domestic producers.

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58. As through the US 1994 notification to amend tariffs on imports of wheat and barley from Canada (under Article XXVIII of GATT) and the subsequent negotiated settlement relating to this issue.

59. As for Japan, this may be due to maintenance of the mark-up charged by this STE at government-determined levels that are less than the tariff on imports, in accord with WTO rules (see footnote 12, Part I). According to STE notifications, private trade importation occurs for some products regulated by the AFMC, but not for honey, which is regulated by the NLCF.

More generally, the STE cases point out that the behaviour of an STE cannot be inferred simply by examining the policy instruments it has at its disposal. For example, BULOG has the ability to set variable import and export quotas which could protect domestic rice producers, but does not appear to have used these powers in this instance. Another example is provided by the CWB. Although the CWB is the single-desk seller of Canadian wheat to flour millers in Canada (and until recently this agency had import licensing authority for grain) its domestic pricing policy for sales of wheat to millers does not involve the exertion of potential market power against domestic consumers, but is constrained in this regard by government policy. From these two examples, it is evident that the behaviour of an STE can only be inferred through an in-depth analysis. This should apply an appropriate theoretical framework and focus on the prices and quantities that result from the operations of the STE. As Barichello points out, in the case of BULOG, the presence of what appear to be export subsidies (or import purchases at lower than domestic prices) can be evidence of either price stabilization or protectionism. While it is improper to interpret such observations to be evidence of protectionism, it is equally improper to interpret such observations to be evidence of price stabilization. Care must be taken to interpret properly the empirical evidence. The BULOG case study provides one further lesson: while a given agency may not be pursuing protectionist policies in one commodity, this conclusion cannot be carried over to other commodities. BULOG appears to use the policy instruments at its disposal to provide protection to sugar, soybean, and wheat producers. Thus, analysis of STE must occur not only on an STE-by-STE basis, but also on a commodity-by-commodity basis.

#### **4. Overall Summary of Part III**

Part III of this report builds on the review of literature and concepts related to STE that were presented in Part I and on the analyses of STE operations in Part II. We have overviewed the body of economic theory and previous literature that relates to the classification of STE. Based on the earlier parts of this report, we identify criteria that are appropriate to the classification of STE. We focus in particular on the impact of the STE, and the impact of associated government regulation, on market contestability, since this concept is now recognized as the primary influence on the performance, from a social point of view, of marketing institutions. We propose a classification scheme or typology, which necessarily uses indicator criteria. It is inevitable that these involve some arbitrary judgements, for example in the specification of particular market shares that could serve as indirect indicators of contestability. The precise levels that we have suggested for the indicative criteria of contestability are, of course, issues of judgement and the appropriateness of these levels can be debated. We have suggested that a market share of thirty-three percent (approximately one-third of the relevant market) be applied as one criteria in this regard. This precise level is, of course, a matter of judgement and this may be influenced by particular features of the market in question, such as the existence (or absence) of close substitutes to the commodity in question. This particular level that we have suggested is chosen since it is appreciably less than the lower level of the market share suggested by Shepherd [1985, p. 73] to define a dominant firm. Shepherd specified a dominant firm as one that holds 50% to 90% of market sales. We have adopted his lower level as the suggested limit to define market share of a Type III export STE. Since the information to apply an effective classification system for STE is not currently generally available, we also propose a list of necessary information for this purpose; this could well be provided by adjustments of the current questionnaire used for STE notifications to the WTO. We believe that such information, and its application in appropriately classifying STE, will usefully contribute to the current debate concerning these institutions.

#### **4.1 Recommendations for Further Study**

Our analysis suggests several lines of further research on STE. Some refinements of the theoretical analysis are of interest, such as the incorporation of trading operations by MNE acting as agents for export STE into the analysis of export STE. Similarly, the analysis of import STE with monopoly power could be further refined to incorporate actions of MNE or STE in the rest of the world. Also germane is the consideration of whether the market failures which STE were often developed to counteract continue to exist, and whether these can be solved by other means. However, we consider that the most useful areas of further research will be in the accumulation of consistent sets of data and application of this to extended case studies of import and export STE based on the types of information and criteria outlined in Part III of this study. The accumulation of the information specified in Figure III.1 for STE is, in itself, a major research activity. The collection of these data, and its analysis along the lines discussed in this report, will aid the assessment of the impact of STE on world trade in farm products.



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# Appendix A: Mathematical Model of Private Traders with Market Power

## A.1 Introduction

The model in this paper has three regions: a domestic country, a foreign country, and a rest-of-the-world (ROW) region. The domestic and foreign countries have farm supply sectors and processing sectors, while ROW has only a processing sector. Product is purchased from the farm supply sector and sold to the processing sector by traders. The model developed in this Appendix assumes the traders are privately owned and are interested in maximizing profits. The traders possess market power, with the degree of market power depending on the number of traders operating in each of the markets. Table A1 shows the notation used in the model.

Two types of traders are distinguished in the model: (1) local traders that only carry out their trading activity within either the domestic or the foreign market; and (2) multinational enterprises (MNE) that buy from both the domestic and foreign farm sectors and sell to domestic, foreign processors and ROW processors. All firms are assumed to maximize profits by choosing quantity. Firms make these choices simultaneously. The equilibrium outcome is assumed to be a Nash equilibrium in quantity – i.e., a Cournot-Nash equilibrium. Table A2 shows the supply and demand curves the traders face when making their decisions.

Consider first a local trader who is purchasing product from the farm sector in the domestic country and selling it to processors in the domestic country. The problem facing the  $i^{\text{th}}$  trader is:

$$\max_{\hat{y}_i} \quad \hat{\pi}_i = p\hat{y}_i - w\hat{y}_i$$

where  $\hat{y}_i$  is the quantity purchased from the farm sector and sold to processors by the  $i^{\text{th}}$  trader. The first-order condition for this problem is:

$$\frac{\partial \hat{\pi}_i}{\partial \hat{y}_i} = p - b\hat{y}_i - w - d\hat{y}_i = 0 \quad (\text{A1})$$

Table A.1: Trade Model Notation

Variable Name	Country		
	Domestic	Foreign	ROW
Processor Consumption	y	Y	na
Exports	x	X	na
Imports	na	na	$X^* = x + X$
Farm Production	$q = x + y$	$Q = X + Y$	na
Farm Price	w	W	na
Processor Price	p	P	$P^*$
Number of Local Firms	n	N	na
Number of MNE	$N^*$	$N^*$	$N^*$

na: not applicable.

Table A.2: Specification of Linear Farm Supply Curves and Processor Demand Curves

Location	Inverse Farm Supply Curves	Inverse Processor Demand Curves
Domestic Country	$w = c + d[N^*x_i + N^*y_i + n\hat{y}_i]$	$p = a - b[N^*y_i + n\hat{y}_i]$
Foreign Country	$W = C + D[N^*X_i + N^*Y_i + N\hat{Y}_i]$	$P = A - B[N^*Y_i + N\hat{Y}_i]$
Rest of World	na	$P^* = A^* - B^*[N^*x_i + N^*X_i]$

na: not applicable

The problem facing the  $i^{\text{th}}$  local trader who is purchasing product from the farm sector in the foreign country and selling it to processors in the foreign country is:

$$\max_{\hat{Y}_i} \quad \hat{\Pi}_i = P\hat{Y}_i - W\hat{Y}_i$$

where  $\hat{Y}_i$  is the quantity purchased from the farm sector and sold to processors by the  $i^{\text{th}}$  trader. The first-order condition for this problem is:

$$\frac{\partial \hat{\Pi}_i}{\partial \hat{Y}_i} = P - B\hat{Y}_i - W - D\hat{Y}_i = 0 \quad (\text{A2})$$

Now consider an MNE who purchases from both the domestic and foreign farm sectors for sale to processors in the domestic market, foreign market, and ROW. The problem facing the  $i^{\text{th}}$  trader (all MNE operate in both the domestic and foreign market) is:

$$\max_{x_i, y_i, X_i, Y_i} \pi_i = py_i - w(x_i + y_i) + PY_i - W(X_i + Y_i) + P^*(x_i + X_i)$$

where:  $x_i$  is the quantity purchased from the domestic farm sector and sold to ROW;  $y_i$  is the quantity purchased from the domestic farm sector and sold to domestic processors;  $X_i$  is the quantity purchased from the foreign farm sector and sold to ROW; and  $Y_i$  is the quantity purchased from the domestic farm sector and sold to foreign processors. Sales from the domestic country to the foreign country (and vice-versa) are ruled out because it is assumed that it is always less costly to fulfill the requirements of domestic processors with product from the domestic farm sector (and likewise for the foreign market).

The first-order conditions for the problem above are:

$$\frac{\partial \pi_i}{\partial x_i} = P^* - B^*(x_i + X_i) - w - d(x_i + y_i) = 0 \quad (\text{A3})$$

$$\frac{\partial \pi_i}{\partial y_i} = p - by_i - w - d(x_i + y_i) = 0 \quad (\text{A4})$$

$$\frac{\partial \pi_i}{\partial X_i} = P^* - B^*(x_i + X_i) - W - D(X_i + Y_i) = 0 \quad (\text{A5})$$

$$\frac{\partial \pi_i}{\partial Y_i} = P - BY_i - W - D(X_i + Y_i) = 0 \quad (\text{A6})$$

The first-order equations above form the basis for the graphical models presented in the text, as well as for the simulation model. Each of these is considered in turn.

## A.2 Graphical Models

The perfect competition case (Figure 1) is obtained using the inverse supply and demand curves presented in Table 2. These curves represent the curves  $s$ ,  $d$ ,  $S$ ,  $D$ , and  $D^*$  in Figure 1.

For the oligopoly model, two market structures are examined. In the first case, perfect competition is assumed in the sourcing of products from the farm sector and in the selling of this product to the local processing industry. Oligopolistic MNE, however, export the product from both the domestic and foreign country. Since the local traders do not have market power, perfect competition exists in the trading of product within the domestic and foreign countries. Mathematically, the first-order conditions (equations (A1)–(A6)) reduce to:

$$p = w \quad (A7)$$

$$P = W \quad (A8)$$

$$P^* - B^*(x_i + X_i) = w \quad (A9)$$

$$P^* - B^*(x_i + X_i) = W \quad (A10)$$

Equations (A7) and (A8) indicate that the equilibrium involves equating the farm price and the processor price in both the domestic and foreign market. Graphically, this equating of prices is done by the construction of the excess supply curves (es and ES). Equations (A9) and (A10) indicate that the processor price in ROW exceeds the farm (and processor) price in both the domestic and foreign market. The price in ROW exceeds that in the exporting countries because of the market power of the MNE.

The left-hand side of equations (A9) and (A10) form the basis for the  $PD^*$  curve. To derive the  $PD^*$  curve, note that  $x_i = x/N^*$ ,  $X_i = X/N^*$ , and  $x + X = X^*$ . Substituting these expressions into equations (A9) and (A10) results in:

$$P^* - \frac{B^*}{N^*} X^* = w$$

$$P^* - \frac{B^*}{N^*} X^* = W$$

Substituting in the ROW demand curve, , gives:

$$A^* - \frac{(N^* + 1)}{N^*} B^* X^* = w \quad (A11)$$

$$A^* - \frac{(N^* + 1)}{N^*} B^* X^* = W \quad (A12)$$

The expression  $A^* - \frac{(N^* + 1)}{N^*} B^* X^*$  is the  $PD^*$  curve.  $PD^*$  is termed a perceived demand curve because it shows the quantity purchased by the traders for sale to the processors at price  $w$ . The  $PD^*$  curve has the same intercept as the ROW demand curve. The slope of the  $PD^*$  curve

depends on the number of MNE trading. If  $N^* = 1$ , then the  $PD^*$  is the traditional marginal revenue curve for a monopolist. As the number of MNE increases, the  $PD^*$  curve approaches the ROW demand curve. Equations (A11) and (A12) indicate that, in equilibrium, the value implied by the  $PD^*$  curve must be equated with the farm sector price in both the domestic and foreign countries.

In the second case examined in the text, the MNE are assumed to be the only purchaser of the farm product and the only traders internationally (see Figure 3). The MNE thus have oligopsony power in the sourcing of products from the farm sector and oligopoly power in the supplying of products to the processors in both the national and ROW markets. Since the local traders are not involved in trading the agricultural product, equations A1 and A2 are not relevant and the market equilibrium is determined by simultaneously solving equations A3-A6. Following the procedure used above results in:

$$A^* - \frac{(N^* + 1)}{N^*} B^* X^* = c + \frac{(N^* + 1)}{N^*} dq \quad \Rightarrow \quad PD^* = ps \quad (A13)$$

$$a - \frac{(N^* + 1)}{N^*} by = c + \frac{(N^* + 1)}{N^*} dq \quad \Rightarrow \quad pd = ps \quad (A14)$$

$$A^* - \frac{(N^* + 1)}{N^*} B^* X^* = C + \frac{(N^* + 1)}{N^*} DQ \quad \Rightarrow \quad PD^* = PS \quad (A15)$$

$$A - \frac{(N^* + 1)}{N^*} BY = C + \frac{(N^* + 1)}{N^*} DQ \quad \Rightarrow \quad PD = PS \quad (A16)$$

Graphically, the simultaneous solution of equations (A13)–(A16) is achieved by first deriving the perceived excess supply curves,  $pes$  and  $PES$ . The construction of  $pes$  and  $PES$  ensures that the value implied by the perceived supply curve equals the value implied by the perceived demand curve. Thus,  $pes$  and  $PES$  show the quantities each country will export at any given implied value of the perceived demand (or supply) curve. Horizontally summing  $pes$  and  $PES$  generates the curve  $pes+PES$ . This curve shows the total quantity exported by the two countries for any given implied value of the perceived demand (or supply) curve. Equating the  $pes+PES$  curve with the  $PD^*$  ensures that perceived value of the product when sold to ROW processors equals the perceived value of the product when purchased and/or sold in either the domestic or foreign country.

### A.3 Simulation Model

The solution to the simulation model is obtained by simultaneously solving equations (A1)–(A6). With linear supply and demand curves (see Table A2), equations (A1)–(A6) are linear and can be solved using matrix algebra (see Table A3).

The introduction of a STE into the simulation model requires the removal of the variables  $x_i$  and  $y_i$  and equations (A3) and (A4) from the model, as well as the addition of two new variables and two new equations. Let  $\tilde{x}$  be the amount purchased by the STE from the farm sector and sold to the export market and let  $\tilde{y}$  be the amount purchased by the STE from the farm sector and sold to the domestic processors. The demand and supply curves for the model with an STE present are specified in Table A4.

Suppose the objective of the STE is to maximize producer welfare ( $s$ ) while transferring the income generated from sales to the farm sector via pooling. Formally, the problem facing the STE is:

$$\max_{\tilde{x}, \tilde{y}} s = p\tilde{y} + P^*\tilde{x} - \int_0^{\tilde{x}+\tilde{y}} w(z)dz - \tilde{f}$$

subject to:  $w(\tilde{x} + \tilde{y}) - p\tilde{y} - P^*\tilde{x} - \tilde{f} = 0$

where  $\tilde{f}$  is the fixed costs of the STE. This problem can be written as:

$$\max_{\tilde{x}, \tilde{y}} L = p\tilde{y} + P^*\tilde{x} - \int_0^{\tilde{x}+\tilde{y}} w(z)dz - \tilde{f} + \lambda[\tilde{f} - w(\tilde{x} + \tilde{y}) + p\tilde{y} + P^*\tilde{x}]$$

The solution to this problem is given by the following equations:

$$\frac{\partial L}{\partial \tilde{x}} = P^* - w(\tilde{x} + \tilde{y}) - \lambda[w(\tilde{x} + \tilde{y}) - (P^* - B^*\tilde{x})] = 0 \quad (\text{A17})$$

$$\frac{\partial L}{\partial \tilde{y}} = p - w(\tilde{x} + \tilde{y}) - \lambda[w(\tilde{x} + \tilde{y}) - (p - b\tilde{y})] = 0 \quad (\text{A18})$$

$$\frac{\partial L}{\partial \lambda} = \tilde{f} - w(\tilde{x} + \tilde{y}) + p\tilde{y} + P^*\tilde{x} = 0 \quad (\text{A19})$$

Equations (A17) and (A18) imply:

$$p - b\tilde{y} = P^* - B^*\tilde{x} \quad (\text{A20})$$

Equation (A20) indicates that sales must be allocated to the domestic and ROW markets so that the marginal revenue in the two markets are equated. Equation (A19) indicates that all the revenues obtained from domestic and ROW sales are pooled and returned to the farm sector. To determine the equilibrium quantities sold by the STE, the local traders, and the MNE, equations (A1), (A2), (A5), (A6), (A19) and (A20) are solved simultaneously. Since equation (A19) is not linear in  $x$  and  $y$ , the model cannot be solved using linear algebra. The simulation model presented in the text was solved using the Solver routine in an Excel spreadsheet.

In the second case examined in the text, the MNE are assumed to be the only purchaser of the farm product and the only traders internationally (see Figure 3). The MNE thus have oligopsony power in the sourcing of products from the farm sector and oligopoly power in the supplying of products to the processors in both the national and ROW markets. Since the local traders are not involved in trading the agricultural product, equations A1 and A2 are not relevant and the market equilibrium is determined by simultaneously solving equations A3-A6. Following the procedure used above results in:

Graphically, the simultaneous solution of equations (A13)–(A16) is achieved by first deriving the perceived excess supply curves, pes and PES. The construction of pes and PES ensures that the value implied by the perceived supply curve equals the value implied by the perceived demand curve. Thus, pes and PES show the quantities each country will export at any given implied value of the perceived demand (or supply) curve. Horizontally summing pes and PES generates the curve pes+PES. This curve shows the total quantity exported by the two countries for any given implied value of the perceived demand (or supply) curve. Equating the pes+PES curve with the  $PD^*$  ensures that perceived value of the product when sold to ROW processors equals the perceived value of the product when purchased and/or sold in either the domestic or foreign country.

**Table A.3: Specification of Linear Farm Supply Curves and Processor Demand Curves When an STE is Operating in the Domestic Market**

Location	Inverse Farm Supply Curves	Inverse Processor Demand Curves
Domestic Country	$w = c + d[\tilde{x} + \tilde{y} + n\hat{y}_i]$	$p = a - b[\tilde{y} + n\hat{y}_i]$
Foreign Country	$W = C + D[N^*X_i + N^*Y_i + N\hat{Y}_i]$	$P = A - B[N^*Y_i + N\hat{Y}_i]$
Rest of World	na	$P^* = A^* - B^*[\tilde{x} + N^*X_i]$

na: not applicable

**Table A.4: Matrix Solution for the Simulation Model: Private Trader Case****Structural Equation**

$$\begin{bmatrix} (b+d)(N^*+1) & d(N^*+1) & (b+d)n & 0 & 0 & 0 \\ d(N^*+1) & (B^*+d)(N^*+1) & dn & 0 & B^*(N^*+1) & 0 \\ 0 & 0 & 0 & (B+D)(N^*+1) & D(N^*+1) & (B+D)N \\ 0 & B^*(N^*+1) & 0 & D(N^*+1) & (B^*+D)(N^*+1) & DN \\ (b+d)N^* & dN^* & (b+d)(n+1) & 0 & 0 & 0 \\ 0 & 0 & 0 & (B+D)N^* & DN^* & (B+D)(N+1) \end{bmatrix} \begin{bmatrix} y_i \\ x_i \\ \hat{y}_i \\ Y_i \\ X_i \\ \hat{Y}_i \end{bmatrix} = \begin{bmatrix} a \\ A^* \\ A \\ A^* \\ a \\ A \end{bmatrix}$$

**Reduced Form Equation**

$$\begin{bmatrix} y_i \\ x_i \\ \hat{y}_i \\ Y_i \\ X_i \\ \hat{Y}_i \end{bmatrix} = \begin{bmatrix} (b+d)(N^*+1) & d(N^*+1) & (b+d)n & 0 & 0 & 0 \\ d(N^*+1) & (B^*+d)(N^*+1) & dn & 0 & B^*(N^*+1) & 0 \\ 0 & 0 & 0 & (B+D)(N^*+1) & D(N^*+1) & (B+D)N \\ 0 & B^*(N^*+1) & 0 & D(N^*+1) & (B^*+D)(N^*+1) & DN \\ (b+d)N^* & dN^* & (b+d)(n+1) & 0 & 0 & 0 \\ 0 & 0 & 0 & (B+D)N^* & DN^* & (B+D)(N+1) \end{bmatrix}^{-1} \begin{bmatrix} a \\ A^* \\ A \\ A^* \\ a \\ A \end{bmatrix}$$

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# Appendix B: Measurement of Market Power: Lerner Indices

## Measurement of Market Power: Lerner Indices

The introduction of market power into a model of agricultural trade raises the question of how to measure the resulting distortions. One method is the use of Lerner indices. In the standard oligopoly model, the Lerner index is defined as:

$$L = \frac{(p - mc)}{p}$$

where  $p$  is the price of good and  $mc$  is the marginal cost of producing the good (Jacquemin). The Lerner index provides a measure of the percentage markup of price over marginal cost. Comparing the Lerner index in different market regimes allows the change in the percentage markup of price over marginal cost to be determined.

As Jacquemin shows, the Lerner index for an industry can be constructed by first defining the Lerner index for an individual firm. For example, consider an MNE purchasing from the domestic raw product market and selling to the processing industry in ROW. Assuming Cournot-Nash behaviour on the part of the firm, equation (A3) describes how the firm will choose its output:

$$P^* - B^* X_i^* = w + dq_i$$

The processing demand elasticity in ROW is given as:

$$H^* = -\frac{1}{B^*} \frac{P^*}{X^*}$$

while the supply elasticity in the domestic country is:

$$\varepsilon = \frac{1}{d} \frac{w}{q}$$

Solving for  $B^*$  and  $d$  in the above equations and substituting the resulting expressions into the expression  $P^* - B^* X_i^* = w + dq_i$  gives:

$$P^* \left( 1 - \frac{1}{H^*} \frac{X_i^*}{X^*} \right) = w \left( 1 + \frac{1}{\varepsilon} \frac{q_i}{q} \right)$$

This equation can be rearranged to give the Lerner index for firm  $i$ :

$$L_i^* = \frac{(P^* - w)}{P^*} = \frac{1}{H^*} \frac{X_i^*}{X^*} + \frac{w}{P^*} \frac{1}{\varepsilon} \frac{q_i}{q}$$

Similarly, a Lerner index for the MNE that buys from the domestic raw product market and sells to the domestic processing industry can be written as:

$$l_i^{mne} = \frac{(p - w)}{p} = \frac{1}{\eta} \frac{y_i}{y} + \frac{w}{p} \frac{1}{\varepsilon} \frac{q_i}{q}$$

while the Lerner index for a local trading firm that buys from the domestic raw product market and sells to the domestic processing industry can be written as:

$$l_i^{local} = \frac{(p - w)}{p} = \frac{1}{\eta} \frac{\hat{y}_i}{y}$$

As Jacquemin stresses, the calculation of an industry level Lerner index depends on the weight attached to firm-level Lerner indices. If the firm-level index is weighted by the market share of the firm, the industry-level Lerner index for firms selling to the processing sector in the domestic market can be written as:

$$l = \sum_{i=1}^{N^*} l_i^{mne} \frac{y_i}{y} + \sum_{i=1}^n l_i^{local} \frac{\hat{y}_i}{y} = \frac{1}{\eta} \sum_{i=1}^{N^*} \left( \frac{y_i}{y} \right)^2 + \frac{1}{\eta} \sum_{i=1}^n \left( \frac{\hat{y}_i}{y} \right)^2 + \frac{w}{p} \frac{1}{\varepsilon} \sum_{i=1}^{N^*} \frac{q_i}{q} \frac{y_i}{y}$$

The term  $\sum_{i=1}^{N^*} \left( \frac{y_i}{y} \right)^2 + \sum_{i=1}^n \left( \frac{\hat{y}_i}{y} \right)^2$  is the Herfindahl index (hi) for the trading sector in the domestic country. Thus, the industry level Lerner index for firms selling to the domestic processing industry can be rewritten as:

$$l = \frac{hi}{\eta} + \frac{w}{p} \frac{1}{\varepsilon} \sum_{i=1}^{N^*} \frac{q_i}{q} \frac{y_i}{y}$$

In a similar fashion the Lerner index for firms selling to the foreign processing industry can be written as:

$$L = \frac{HI}{H} + \frac{W}{P} \frac{1}{E} \sum_{i=1}^{N^*} \frac{Q_i}{Q} \frac{Y_i}{Y}$$

where HI is the Herfindahl index for the trading sector in the domestic country, H is the elasticity of demand in the foreign processing sector, and E is the elasticity of supply in the foreign farm sector.

Finally, the Lerner index for MNEs selling to ROW can be written as:

$$L^* = \frac{HI^*}{H^*} + \sum_{i=1}^{N^*} \frac{w}{P^*} \frac{1}{\epsilon} \frac{q_i}{q} \frac{x_i}{x} + \sum_{i=1}^{N^*} \frac{W}{P^*} \frac{1}{E} \frac{Q_i}{Q} \frac{X_i}{X}$$

where  $HI^*$  is the Herfindahl index for the MNE trading sector.

The Lerner indices presented above differ from the traditional Lerner index by the inclusion of additional terms that indicate the degree of oligopsony market power possessed by the trading firms. Thus, if firms possess market power on both the buying and selling sides of the market, the traditional Lerner index will underestimate the firms' market power.

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