Essays on Dumping and the Effects of Antidumping Laws

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- A thesis submitted for the degree of Doctor of Philosophy
  of the Australian National University -
I hereby swear that all the contents in the dissertation are my original works.

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Abstracts

The dissertation addresses various issues related to dumping and antidumping laws (ADL). It consists of five independent essays including one chapter of literature survey. Chapter 2 provides a literature survey on dumping and the effects of ADL. We analyse the results of previous studies and illustrate that excessive AD actions, rather than dumping itself, cause problems in international trade. We argue that such trade-chilling practices should be constrained through changes in the current AD system and international cooperation on AD matters. In chapter 3, we examine the effects of ADL on firm reaction. We illustrate various potential outcomes including the cases where the exporter specialises in a more profitable market and when the exporter relocates its export facility to the export market. In a two-period context we analyse the factors that affect the degree of reactions of firms under ADL. We argue that the popular argument for a strict AD measure which generates tariff revenues may become less convincing in a two-period model. We also address the problems associated with the loose injury criteria in ADL. We show that, when the injury criteria are seen to be manipulable by firms, firms may exhibit perverse reactions to create future protection. In chapter 4 we analyse the effect of ADL in an industry with a learning-by-doing effect. Interestingly, while ADL is detrimental to the social welfare of the ADL-enforcing country when below-cost dumping occurs, it may be welfare-improving when below-cost dumping does not occur. This is so because ADL changes the rule of competition between firms. But, such gains under ADL may be dissipated by the 'normal profit' provision in ADL. By introducing uncertainty into the model, we show that uncertainty rather than unfair trade practices by the foreign country (closed market) may have caused the soft entry of the foreign firm into the home market. In addition to the problems arising from the asymmetric application of competition rule under ADL, this result casts doubts on the legitimacy of the US trade policy on semi-conductor trade with Japan. In chapter 5, we address the problems associated with the frequently observed AD actions by domestic input producers. It is well known that the imposition of AD duties on imported inputs
will generate conflict with national interest because final good producers will lose competitiveness due to the higher input price. Using the results of vertical equilibrium in successive oligopolistic markets, we analyse the strategic aspect of the threat of vertical integration in determining AD actions by input producers. It turns out that the possibility of vertical integration working as a deterrent to AD actions is limited to cases where the market share of imports and/or the AD tariff rates are low. However the social cost of AD actions arising from the imposition of AD duties may be reduced through an increase in the number of vertically integrated firms if the cost of vertical integration is not too high. Therefore, there exists conflict between ADL and antitrust laws when vertical integration becomes difficult due to the high cost of vertical integration (strict antitrust laws). Finally, in chapter 6, we ask why ADL is preferred to free trade as a trade policy among countries. The nature of the political support function (whether the government is impartial or extreme protectionist) and/or the size of transportation cost are the critical factors which determine the choice of trade policy of governments. Our results suggest that, given the prevalence of AD actions across industries regardless of the size of transportation cost, political pressure by industries seems to be the driving force which determines the choice of trade policy. Surprisingly, countries are always made better off by an AD war due to the reduction of waste (transportation cost). Also, we find that the cooperative Nash equilibrium AD duty rates are always lower than the non-cooperative Nash equilibrium AD duty rates. This result suggests that countries can improve social welfare through negotiations on AD matters.
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Chapter 1. Introduction

Since the publication of Viner's seminal book on dumping, dumping has been one of the most controversial research areas for international trade economists. The history of disputes about the economic rationale for antidumping laws (ADL) as a trade policy is as long as the history of dumping itself. Viner (1923) summarises the arguments of both sides of the ADL debate as follows.

"Many free traders, ..., have taken the position that restrictions on the free importation of dumped commodities are as undesirable as import restrictions of the ordinary protectionist kind. Some supporters of antidumping legislation, on the other hand, have maintained that such legislation does no violence to the free-trade principles, since it does not interfere with the normal course of trade, but on the contrary places obstacles in the way of the departure of commerce from its normal and economically desirable channels." (Viner (1923) P 144)

The arguments by proponents of ADL, which seem to be the cornerstone of the current AD system, can be summarised as follows. First, dumping is unfair because the exporters' domestic market is closed against imports from other countries by the protection of the exporters' government. Second, gains from low prices of dumped goods are more likely to be temporary because of the predatory nature of dumping. Therefore, they argue that there exists no conflict between free trade principles and ADL which is supposed to police such unfair trade practices by foreign exporters.

However, for free traders, a recurring question is whether the use of ADL as a trade policy makes any economic sense at all. The answer to this question from most previous studies is negative. Clearly, the most obvious reason is that, given the results of previous empirical and theoretical studies that predation is never likely to be the motive of dumping by foreign exporters, the importing country is always better off by accepting low import prices. Also, recent studies, such as Weinstein (1992), show that,
contrary to common belief, dumping may occur from a country with a more competitive domestic market to a country with a less competitive domestic market. Further, free traders argue that, considering the unvarying tendency of import-competing firms to engage in protection-seeking activities regardless of the pricing behavior of foreign exporters, excessive AD activities under the current AD system (rather than dumping itself) seem to be the source of problems in international trade. The following comments by Viner (1923) summarise the possibility of spurious injury by import-competing firms.

"... Nevertheless there has been a large element of exaggeration in the complaints of injury suffered through dumping. Domestic manufacturers are often insufficiently acquainted with the export and domestic prices of their foreign competitors to be in a position to determine with certainty whether the pressure of foreign competition is the consequence of dumping or of comparative advantages in production of the foreign producer. If they feel keenly the effects of foreign competition, manufacturers are all too prone to make sweeping charges of foreign dumping or foreign unfair method of competition without being in a position to substantiate such charges by any evidence. They often exhibit deplorable tendency to identify any manner of foreign competition with unfair competition. They often use alleged foreign dumping as a pretext for higher import duties where what they really seek is a greater measure of tariff protection against foreign competition in general. ..." (Viner (1923) P 142)

The above excerpts from Viner (1923) suggest that, even in earlier days, there were many instances where the existence of readily available protection measures invited protection-seeking activities by import-competing firms. Accordingly, free traders have prescribed the following alternatives to the current AD system to cure these problems.

1) ADL should be repealed.

2) ADL should be merged into a new system. One suggestion is merging current ADLs into safeguard measures which represent an alternative to ADL. Such internalising of the possibility of retaliation by foreign countries as in safeguard measures could reduce the tendency for governments to grant high levels of protection without considering the
social welfare of the economy as a whole. Also, the merging of the two measures would eliminate the problems arising from the discriminatory nature of ADL which directly contradicts GATT principles. A second alternative is the abolition of ADL and the application of domestic antitrust law (ATL) to exporters. Given the empirical evidence for the ex-ante and ex-post cartel-inducing effect of ADL, free traders argue that this will eliminate the conflict between ADL and ATL arising from the asymmetric competition rule under ADL.

1. Summary of previous studies on dumping and the effects of ADL

1.1 Previous studies on dumping and the effects of ADL

As described in detail in chapter 2, previous studies on dumping and the effects of ADL can be divided into two groups as follows: (i) those which attempt to explain why firms engage in dumping; and (ii) those which analyse the effects of antidumping laws on firm behavior.

Although Viner's original study analyses both the cause of dumping and firm behavior under ADL, most other studies prior to the late 80's have concentrated on the first question. During the 80's many different dumping models, such as Davies and McGuinness (1982), Ethier (1982), and Brander and Krugman (1983) among others, have been developed and our understanding of the causes of dumping has been extended considerably. The results of those studies illustrated the importance of uncertainty and imperfect market structure as causes of dumping by rational profit-maximising firms, which clearly departs from the traditional view of dumping as arising from the predatory intention of exporters or the protection by the exporter's government in the exporters' domestic market as causes of dumping.

As the frequency of AD actions increased, especially during the 80's, an increasing number of studies attempted to analyse the problems arising from AD actions, rather than dumping itself. These studies are more concerned with the incentive effect of ADL
on firm behavior. These studies show how, contrary to the original policy goal of government of the ADL-enforcing country to protect domestic industries from unfair trade practices by foreign exporters, import-competing firms may exploit the readily available AD system as a tool to create future protection. Thus, perverse outcomes may be the result of the enforcement of ADL due to the strategic behavior of domestic firms. Previous studies, such as Fischer (1992), Leidy and Hoekman (1989, 1990a, 1991), concentrated on the effects of loose injury criteria of ADL which are seen to be manipulable. They showed that various perverse outcomes, such as de facto collusion between exporters and import-competing firms (even without actually imposing AD measures) or predatory pricing behavior by import-competing firms to create future protection, may arise as a result of the enforcement of ADL. Also, Prusa (1991, 1992) showed that a loophole in the US AD settlement system may be exploited by import-competing firms to derive favourable out-of-court settlements from the defendant (exporters). Prusa argued that, because the consensus between the AD petitioners and the defendants may be possible only when the out-of-court settlement outcome yields higher profits to both parties, such a result may be more harmful to the economy than the actual imposition of AD duties on imports.

As shown, a trade policy will inevitably create another distortion in the economy by providing an incentive to import-competing firms to exploit the system. Those studies show that the welfare loss associated with the abuse of ADL, mainly through a threat effect, should be added to the usual Harberger triangle which results from the actual imposition of AD measures on the concerned imports.

1.2 Other related literature

In addition to the above literature on dumping, the political economy of protection literature and antitrust literature have provided useful tools for analysing problems associated with the current AD system.
The political economy of protection literature provides one reason why trade impediments exist in the first place. Literature in this area, including Mayer (1984a), Magee, Brock, and Young (1989), incorporates the political process of policy decision and shows why certain trade policies are chosen by politicians among different protection measures. The policy decision of politicians in this model is inevitably affected by the lobbying activities of interest groups. While most political economy models do not venture beyond a one-country framework, recent developments, such as Fumio (1990) and Collie (1991), emphasise the game-theoretic aspects of policy choice in a two-country context. In chapter 6 of this dissertation we combine the political economy model and the choice of trade policy in a two-country model to derive the conditions for the choice of ADL as a trade policy.

Antitrust laws regulate firms' anti-competitive behavior. Consequently, horizontal and/or vertical merger between firms has long been one of the research interests of economists in this area. The main theme of this research is how the ex-post prices/outputs of concerned products are affected by such economic activities of firms. While there is no consensus about the effect of vertical merger on the price of the final good, it is generally accepted that horizontal merger increases the price of a final good. Therefore, while the effect of horizontal merger is more likely to be anti-competitive, previous studies show that vertical integration may improve social welfare of the economy depending on the underlying assumptions about (a) market structures; (b) the characteristics of demand functions; (c) the production technology of firms. For this reason, current ATLS are quite strict against horizontal integration (merger), but they are less hostile toward vertical integration.

2. Scope of the dissertation

The dissertation consists of five independent essays on issues related to dumping and ADL including one chapter of literature survey. The plan of the thesis is as follows.
i) Chapter 2 provides a critical literature survey on dumping and the effects of antidumping laws. We analyse the results of previous studies and illustrate that excessive AD actions, rather than dumping itself, cause problems in international trade. We argue that such trade-chilling trade practices should be constrained through changes in the current AD system and international cooperation on AD matters.

ii) In chapter 3, we analyse the effect of ADL on a price-discriminating foreign exporter both when the exporter always abides by ADL and when firms face an endogenous probability of protection under ADL. We find that, when the exporter always abides by ADL, three distinctive reactions by the exporter - supplying both markets (the exporter's domestic market and the export market) as an exporter, specialisation in a market where the size of profit under free trade is larger, and supplying the export market by direct foreign investment (DFI) - are expected depending on the relative size of profits under each reaction. Also, using a two-period model, we show that, when the foreign exporter faces uncertainty about future protection under ADL, the degree of price adjustment of the exporter in each market crucially depends on the curvature of demand curves in both markets and the size of each market.

iii) In chapter 4, we analyse the effect of ADL on firms' production choice when the industry exhibits a learning-by-doing effect. We find that the social welfare of the ADL-enforcing countries can be improved under ADL because the home firm of the ADL-enforcing country may use the shut-out production strategy due to the changed competition rule under ADL. For example, as shown in chapter 4, when there is no below-cost dumping under free trade, the firm in the ADL-enforcing country may increase its output in its domestic market either (i) to put its foreign rival at a cost disadvantage in the future as in the one-market case or (ii) because firms face a prisoners' dilemma in the two-country case. In addition to this unconventional welfare-improving result of ADL, we show that in the US vs. Japan semi-conductor trade disputes, uncertainty rather than the alleged closed Japanese market may be the cause of
a soft entry of Japanese firms in the US market. This result casts strong doubt on the way semi-conductor trade disputes are settled between the US and Japan.

iv) Another controversy surrounding the use of ADL comes from frequent AD actions by domestic input producers against imports of foreign inputs. One of the major arguments for the use of AD measures (and protection in general) is the reduction of adjustment (relocation) costs in import-competing industries\(^1\) adversely affected by dumping. When imported inputs are used by domestic downstream industries which compete with foreign downstream industries, the incentive for the use of AD measures on imports of inputs may be reduced considerably because, while injury to domestic input producers may be reduced by the imposition of AD duties on imports of inputs, the imposition of AD duties on inputs will make domestic downstream industries less competitive in the downstream market. As Viner (1923) pointed out, the importing country will gain from dumping of intermediate goods.

"Where the dumped commodity is a raw material or a product in a partial stage of manufacture so that the immediate 'consumers' thereof are purchasers for use in further manufacture, the gain from dumping to the consumer can generally more objectively and convincingly demonstrated." (Viner (1923) P 134)

Thus, the conflict of interests between domestic input producers and the economy as a whole (national interest) becomes a problem for policy makers. At the same time, many authors have emphasised the conflict between ADL and antitrust law. The main point here is that while antitrust law regulates anti-competitive behavior of firms, ADL restricts competition between domestic import-competing firms and foreign exporters in the domestic market of the ADL-enforcing country. In chapter 5, we develop a model which explicitly shows another source of conflict between ADL and antitrust law. In an economy where domestic input producers resort to AD activities against imports of

\(^1\) See Viner (1923) PP 138-141
foreign inputs, the possibility of vertical integration by domestic downstream firms which is contingent on AD actions by the input producers may deter AD activities by input producers. We show that a strict antitrust law which restricts vertical integration between domestic firms may be detrimental to the economy of the ADL-enforcing country because it may make it costly for domestic firms to vertically integrate with each other and so may encourage AD activities by input producers.

v) During the 1980's there was not only an increase in AD activities but also an increase in the number of countries which used ADL as a trade policy. Previous studies on dumping were mainly concerned with the effects of ADL when ADL is active in one country. They analysed the effects of ADL on firm behavior either when the exporter always abided by ADL or when he faced an endogenous probability of AD protection in a two-period model. These studies neglected the question why governments choose ADL as a trade policy in the first place and what is the consequence of an AD war among countries. The use of ADL as a trade policy by governments may occur for different reasons. Since the most plausible explanation for high incidence of AD cases (and protection in general) can be found in the political economy of protection literature, chapter 6 applies a combination of a game-theoretic approach and political economy approach to a two-country reciprocal dumping model deriving conditions for ADL to be preferred to free trade by governments. As shown in chapter 6, when the markets are oligopolistic and when reciprocal dumping occurs under free trade due to positive transportation costs, an AD war between the two countries always increases social welfare. Nevertheless, much of the gains from an AD war, which come from the endogenous characteristics of AD duties and from the imperfect market conditions, may be eroded by the excessive level of protection when the two countries can not cooperatively set the level of AD duties.

2. Messerlin (1990b) reports that more developing countries, such as Mexico and Morocco among others, adopted ADL as a trade policy during the 80's.
vi) Also, throughout this dissertation, we analyse the real effect of AD clauses, whether they are procedural or substantive, and show how those clauses work to the advantage of domestic import-competing firms in the ADL-enforcing country. Apart from the problems associated with 'national interest' provisions analysed in chapter 2 and chapter 5, AD clauses analysed in this dissertation are as follows.

1) One of the most frequently cited problems in the current AD system is the incentive effect for import-competing firms arising from the manipulable injury criteria. Previous studies showed that, when the probability of future protection is endogenous, perverse outcomes, such as ex-ante collusion between the exporter and the import-competing firm or predatory pricing by the import-competing firm depending on the perceived injury criteria, may be the result of the existence of readily available and manipulable ADL. While previous studies assumed that only the probability of protection is endogenous, in chapter 3, we assume that both the probability of protection and the degree of AD duty become endogenous. We find that the incentive for the import-competing firm to reduce current output to increase the future probability of protection weakens because while it may increase the probability of protection it also reduces the size of the firm's gains from protection because of lower AD duty rates.

2) In chapter 3, we examine the conventional wisdom about the effect of different types of AD measures on social welfare. A popular view is that a strict AD measure, such as imposition of AD duties on imports, will be beneficial to the economy as it generates tariff revenues while other soft measures, such as price-undertakings, never do. Because GATT article VI does not restrict the choice of AD measures, in the actual world countries use different AD measures. In some cases, a country uses different AD measures for different countries and/or different AD cases. Using a two-period model, we show that the nature of AD measures does not significantly affect the level of social welfare of the ADL-enforcing country. Rather, the choice of a strict AD measure enhances the intertemporal profit of import-competing firms. Furthermore, when a country discriminates by deliberately applying different AD measures to different groups of countries, it is in direct conflict with the non-discriminatory GATT principle.
3) In chapter 4, we analyse the effect of the 'normal profit' provision in ADL on firms' production choice. The two-country simulation results show that firms are forced to overproduce due to the existence of ADL in both countries and, for a range of learning coefficients, they face prisoners' dilemma under ADL. That is, while the profit of firms under free trade is higher than when each firm uses the shut-out production strategy in its domestic market, when they can not cooperate, the resulting Nash equilibrium is a mutual imposition of ADL. When normal profit is added in calculating the normal value of imports, firms may be able to escape from a prisoners' dilemma because they produce less (than the initial shut-out production level when the normal profit is not added in the calculation of the normal price of imports) without losing monopoly power in their domestic markets.

In this dissertation we analyse various issues associated with the current AD system. Given the fact that the use of ADL as a trade policy lacks economic rationale, the excessive recourse to ADL among the major users and an increase in the number of countries which have adopted ADL as a trade policy pose a great threat to world trade. Although we find a couple of unconventional cases where the use of ADL may actually increase social welfare of the ADL-enforcing countries, the fundamental results obtained from our analysis, particularly the incentive effect of ADL, and the evolution of ADL during past decades, suggest that antidumping actions rather than dumping itself constitute the main problem.
Chapter 2. An overview of problems in the current antidumping system

1. Introduction

GATT article VI defines two types of dumping\(^3\) and describes the conditions when signatories may impose an antidumping duty on the dumped product to offset or prevent dumping. Despite the legitimate status of AD actions recognised by the GATT Code, doubts about the economic rationale for AD actions and the possibility of abuse of ADL by the host countries have made the use of ADL contentious. It is interesting to see how economists' views on dumping have been changed since the seminal work of Viner (1923). As the title of his book suggests, dumping itself was perceived to be a problem in international trade. Nowadays, economists seem to be almost unequivocal in denouncing the excessive use of ADL. Many claim that it should be repealed to prevent the world trading system from degenerating into a protectionist regime under the guise of fair trade. The two main sources of controversy surrounding the use of ADL can be summarised as follows.

i) Why do countries choose ADL as a trade policy?

ii) Is ADL working as the way it is supposed to be?

The first question is related to both the fundamental economic efficiency of ADL and to the underlying nature of ADL; in particular whether it is a reflection of the protectionist nature of governments or not. People who believe that ADL is inherently a protectionist measure ask why, if consumers and an economy as a whole benefit from a low import price (dumping), do governments impose AD duties which will reduce the

\(^3\). They are price-discriminating dumping and selling-below-cost dumping.
social welfare of the importing country through higher prices. As is well known, the only case when the use of ADL may be justified on efficiency grounds is when exporters engage in predatory dumping. When the motive of dumping is predatory, exporters will raise export prices to the monopoly price level after home producers exit from the market. They recoup all the losses incurred during the process of predation. At the same time, it is also well known that predatory actions will never be profitable for predators due to the possibility of entry of new firms in the market and that, therefore, firms are unlikely to engage in a predatory pricing strategy. The last resort of pro-ADL argument seems to be based on the 'reciprocity principle'. Proponents of this view argue that exporters are justified in engaging in dumping due to the protection of the exporters' domestic market by the exporters' government. ADL is then justified as a means of punishing unfair trade practices and preventing domestic industries from injury. This ancient proposition has been the cornerstone of the existence of ADL among countries and seems to constitute the logical basis of the GATT AD Code.

On the other hand, some argue that, under a democratic political system where policy makers face pressure from various interest groups in the economy, the choice of ADL as a trade policy does not reflect the protectionist nature of governments. Rather, policy makers may be wise enough to provide less restrictive protection measures, such as ADL, to calm down the pressure for protection from domestic import-competing industries instead of using some of the more restrictive measures available. They argue that the country-specific nature of most non-tariff trade barriers (NTBs) including ADL makes the trade-deterring effect of those measures less severe than traditional measures because the subsequent trade diversion effect will alleviate the detrimental effect on trade flows.

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4. In section 3 of this chapter, we show new developments in theories of dumping which may nullify the basis for this argument. For example, dumping may occur from a country with more competitive domestic market to the country with less competitive market.

5. Feenstra and Bhagwati (1982) call this type of government a 'two-headed government'. In their model, they show that government may use part of tariff revenues to bribe the lobbyists to set the tariff rate at the socially optimal level instead of the higher tariff level initially claimed by the lobbyists. Also, Stegeman (1991) referred to this political function of ADL as a 'safety valve'.
The second question is concerned with the way ADL is perceived and actually implemented by industries and governments in comparison to the original spirit of the GATT AD Code. Concern about the abuse of the AD system is based on several aspects of ADLs. (1) Many believe that import-competing industries see ADL as an easier and cheaper substitute for safeguard measures. When we consider the obscure nature of ADL, less competitive import-competing industries will be more likely to get protection through ADL which, in turn, widens the scope for distortion in the economy. (2) The asymmetric nature of ADL gives too much strategic advantage to import-competing firms and may invoke an adverse reaction from domestic industries (spurious injuries etc.). (3) Although initial ADLs may have been in line with the spirit of the GATT AD Code, as we have seen from previous experiences, the open-endedness of ADL may lead ADLs of countries to converge to a more protectionist regime. The inability of GATT to control these trends adds concern about the consequence of these phenomena. (4) The intrinsic nature of ADL being biased toward protecting domestic industries and the observed tendency of some governments in exercising too much political discretion in the settlement process will invite excessive AD actions from protection-seeking industries and cause too great an impediment to trade flows.

When it comes to problems arising from the second question, the two groups which differ in the interpretation of the real nature of ADL as a protection measure seem to be unequivocal in condemning the trade-chilling effect by the excessive use of ADL in the actual world. They agree that the detrimental effect of AD actions on trade flows may be large enough to nullify the beneficial pro-competitive effect of trade liberalization efforts through several rounds of tariff reductions. Also, they argue that the selective, bilateral, and non-transparent nature of AD measures directly contradicts the GATT spirit of non-discriminatory multilateral trade liberalization.

In this chapter, we summarise recent studies on dumping and the effect of ADL. Using the facts and conclusions drawn from those theoretical works and empirical
studies, we reevaluate the above two questions and attempt to draw suggestions for the desirable direction of changes in ADLs among countries.

2. Viner's taxonomy of dumping

As shown in Table 1, Viner (1923) classified dumping according to motive and continuity. A common assumption employed in all the dumping cases is that exporters have a considerable degree of monopoly power in their domestic market. There are two major elements in the argument against dumping. The first one is that dumping becomes viable when the exporters' domestic market is protected by the exporters' government. This makes dumping 'unfair'. The second one is that the motive of dumping is predatory. Thus, initial gains to the importing country from a low import price will vanish afterwards due to an increase in the import price of the good once predation becomes successful.

Contrary to the title of his book, which implies problematic aspects of dumping in the international trade arena, his objection against dumping was restricted to the case where dumping is intermittent and predatory so as to destroy or threaten the establishment of domestic industries. When the motive of dumping is predatory, the prospect of price

6. Viner (1923) also illustrates other forms of dumping which differ from genuine dumping illustrated in Table 1. They are reverse dumping, spurious dumping, exchange dumping, freight dumping, and concealed dumping.
1) Reverse dumping may occur (i) when the monopolist exporter is restrained by the pressure from domestic consumers not to set price at the full monopoly price while he is free from such restraint in the foreign market, (ii) when the exporter faces tariff protection in a large foreign market where the tariff rate is proportional to the domestic price.
2) Both spurious dumping and concealed dumping are related to the pricing behavior of the exporter when the terms and condition or sales may differ between different destinations. While spurious dumping refers to the case where price discrimination between different markets arises from the difference of terms and conditions of sales, concealed dumping occurs when the price differential between markets does not reflect the full difference in the terms and conditions of sales between different markets.
3) Exchange dumping may result from rapid depreciation of the currency of the exporting country.
4) Freight dumping occurs when the freight cost for export does not reflect the real cost of transportation due to government policy to promote export (when there exists preferential freight rate arrangement in favour of exporters).

7. He clearly recognised the gains to the importing country from dumping. He stated, "... It is nevertheless unquestionable that only in the case of long-continued dumping will be a substantial and unqualified gain to the consumer in the country dumped on." (Viner (1923) p133) He also argued that sporadic dumping is less likely to cause injury to the industries of the importing country.
increase after the successful predation was his main objection to dumping. That is, AD action is needed to protect domestic industries and the intertemporal welfare of the whole economy either when the predatory intention of exporters is clear and when well-established domestic firms suffer injury from dumping or when domestic industries need time to develop and to attain competitiveness to meet foreign competitors. But, at the same time, he argued that such predatory dumping behavior by foreign exporters and the subsequent appearance of a monopolist regime would be unlikely because other competitors would enter the market once the original foreign dumper receives an above-normal monopoly profit in the export market.

The whole emphasis of his argument against dumping seems to be shifted to the alleged unfairness of dumping activities. Dumping is condemned because of the 'beggar-thy-neighbour' consequence of dumping activities. Injury by 'unfair' dumping activities and the cost of relocation of production factors in the injured industries provide a rationale for enforcing AD measures.

One interesting aspect of the analysis in his book is how the existence of a foreign dumping ground affects the production decision of exporters in their domestic market. As shown in the following statement, he argues that the existence of a dumping ground abroad will not affect the exporters' domestic market price.

"The domestic price which would yield the maximum return from domestic sales in the absence of dumping will continue to be the most profitable domestic price after dumping is resorted to. ..., there is, therefore, no ground for maintaining that it causes domestic price to be higher." (Viner (1923) p102)

8. Viner argued, "... If these (predatory) types of dumping are successful in achieving their objectives, the temporary gain to the consumer in the country dumped on may in the long run be counterbalanced by the higher prices which their resort to dumping will eventually enable the foreign producers to exact. Predatory dumping, it is true, will often fail to attain its objective of complete or partial monopoly control over prices; even if the original competitors are eliminated or subdued, new competitors may spring up to take their place and it may become necessary to persist in the process of selling at artificially low prices or to abandon the aim of gaining monopoly control. ..." (Viner (1923) p133)
Further, he argues that the existence of a profitable dumping market may make the exporter lower its domestic price\(^9\).

(Table 1): A classification of dumping according to motive and continuity\(^{10}\)

<table>
<thead>
<tr>
<th>Motive</th>
<th>Continuity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. To dispose of a casual stock</td>
<td>Sporadic</td>
</tr>
<tr>
<td>B. Unintentional</td>
<td></td>
</tr>
<tr>
<td>C. To maintain connections in a market in which prices are on remaining considerations unacceptable</td>
<td></td>
</tr>
<tr>
<td>D. To develop trade connections and buyer's goodwill in a new market</td>
<td>Short-run or intermittent</td>
</tr>
<tr>
<td>E. To eliminate competition in the market dumped on</td>
<td></td>
</tr>
<tr>
<td>F. To forestall the development of competition in the market dumped on</td>
<td></td>
</tr>
<tr>
<td>G. To retaliate against dumping in the reverse direction</td>
<td></td>
</tr>
<tr>
<td>H. To maintain full production from existing plant facilities without cutting domestic prices</td>
<td>Long-run or continuous</td>
</tr>
<tr>
<td>I. To obtain the economies of larger-scale production without cutting domestic prices</td>
<td></td>
</tr>
<tr>
<td>J. On purely mercantilistic grounds</td>
<td></td>
</tr>
</tbody>
</table>

Although he mentioned the effect of changes in demand on dumping behavior, as shown in Table 1, it seems that he was not clearly aware of how firms make investment or production decisions under uncertainty and how it may result in ex-post dumping. As will be discussed in the following section, many of the recent developments in dumping theories have analysed how firms' investment or output decisions under uncertainty may result in dumping when the actual state of market conditions unfolds. Also, most of above classifications of motives of dumping have been adopted and sharpened by studies mostly during the 80's and the early 90's.

\(^9\) He argues that when the exporter gets additional profit from dumping, the exporter may face downward pressure on domestic prices. He illustrates hostile public sentiment, a hostile legislature, and potential competition as the driving forces to make the successful exporter lower its domestic price.

\(^{10}\) See Viner (1923) p23.
3. Why dumping occurs - recent developments

As shown in section 2, the traditional dumping model assumes that dumping occurs because the exporter's domestic market is protected by government intervention and/or the motive of dumping is predatory. Recent developments in the theory of dumping have expanded our understanding of the process by clearly showing how firms' rational choice under certain conditions results in dumping. Causes and conditions for dumping in the new theories can be divided into several groups: uncertainty in market conditions, imperfect market structures, intertemporal profit maximisation problem of firms, and (expected) policy implementation by governments. What we learn from these new developments is that there exists virtually no logical basis for the two pro-ADL arguments - the unfairness of dumping activities and the predatory motive of dumping. The new theories show that dumping occurs mainly as a result of rational profit-maximising behavior of firms rather than from predatory intention. And, more importantly, under ADL, business practices which are normal and legitimate when used by domestic firms of an ADL-enforcing country are denied to exporters. Further, dumping might be a reflection of a more competitive market structures in the exporters' domestic market than in the export market as illustrated in Weinstein (1992).

3.1. Price discrimination by monopolist: traditional one-way dumping

Traditionally, dumping refers to the case when an exporter which is a monopolist in its domestic market engages in price-discriminating dumping to the other countries. When markets are separable, the monopolist will apply different prices in different markets to maximise its combined profit. The price of a good in the market with a high price elasticity of demand will be relatively low while the price in the market with a less elastic

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11. In connection with Viner's earlier classification, some of new theories can be viewed as a formalisation of Viner's arguments, such as price-discriminating dumping, predatory dumping, promotional dumping etc, while others, reciprocal dumping model, uncertainty models, learning-by-doing effect model, signal-jamming model etc., depart from Viner's examples.

12. Although these new models provide different explanations for the existence of dumping, most of the new models still adopt the old tradition of one-way trade.
demand will be high. For such price discrimination to be sustainable, it is necessary that there be no arbitrage between the two markets. Consequently, a critical precondition for the existence of one-way dumping is that the exporter's domestic market is protected by some form of prohibitive protection measures. Thus, a reciprocity problem arises. The existence of a dumping ground offers a chance for the monopolist to increase its output without affecting the profitability in its domestic market. The monopolist increases its total output at the expense of import-competing firms in the importing country.

(Figure 1) Traditional dumping model

Figure 1 shows how the existence of a foreign dumping ground affects the production decision of the monopolist. The monopolist faces domestic demand $D(Q)$ and foreign demand at world price $P^*$. When dumping is not possible, the monopolist will produce

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13. As Viner indicated, reverse dumping will occur when the price elasticity of demand in the exporter's domestic market is higher than export market. Yet, when we refer to dumping, we assume that the price in the export market is lower than in the exporter's domestic market.
Oe where marginal revenue from its domestic market is equated to its marginal production cost. The autarky monopoly price is determined at $P_m$. Given the opportunity to dump in the foreign market at constant price $P^*$, the monopolist faces a new marginal revenue curve abc. Total production of the monopolist increases to Of where marginal cost is equated to the new marginal revenue. Of the total production Of, Od will be sold in its domestic market at a higher price $P_d$ and df will be sold in the export market at world price $P^*$. In this example, while the total production of the monopolist is increased from Oe to Of, the domestic sales volume is decreased to Od14.

3.2. Imperfect market structure: two-way (reciprocal) dumping

While the previous one-way dumping model requires the existence of exogenously given prohibitive trade protection in the exporter’s domestic market to explain dumping activities, it does not give any plausible explanation of the reciprocal dumping phenomenon. New developments in international trade theories during the 80’s enabled us to understand the prevalence of intra-industry trade in the actual world. Brander and Krugman (1983) showed that, using a two-country two-firm model, trade will take place between two countries due to the existence of above-normal profit in each market, provided that the two markets are separable and marginal costs of production of the two firms are not too different. Also when trade incurs positive transportation costs, reciprocal dumping will occur. Oligopolistic market structures and the existence of positive transportation costs are the crucial factors which lead to reciprocal dumping.

Using a more general oligopolistic market structure, Weinstein (1992) showed that, when firms have an identical marginal production cost, reciprocal dumping may occur if the number of firms is not too different between the two countries. Also, he was able to show that, if unilateral dumping occurs, the direction of dumping will be from a more competitive market to a less competitive market. This result stands in contrast to the

14. This shows a counter example to Viner’s argument that the existence of a dumping ground does not affect the exporter’s domestic market price. This example shows that the exporter’s domestic market price rises from $P_m$ to $P_d$ when dumping occurs. Consumers in the exporter’s domestic market become worse off as a result of the dumping.
traditional belief that dumping occurs from a less competitive country to a more competitive country due to the protection by the exporters' government. Consequently, the result greatly reduces the credibility of the protectionist argument which favours antidumping actions against the allegedly unfair trade practice of exporters.

3.3. Uncertainty and dumping

When firms face uncertainty in market conditions, such as the level of domestic demand, the ex-ante optimal production strategy of firms may not be optimal ex-post when the state of demand is revealed. When firms face uncertain demand, dumping becomes cyclical. When the demand in the market(s) is high, dumping is less likely to occur. Dumping is more likely to occur when firms face a sluggish state of demand. This selling-below-cost dumping (even below marginal production cost) during a sluggish demand period differs from traditional dumping as defined by Viner and can be shown to be the outcome of the firms' production (investment) choice under uncertainty.

Davies and McGuinness (1982) analyse the case where a monopolist faces an uncertain net export price for some reason (e.g., floating exchange rate). The monopolist will choose an optimal output which equates the expected marginal revenue to its marginal production cost. The possibility of dumping encourages the monopolist to expand output beyond the autarky optimum output level. Therefore, when the world price is low enough, below-cost dumping may occur. This will happen because, ex-post, the production cost of surplus output under unfavourable demand is sunk. They also show that dumping may occur either when the objective of the firm is sales maximisation rather than profit maximisation or when the firm tries to deter entry of domestic rivals in its domestic market.

15. As will be explained later, the only exception to this proposition can be found in Clarida (1991).
16. This strategy of the incumbent monopolist looks like an informal version of entry deterrence through excess capacity investment. In their model, potential entrants in the exporter's domestic market are deterred from entering that market by the possibility that the incumbent may redirect the output currently exported to the domestic market.
Blair and Cheng (1984) assume that firms face uncertain foreign market demand. They examine the effect of different forms of uncertainty (additive or multiplicative) and of behavioral assumptions of firms (risk-neutral or risk-averse) on the pricing behavior of firms. For a risk-neutral firm, dumping occurs when its marginal production cost is decreasing and when the firm faces multiplicative demand uncertainty. A risk neutral firm selects a lower price in a riskier market to exploit economies of scale. When its marginal production cost is increasing under multiplicative demand uncertainty, reverse dumping occurs. When firms are risk-averse, dumping occurs under certain conditions. As they admitted, the existence of dumping in the model is sensitive to the model specification and to behavioral assumptions. What is different from the traditional price-discriminating dumping model is that the existence of dumping may have nothing to do with the difference in price elasticities of demand between two markets. Rather, it is argued that uncertainty may be the principal cause of dumping in international trade.

Hillman and Katz (1986) analyse the consequences for the production choice of a risk-neutral firm of uncertainty in outputs and domestic demand. In their model, in addition to domestic demand, a firm faces world demand at a fixed price which does not cover the marginal production cost of the firm. They ask whether there is any difference in pro-dumping bias when the form of uncertainty changes (additive or multiplicative). Under demand uncertainty, when demand is low, a risk-neutral firm may engage in dumping even if the world price is never high enough to cover even its marginal cost of production. This will happen regardless of the forms of uncertainty. If the uncertainty arises from output, the pro-dumping bias appears only when the bias is multiplicative.

Ethier (1982) studies how cyclical dumping may occur under world demand uncertainty when there exists asymmetry in the labor markets between the two trading partners (the US and Japan). There are two types of labor in his model; managers and

Viner (1923) also suggested this type of predatory dumping by the exporter where dumping occurs due to the predatory purpose of the exporter in its domestic market. Viner argued that, due to the extra profits from dumping in the export market, the dominant exporter becomes financially better equipped than the rest of the potential domestic competitors to exercise a predatory pricing strategy in its domestic market. Also, as in this model, the possibility of redirecting the export to the domestic market (excess capacity) deters the potential entrants from entering the market. It looks like a combination of long purse theory and excess capacity choice by incumbent firms in the industrial organisation literature. That is, dumping works as a tool to financially support the dominant exporter and to turn away potential entrants so that the exporter remains as a monopolist in its domestic market.
labourers. In the US, only managers enjoy permanent employment and the employment level of labourers is determined by the market clearing condition. But, in Japan, both managers and labourers are permanently employed regardless of the state of world demand. Because of the commitment to permanent employment in Japan, sales-below-cost dumping occurs from Japan to the US when the state of world demand is low. When demand is high, the US will export to Japan at a price higher than the marginal production cost. It turns out that the commitment of permanent employment by the Japanese induces dumping and increases the variability of American unemployment creating protectionist sentiments in the US.

Bernhardt (1984) analyses how dumping occurs when the industry faces high adjustment costs under uncertain demand conditions. A large continuous production industry such as steel is a good example of this type of industry. In his model, the exporter, which is a monopolist in its domestic market and a perfect competitor in the world market, chooses its production capacity before the realisation of the state of demand in the domestic market. It may adjust its output after the realisation of demand but with positive adjustment costs when the actual output deviates from the optimal output level. He shows that the possibility of dumping (existence of a world market) makes the firm choose a higher production capacity than the autarky production level. Given the world market as a dumping ground, the greater the cost of adjustments, the greater the capacity choice and the larger quantity of dumping. Also, he shows that, as the structure of the domestic market becomes more competitive, the less the domestic firms will dump to the world market because increased competition will squeeze the expected profit from the domestic market and, thus, the potential loss from dumping is less likely to be compensated by the sales in the domestic market.

Das (1992) analyses cyclical dumping by a risk-neutral firm. He combines uncertainties both in the domestic market and in the world market using a two period model. He assumes that input decisions are made at the first period before the output is realised and the firm which is a monopolist in its domestic market faces infinitely large adjustment costs. He derives general conditions when either below-cost dumping or
price-discriminating dumping would occur. Also he summarises the effect of various demand shocks on the probability of each type of dumping to occur. What is new in his model is his analysis of the effect of demand shock on the probability of each type of dumping when fluctuations of demand in the two markets are correlated. He shows that when the demand uncertainty of either of the two markets increases, the probability of below-cost dumping increases while the probability of price-discriminating dumping may increase or decrease depending on the relative size of each market. When the correlation between the two markets increases, the probability of below-cost dumping increases and the probability of price dumping decreases. Finally, when a production subsidy is introduced, the probability of below-cost dumping in the current period does not change but the future probability increases. The introduction of a production subsidy does not affect the probability of price-discriminating dumping.

Clarida (1991) develops a dumping model where firms face uncertainty about their own production technologies. Firms acquire knowledge about their production functions by actually producing the good. Using a two-sector, two-country Ricardian model where entry and the terms of trade are endogenous, he shows that dumping can arise in the free trade equilibrium even if the two countries differ only in their initial stock of technological knowledge. Even when firms are identical ex-ante, the positive profit to the ex-post efficient firms induces excess entry in the industry. Excessive competition among ex-ante identical producers will drive down the price to such a level that the industry suffers losses (below-cost dumping). The ex-post inefficient firms, realising that the loss would never be recouped, will exit the industry. What is unique in this model is that dumping occurs in the period of high demand rather than during a sufficiently slack demand period as other previous models predict.

3.4. Intertemporal profit maximisation

As Viner (1923) noticed, firms may engage in short-run dumping to maximise their intertemporal profit from the market. Viner illustrated three motives of such intermittent
dumping - creating market demand, predatory dumping, and limit pricing to deter entry of new firms. Recent studies added several new cases where firms engage in dumping during the initial period to maximise their intertemporal profit: the existence of learning-by-doing, reaction to the expected policy implementation, and a signal-jamming strategy under asymmetric information. One of the striking features of these types of dumping is that, contrary to the common belief that short-run below-cost dumping is intrinsically predatory, there may be no predatory motive in most of those types of dumping. Rather, problems may arise as a result of denying normal trade practices to foreign firms. As analysed in the following section, the asymmetry confers an undue strategic advantage on domestic firms of the ADL-enforcing country over exporters and may severely constrain international trade flows.

3.4.1. Predatory dumping

Berck and Perloff (1990) analyse predatory dumping using a dynamic limit-pricing model. They examine the predatory pricing strategy by a low cost foreign exporter using both open-loop and closed-loop models. A dominant exporter faces a competitive fringe which has an adjustment cost of entering or exiting the industry in the export market. Using an open-loop model, they show that for the initial phase when the foreign exporter faces few fringe firms, it sets a high price. A high price in the market will invite the entrance of fringe firms. If fringe firms are rational, the exporter has to price below the fringe firms' cost to prevent the increase of the fringe and to drive out the fringe from the export market. It may export at price lower than its marginal cost for some periods. After successfully driving out fringe firms, the foreign exporter will exercise a limit-pricing strategy to keep the fringes out forever.

Eaton and Mirman (1991)'s signal-jamming model is a different version of the traditional predatory dumping model. It is a two-country, two-period Cournot competition model. In their model, a home firm which supplies both a home market and a foreign export market with increasing marginal cost has an informational advantage
about the market conditions over the foreign firm which supplies only its domestic market. While the home firm has perfect information about demand conditions of both its own market and the foreign export market, the foreign firm faces uncertainty about the level of home market demand. Because the subjective probability of the foreign firm about the state of home demand in the second period may be revised after the foreign firm observes the output of the home firm at the end of the first period, the home firm has an incentive to signal-jam the state of demand in its domestic market. The home firm will export more and sell less in its domestic market in the first period to obtain a higher profit in the second period in the foreign market. Its supply decisions in the two markets are consequently interdependent because its marginal production cost is increasing. An increase in current exports makes the foreign firm believe that the demand in the home market is low and that future exports will be high (low marginal cost), thus making the foreign firm produce less in the second period. The production behavior of the well informed home firm looks quasi-predatory because the foreign firm responds to the signal-jamming strategy of the home firm by reducing its output.

Although the predatory motive seems to be the most often cited and most feared reason for dumping, recent developments in industrial organisation theories tell us that such fear may be unfounded in most cases. Also empirical studies on dumping cases confirm that predatory dumping cases are virtually non-existent\(^\text{17}\). Often cited shortcomings of the predatory strategy are as follows:

i) As mentioned by Viner (1923), predation is less likely to be successful given the possibility of entry of new competitors in the market.

ii) Even though complete predation may be possible in some cases, there may exist more efficient strategies, such as merger etc., for the predators.

3.4.2. Learning-by-doing/consuming effect

\(^{17}\) According to Messerlin (1990b), no foreign country (exporter) has more than 5% of the EC domestic market in almost 56% of EC AD cases and foreign countries have less than 25% of the EC market in more than 90% of AD cases.
One of the most controversial dumping cases during the 80's was the semi-conductor case initiated by the US firms against Japanese producers. In the semi-conductor industry, firms' production technology exhibits a firm-specific learning-by-doing effect. Production experience represented by the past cumulative production level is an important factor that determines the current competitiveness of firms. Because firms can reduce future production costs by an increase in current production, firms produce more than the usual short-run optimal production level. A typical cost function of firms in this industry can be represented as the sum of two components: fixed minimum efficient cost and variable cost which is decreasing in past cumulative outputs.

$$C(t) = C + h \left( \sum_{i=0}^{t-1} q(i) \right)$$

where $C$ is the minimum efficient cost and $h(\sum_{i=0}^{t-1} q(i))$ is the variable cost.

$$\sum_{i=0}^{t-1} q(i)$$ is the cumulative output.

$h(0) = C_0 > 0, \ h'(\sum_{i=0}^{t-1} q(i)) < 0$

Using a continuous infinite-horizon model, Spence (1981) shows that firms with a learning-by-doing effect will set price where marginal revenue is equated to the minimum efficient cost level ($C$) at all stages of learning. Therefore, if the learning effect is large, firms may sell their product even below the current marginal production cost at early stages of production. This model differs from the traditional dumping model in the sense that firms may sell their products at below current marginal production cost in both their domestic and export markets. No price discrimination and no protection in its domestic market by the exporters' government are necessary conditions for below-cost dumping to occur.

While the above learning-by-doing model emphasises the importance of the production technology of firms on their pricing behavior, Mayer (1984b) illustrates how the
existence of a positive intertemporal externality of current exports makes government engage in export promotion policy at the earlier phase of foreign market cultivation. A government faces a problem of cultivating a new export market where consumers in the export market show an Arrow-type learning-by-consuming behavior. That is, for a new product to get a market share in the export market requires some period of low-price-sales strategy to compete with the already available goods. Once the export market is cultivated, exporters may have some monopoly power in the export market and benefits of cultivation last for a long time. Because the social returns on investment in export market cultivation exceed the private returns\(^\text{18}\), the government has an incentive to subsidise exports, at least for some time, to raise social welfare. Thus the net export price of a firm at the initial stage of export market cultivation may be lower than its domestic price or even below the current marginal cost. The exporting country may recoup the initial cost by the subsequent flows of benefits in the form of monopoly rents.

### 3.4.3. Policy-induced dumping

Commercial policies to promote exports have been one of the most frequent sources of dumping. Apart from the usual export subsidy case, Pursell and Snape (1973) show how a government of a small country can create an export industry by using a prohibitive tariff on the import of the good, when there is a domestic monopoly and the industry exhibits increasing returns to scale\(^\text{19}\). In their model, the domestic firm has a cost disadvantage compared to foreign rivals. Without protection by the government, the domestic firm can not export. When the domestic market is protected from the competent foreign rivals and if the world price is not too low (lying below the average cost curve but intersecting the marginal cost curve), the domestic firm can reach a more efficient scale by engaging in price-discriminating dumping. Although the world price does not

\(^{18}\) The export market cultivation by exporters has a public good aspect (positive externality).

\(^{19}\) This is the case where the exporter engages in dumping to obtain economies of larger-scale production when its domestic market is protected from foreign competition (see 1. in Viner's classification in Table 1).
cover the average cost, the firm can be compensated by the monopoly profit in its domestic market. Thus domestic consumers are made worse off by the protection.

Another interesting development is the analysis of the effect of government policy on firms' behavior when firms can either anticipate or influence policy outcomes. While, as shown above, the traditional literature emphasised how trade policies of the exporters' home government affect exporters' production (export) decisions, few studies have concentrated on the effect of the prospect of protection by the importing country on the exporters' production strategy during the current period. Yano (1989) and Anderson (1992) analyse how the possibility of a future voluntary export restraint (VER) can generate competition among exporters to gain a higher share of the VER in the future. When an industry faces increased competition, it naturally seeks protection from the government through various routes. When the concerned industry has considerable political power, trade disputes are usually settled by undertakings of VER by exporting countries. The ex-post rent-shifting effect of VER in favour of exporters and the facilitating effect of VER are well known from various studies\(^\text{20}\). At the same time, ex-ante, the prospect of a VER being imposed by the importing country may make exporters produce (export) more to capture a higher market share in the more profitable future market under a VER. This competition among exporters may cause dumping (maybe below-cost dumping) before a VER is actually implemented. Also, it might have a snowball effect by influencing the expectations of firms in other industries about the prospect of a VER. This may result in 'domino dumping' and may cause injury to the other domestic industries of the importing country until VERs are actually imposed in those industries. This shows another source of inefficacy of government policies.

3.5. Others

As shown in the previous section, Viner (1923) argued that exchange dumping may arise when the exporter's domestic currency is undergoing a progressive depreciation.

\(^{\text{20}.\text{ See Harris (1985) and Krishna (1989) among others.}}\)
Foreseeing the depreciation of the currency, exporters may set export prices abnormally low in terms of foreign currency. In this case, dumping occurs because of the existence of an exchange premium. Though he does not explicitly present it as a model of dumping, the model of Dornbusch (1987) can easily be interpreted as a dumping model arising from the appreciation of the exporters' domestic currency. Actually, in this model dumping occurs because of imperfect market structures in the export market. Exporters supply both their domestic market and the export market. The export market is oligopolistic with a fixed number of firms (exporters and import-competing firms).

Suppose, at the initial equilibrium, prices in both markets are the same. When the exporters' domestic currency experiences an unexpected appreciation for some reason, it can be shown that exporters will not fully adjust their export price corresponding to the size of appreciation of the currency. Only a proportion of the appreciated value of the currency (proportional to the numbers of firms in the market) will be reflected in the export market. Thus, after the appreciation of the currency, there exists a price differential between the two markets and exporters are dumping to the foreign market.

4. Responses to dumping and the effects of ADL

In the previous section, we summarised recent developments in dumping theories. The conclusions from these new theories suggest that there is little room to justify the use of ADL under the slogan of policing 'unfair' trade practices. Dumping statistics of the US show that about 60% of total cases are less-than-cost dumping cases\(^2\). Yet, as shown in the previous section, it is hard to find any evidence of predatory intent by exporters. Also, contrary to the common belief about dumping, price-discriminating dumping may occur from a more competitive market to a less competitive market as in Weinstein (1992). Therefore, apart from the cases where dumping occurs as a result of commercial policies by the exporters' governments, there seems to be nothing intrinsically 'unfair'.

\(^2\) See Horlich (1989)
in the dumping practice by exporters. Then, how can we explain the prevalence of AD actions and consequent imposition of AD duties among countries? In this section, we briefly survey theories of political economy of protection which show why governments use protection measures at all and why ADL may be chosen as a trade policy. Then, we summarise the results of previous studies which show how the existence of ADL changes firm behavior (both exporters and import-competing firms) and how ADL works in the actual world.

4.1. Political economy of protection

While the traditional trade literature does not give any plausible explanations about the high incidence of trade protection by governments, new developments in international trade theory, especially in the political economy of protection, have provided an economic rationale for such measures. Major arguments for the prevalence of protection in general can be summarised as follows:

i) Losers are a more identifiable and vocal constituency than winners.

ii) The concentration of injuries in a small group of the economy may make the politicians decide to provide protection to the group to maximise its political objective function under certain conditions.

Although international agreements among governments to reduce traditional tariff rates seem to be the most obvious reason for the prevalence of non-tariff trade barriers, the foregoing explanation shows why protection in general is prevalent in the actual world.

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22. Social insurance theory or the redistributive motive of Rawlesian governments also explain the prevalence of protection. According to Hillman (1989) the social insurance theory views trade policy as having an insurance role in protecting individuals' incomes against unforeseen changes in world markets. Corden (1974) uses the term 'the conservative social welfare function' to explain the prevalence of protection measures. He argues that trade policies are used to prevent 'any significant absolute reductions in real incomes of any significant section of the community'. But the study of Hutton and Trebilock (1990) on AD cases in Canada shows that, contrary to the supposedly egalitarian nature of trade policies, most of the recipients of protection through AD system consist of industries in which the average wage is higher than the national average.

23. For example, the existence of a positive voting cost or of lobbying activities.
When it comes to ADL, there are few discussions about the popularity of administered protection measures among democratic industrialised countries. The most convincing argument can be found in Finger et al (1982), who explain why administered protection is prevalent in the US. They start by classifying non-tariff trade protection measures into two categories, high-track measures and low (technical)-track measures, according to how decisions are made on the matters.

"Political influence is applied directly in high-track cases, but comes to bear on low-track cases only indirectly, through the shaping of laws and regulations which define their technocratic nature." (Finger et al. (1982) p452)

Less-than-Fair-Value cases are examples of low (technical)-track cases where the authority to regulate trade is delegated by the Congress to administering bodies. They argue that governments may prefer those low-track measures because they minimise the political cost of any decision for the following reasons:

i) the rule-oriented decision criteria make it possible to diffuse the political cost of decision without preventing the government from harvesting the gratitude of the winners.

ii) The complicated and technical nature of low-track measures create misdirection and obfuscation, especially among the potential losers, enabling the system to keep going without much opposition by the losers.

The above discussion shows only the domestic political factors that make ADL popular. Obviously, other factors - such as the legitimacy of AD measures approved by GATT, prohibition of retaliation by exporting countries affected by AD measures, and the less transparent nature of AD measures with no limit on AD duty rates - also seem to be important reasons for the preference for ADL among countries.
A related question is why governments choose ADL as their trade policy among many alternative trade policies. In particular, are governments protectionists which have succumbed to the pressures from industries or are they sufficiently smart administrators to avoid confrontation with industries by giving a small carrot - ADL or other non-traditional protection measures- to calm down protectionist pressures from industries? While the current prevalence of AD actions among some developed countries gives more credit to the protectionist argument, Bhagwati (1988) argues that, contrary to the common belief about the stance of governments, the prevalence of non-tariff barriers after the reduction of traditional tariff rates may be the result of an effort by smart governments to reduce the overall protection level by providing less stringent protection measures\textsuperscript{24}.

This debate, in tum, raises the question of just how restrictive AD measures are. One group which is more concerned with the preventive effect of ADL argues that the trade-restricting effect of ADL is very large and will be larger when we take the unobservable threat effect into account\textsuperscript{25}. The other group argues that the country-specific nature of AD measures and the consequent possibility of trade diversion will make the effect of AD measures less restrictive\textsuperscript{26}. While each party has different views on the real effect of ADL, they both agree that the scope for abuse of ADL arising from various sources, such as obscure definitions, too much room for government discretion, etc., has to be reduced.

In the following sections, we show how ADL differs from other protection measures and examine how it works in the actual world. We reevaluate those arguments and the above sets of opposing views.

4.2. Harassment thesis and threat effect

\textsuperscript{24} This also echoes the Becker (1983) argument that, ceteris paribus, more efficient policies are chosen.
\textsuperscript{25} Messerlin (1989) showed how trade of the goods under AD measures is affected in the context of EC.
\textsuperscript{26} See Baldwin (1985) and Bhagwati (1988) among others.
ADL has different effects on firm behavior from other protection measures. The difference arises from the fact that ADL is endogenous to the reaction of firms, in particular the endogenous probability of detection and endogenous AD duty rates\textsuperscript{27}. Because exporters face an endogenous probability of protection under ADL, a mere 'threat of AD actions' by import-competing firms may have 'trade-chilling' effects. We divide the source of the threat from AD actions into two different categories; 'harassment thesis' and 'threat effect'\textsuperscript{28}. The harassment thesis refers to the trade chilling effect of ADL when exporters have to take the administrative and legal costs arising from AD petitions into account when making decisions about export to the foreign market. Given the nature of the costs incurred by AD investigations as costs of maintaining or developing a foreign market, it is certain that they have negative effects on exporters' decision. Also, the high cost of employing expensive lawyers for the AD suits will certainly disadvantage small exporters and, consequently, small exporters may be completely deterred from entering the export market.

The other two elements of the 'harassment thesis' discussed in Finger (1981) both amount to threat effects. They are i) the risk of the export project by the possibility of AD actions and ii) the changes in the expected revenue by the anticipated outcome of AD investigation. These two factors determine the degree of reaction of exporters. They are endogenous because they depend on the production decisions of the exporters both in their domestic market and the export market. Thus, under ADL, a typical price-discriminating exporter will sell (produce) more in its domestic market and sell less in the export market compared to free trade to reduce both the probability of AD petition by import-competing firms and the expected AD duty rates\textsuperscript{29}. Trade volume under ADL is

\textsuperscript{27}As stated, the endogeneity of protection under ADL is two-fold. But previous studies, such as Leidy and Hoekman (1989,1990a), Staiger and Wolak (1989), and Fischer (1992), assumed that only the probability of protection is endogenous while the degree of AD duties is fixed. As will be shown in chapter 3, the conclusions obtained by incorporating these two endogenous elements of ADL may be quite different from the previous results.

\textsuperscript{28}Finger (1981) used the term 'harassment' to include both effects.

\textsuperscript{29}Obviously, the degree of reaction crucially depends on many other factors, such as relative market size, shape of demand curves and cost functions etc. Also, protection induced DFI and specialisation in its domestic market (cease exporting) are other possible outcomes. As Staiger and Wolak (1992) and Bernhardt (1984) showed, when firms make an investment decision under demand uncertainty, the facility choice under ADL will be smaller than under free trade.
certainly smaller than under free trade while the sales in the exporters' domestic market increases. Also, contrary to the positive repercussion effect under the prospect of VER analysed in Yano (1989), AD activities in one industry may make exporters in other industries reduce their export volume (negative repercussion effect).

4.3. Abuse of ADL

Recently, a 'dump ADL' argument is heard frequently in various sections of the world. The essence of the argument is that there is little economic basis for supporting ADL and, even worse, the use of ADL seems to be biased toward protectionist groups in the importing countries through various routes. As analysed by various authors, such as Staiger and Tabellini (1987) and Tornell (1991) among others, the prospect of protection changes the optimal choice of the private agents, dampening the effect of protection when it is implemented and thus weakening the efficacy of government policy. When it comes to ADL, it seems to be even worse because there exist additional strategic advantages to the domestic firms and, fully aware of this, import-competing firms may exploit the AD system to the limit. The allegations for the abuse of AD system can be summarised as follows.

4.3.1. ADL as a substitute for safeguard

In section 4.1 we analysed why ADL is a popular weapon as a protection measure by politicians (supply of protection). In this section we analyse why firms resort to an AD system for protection instead of others such as safeguard measures. Import-competing industries tend to regard ADL as a cheap and easier substitute for safeguard measures\(^\text{30}\).

\(^{30}\) There are differences in conditions for legitimate use between safeguard measures and ADL. (1) The use of safeguard measures does not require that the injuries to the domestic industries were made by 'unfair' trade practices by the exporters. (2) While safeguard measures are applied in a non-selective manner, the imposition of AD duties is selective. (3) Under GATT agreement, when a country uses safeguard measures to protect its industries, rival countries under the measures reserve the right to retaliate against the imposition of those measures. When it comes to imposition of AD measures, they do not have the right to retaliate against the imposition of AD measures.
It is cheap because other protection measures demand legislative changes or higher lobbying costs. Also, it is easier because it is readily available and because safeguard measures require a strict injury criteria. In the US, even when injury criteria are satisfied, the President reserves the right to veto positive findings by the International Trade Commission (ITC). Although protection through ADL requires the existence of dumping and injuries to domestic industries caused by the import competition, the ambiguity of definitions in ADL and the intrinsic nature of ADL as a policy to protect domestic industries tend to provide biased and excessive protection to less competitive domestic industries. Firstly, there are various methods to determine the 'normal value' of the import under investigation. Many believe that the exporters' domestic price or export price to third countries (when there is no arm's length trade in the exporters' domestic market) should be used as the 'normal price' of the good. But, in practice, 'constructed value' and 'best information available' (BIS) are used in the majority of AD cases. When the 'constructed value' method is used, the choice of surrogate countries in cases of dumping from non-market economies and the inclusion of expenses and normal profits in the calculation of 'normal price' are said to be the major factors that lead to positive findings with high dumping margins. Also, because the source of BIS is usually information supplied by AD petitioners, it will inevitably result in positive dumping findings and high dumping margins. Secondly, less competitive firms seem to be more likely to prove themselves to be injured by the import competition because of the ambiguity in determining injuries and in the causality of injury from dumping. Increased competition by imports will inevitably result in reduction of sales and consequent financial pressure to import-competing firms whether the competition arises

31. Gruen (1986)'s study on Australian AD cases during Jan. 1980 - Dec. 1985 shows that only 41% among total 176 AD cases used exporter's domestic price as the 'normal price'. 'Export price to third country' has never been used in determining the 'normal price' during that period. Messerlin (1991) also reports that third country export price has never been used in the EC since 1980.

32. Baldwin and Moore (1991) find that the dumping margins in BIS cases are almost 50% higher than those obtained by other methods.

33. Kaplan (1991) illustrates five methods of determining injury and causation employed by ITC of the US; weak 201, trend analysis, five factors approach, margin analysis and comparative approach. He argues that four out of five methods fail to successfully explain the existence of causality. Also, the only satisfactory method, the comparative approach, seems not to be suitable to explain the below-cost dumping cases.
from fair trade or not. Also, considering the fact that the causality test requires that the dumped import is 'a' factor for the injury (not 'the major' factor), it may not be too difficult to find any degree of causal relationship between the increased import and the injury incurred by domestic industries.

For the stated reasons, it may be easier for the less competitive firms to prove themselves injured from import competition even though the injury may have arisen mainly due to the incompetence of import-competing firms themselves. Combining those two explanations, it can be said that, under the current AD system, ADL may work as an easier and cheaper substitute for safeguard measures to import-competing industries.

4.3.2. Behavioral assumptions, the nature of penalty and the reaction of firms under ADL

As stated before, one of the most distinctive characteristics of ADL is that the probability of future protection is endogenous to the behavior of both exporters and import-competing firms. In section 4.2, we showed how the existence of ADL affects exporters' production decisions in both markets. To show the threat effect clearly, we assumed that penalties for violating ADL have a negative effect on the expected future profits of exporters. Faced by the prospect of protection, exporters have an incentive to reduce the probability of future protection by changing current production/pricing behavior. In the actual world, settlements of AD cases sometimes take the form of soft measures such as VER and price-undertakings which may be even beneficial to exporters. The nature of the penalty determines exporters' reaction under the threat of AD actions. Therefore, when exporters expect the imposition of soft measures which may increase their future profits even compared with the profit under free trade, their reaction under the threat of AD action may be perverse as shown in Yano (1989).

For import-competing firms, ADL also affects the domestic firms' production decisions in two ways. The first one is the effect of injury criteria on the domestic firms'
output (price) decision. Imposition of AD measures requires that the investigation into AD cases conclude with positive findings on the following three factors: existence of dumping by the exporters, injuries to the domestic industries, and evidence of causation. Among these requirements, proving injuries seems to be the key to secure protection\textsuperscript{34}. Therefore, intertemporal-profit-maximising domestic firms may find it profitable to pretend to be injured to increase the probability of imposition of AD measures. The loss of profits in the current period can be more than compensated for if AD measures are taken in the future. The ambiguous nature of injury criteria, which is a collection of all the possible symptoms of injured industries, makes it difficult to determine whether the injury is genuine or spurious\textsuperscript{35}.

Combining those two factors we analyse how the probability of future protection changes firms' behavior. As shown in Appendix 1 and Figure 2, if we assume that firms exhibit Cournot-Nash (Bertrand-Nash) behavior and when market share is perceived to be critical in injury determination, import-competing firms have an incentive to reduce (raise) their outputs (prices) to increase the probability of detection through decreased sales and/or market share. In contrast, if depressed price is perceived to be the critical factor, import-competing firms are more likely to increase outputs (lower prices) to increase the probability of detection by showing that the industry suffers from depressed price and reduced profit from import competition.

The second effect of ADL is concerned with the nature of expected penalties on the foreign exporters' behavior. AD cases are terminated by various settlement measures, such as imposition of AD duties or price-undertakings etc. If the expected AD measures are traditional ones, such as specific or ad valorem tariffs which are expected to reduce exporters' future profits, exporters will reduce export volume to reduce the probability

\textsuperscript{34} The study of Finger and Murray (1990) on the US AD cases shows that the reason for negative results of unfair trade cases is almost always that the injury test is negative.

\textsuperscript{35} As Leidy and Hoekman (1991) argued, we may be able to judge whether the injury is spurious or not only after actual AD actions are taken. They argue that if the financial recovery of the domestic firm(s) is rapid and large after the imposition of AD duties, then the injury is more likely to be spurious. Although they address the difficulties of discerning spurious injuries from the genuine ones, they do not provide any solution for the adverse selection problem arising from obscure injury criteria. As mentioned from the previous section, the ambiguous nature of AD clauses may be exploited by incompetent domestic firms to get protection even when the trade is fair.
of future protection. But, if the expected penalties are seen to be beneficial in the sense that the imposition of those measures would actually increase the exporters' future profit compared to free trade, such as VER or in some cases price-undertakings, then the existence of ADL may even increase the export volume during current period. Combining the two factors, we have four different potential outcomes as follows\textsuperscript{36}:

i) Market share injury criteria and hard AD measures: This will typically lead to a collusive outcome between the two parties. Because the endogenous probability of the imposition of AD measures makes both parties reduce (raise) their outputs (prices) in the export market, AD measures may never be implemented and both firms enjoy a higher profit due to the de facto collusion result\textsuperscript{37}.

ii) Depressed price criteria with hard AD measures: In this case, import-competing firms increase (lower) their outputs (prices) to increase the probability of future protection and exporters increase export prices. The outcome in the first period depends on the degree of reaction by both parties.

iii) Market share injury criteria and soft AD measures: While domestic firms reduce (raise) outputs (prices) in the first period foreign exporters increase (lower) their outputs

\textsuperscript{36} A similar classification can be found in Fischer (1992).

\textsuperscript{37} Staiger and Wolak (1989) and Leidy and Hoekman (1991) analyse this type of spurious injury/de facto collusion problem under ADL. Both of them assumed that only the probability of detection is endogenous. There seem to be two problems with this popular result. The first one is related to the question of how the expectation of the probability of detection is formed in the first place. The above result suggests that the mere existence of ADL will be enough to forge de facto collusion between the two firms even without any AD actions by home firms. This raises the following question: 'What is the result if we assume the exporters' perceived probability of future protection is continuously revised according to the previous AD actions by importing-competing firms?' Also, as shown in chapter 3, when both the probability of detection and the degree of AD duties are perceived to be endogenous the incentive for the import-competing firm to pretend to be injured is dampened under Cournot-Nash assumption. A reduction in output which raises the perceived probability of protection will reduce the expected dumping margin which will reduce gains from protection. Thus, the overall effect of future protection on expected intertemporal profit of import-competing firms does not increase as much as when only the probability of detection is endogenous. Therefore, the incentive to feign injury may be high either when the expected settlement measure is not affected by the dumping margin or when there exists a loophole in the AD system. As Prusa (1991, 1992) illustrated, when import-competing firms are able to force out-of-court settlements instead of waiting for the final AD findings by the authority the above result will be the outcome.
(prices). Thus, the probability of detection and the prospect of the imposition of AD measures in the second period increases.

iv) Depressed price criteria with soft AD measures: Both domestic producers and exporters increase (reduce) outputs (prices), which results in an increase in the overall consumption level in the first period and in a higher probability of protection in the second period.

One of the striking results obtained from the above classification is that detrimental effects of ADL are not restricted to those cases where AD measures are actually imposed. The first case shows that the mere existence of ADL may lead to a de facto collusion between firms at the expense of consumers. Thus, it is clear that the domestic import-competing firm has every incentive to pretend to be injured (spurious injury) to create ex-ante collusion, ex-post tariff protection, and, in some cases, ex-post collusion. Also, once protection is granted, X-efficiency and/or a time-inconsistency of protection problem may arise.

What we have learned from this analysis is that, whatever the original purpose of governments for granting such protection measures, when there exist readily available institutional arrangements and when the criteria for injury determination are seen to be manipulable by import-competing firms due to loose definitions, firms may have an incentive to pretend to be injured. These problems can be cured when the injury criteria in ADL are strict and when the causation test in AD cases is strengthened. For example, in case i, if injury criteria are strengthened such that not only output/market share criteria but suppressed price/profit have to be shown to satisfy the injury test, import-competing firms have every incentive to pretend to be injured. These problems can be cured when the injury criteria in ADL are strict and when the causation test in AD cases is strengthened. For example, in case i, if injury criteria are strengthened such that not only output/market share criteria but suppressed price/profit have to be shown to satisfy the injury test, import-competing

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38. Leidy and Hoekman (1991) clarify the difference between genuine free trade and free trade under the threat of future protection. In their model, under the threat of ADL, actual execution of AD measures may never occur because the spurious injury by the petitioners and the reduction in exports via the threat effect result in implicitly collusive outcome.

39. As Bhagwati (1988) and Prusa (1991) argued, this is another source of asymmetry between the two parties because there is no penalty for initiating spurious AD actions.

40. See Corden (1974) for X-efficiency problems of protection and see Staiger and Tabellini (1987) and Tornell (1991) for a time-inconsistency problem. Many authors emphasised that a strict 'sunset' provision has to be implemented to prevent those types of problem occurring.
firms may never be able to feign to be injured. Also, in case iv, if the causation test of AD cases is strict, import-competing firms would not initiate a price war to create future protection.

4.3.3. Asymmetric competition law and strategic advantage of domestic firms

It is well known that, under ADL, the rule of competition differs between exporters and domestic firms of an ADL-enforcing country. In fact, the detrimental effect of the asymmetric competition rule arises from two sources. First, business practices, such as promotional sales, sales-below-cost for outdated goods, and end-of-season bargain etc., which are deemed to be normal to domestic firms become illegitimate when they are exercised by foreign exporters. Second, this asymmetric rule may confer a great strategic advantage on the choice of production strategy to the domestic firms over the exporters. That is, knowing that the exporters are subject to the constraint, domestic firms may exert a shut-out production strategy producing just enough to completely force the exporter out of the market. As explained in Gruenspecht (1988), when there exists below-cost dumping due to a firm-specific learning-by-doing effect, the strategic advantage becomes large enough to force exporters completely out of the export market. This reduces not only the current welfare level of the economy but also the

41. Also, as Davidow (1991) indicated, while antitrust law has progressed to favouring marginal cost pricing, the 'normal price' in ADL means average cost of production which includes full cost plus a profit.


43. Apart from the fact that semi-conductor disputes between the US and Japan have been an important source of trade policy debate among economists, the conclusion of the semi-conductor AD case also divided economists into two opposing groups. Baldwin and Krugman (1988) represent the hawk approach against the market closure of Japan in the debate and their conclusions seem to have had great influence on the outcome. They assume that, while the US firms are technologically superior to their Japanese counterparts, the weakening of market power (share) of the US firms in the US market and in the world market is just a reflection of denial of market access of the US firms in the Japanese market by the Japanese government (industries). This market closure is viewed as an implicit tariff on the US products. Thus, they stipulated that, if the Japanese market is open, then the trade dispute would have never arisen. Therefore, instead of analysing the effect of AD actions, they examine the effect of free trade on the firms' market share and world welfare. Their simulation results show that once the Japanese market is open, the US firms will regain dominance in the markets.

Dick (1991) stands on the opposite side of policy appraisal. While Baldwin & Krugman (1988) claim that the unfair trade practice of Japanese firms (and government) is the major cause of the disputes, Dick, using statistical cost data of Japanese firms, argues that the reason why the Japanese firms are pricing so aggressively and why do they gain supremacy in the markets is simply because they have a higher speed
economy's future welfare because it reduces the speed of learning and consequently the marginal production cost remains higher than it would be under free trade. Even worse, as explained in chapter 4, the inclusion of a 'normal profit' in sales-below-cost dumping cases not only increases the probability of finding dumping with high dumping margins but enables domestic firms to produce less without risking their monopoly rent in the market.

In addition to the above strategic advantage of domestic firms from the asymmetric competition rule, an asymmetric rule of comparison between AD petitioners and defendant (exporters) exercised by AD authorities may disadvantage exporters. Palmeter (1991) and Baldwin & Moore (1991) show how 'seemingly innocent' AD procedures may have a profound effect in the determination of AD cases. They illustrate how changes in time limit for AD investigations and for the completion of inquiry format issued by the Department of Commerce (DOC) of the US to the defendant of AD cases affect the result of AD investigations. Normally, a reduction in the investigation period is regarded to be beneficial to the defendant (exporters) because it will reduce the period of uncertainty to exporters. But there exist asymmetries because, while changes in time schedule never affect the position of domestic petitioners who have already lodged information required for the petition, it may become a burden for defendants (exporters) who have to complete the inquiry form within the changed time schedule. Palmeter (1991) argues that, because of the vastness of information requirements for the completion of an AD inquiry format, more and more exporters cannot lodge the format in time. This, in turn, will make the DOC use best information available (BIS) - usually data supplied by the complainants. Naturally, as mentioned in the previous section, these cases are more likely to be finalised with positive findings and with very high dumping margins.
Also, as Palmeter (1991) argues, the use of a constructed value method for the AD cases against non-market economies (NMEs) may result in double asymmetry in price comparison to the disadvantage of exporters. The first disadvantage comes from the choice of surrogate country and the second one from the choice of a comparable price of the surrogate country. He illustrates using the following example: "... A dumping margin of more than 27 percent was based on a comparison of prices charged by the exporter in China for sale to the United States to the prices charged by a Sri Lankan manufacturer for sale in Sri Lanka." Similarly, Hindley (1988) shows that the asymmetric method employed in calculating normal value of the goods between the export price and domestic price makes it more likely to find dumping with a higher dumping margin.

4.3.4 Conflict with domestic antitrust laws

As Barcelo (1991) commented, GATT antidumping law is a hybrid of antitrust and safeguard policies. Yet fundamental discrepancy seems to exist between domestic antitrust laws and antidumping laws. While domestic antitrust laws are designed to prohibit restraints on competition between competitors, ADLs are designed to restrict certain forms of competition by foreign firms in the domestic market. The following comment by Leidy and Hoekman (1989) summarises the paradox of ADL. "It is rather paradoxical that vigilant and enthusiastic application of AD by policy officials tends to promote the result that it is supposed to combat under the predation justification: monopoly pricing." 44

As briefly mentioned in section 3.4.2, domestic import-competing firms may exploit the asymmetric competition rule between domestic firms and exporters under ADL as a strategic tool to reduce competition. As shown in previous section 4.3.2., AD actions may be used as a lever to create or sustain a cartel among various groups; between exporters and import-competing firms or among import-competing domestic firms.

44. See Journal of World Trade (1989) vol. 23 no. 5 p33
Previous studies, such as Staiger and Wolak (1989) and Leidy and Hoekman (1991), have shown that ADL may work as a tool to induce implicit collusion between exporters and domestic import-competing firms. They argue that the existence of ADL reduces the export level through the threat effect and also domestic import-competing firms may reduce output to satisfy the injury criteria under ADL. As a result, overall consumption may be reduced to a level where profits of both firms increase at the expense of consumers, which would have been impossible without ADL. This is in line with previous research on the effect of trade protection on firms' behavior in a duopoly, such as Harris (1985) and Krishna (1989), who show that the actual imposition of trade protection measures (mainly quantity restrictions e.g. VER) may work as a facilitating device between import-competing firms and exporters.

Using AD statistics of the US, Prusa (1991, 1992) shows that the reduction in trade volume for the withdrawn AD cases is as great as the cases where AD duties are actually imposed. Based on this observation, he provides interesting explanations about the high frequency of withdrawn or voluntarily terminated cases by petitioners before final decisions are made by International Trade Commission (ITC). He argues that ADL seems to be used as an offensive measure by the petitioners to extract more favourable out-of-court settlement such as price-undertakings or quantity restrictions. He shows that, apart from the reduction in the administrative expense of government by the withdrawal, this type of settlement may be more detrimental to the economy than the actual imposition of AD duties on the alleged imports because the settlement would be feasible only when the expected profit to both parties by the settlement is at least not less than that obtainable under the formal process. In other words, when the petition is voluntarily withdrawn, we expect that the combined output level of firms will be lower than even when AD duties are actually levied on imports.

While the above studies examined the effect of ADL on the collusive behavior between foreign firms and domestic firms, using the information of AD cases and antitrust cases of EC chemical industries, Messerlin (1990a) studies the pro-cartel (between EC firms)
effect of AD actions against imports by noticing the prevalence of twin cases where, on the one hand, AD actions are taken against imports and, on the other hand, antitrust decisions are made on EC firms in the industry. He argues that cartelisation between EC firms is enhanced when AD measures are imposed on imports. Under free trade, EC firms had difficulty in creating and sustaining a cartel among themselves due to the competitive pressure from foreign imports. EC firms have used the AD actions as a lever to facilitate cartelisation and to obtain de facto exemption from EC competition law. When AD measures are taken against foreign imports, cartelisation took place among the domestic firms and domestic antitrust cases followed.

In chapter 5 which analyses the strategic effect of vertical integration on AD activities by domestic upstream firms, we present another new finding related to the conflict between the domestic antitrust laws and ADL. It shows that the dilemma of governments which face frequent AD actions by domestic input producers can be solved by softening legal requirements of vertical integration between domestic input and final good producers. It is shown that a strict domestic antitrust law against vertical integration between domestic input suppliers and final good producers in an industry where the domestic input producers resort to antidumping actions will be detrimental to the economy as a whole through two channels. First, vertical integration may not work as a strategic deterrent against AD actions if the perceived cost of vertical integration is too high due to strict regulations. Second, when vertical integration occurs, a strict regulation will reduce the number of vertically integrated firms and, thus, gains from vertical integration.

4.3.5. Evolution of ADL

Describing the problems of an AD system, Bhagwati (1992) states,

"... And new definitions of widening scope, of what constitutes unfair, 'unreasonable' and unacceptable trade can be invented in
unending improvisations. It is this other ugly face (of AD system) that we currently see and must fear. 

Apart from the 'big industry' argument which shows how politically strong industries use AD actions to acquire a stable form of protection, such as a VER, it is believed that administered protection measures, especially ADL, would invite less lobbying activities due to their rule-oriented nature. Looking back at the history of the evolution of ADL among countries, doubts about the supposedly rule-oriented characteristics of ADL naturally arise. Although the administrative nature of ADL seems to hinder lobbying efforts by the concerned industries in the short-run, lobbying activities may be concentrated on the modification of ADL over time into a more protective form through introduction of new cases and by loose interpretation of ADL.

Changes in injury criteria offer a good example of how the definitions of the words used in ADL have changed to favour AD petitioners. Anti-circumvention provisions (local content schemes), inclusion of selling-below-cost dumping, and primary producer provision are good examples of new cases in the AD system which enhance its protectionist nature.

When we compare the above changes with how AD clauses of more liberal nature, such as 'national interest' provision and 'sunset' provision, are used in the actual world, it is not too difficult to see that the changes in ADL have only one direction: towards a more protectionist regime. Many argue that 'national interest' provision is a dead provision except when downstream users are politically strong. It is similarly easy to see how the ambitious Australian experiment of 1988 ADL, where the most liberal 'sunset' clause\(^46\) is adopted, ended in a failure through intense lobbying activities by industries to remand it to one involving at least a level comparable to other countries'.

\(^{45}\) See The World Economy (1992) vol.15 p444

\(^{46}\) Following the recommendation of Gruen report (1986), the sunset clause was introduced in Australia in 1988 ADL. Most prominent features of the new sunset clause are:

1. AD measures will automatically be lifted after three years from the date of imposition.
2. AD measures imposed on the same good by subsequent AD actions against imports from other sources will be lifted on the same date. Therefore, the duration of AD measures is generally less than three years except for the original case.
4.4. Protection-induced protection

Hoekman and Leidy (1992) develop a model which shows how protection-induced protection occurs. They show that when an upstream industry succeeds in obtaining protection through AD actions, business activities of the affected domestic downstream industry will be adversely affected by an increase in the cost of production after the imposition of AD measures on imported inputs. This, in turn, will make downstream firms more likely to get protection afterwards. Ironically, the cost disadvantage of domestic downstream firms by the imposition of AD measures on imported inputs may make the firms more profitable once downstream firms succeed in AD actions against imports of final goods. Thus, contrary to previous views on conflicting interests between the two groups there may be a mutually beneficial range of AD activities by domestic upstream firms. When downstream firms also succeed in AD actions, benefits from AD actions to domestic upstream firms magnify through the increase in demand for the inputs by domestic downstream firms.

While above studies show how successful AD actions by upstream industries affect the probability of downstream industries in securing protection in an economy, Nogues (1991) shows how AD activities in a country may force the affected countries to take a protectionist trade policy. Nogues (1991) examines the country incidence of the US AD cases. He finds a high incidence of positive AD findings against South American countries among all AD cases. Considering the fact that those South American countries suffer from huge amounts of foreign debt, constraints imposed on their exports by the AD actions of the US industries will pose another threat to the countries in terms of reduced export earnings and will certainly trigger defensive actions by those countries to restrict imports to control their foreign debt. Thus, frequent AD actions in the US may also force defensive protection by foreign deficit-stricken countries, causing world trade to degenerate into a protectionist regime.
5. Empirical studies

Empirical works on AD activities can be divided into three broad categories: studies on (i) determinants of AD petitions by domestic firms and of positive decisions by the authorities, (ii) the effect of AD action on trade flows, and (iii) the political economy of ADL as a trade policy.

The questions asked in these studies can be summarised as follows.

i) Which industries are more likely to initiate AD actions against imports? Under what economic circumstances are industries more likely to get favourable decisions (and which industries)?

ii) What is the real effect of ADL on international trade flows?

iii) Is the AD system really rule-oriented or is there any evidence showing that the use of ADL's is influenced by political considerations?

5.1. Factors determining AD petition and AD decision

Various studies have examined the determinants of AD petitions by domestic industries. One major hypothesis tested under these studies is whether the tendency of AD actions by industries is related to the size of expected rent from AD actions. Obviously, market structure of industries matters. When the size of rent is large and if there is no free rider problem the industry would be more likely to use AD actions frequently. In other words, concentrated industries would be more likely to engage in AD activities.

Feinberg and Hirsh (1989) examine the incidence of LFV filing in the US and argue that the willingness to protect or create rents through the filing of LFV cases should be related to the cost and benefits of such activities. They ask which industries will be more likely to engage in such rent-seeking activities. They find that, contrary to the common belief, the filing activities are weakly related to market concentration and union coverage. Instead, it is closely related to capital intensity and employment change. Large
capital-intensive industries which face employment losses and rising import shares are found to be likely to file complaints. They argue that these results suggest that the major factors that give impetus to protection activities by industries are the protection of quasi-rents accruing to capital and labor, rather than monopoly rent.

Staiger and Wolak (1991) divide the AD process into three separate stages and asked when the industries are likely to file petitions and what is the effect of AD filing during the AD investigation process and after the final decision is made. They find that firms are more likely to lodge AD petitions when they are suffering from high level of imports and when the capacity utilisation level is very low. As found in other studies, they find that the uncertainty during the AD investigation period makes the volume of imports shrink to a sufficiently low level for the US firms to be temporarily relieved from injuries, even though the final decision turns out to be negative. But, the decrease in imports is not fully compensated by the increase of production of the US firms, leaving a substantial welfare loss to the consumers. They argue that the seemingly large gains to the firms from AD actions implies that a potential for abuse of the AD system exists.

Salvatore (1989), using highly aggregated data, found that the relative GDP growth of the US among the industrialised countries has a negative effect on the frequency of AD filings. When the economy is slow the number of AD filings increases and vice versa. Baldwin & Moore (1991) show that fluctuation of exchange rate is one of the most important factors increasing the dumping margin of the imports.

5.2. The real effect of ADL on trade flows

As mentioned earlier there are two opposing views on the effect of AD actions on trade flows. The first one argues that the detrimental trade effect of ADL is rather small because the country-specific nature of AD measures and the consequent trade diversion effect will alleviate any reduction in trade. But the other view is more concerned about the unobservable threat effect arising from the endogenous characteristics of AD
measures and argues that the overall welfare loss from the use of ADL will become larger when we take this effect into consideration.

Messerlin (1989)'s analysis of EC antidumping regulations during the 80's shows that antidumping actions sharply reduce import quantities subject to positive AD measures. He shows that the import volume in the first year of AD initiation, when generally definitive measures are unknown, is decreased by 18 percent. The import volume is decreased by one-third of the initial year three or four years later. Five years later, they were reduced to one half of the initial imports. Apart from reported high AD duty rates about four times higher than the MFN tariff rates, this large trade reduction effect shows that the threat posed by initial AD actions continues to exert its power against new entrants. At the same time, he shows that the sharp decrease in trade volume from the countries under AD measures are more than compensated for by the increase in both intra-EC trade and imports from non-dumping countries. A large trade diversion effect occurs for those products under AD measures.

Although the above finding confirms the belief that the effect of AD measures on trade flows is not so detrimental due to the trade diversion effect, one of the worries about the current AD system common to most of the existing literature is that the real effect of the AD system may be far greater than what is shown by simple AD statistics. They argue that the above optimistic view on the effect of ADL is based on observable statistical data and that it needs to be complemented by including the dynamic factor: the dynamic feedback effect between import penetration and AD petitions. In examining the 'harassment thesis' both Finger (1981) and Herander and Schwartz (1984) found that the number of affirmative findings as well as the number of complaints filed have negative effects on import penetration rates. Using firm level AD data during 1976-1981, Herander and Schwartz found that, because the probability of AD decisions is endogenous, foreign exporters that engage in dumping in the US market reduce dumping margins to lower the probability of i) AD actions, ii) affirmative findings by

47. It is not clear whether Messerlin (1989) takes the effect of protection-induced DFIs in his calculation.
the Commerce Department, or iii) causing material injury to US competitors. This confirms the belief that a mere threat of AD actions is sufficient to change the patterns of trade. The fact that a small group of firms in certain industries\textsuperscript{49} which are specialised in AD actions tends to initiate AD actions against all the potential foreign competitors makes the possibility of trade diversion less likely. When this tendency is combined with the cumulation principle employed in AD investigation, which makes it easier to find injuries to domestic industries by import competition, the prospect of trade diversion becomes less likely. Recently, questioning about the low estimates of the welfare effect of trade liberalization by previous studies, Trefler (1993) argues that the improper method adopted in those studies may have resulted in low estimates of welfare loss from protection. Using a simultaneous equation model, he shows that, when protection\textsuperscript{50} becomes endogenous, the welfare loss from the (possibility of) protection is about ten times larger than when we treat protection as an exogenous factor. That is, the prospect of future protection dampens the speed of increase in trade volumes among countries and this unobserved detrimental effect seems to be too large to be ignored.

5.3. Political economy of AD cases

In section 5.1, we summarised the results of empirical studies which show which industries (firms) are more likely to initiate AD actions. In this section, we summarise the empirical studies which test for any political bias by governments in providing AD measures to industries. The major difference between the traditional 'legislated' protection measures and the administered protection measures lies in the fact that administered protection measures are deemed to be politically neutral because their execution is based on rules rather than the political discretion of the legislators. Apart

\textsuperscript{49} AD statistics shows that chemical industries and steel industries are the most frequent users of the AD system in all of the four major users. A small number of firms in chemical industries, such as ICI both in the EC and Australia, initiate a large proportion of total AD actions in the industries. Those firms seem to be specialised in AD actions in securing protection and when they initiate AD actions, all the potential competitors (exporters) are included in each AD case leaving no room for the possibility of future trade diversion.

\textsuperscript{50} He included all the NTBs in this estimation including ADL.
from the fact that ADL itself is the outcome of the legislative process in the parliament, there have been doubts whether the AD system really works in a politically neutral ways. Indeed previous studies show that political considerations may work as an important factor in determination of AD cases in various routes.

It has been common knowledge that, when the unemployment rate is high, governments may use tariff protection as a tool to induce foreign direct investment in the economy\(^{51}\). One of the distinctive features of the evolution of ADL among countries is that current ADLs include an implicit local content scheme clause to prevent the "screw driver operation \(^{52}\)" by foreign exporters which are under AD measures. The implicit local content scheme in ADL is generally viewed as a protection measure to boost domestic employment. In Australia, in addition to the legal limit on the domestic value added to the total product value (25%), it is required that a substantial part of the manufacturing process for the production of the good has to be made in the territory, which inevitably requires a substantial level of employment of local labor. But, as Bhagwati (1988) has succinctly noted, the weakness of this type of policy using a threat of protection to induce DFI is that the host government may become a captive of firms at least for a period of time while firms recoup their investment\(^{53}\). Also, unless firms become efficient in international standard, the resource allocation of the host country will remain distorted. This means governments should have focused more directly on curing the underlying cause of such phenomena (unemployment etc.) rather than using trade restrictions to temporarily solve the problem. In addition, the beggar-thy-neighbour nature of the policy will certainly provoke retaliation by other countries.

While the above discussion shows how governments may use ADL as an industrial policy to boost employment, Finger (1981) asks whether final AD decisions are biased by other political factors. He finds that the size of the Less-than-Fair-Value (LFV) complainant industries which represent a higher voting power of the industry, rather

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\(^{51}\) See Bhagwati (1988) and Beldevous (1992)

\(^{52}\) When foreign exporters under AD measures set up assembly operations in the ADL-enforcing country to evade AD duties, the assembly operations are called screwdriver plants.

\(^{53}\) In the US, a Japanese DFI firm initiated AD action against imports from the subsidiary of a US multinational firm.
than the concentration ratio of industries, is more related to the high incidence of LFV petitions. Interestingly, the success rate of AD petitions is shown to be negatively related to the size of industries. He provides two alternative explanations for this finding. The first one is that AD cases may be terminated by the provision of alternative protection measures outside the AD system, such as the steel Trigger Price Arrangement, without reaching final decisions. The second one is that because such AD cases have a large influence on users and consumers in the economy, user groups and consumers are more aware of the result of protection to large industries. Therefore, those LFV petitions face strong resistance from them and it is difficult to expect a clear outcome. Another finding is related to the possibility of discrimination between developed countries and less developed countries (LDCs) under the LFV system. The result shows that while the number of LFV petitions against developed countries is high, the success rate of AD petitions (affirmative finding) is slightly higher when defendants are LDCs.

Finger et. al. (1982) examine the relationship between political influences and the success rate in the LFV mechanism. They divide the political influence variables into two sub-categories; international political influences and domestic political influences. International influence variables consist of export volume from US to the defendant countries and developed country (DC)/less developed country (LDC) division. They find that political variables become more significant in the political part of investigation (material injury determination) rather than in the technical part (pricing determination). Also, they find only domestic politics matters in the determination of AD cases.

Salvatore (1989) finds that the ratio of successful filings (affirmative findings) in the US is inversely related to the trade balance and the level of economic activity in the US. He also finds that the transition of AD administration in 1979 from the Treasury to the Commerce department which is thought to more represent narrow interest groups (industries) in the economy than the Treasury has positive relationships with both the frequency of AD filings and the ratio of success.

As argued in Baldwin and Moore (1991), in the domestic political arena of the US, Congress views ADL as a protection measure which allows Congress to exert its
influence on trade matters without any intervention by government. They analyse how the US Congress has influenced the formation and the administration of the US ADL through various routes. They illustrate four means of implementation of ADL: (1) change the provisions; (2) change the administering agencies (from Treasury to DOC in 1979); (3) change the administrative rules and regulations needed to carry out the provisions of the laws; (4) change the manner in which the rules and regulations are interpreted by the administering agency. They argue that while the executive branch has been pro-free trade during past decades, the changes and administration in ADL to a more protectionist direction came mainly from the Congress which is more sensitive to the pressure from local industries. The following statement by Senator Lloyd Bentsen shows why Congress had been the dominant force in shaping the legislation and influencing the direction of the application of ADL in the US.

"Not even the President has the authority to overrule that technical finding, and that is the way we want to keep it." 54

Moore (1992) examines the effect of institutional arrangements on the outcome of AD cases in the US. He asks whether the US ITC commissioners' decisions on dumping matters (injury determination) are influenced by political factors. While previous studies assumed that administrative agencies dealing with trade disputes by the authorisation of Congress may make decisions relatively free from political considerations and may function as important barriers between protectionist demands and vote-seeking politicians, Moore finds that the decision of ITC commissioners may be under political influence especially through the congressional oversight process. Using 304 AD cases of the US during 1980-1986, he finds that while decisions of ITC may have been consistent with the US ADL (rule-oriented decision), statistically significant coefficients of various political variables show that ITC decisions were also systematically favourable to firms with low-wage workers and low profit level 55 (substitute for

54. See Baldwin and Moore (1991) p256
55. These findings draw a striking contrast to the findings of Hutton and Trebilock (1990) which is based on Canadian AD experience. In their study, workers in those industries under AD measures receive
safeguard measures) or firms which are located at the constituencies of the Senate trade subcommittees which have direct influence over the ITC, and disadvantageous to cases involving LDCs. In addition to the above results obtained from using overall ITC decisions, using individual vote data of the commissioners, Moore also finds that Republican commissioners are more protectionist than Democratic commissioners. These results indicate that the composition of ITC membership is important in determining the result of material injury of AD cases.

Tharakan (1991a) raises allegations about the neutrality of AD cases from the political objectives of government in his study on EC AD cases. He is concerned with the way price-undertakings, which are thought to be more beneficial to exporters than the imposition of AD duties, are selectively accepted by the EC authority against different groups of countries. Allegations range from the trade tension hypothesis to the Japanese bashing hypothesis. He analyses factors which influence the acceptance of price-undertakings as final settlement measures for AD cases in EC. He argues that the EC Council used the choice of AD settlement measures as part of its trade policy. Contrary to Finger et al (1982), he finds that while the monitorability hypothesis is partly acceptable, other international political factors, such as trade tension, third country (LDCs), lobbying, and Japanese bashing, are all statistically significant. These results confirm the allegations that the EC uses the choice of settlement measures (price-undertakings vs. definitive duties) as a weapon to discriminate among countries according to its policy purposes.

6. Conclusion

higher than the national average wages of Canada. A most persuasive explanation for these differences may be found in Finger (1981) and Prusa (1992). Finger argues that, in the US, politically strong industries regard AD actions as a step to reach a higher order protection and Prusa reports that one-third of AD cases in the US are finalised by out-of-the-court settlements. Therefore, there remain doubts about these results in Moore's study.
As shown above, as conflicts surrounding the AD system have increased due to excessive use of ADL among countries, our understanding of dumping and the effect of ADL has grown. Contrary to previous beliefs on the purpose of dumping as predatory (a hypothesis which does not seem to fit well with the results of both theoretical and empirical studies) many studies show that normal business practices which are perfectly legal when they are made by domestic firms are subject to AD actions when they are followed by foreign exporters.

Existing studies do not provide any plausible evidence whether policy makers deliberately choose ADL as a reconciliatory trade policy to calm down domestic pressure groups rather than providing a high level of protection which will certainly provoke retaliation by other countries. What we have learned from the past AD experiences among countries is that whatever the reason a trade policy is chosen, it rarely works in the manner intended by the policy makers and it is almost certain to create another distortion. In the AD area, the prevalence of AD actions, alleged abuses of the AD system among major users and conflicts which arise from applying asymmetric competition rules against exporters have become important sources of international trade disputes among countries.

The survey of this chapter shows that, contrary to the low welfare loss estimates of previous studies based on static models, the dynamic and real effect of ADL seems to be far greater than what the statistical data of affirmative AD cases suggests. The role of the threat effect in changing trade patterns and in retarding growth of trade flows seems to be large enough to become a worrying aspect of the AD system.

Therefore, concern about the loss from potential abuse of AD system increases. It becomes even worse when we take into account the direction in which AD systems are evolving. In particular, current AD systems seem to conflict with the core principles of GATT- non-discriminatory multilateral trade liberalization. As emphasised by many authors, the wide-spread use of AD measures in politically selective ways and the high AD duty rates far above MFN tariff rates are the major threat to the principles of GATT.
As empirical researches have shown, given the political nature of protection it is
difficult to resist pressures from domestic industries during periods of recession. In the
domestic political arena, the fact that the administering bodies of the AD system
represent only narrow interest groups of the economy seemed to be an important factor
explaining the abnormally high AD incidence across countries.

Although we know that there may be nothing intrinsically unfair or predatory in
dumping behavior, given the fact that the introduction of GATT AD Code was the
product of political negotiations among countries to make the tariff reductions
acceptable, the argument that ADL should be repealed without any alternatives seems to
be unrealistic\textsuperscript{56} at least in the short run. Then what is the most realistic prescription to
remove the threat to international trade caused by the excessive use of ADL?

Baldwin and Moore (1991) have argued that the use of ADL by domestic industries
will eventually be decreased by the reaction from both internal and international
countervailing powers as follows: (1) the increase in multi-national firms and in
procurement arrangements among the internationally related firms will act as a
countervailing power to resist the frequent AD actions of domestic input producers and
(2) the tendency for more countries, which have never used ADL before, to adopt ADL
as a trade policy will hurt domestic exporters who will eventually lobby against the
excessive use of ADL by domestic import-competing firms.

But, given the fact that most of the successful AD users are large concentrated
industries and that it will take a long time for international pressures to become large
enough to offset the domestic firms' interests, solution by the above natural process
would seem unlikely.

Rather, because we know that the causes of the current problems and what is needed
to solve them, we might be able to concentrate effort on correcting the problems at their
source through international negotiations rather than resorting to the above natural and

\textsuperscript{56} Some authors, such as Barcelo III (1991), argue that the formation of regional trading blocs will
make countries use antitrust laws instead of ADLs for their intra bloc trade. If these regional trading
c blocs become larger, problems from the abuse of ADL will be reduced and, eventually, when the world
becomes one trading bloc, the problem will naturally be solved.
costly solutions. Considering the fact that, as we have shown in section 3, the alleged unfairness of dumping may not be adequate in explaining majority of dumping cases, suggestions by Messerlin (1990b) are worthy of our attention. Messerlin argues that the unfair trade law (ADL) should be merged into a fair trade relief (safeguard) mechanism. It seems that, if any type of consensus for this movement is attainable among countries, many of conflicts posed by current AD systems could be solved in a more harmonious fashion.

Firstly, the frequency of AD actions and the degree of AD penalties can be reduced significantly by this proposal for the following reasons.

- A more strict injury test procedure under new safeguard mechanism will result in less positive findings.
- A broader interest-based review of AD cases under the new safeguard mechanism will make the result less protective. When the possibility of retaliation by the defendant countries is taken into consideration in determination of AD cases as current safeguard mechanism operates, it will further reduce the room for protectionist bias.

Secondly, the selective nature of AD measures, which is the most talked-about source of conflict with GATT principles under current AD system, will disappear under the new safeguard mechanism.

Even if the proposed solutions cannot be implemented, there seems to be much room for improvement in the current AD systems through international negotiations. Considering comments by authors of previous studies, efforts should be made simultaneously both in international and domestic level to reduce the potential for the abuse of the AD system, to reduce the source of conflicts arising from applying different rules between domestic and foreign firms and to redefine a GATT consistent AD system through changes in GATT AD Code to reduce the trend of increasing reliance on the AD system as a cheap and effective substitute for traditional protection measures. Thus, it is inevitable to clarify and strengthen the role of GATT in AD matters from the administration to the surveillance of the functioning of AD systems among countries.
Also, as many have argued, establishment of a more broad interest-based panel seems to be required to deal with AD matters and to minimise the danger that governments become a captive of the AD system. Given that policy makers in democratic countries are susceptible to political pressure from domestic agents, establishment of such an institution will free up the government from such pressure. Only these 'simultaneous' reforms will make it possible to harmonise domestic and international conflicts through GATT by reducing the room for discretion of governments.
(Appendix) The effects of ADL under different behavioral assumptions

For simplicity, we abstract from the exporter's domestic market. We assume that the domestic market of the ADL-enforcing country is duopolistic; one domestic firm and one exporter in the market. When the exporter faces an endogenous probability of imposition of AD measures on its exports in the future, the profit maximisation problem of each firm in the current period can be written as follows.

\[
\max \Pi = R_1(i) + \delta (i, i^*) R_2^A + (1 - \delta (i, i^*)) R_2^f \\
\max \Pi^* = R_1^*(i^*) + \delta (i, i^*) R_2^A + (1 - \delta (i, i^*)) R_2^{f^*}
\]

where \(\Pi\) (\(\Pi^*\)) is the expected combined profit of the import-competing firm (exporter).
\(R_1(i)\) (\(R_1^*(i^*)\)) is the profit of import-competing firm (exporter) in the first period.
\(R_2^f\) (\(R_2^A\)) is the profit of the import-competing firm in the second period under free trade (AD measures).
\(R_2^{f^*}\) (\(R_2^{A^*}\)) is the profit of the exporter in the second period under free trade (AD measures).
\(i\) (\(i^*\)) represents the nature of competition.
\(\delta (i, i^*)\) is the perceived probability function of future protection (\(0 \leq \delta (i, i^*) \leq 1\))

We assume that the profit of the import-competing firm in the second period under AD measures is always higher than under free trade. For the exporter, the sign of profit differential between the two states depends on the nature of AD measures. For simplicity, we call AD measures which increases the expected profit of the exporter in the second period a soft AD measure and the other case a hard AD measure.

\(R_2^f < R_2^A\), \(R_2^{f^*} < R_2^{A^*}\)
From A.1 and A.2, we get the following f.o.c's.

\[ \frac{\partial \Pi}{\partial i} = \frac{\partial R_1(i)}{\partial i} + \frac{\partial \delta(i, i^*)}{\partial i} \left( R_2^A - R_2^f \right) \quad \text{(A.3)} \]

\[ \frac{\partial \Pi^*}{\partial i^*} = \frac{\partial R_1^*(i^*)}{\partial i^*} + \frac{\partial \delta(i, i^*)}{\partial i^*} \left( R_2^* - R_2^f \right) \quad \text{(A.4)} \]

The probability of future protection is mainly influenced by injury tests where the term injury in ADL includes all the symptoms of injured industries. Because firms know that the probability may be changed by their current production/pricing behavior, we may observe different types of equilibrium due to strategic reaction of firms under the prospect of future protection.

1) Quantity competition

When firms engage in quantity competition, the resulting equilibrium in the first period under the prospect of protection crucially depends on the nature of probability function \((\delta(\cdot))\) and the nature of AD measures.

For the import-competing firm, because its profit in the second period under AD measures is always higher than under free trade, it has an incentive to pretend to be injured. If market share is a critical factor that determines the probability of AD action \(\frac{\partial \delta(i, i^*)}{\partial i} < 0\), then the import-competing firm will reduce its output in the first period. But, if depressed price/profit (and/or dumping margin) is the critical factor \(\frac{\partial \delta(i, i^*)}{\partial i^*} > 0\), then the domestic firm will increase its output in the first period.

On the exporter's side, because an increase in export will increase the probability of future protection for both cases \(\frac{\partial \delta(i, i^*)}{\partial i^*} > 0\), the reaction of the exporter crucially depends on the nature of AD measures. If AD measures are expected to be soft, the exporter will increase its export volume, and vice versa.
2) Price competition

By the same token, when firms engage in price competition, the resulting equilibrium depends on injury criteria and on the nature of AD measures. If market share determines the probability, then the import-competing firm will raise its price. But, if depressed price/profit (and/or dumping margin) is an important criteria, it will lower its price. For the exporter, because an increase in its price will always reduce the probability of protection for both cases, the reaction of the exporter depends on the nature of AD measures.

All the possible outcomes are shown in Figure 2.
(Figure 2) Reaction of firms under the prospect of future protection

(1) Quantity competition

(1-a) market share criteria with hard AD measures

(1-b) market share criteria with soft AD measures

(1-c) depressed price (or dumping margin) criteria

(1-d) depressed price (or dumping margin) criteria

(2) Price competition

(2-a) market share criteria with hard AD measures

(2-b) market share criteria with soft AD measures

(2-c) depressed price (or dumping margin) criteria with hard AD measures

(2-d) depressed price (or dumping margin) criteria with soft AD measures

* R (R') represents the home firm's reaction curve under free trade (ADL).
* r (r') represents the foreign firm's reaction curve under free trade (ADL).
* F, A represents the equilibrium under free trade and under ADL respectively.
Chapter 3. The effects of antidumping laws: price-discriminating dumping

1. Introduction

Due to ongoing efforts through GATT negotiations, the role of tariffs as a trade protection device has declined considerably. At the same time, the use of non-tariff trade barriers, such as quotas, voluntary export restraints (VER's), antidumping laws (ADL), etc., has increased in the name of protecting domestic industries. Among these barriers, antidumping legislation has been an important weapon for certain countries as a protection measure for almost all the industries ranging from agricultural products to high-tech computer components. ADL limits price competition by foreign exporters. GATT article VI describes two types of dumping: price-discriminating dumping (traditional definition) and selling-below-cost dumping (modern definition). It both allows and restricts the imposition of AD duties according to the following rule: "In order to offset or prevent dumping, a contracting party may levy on any dumped product an anti-dumping duty not greater than the margin of dumping ...."

The analysis of price-discriminating dumping has a long history. Viner's (1923) classic analysis of dumping shows that a profit-maximising monopolist may engage in dumping when demand elasticities differ between countries. Contrary to the traditional one-way dumping, Brander and Krugman (1983) develop a model of reciprocal dumping. They show that when the home market and the foreign market are separate, the existence of above-normal profits and of positive transportation costs may result in reciprocal price-discriminating dumping. Other studies, such as Davies and Mcguiness (1982) and Hillman and Katz (1986) among others, show that firms may engage in dumping when firms face uncertainty about future demand conditions.

57. The US, the EC, Canada, and Australia are the four major users of ADL.
58. See Messerlin (1988) p95
While the above-mentioned papers mainly focus on the cause of dumping, in this chapter, we concentrate on the effect of ADL on firm behavior when a foreign exporter which is a monopolist in its domestic market engages in price-discriminating dumping. We are concerned with the following questions.

i) What is the effect of ADL on the price-discriminating exporter when the exporter abides by ADL?

ii) What determines the degree of price/production reaction of the exporter under the threat of ADL? Does the nature of AD penalties matter to the overall social welfare of the ADL-enforcing country?

iii) What is the strategic reaction of firms when firms face an endogenous probability of protection under ADL?

Previous studies related to our first question are Webb (1987, 1992). Using a three country model, Webb (1987) analyses the effect of ADL on the exporter's production location. He shows that, when the mobile exporter's production facility was initially located in a less efficient (high marginal production cost) country due to the existence of a tariff in that country (country 1), the enforcement of ADL by the home country (country 3) on imports may make the exporter relocate its export production facility to the third country (country 2) where the marginal production cost is lower. As a result, the price in the ADL-enforcing country may become lower than before the imposition of AD duties. Another study of Webb (1992) deviates from the traditional one-way dumping model by modelling an imperfectly competitive market structure in the ADL-enforcing country. Instead of assuming the existence of fringe firms in the importing country, he assumes that a foreign exporter competes with a home firm in the home market (duopoly). He shows how, when the exporter always abides by ADL, ADL may change firms' behavior and illustrates ambiguous welfare outcomes of AD enforcement under various assumptions on firms' behavior and on the nature of production technology. One of the interesting results of his model arises when the home firm acts as a Stackelberg leader. Even though Webb uses a static model, he shows that the
outcome of AD enforcement may result in de facto collusion between the two firms which is also a typical result in the two-period model with endogenous probability of protection developed in section 4 of this chapter.

Our analysis complements the results of the above studies. By using a price constraint and profit constraints on the foreign exporter, we show various potential outcomes including the possibility of specialisation of the exporter in either market and of direct foreign investment (DFI) in the home country.

This chapter sheds new light on question (ii) above. We develop a two-period Bertrand-Nash model which explicitly captures the threat effect of ADL and factors which determine the degree of change in the reaction of the foreign firm. Also, in contrast to the popular view of the welfare consequence of different AD measures, a view based on a static model, in a two-period model, the choice of AD measures may have less significance for the social welfare of the ADL-enforcing country than hitherto thought. In fact, the choice of different AD measures affects the import-competing firm's intertemporal profit rather than social welfare.

Recent studies, such as Leidy (1991), Leidy and Hoekman (1989, 1990a, 1991), and Fischer (1992) among others, have analysed the third question. They show that when the probability of protection becomes endogenous and when the injury criteria are perceived to be readily manipulable, the import-competing firm has an incentive to feign injury to secure future protection. While previous studies have assumed that only the probability of protection is endogenous, we incorporate another prominent feature of ADL that distinguishes it from other protection measures - specifically, we allow both the probability of protection and the degree of AD duties to become endogenous. When the probability of detection becomes endogenous, the home firm's reaction may depend on the perceived nature of injury criteria. Because the probability of future protection depends on firms' current activities, we may observe perverse outcomes under ADL. Under the depressed price/profit injury criteria, the home firm may initiate a price war during the initial period to raise the probability of future protection. Also, when the injury criteria is based on the home firm's market share in the home market, the outcome
may be de facto collusion between the two firms. While previous studies show that the import-competing firm has an incentive to reduce its output during the current period to increase the probability of protection, when the degree of AD penalty also becomes endogenous, the incentive for the home firm to feign injury will be dampened because a reduction in its current output will lower the expected AD duty rate.

The asymmetric competition rule under ADL confers a strategic advantage on the home firm. Similar to rent-seeking activities, the home firm may endure a loss in its current profit to secure future protection. The larger the profit differential between the free trade and AD situations, the more likely it is that the home firm will pretend to be injured during the initial period. Thus, the abuse of ADL is more likely to occur in concentrated industries. These perverse outcomes arise because of the ambiguous nature of injury criteria in ADL. We argue that the abuse of ADL as illustrated above can be reduced only when the injury criteria are tightened and when the causation test is strengthened.

The structure of this chapter is as follows. In section 2, we develop a basic model in which the foreign exporter always abides by ADL. We show that there are various outcomes depending on profit constraints of the exporter under ADL. In section 3, we extend the basic model to the case where firms face exogenous uncertainty of protection using a two-period model. We explicitly identify those factors which determine the degree of firms' reaction under the threat of ADL. Also, we show that the argument for a hard AD measure which generates tariff revenues may carry less weight in terms of the social welfare of the ADL-enforcing country when considered in a two-period framework. In section 4, we illustrate two cases where the import-competing firm may exhibit strategic pricing/production behavior to secure future protection. Section 5 summarises the results.

2. Model
We consider a two-country, two-firm model. We assume that the home and foreign markets are segmented. The foreign firm sells its product in both markets while the home firm sells only in the home market. Each firm produces a differentiated product which is an imperfect substitute for the other. Assume that firms exhibit Bertrand-Nash behavior in the home market where the foreign firm competes with the home firm and engages in dumping. Both firms have constant marginal costs, \( c^* \) for the foreign firm, \( c \) for the home firm. \( F_1^* (F_2^*) \) is the fixed cost of the foreign firm in the foreign (home) market. \( F_2 \) is the fixed cost of the home firm in the home market. We assuming that the foreign firm supplies both markets under free trade. Firms maximise profit from each market by choosing prices.

\[
\begin{align*}
\max_{p_1^*, p_2^*} & \quad \Pi^* = p_1^* q_1^* (p_1^*) + p_2^* q_2^* (p_2^*) - c^* \cdot (q_1^* + q_2^*) - F_1^* - F_2^* \quad \text{----- (1)} \\
\max_{p_2^*} & \quad \Pi = p_2^* q_2^* (p_2^*) - c q_2 - F_2 \quad \text{----- (2)}
\end{align*}
\]

Where \( p_1^* (q_1^*) \) is the foreign firm’s price (sales) in market \( i \).

\[ i = 1, 2 \quad 1 = \text{foreign market}, \ 2 = \text{home market} \]

\( p_2^* (q_2) \) is the home firm’s price (sales) in the home market.

\( \Pi^* (\Pi) \) is the foreign (home) firm’s profit.

2.1. Free trade equilibrium

From the above profit function, the foreign firm’s first order conditions for profit maximisation are as follows.

\[
\frac{\partial \Pi^*}{\partial p_1^*} = p_1^* \frac{\partial q_1^*}{\partial p_1^*} + q_1^* \frac{\partial q_1^*}{\partial p_1^*} - c^* \frac{\partial q_1^*}{\partial p_1^*} = 0 \quad \text{----- (3)}
\]

or, \( p_1^* \left( 1 + \frac{1}{\epsilon_1^*} \right) = c^* \quad \text{----- (3')} \)
The foreign exporter maximises its profit by equating marginal revenue (MR) from each market to its marginal cost (MC). From (3'), (4'), we know that the foreign firm engages in price-discriminating dumping when the price elasticity of demand for the good is less elastic in the foreign firm's domestic market. As mentioned, we assume that the foreign market is served solely by the foreign firm under the protection of the foreign government. As usual, we assume the following s.o.c's hold.

59. When the elasticity of demand for the exported good in the home market is less elastic, reverse dumping will occur. Because this is an uninteresting case for the analysis of the effect of ADL, we assume that reverse dumping never occurs.
\[ \frac{\partial^2 \Pi}{\partial P_1^2} < 0, \quad \frac{\partial^2 \Pi}{\partial P_2^2} < 0, \quad \frac{\partial^2 \Pi}{\partial P_2} < 0 \]

From (4), (5) we get reaction curves of firms in the home market. Let the reaction functions of the foreign firm and the home firm be denoted \( h^*(P_2), h(P_i) \) respectively. The slope of the reaction curves are both positive. In figure 1, the point F where \( h^*(P_2) \) intersects \( h(P_i) \) represents the free trade equilibrium.

2.2. The effects of antidumping laws: when the foreign exporter abides by ADL

When ADL is active in the home country and if the screening technology of the home government is perfect enough to force the foreign firm to abide by ADL, then the profit maximisation problem of the foreign firm becomes as follows.

\[
\max_{P_1, P_2} \Pi^* \\
\text{s.t. } P_1^* = P_2^* = P^* \quad \text{------ (6)}
\]

\[
P_1^* + P_2^* \geq \max (\Pi_1^*, \Pi_2^*) \quad \text{------ (7)}
\]

where, \( \Pi_1^* (\Pi_2^*) \) is the foreign firm's profit from the foreign (home) market under ADL and \( \Pi_1^* (\Pi_2^*) \) is the foreign firm's profit from the foreign (home) market under free trade.

(6) is the price constraint under ADL for the foreign firm. This says that the foreign firm must sell its product in both markets at the same price so that dumping never occurs. (7) is the profit constraint for the foreign firm to sell in both markets under ADL. For the foreign firm to sell in both markets under ADL, the combined profit of the

\[60\text{. Since the profit of the foreign firm under free trade is the unconstrained maximum profit, } \Pi_1^* \leq \Pi_1^*, \quad \Pi_2^* \leq \Pi_2^*.\]
foreign firm from both markets under ADL should be larger than the profit from either market under free trade. If this condition is not satisfied, the foreign firm will specialise in either market where the free trade optimal profit is larger. If we introduce the possibility of direct foreign investment (DFI), the foreign firm may relocate its export facility to the home country under certain conditions. Therefore, there are three possible outcomes as follows. i) When the profit constraint does not bind, the foreign firm will continue to sell in both markets. ii) When the profit constraint is binding, the foreign firm will specialise in either market according to the size of profit. iii) When direct foreign investment is allowed, the foreign firm may relocate its export facility to the home country and continue to supply both markets. For this to occur, profit from DFI strategy should be higher than those under i) or ii).

2.2.1. When the foreign firm continues to sell in both markets

When both markets are supplied by the foreign firm, its first order condition under ADL becomes

\[
\frac{\partial \Pi^*_1}{\partial P^*_1} + \frac{\partial \Pi^*_2}{\partial P^*_2} = 0
\]

--- (8)

where \(\Pi^*_1\) (\(\Pi^*_2\)) is the profit of the foreign firm in its domestic (the home) market under ADL.

Under ADL, prices should be the same in both markets. The foreign firm maximises its profit by choosing the price which yields the combined marginal profit from both markets equal to zero. Therefore, we have a new reaction function of the foreign firm \(h^*(P_2)\) in the home market. Slope of the new reaction curve of the foreign firm becomes
From (8) and (9), the new ADL equilibrium price is always higher than under free trade. Although the slope of the ADL reaction curve of the foreign firm depends on the curvature of the demand curves for the foreign good, from (9) and s.o.c’s, we know that it is always flatter than under free trade. This result says that when the profit constraint is not binding the change in the slope depends on the curvature of demand curves in both markets. We also know that the imposition of ADL does not have any effect on the home firm’s reaction curve \( h(P_2^*) \). The new ADL equilibrium of the foreign firm lies between the free trade monopoly price \( P_{2}^{m} \) in the foreign market and the free trade duopoly price in the home market \( P_{2}^{d} \).\(^{61}\)

\[
\frac{dP^{*2}_{A}}{dP_2}(h^*) = \frac{-\frac{\partial^2 \Pi^*_A}{\partial P^*_A \partial P_2}}{\left(\frac{\partial^2 \Pi^*_A}{\partial P^*_A^2} + \frac{\partial^2 \Pi^*_A}{\partial P^*_A^2}\right)} > 0 \quad \text{----- (9)}
\]

(Figure 2) When the foreign demand curve is convex

\(^{61}\) The kinked point of the foreign firm’s reaction curve under ADL occurs at the free trade price in the foreign market \( P_{1}^{*m} \). This is so because, by definition, the enforcement of ADL becomes a problem to the exporter only when the price in the export market is lower than its domestic market price.
Figures 2 and 3 show the changes of the foreign reaction curve relative to free trade. They show that the tariff equivalent of ADL varies according to the curvature of demand curves for the foreign good in both markets. If the demand curve for the foreign firm’s product in its domestic market is convex\(^62\), the new ADL equilibrium A in Figure 2 lies very close to the free trade equilibrium F. In this case, the tariff equivalent of ADL is relatively low. Prices, outputs, profits of both firms in the home market do not change much as a result of the imposition of ADL. Instead, the foreign firm adjusts its domestic market price. Price in its domestic market falls and the sales volume increases.

\[ P^*_2 \quad h^* \]

\[ h^A \]

\[ h^F \]

\[ P^*_2 \]

(Figure 3) When the foreign demand curve is not convex

When the foreign demand curve is not convex, the new equilibrium under ADL is not so close to the free trade equilibrium F. The tariff equivalent of ADL is relatively high. As shown in Figure 3, the price change (consequently the quantity of sales) of the foreign firm in the home market becomes larger relative to the case when the demand curve is convex. Also changes in domestic market price (sales) of the foreign firm are relatively small compared to the convex case. As illustrated above, it is a distinctive feature of ADL that it has an effect on the sales volume of the foreign firm both in the

\(^62\) Although we are allowing the demand curve to be convex, it should not be too convex, otherwise \( \Pi \) would be convex in \( P^*_2 \) (violating s.o.c.) and/or one of the reaction curves would become negatively sloped.
home market and in its domestic market. Also, the degree of reaction by the exporter depends on the curvature of demand curves in both markets. From the above results we know that, in general, ADL results in a loss for home consumers and a gain for foreign consumers.

2.2.2. When the foreign firm specialises in one market

When the profit constraint (7) is not satisfied, the foreign reaction curve is discontinuous and the foreign firm specialises in either market depending on the size of profits from each market. First, we explain the case when the home market profit of the foreign firm under free trade is larger than that of the foreign firm's domestic market. Figure 4 illustrates the result. As we move down along the new (ADL) reaction curve from the foreign firm's free trade foreign market monopoly price $P^*$ away from the initial free trade reaction curve, the profit level in both markets decreases. When selling in both markets under ADL becomes less profitable than the free trade profit from the home market, the foreign firm will specialise in exports to the home market. So there is a jump from the ADL reaction curve to the free trade reaction curve (discontinuous reaction curve). The new ADL equilibrium in the home market is the same as the free trade equilibrium. So the imposition of ADL has no effect on the home market price, sales and profit of both firms in the home market. But the foreign firm does not sell its product in its own domestic market. The opposite case occurs when the profit in the foreign firm's domestic market is larger. In this case, the foreign firm will cease to export to the home market after the imposition of ADL. It is better for the foreign firm to enjoy the monopoly profit from its domestic market rather than serving both markets.63 The home firm also becomes a monopolist in the home market. Consequently, although the production of the home firm may rise after the imposition of ADL, the overall consumption of the home country will decrease.

63. During the middle of the 80's, many AD cases in Australia were revoked because imports of those goods under AD measures ceased. Although it might have been caused by high AD duties, considering the fact the Australia is not a large market for most of exporters, those observations may be seen as an evidence to support our argument.
These results can be explained intuitively. If the profit of the foreign firm from the home market is relatively large and profit from one of the two markets is declining rapidly relative to the other, then the foreign firm will specialise in exporting as a result of the imposition of ADL, and vice versa. Since profit is (mark-up)x(sales), the result will depend on market size which determines the relative size of profit from each market. When the foreign firm’s domestic market profit is large, it degenerates into an autarky situation. When the home market profit of the foreign firm is large, the foreign firm will specialise in exporting. This suggests that if a country which imposes ADL is small and if the foreign firm has a larger market elsewhere, then ADL is more likely to make the foreign firm withdraw from the home market as it would under a prohibitive tariff. ADL is a very strong protection policy especially when it is used by a small country, because it may make the foreign firm withdraw from the home market even when the tariff equivalent of ADL is far below the actual prohibitive tariff rate. Therefore, it is more likely that the imposition of ADL by a small country will have a negative welfare effect, because it confers monopoly power on the home firm.

2.2.3. When direct foreign investment is allowed
In section 2.2.1 and 2.2.2 we analysed the effect of ADL when the foreign firm either sells to both markets or specialises in one market. In this section we consider another possible outcome of the enforcement of ADL where the foreign firm supplies the home market by direct foreign investment (DFI) in the home country instead of exporting to the home country. While the foreign firm's DFI decision may arise as an outcome of ADL enforcement by the home country, when the foreign exporter relocates its export facility to the home country, the existence of ADL never affects the price decision of the foreign firm in its domestic market\(^{64}\). The foreign firm can set its price in its domestic market at the monopoly price under free trade. Therefore, the foreign firm's combined profit under DFI becomes

\[ \Pi^* = \Pi_1^* + \Pi_2^* \]

where \( \Pi_2^* \) is the profit of the foreign firm in the home market\(^{65}\) under DFI strategy.

Therefore, when \( \Pi_2^* \) is larger than zero, the foreign firm will never specialise in its domestic market under ADL. The profit conditions for DFI to occur are as follows.

\[ \Pi_1^* + \Pi_2^* > \Pi_1^* + \Pi_2^*, \quad \Pi_1^* + \Pi_2^* > \text{Max} (\Pi_1^*, \Pi_2^*) \]

The above conditions tell us that, for DFI to be feasible, the profit from DFI should be higher than any other alternative strategies explained in 2.2.1 and 2.2.2. If these conditions are satisfied, the foreign firm will divide its production facility into two: one for its domestic market and the other for export market. It shows the possibility of ADL-

---

\(^{64}\) But it may affect the price decision of the foreign firm in the home market if there are local content provisions in ADL.

\(^{65}\) The DFI profit of the foreign firm in the home market (\( \Pi_2^* \)) may be affected by the increase not only in marginal production cost in the home market but in the fixed cost in the home market. Marginal production cost changes partly by the rule regulating the use of inputs (local content scheme). Also, the fixed cost of the foreign firm in operating in the home market is more likely to increase due to additional information costs or organisational costs, etc.
induced DFI\textsuperscript{66}. But the effect of DFI on the foreign firm's combined profit is different from existing results in the literature. Previous studies on DFI can be divided into two groups: tariff-jumping DFI\textsuperscript{67} and DFI to diffuse protectionist movement in the home country\textsuperscript{68}. The difference of results between the two groups and our result is that while DFI in the two previous groups of studies affects the profit of the foreign firm only in the home market, our result has DFI affecting profit of the foreign firm in both markets. This occurs because DFI in our model frees up the price constraint of the foreign firm in its domestic market by rendering it not subject to an ADL by the home country.

3. Two-period model with uncertainty

In the previous section, we analysed the effect of ADL when the foreign exporter always abides by ADL. In this section, we analyse the effect of ADL by using a two-period \((0, 1)\) model in which the foreign firm faces uncertainty\textsuperscript{69} about future protection under ADL. In the current period (in our model period 0) the foreign firm engages in trade with the home country under the prospect of AD protection. We assume that the probability of protection by the home government in period 1 is \(\phi (0 < \phi < 1)\). At the end of period 0, the result of an AD investigation is announced by the home government. If the foreign firm is detected dumping, the home government will impose dumping duties on imports from the foreign country proportional to the dumping margin of the foreign firm in the home market at period 0. If not, the foreign firm is in a free trade situation in period 1.

\textsuperscript{66} As mentioned, Webb (1987) illustrates the possibility of relocation of the whole production facilities by the exporter to a third country under ADL. In our model, the foreign exporter relocates only its export facility to the ADL-enforcing country under the threat of ADL. Also, while Webb (1987) shows an example of price fall in the ADL-enforcing country, in our model, the price in the ADL-enforcing country always rises compared to free trade. These results come from the relocation of production facility to a more efficient country in Webb's case and to a less efficient country in our example.

\textsuperscript{67} See Belderbos (1992) among others.

\textsuperscript{68} See Bhagwati, Brecher, Dinopoulos, and Srinivasan (1987) among others.

\textsuperscript{69} We assume that the foreign exporter continues to sell in both markets under ADL.
Two cases are considered; one in which the probability of protection $\phi$ is exogenously given and the other in which $\phi$ can be influenced by the actions of the firms and is thus endogenous. We proceed to analyse these cases in turn in this and the following section.

3.1. When the probability of protection is exogenously given

The foreign firm’s profit maximisation problem can be written as follows.\(^{70}\)

\[
\text{Max } \Pi_1^* = \Pi_0^* + \Pi_1^* = P_1^* Q_1^* (P_1^* ) + P_2^* Q_2^* (P_2^* , P_2) - c^* ( Q_1^* + Q_2^* ) \\
+ \phi (P_1^* Q_1^* (P_1^* ) + P_2^* Q_2^* (P_2^* , P_2) - c^* ( Q_1^* + Q_2^* ) - k (P_1^* - P_2^* ) Q_2^* ) \\
+ (1 - \phi ) (P_1^* Q_1^* (P_1^* ) + P_2^* Q_2^* (P_2^* , P_2) - c^* ( Q_1^* + Q_2^* ) ) \quad \text{----- (10)}
\]

where $k$ represents the degree of AD duty and the superscript represents the period.

As shown in (10), while the degree of dumping duties ($k$) and the probability of detection ($\phi$) are exogenously given, the dumping margin ($P_1^* - P_2^*$) becomes endogenous. The expected AD duty rate in period 1 depends on the pricing decision of the foreign firm in both markets in period 0. Also, the home firm’s profit maximisation problem becomes

\[
\text{Max } \Pi_1 = \Pi_0 + \Pi_1 = P_2^* Q_2^* (P_2^* , P_2) - c Q_2^* + \phi (P_2^* Q_2^* (P_2^* , P_2) - c Q_2^* ) \\
+ (1 - \phi ) (P_2^* Q_2^* (P_2^* , P_2) - c Q_2^* ) \quad \text{----- (11)}
\]

In period 1, because the result of the dumping investigation is already known to each firm, the foreign firm either trades freely or engages in trade with the home country.

\(^{70}\) For simplicity, we assume that the discount rate is zero.
paying dumping duty proportional to the dumping margin in period 0. Therefore, we get
the reaction curve of each firm at period 1 according to the outcome in period 0. The
effect of ADL on the reaction curves of both firms and the location of the new
equilibrium at period 0 are of interest. From (10), (11), we get the following set of
f.o.c.’s for period 0.

\[ \frac{\partial \Pi^*_1}{\partial P_{1*}} = Q_{1*}^* + P_{1*}^* \frac{\partial Q_{1*}^*}{\partial P_{1*}^*} - c^* \frac{\partial Q_{1*}^*}{\partial P_{1*}^*} - \phi k Q_{2*}^* = 0 \]  

----- (12)

\[ \frac{\partial \Pi^*_2}{\partial P_{2*}} = Q_{2*}^* + P_{2*}^* \frac{\partial Q_{2*}^*}{\partial P_{2*}^*} - c^* \frac{\partial Q_{2*}^*}{\partial P_{2*}^*} + \phi k Q_{2*}^* = 0 \]  

----- (13)

\[ \frac{\partial \Pi}{\partial P_{2}^*} = P_{2}^* \frac{\partial Q_{2}^*}{\partial P_{2}^*} + Q_{2}^* - c \frac{\partial Q_{2}^*}{\partial P_{2}^*} = 0 \]  

----- (14)

From (12), (13), because the foreign firm’s pricing decision in each market in period
0 affects its dumping margin, the foreign firm maximises its combined profit by setting
its marginal profit in its domestic (home) market in period 0 plus the expected increase
(decrease) in AD duties in period 1 to zero. (12) tells us that if the probability of
protection \( \phi \) is larger than 0, the foreign firm’s domestic monopoly price (sales) under
ADL will be lower (larger) than the free trade monopoly price (sales) level. The foreign
firm’s domestic price becomes lower as the probability of protection \( \phi \), the degree of
penalty on the foreign firm \( k \), and sales in the home market in period 1 \( Q_{1*}^* \) become
larger. From (13) we know that the export price of the foreign firm under ADL will
become higher than under free trade as the probability of protection \( \phi \), the degree of
penalty on the foreign firm \( k \), and sales in the home market at period 1 \( Q_{2*}^* \) become
larger. Also (14) shows that the home firm’s reaction curve remains the same as under
free trade.

We obtain the effect of an ADL on prices by simple comparative statics. First, from
the f.o.c’s, we get the new reaction curves \( h^A(P_{2}^*) \), \( h^A(P_{2}^*) \) in the home market. The
slope of each reaction curve is the same as under free trade. By totally differentiating (12), (13), (14) and rearranging them

\[
\begin{bmatrix}
\frac{\partial^2 \Pi^*_1}{\partial P^*_1 \partial^2} & 0 & 0 \\
0 & \frac{\partial^2 \Pi^*_2}{\partial P^*_2 \partial^2} & \frac{\partial^2 \Pi^*_2}{\partial P^*_2 \partial P^*_2} \\
0 & \frac{\partial^2 \Pi}{\partial P^*_2} & \frac{\partial^2 \Pi}{\partial P^*_2 \partial P^*_2}
\end{bmatrix}
\begin{bmatrix}
\frac{dP^*_1}{d\phi} \\
\frac{dP^*_2}{d\phi} \\
\frac{dP^*_2}{d\phi}
\end{bmatrix}
= \begin{bmatrix}
k Q^*_1 \\
-k Q^*_2 \\
0
\end{bmatrix}
\] ---- (15)

We know that the foreign firm's reaction curve shifts out as a result of an increase in \( \phi \) and the home firm's reaction curve remains unchanged. The slope of the reaction curves of both firms also remains the same as free trade. That is, the foreign firm raises its price in the home market in period 0 due to the expected dumping duty in period 1.

(16), (17), (18) show the changes in the prices after the imposition of ADL.

\[
\frac{dP^*_1}{d\phi} = \frac{k Q^*_1}{\frac{\partial^2 \Pi^*_1}{\partial P^*_1 \partial^2}} < 0
\] ---- (16)

\[
\frac{dP^*_2}{d\phi} = \frac{-k Q^*_2 \frac{\partial^2 \Pi}{\partial P^*_2}}{B} > 0
\] ---- (17)

\[
\frac{dP^*_2}{d\phi} = \frac{k Q^*_2 \frac{\partial^2 \Pi}{\partial P^*_2 \partial P^*_2}}{B} > 0
\] ---- (18)

where \( B = \frac{\frac{\partial^2 \Pi^*_1}{\partial P^*_1 \partial^2} \frac{\partial^2 \Pi}{\partial P^*_2 \partial^2} - \frac{\partial^2 \Pi}{\partial P^*_2 \partial P^*_2} \frac{\partial^2 \Pi^*_1}{\partial P^*_1 \partial P^*_2}}{\partial P^*_2 \partial P^*_2} \) > 0 from the stability condition.

Here, we have an explicit relationship involving the degree of dumping duty, the foreign firm's sales volume in the home market in period 1, and the curvature of demand curves on prices under the threat of ADL. When the exogenously given probability of protection \( \phi \) equals zero, it is a free trade situation. The results tell us that
the sales volume of the foreign good in the home market in period 1 affects changes in
the prices, consequently sales, in both markets. The larger the home market size in
period 1, the larger the fall (increase) in the foreign firm’s domestic (home) market price
in period 0. The more convex the foreign firm’s domestic demand curve, the larger the
fall in its domestic price. The higher the degree of penalty, the larger the fall in the
foreign firm’s domestic price and the larger the increase in the foreign (home) firm’s
home market price. Thus as well as the curvature of the demand curves faced by the
foreign firm in both markets (see section 2), we have additional factors affecting the
change of the foreign firm’s reaction curve. These are the curvature of the home firm’s
demand curve, the foreign firm’s sales volume in the home market, and the degree of
dumping duty.

3.2. Does the nature of AD penalty matter?

So far, we have assumed that AD tariffs proportional to dumping margins are imposed
on dumped imports. But, there is no restriction in the GATT AD Code on the nature of
AD measures. In practice, the choice of AD measures differs among countries and
cases. For example, while the EC uses not only AD tariffs but price-undertakings for a
large proportion of AD cases, in the US, AD tariffs equivalent to dumping margins are
imposed on all AD cases with positive findings. One of the controversies surrounding
the choice of AD measures among various alternatives is that a less strict form of AD
measures, such as price-undertakings, is detrimental to the welfare of the ADL-enforcing
country compared to imposition of AD tariffs. Some argue that the AD
authorities should use AD tariffs as the settlement measures of AD cases because it
would generate tariff revenues instead of conferring all the rents accruing from
protection to foreign firms as in price-undertakings. The following statement in Gruen
(1986) clearly shows how popular this argument is even to economists71.

71. In Australia, AD cases with positive findings can be settled by either imposition of AD tariffs (floor
price) on imports or by price-undertakings. But the amount of AD tariff revenues is very small because
tariffs are imposed when the price of imports exceeds the floor price set by the authority. Therefore,
when a floor price is set, exporters will export at a price not lower than the floor price.
Furthermore when exporters increase the FOB price until it is equal to the normal value Australia loses income which it would not lose if the reduction of imports was brought about by an increase in tariffs. As the Chairman of the IAC pointed out in his submission 'These transfers to overseas producers can be substantial. In its anti-dumping report on Polyvinyl Chloride Homopolymer the Commission estimated that anti-dumping action has resulted in a loss to Australia over $1 million. ...' 72

Figure 5 shows the basis of the above argument. In Figure 5, $D(Q^*)$ is the demand curve for imports in the home market. $P^*, P_t$ represent the free trade price of imports and the price of imports under AD measures respectively. The above argument claims that the potential tariff revenue of area $P^*TAP^*$ in Figure 5 is lost by the use of soft AD measures which allow exporters not to pay AD tariffs when they export at a price not lower than $P^*$. 

This claim seems to hold in a static world. In the actual world, exporters face uncertainty about future protection by the home government. The true nature of ADL and the effect of different AD measures on social welfare can be captured by analysing the firms' intertemporal profit maximisation problem. The above claim may be less convincing in the context of a two-period model in which firms have perfect information about the nature of AD measures. As shown in section 3.1, the production decision of firms under the prospect of protection differs from the production level of firms' static short-run optimal production level. The results in section 3.1 show that the production decision of exporters depends upon not only the probability of protection but also the nature of AD measures which affects the future profit of exporters. Thus, exporters' response to the threat of AD actions differs under different AD measures. When hard AD measures, such as imposition of AD duties (which reduce exporters' future profit more than other soft measures) are expected to be imposed on imports from the foreign country in the future period, the current level of imports will be lower than when the expected AD measure is a soft one (such as price-undertakings). Thus, current prices of

72. See Gruen (1986) P. 26. A similar argument can be found in Tharakan (1991a) in the EC AD context.
imports under the prospect of a hard AD measure will be higher than under a soft measure. Therefore, the expected gains from tariff revenues under a hard AD measure in the static model may be dissipated by the loss of social welfare during the current period from the current price increase of imports.

(Figure 5) Choice of AD measures and the rent shifting effect

The above discussion shows that the overall (intertemporal) welfare effect of AD measures may not be as sensitive to the particular choice of measure as previous arguments based on a static model have suggested. Also, it is easy to see that, when a hard AD measure is expected to be imposed on imports from the foreign country, import-competing firms can increase their outputs/profits during the current period at the

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73. Actually, the outcome depends on market structures. When the market structure becomes oligopolistic, the effect on social welfare becomes more complicated. Changes in the expected AD measures affect not only the current price of the good but the profit of import-competing firms.
expense of consumers and exporters. Thus, income redistribution occurs in favour of import-competing firms even before AD measures are actually imposed.

The GATT AD Code states that AD measures may be taken to remove injury to domestic industries incurred by the alleged imports within the range of actual dumping margins. As we have seen from the above analysis, hard AD measures seem to be doing more than what is required to remove injury to domestic import-competing firms. The use of hard AD measures provides excessive protection even before they are actually imposed. Thus, trade flows will be further restricted. More importantly, we argue that the real problem arises when governments deliberately use different AD measures to different groups of exporters in a selective way\textsuperscript{74}. This is a problem because it directly contradicts the non-discrimination principle of GATT.

4. Endogenous probability of protection

In 3.1, we assumed that the probability of protection is exogenously given. Under this assumption, we were able to show that the prospect of AD protection and the endogenous rate of AD duties under ADL make the exporter reduce exports (threat effect). In addition to this threat effect under the prospect of protection, the possibility of abuse of ADL by import-competing firms has been a problem under the current AD system. As shown in Leidy (1991), Leidy and Hoekman (1989, 1990a, 1991) and Fischer (1992), because the injury criteria is perceived to be readily manipulable by firms, especially when they have market power, the reaction of firms under ADL may produce perverse outcomes. The ambiguity of material injury criteria and a weak causation test requirement seem to create a more serious problems for policy makers. In the following sections, we analyse how the endogenous probability of protection (\(\phi\)) creates an incentive for import-competing firms of the ADL-enforcing country and how

\textsuperscript{74} There have been such allegations about the abuse of AD system by the EC Council. Tharakan(1991a) examines those hypotheses related to various allegations.
import-competing firms exploit the manipulable injury criteria to increase the probability of future protection.

4.1. Material injury and causation test

GATT allows signatories to impose AD duties when the investigation into AD cases concludes with positive findings on the following three factors; existence of dumping by exporters, injury to domestic industries, and evidence of causation. As previous studies showed, among these requirements, proving injury seems to be the key for import-competing firms to secure protection. Problems may arise due to the ambiguity of definitions of material injury to domestic industries in ADLs. For example, the Australian AD legislation lists non-exhaustive factors which can be considered in determining the existence of material injury. These factors include the quantity of imports, the changes in the market share of the imports, the price difference between imports and Australian goods, depressed price/profit of the import-competing industry, and other relevant economic factors in relation to the Australian industry, etc.

Increased competition by imports will inevitably result in reduction of sales and consequent financial pressure to import-competing firms whether the competition arises from fair trade or not. If import-competing firms have some market power, those injury criteria may become manipulable. In this environment, the prospect of protection under ADL affects domestic firms' production decisions. Therefore, intertemporal-profit-maximising domestic firms may find it profitable to pretend to be injured to increase the probability of imposition of AD measures. The loss of profits in the current period can be more than compensated for if AD measures are taken in the future. The ambiguous nature of injury criteria, which are a collection of all the possible symptoms of injured industries, makes it difficult to determine whether the injury is genuine or spurious. Also, considering the fact that the causality test requires that the dumped import is 'a' factor for the injury (not 'the major' factor), it may not be too difficult to find some
degree of causal relationship between the increased imports and the injuries incurred by the domestic industries.

4.2. Examples of incentive effect under ADL

Given the possibility of spurious injury by import-competing firms arising from the ambiguity of injury criteria, we now proceed to illustrate two examples of perverse outcomes with different injury criteria assumptions for the separate cases where: (a) firms produce differentiated goods; and (b) they produce a homogeneous good. While previous studies were concerned with the case where only the probability of protection is endogenous, we now allow that both the probability of protection and the expected AD penalty to be endogenous. In our homogeneous good case, contrary to the results of previous studies which assume that only the probability of protection is endogenous, we show that the probability of feigning injury by the import-competing firm and the chance of ex-ante collusion under the prospect of AD protection is not as high as in previous studies.

4.2.1. Differentiated good: Bertrand-Nash behavior

We consider the case where depressed price/profit of the import-competing firm is perceived to be the critical factor to determine the existence of injury. The home firm knows that its price/profit in period 0 will affect the export price of the foreign firm in the home market by affecting the probability of protection in period 1. Also given the fact that the two goods are substitutes, the export price of the foreign firm will have an effect on the probability of protection through changes in the price/profit of the import-competing firm. Therefore, the probability function can be written as follows.

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75 This is the essence of the 'margin analysis' frequently used in the US in determining the existence of injury. The logic of margin analysis is that a larger dumping margin would cause a greater injury to import-competing firms. For a detailed explanation, see Kaplan (1991)
\[ \phi = \phi(P_q^*, P)^* \]

where, \( \frac{\partial \phi}{\partial P^*_q} < 0, \frac{\partial \phi}{P^*_q} < 0, 0 \leq \phi \leq 1 \)

These conditions show that the probability of protection becomes lower as prices of firms in period 0 become higher. In other words, whoever initiates it, a price war will always increase the probability of protection.

Then, the foreign firm’s profit maximisation problem becomes

\[
\text{Max } \Pi^*_f = \Pi^0 + \Pi^1 = P^*_q Q^*_q \left( P^*_q \right) + P^*_q Q^*_q \left( P^*_q, P^*_q, P^*_q \right) - c^* \left( Q^*_q + Q^*_q \right)
\]

\[ + \phi \left( P^*_q, P^*_q \right) \left( \Pi^A^1 - \Pi^F^1 \right) + \Pi^F^1 \]

----- (19)

where \( \Pi^A^1 \): profit of the foreign firm at period 1 under AD measure

\( \Pi^F^1 \): profit of the foreign firm at period 1 under free trade

\[ \frac{\partial \Pi^A^1}{\partial P^*_q} < 0, \frac{\partial \Pi^A^1}{\partial P^*_q} > 0, \Pi^A^1 - \Pi^F^1 < 0 \]

The home firm’s profit maximisation problem becomes

\[
\text{Max } \Pi_h = \Pi^0 + \Pi^1 = P^*_2 Q^*_2 \left( P^*_2 \right) - c^* Q^*_2 + \phi \left( P^*_2, P^*_2 \right) \left( \Pi^A^1 - \Pi^F^1 \right) + \Pi^F^1 \]

----- (20)

where \( \Pi^A^1 \): profit of the home firm at period 1 when AD measure is imposed on imports.

\( \Pi^F^1 \): profit of the home firm at period 1 under free trade

\( \Pi^A^1 - \Pi^F^1 > 0 \)

We get the following set of f.o.c’s for period 0.
\[
\frac{\partial \Pi}{\partial P_1^*} = Q_1^* + P_1^* \frac{\partial Q_1}{\partial P_1^*} - c \frac{\partial Q_1}{\partial P_1^*} + \phi \frac{\partial \Pi}{\partial P_1^*} = 0
\]  \hspace{1cm} (21)

\[
\frac{\partial \Pi}{\partial P_2^*} = Q_2^* + P_2^* \frac{\partial Q_2}{\partial P_2^*} - c \frac{\partial Q_2}{\partial P_2^*} + \phi \frac{\partial \Pi}{\partial P_2^*} (\Pi^{A1} - \Pi^{f1}) = 0
\]  \hspace{1cm} (22)

\[
\frac{\partial \Pi}{\partial P_2^0} = P_2^0 \frac{\partial Q_2}{\partial P_2^0} + Q_2^0 - c \frac{\partial Q_2}{\partial P_2^0} + \phi \frac{\partial \Pi}{\partial P_2^0} (\Pi^{A1} - \Pi^{f1}) = 0
\]  \hspace{1cm} (23)

From (21),(22), we know that the foreign firm will lower its current domestic market price to reduce the dumping margin which affects the degree of AD duties and consequently the profit level in period 1 as in the exogenous probability case. It will raise the export price both to reduce the probability of future protection and the degree of AD duties. (23) shows that the home firm has an incentive to lower its price in period 0 to raise the probability of detection.

(Figure 6) Differentiated goods case

As shown in Figure 6, the result of ADL on prices in the home market and on the probability becomes ambiguous. But, when the demand for the foreign good in the
home market is convex, then the probability of detection is more likely to decrease. Also, the higher the degree of dumping duty and the larger the profit differential of the foreign firm from the home market, the more likely is it that the probability will decrease. If the foreign firm's domestic demand is convex and if the home firm's profit differential (between the duopoly profit when the foreign firm pays the dumping duty and the free trade duopoly profit) in period 1 is large, the probability of detection in period 0 is more likely to increase.

It looks as if the home firm is setting a trap to induce the foreign firm into dumping by lowering its price in the initial period. In other words, the home firm exploits the asymmetry of ADL. Contrary to the common belief that ADL exists to regulate the predatory behavior of the foreign exporter, the home firm may sell its product below cost (predatory pricing behavior) in period 0 to get a higher profit in period 1. While a firm with dynamic returns to scale can lower its future production cost by increasing its current production, we do not have such a beneficial effect in this case (see chapter 4). When a protection policy is imposed in the future period, the output of the home firm may decrease. As is the case with rent-seeking activities, the home firm endures loss of current profit to secure future protection. The higher the profit differential in period 1 (between the two states when the foreign firm pays the dumping duty and when it trades freely), the lower its price in period 0. When the industry is competitive the benefits from future protection are zero. These results suggest that the manipulation of ADL by the home firm(s) is more likely to occur in a concentrated industry.

4.2.2. Homogeneous good: Cournot-Nash behavior

In this section, we analyse the effect of ADL on the behavior of firms where firms produce a homogeneous good and exhibit Cournot-Nash behavior. We consider the case where the market share of the import-competing firm is perceived to be the critical

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76. As analysed in section 2.2.1, the change in export price of the foreign firm depends on the curvature of demand for the foreign firm's product in both markets. If the demand for the foreign good in the home market is convex, the foreign firm's export price will rise more than when it is not.
factor determining the existence of injury. The probability function can be written as follows.

\[ \phi = \phi(Q_0^*, Q_2^*) \]

where, \( \frac{\partial \phi}{\partial Q_2} < 0, \frac{\partial \phi}{\partial Q_0} > 0, 0 \leq \phi \leq 1 \)

Then, the foreign firm's profit maximisation problem becomes

\[
\text{Max } \Pi_T^* = \Pi_0^* + \Pi_1^* = Q_1^* P_1^* (Q_1^*) + Q_2^* P_2^* (Q_2^*, Q_0^*) - c^* (Q_0^* + Q_2^*)
\]

\[ + \phi (Q_2^*, Q_0^*) (\Pi_A^* - \Pi_f^*) + \Pi_f^* \]

where \( \frac{\partial \Pi_A^*}{\partial Q_1^*} > 0, \frac{\partial \Pi_f^*}{\partial Q_0^*} < 0, \Pi_A^* - \Pi_f^* < 0 \)

The home firm's profit maximisation problem becomes

\[
\text{Max } \Pi_T = \Pi_0 + \Pi_1 = Q_2^* P_2^* (Q_2^*, Q_0^*) - c^* (Q_0^* + Q_2^* + \phi (Q_2^*, Q_0^*) (\Pi_A - \Pi_f) + \Pi_f^* \]

where \( \Pi_A - \Pi_f > 0 \)

We get a new set of f.o.c's for period 0.

\[
\frac{\partial \Pi_T^*}{\partial Q_1^*} = P_1^* + Q_1^* \frac{\partial P_1^*}{\partial Q_1^*} - c^* + \phi \frac{\partial \Pi_A^*}{\partial Q_2^*} = 0 \quad \text{----- (24)}
\]

\[
\frac{\partial \Pi_T^*}{\partial Q_2^*} = P_2^* + Q_2^* \frac{\partial P_2^*}{\partial Q_2^*} - c^* + \frac{\partial \phi}{\partial Q_2^*} (\Pi_A^* - \Pi_f^*) + \phi \frac{\partial \Pi_A^*}{\partial Q_2^*} = 0 \quad \text{----- (25)}
\]
As in the previous example in 4.2.1., as shown in (24), (25), the foreign firm increases its sales in its domestic market to reduce the dumping margin which affects the degree of AD duties and consequently the profit level at period 1. It will reduce its export volume both to reduce the probability of future protection and the degree of AD duties. The difference between this case and previous studies is due to the reaction of the import-competing firm as shown in (26). (26) shows that we have an extra term, \( \phi \frac{\partial \Pi_{A1}}{\partial Q_2} \), whose sign is positive. While the home firm has an incentive to reduce its output in period 0 to raise the probability of detection, a reduction of current output will reduce the size of the AD duty to be imposed on imports from the foreign country in period 1.

(Figure 7) Homogeneous good case

This dampens the incentive for the home firm to feign injury. The inward shift of the home firm's reaction curve is not as large as that of previous studies which assume that the production decision of firms during the current period does not affect the expected gains from protection. Figure 7 shows the results.

77. AD cases can be settled by various methods. While, in the US, all the AD cases with positive final findings are settled by imposition of AD duties of the full dumping margin, price-undertakings and floor
As shown in the above two examples, the detrimental effects of ADL are not restricted to those cases where AD measures are actually imposed. Also, what we have learned from this analysis is that, whatever the original purpose of governments for granting such protection, when there exist readily available institutional arrangements and when the criteria for injury determination is seen to be manipulable by import-competing firms due to loose definitions, firms may have an incentive to pretend to be injured. The second case shows that the mere existence of ADL may lead to de facto collusion between firms even before AD measures are actually imposed. Thus, it is clear that the domestic import-competing firm has every incentive to pretend to be injured (spurious injury) to create ex-ante collusion, ex-post tariff protection, and, in some cases, ex-post collusion.

These problems can be cured only when the injury criteria in ADL are strict and when the causation test in AD cases is strengthened. For example, in the second case, if injury criteria are strengthened such that not only output/market share criteria but depressed price/profit have to be shown to satisfy the injury test, import-competing firms may never be able to feign injury. Also, in the first case, the import-competing firm is shown to initiate a price war to create future protection. If the causation test of AD cases is strict, import-competing firms would not initiate a price war to create future protection.

5. Conclusion

In this chapter, we have analysed the effect of AD enforcement on firms' behavior when the foreign exporter engages in price-discriminating dumping. Apart from the fact that ADL is a low track protection measure allowed by GATT, our results suggest that its discriminating and non-revealing nature may have been one of the reasons for the wide use of ADL in some countries. As shown in section 2, the existence of ADL price schemes, where the size of dumping margin has less effect on the outcome, are used in most cases in the EC and Australia.
causes not only reduction in trade volumes but, in some cases, inefficient allocation of resources to less efficient countries.

It was demonstrated that the effect of ADL on the reaction of firms crucially depends on the curvature of demand curves in both markets and the size of the home market both when the foreign firm actually abides by ADL and when the firms face uncertainty. Also, it was shown that the argument for the introduction of hard AD measures on the ground of social welfare of the ADL-enforcing country may have no economic sense once we introduce a two-period model which can better serve to capture the real characteristics of ADL. If firms have perfect information about the nature of future protection, the gains from tariff revenues in a static model will dissipate due to the increase in current price of imports.

When the probability of ADL becomes endogenous, the intertemporal-profit-maximising home firm may exhibit perverse reactions to secure future protection. Contrary to the original purpose of preventing injuries to domestic industries by unfair trade, ADL might be used by the home firms to create protection. Our results show that when the injury criteria can be manipulated by firms, it may create another distortion in the economy either by allowing the home firm to engage in predatory pricing strategy or to use ADL as a tool to create a quasi-cartel with exporters even before protection is actually granted. Given the fact that the incentive for import-competing firms to engage in such rent-seeking behavior will certainly increase as the perceived probability of protection under current AD system becomes higher, a more strict injury test and causation test seem to be needed to discipline import-competing firms.
Chapter 4. Learning-by-doing and the effects of antidumping laws under incomplete information

I. Introduction

The semi-conductor industry is an industry where the production technology of firms exhibits a learning-by-doing effect (LBD). Apart from the fact that a typical firm in this industry incurs a high up-front cost (e.g., R&D costs), the most striking feature of firms in this industry is that their marginal production cost is dramatically reduced as the level of cumulative outputs increases. Because a unit increase in current production of a firm reduces its future marginal production cost, a firm with LBD effect will produce more than the short-run profit-maximising production level of firms with constant returns to scale production technology. The current production level affects the accumulated output, and, through it, future costs and market positions of firms. Therefore, selling-below-cost dumping may occur during earlier periods of the product life cycle to gain experience. Characteristics of the semi-conductor industry and the importance of LBD effect are well described in Baldwin and Krugman (1988) and Dick (1991). In the semi-conductor industry, several products of different generations (e.g., 64K, 254K, 1MB) are produced and traded at the same period of time. Each product is located at different stages of learning. Some of them are relatively new, while others relatively old. A new product, presumably, will have a higher learning effect while an old product has a lower learning effect. The stage of learning of a product may be approximated in a model by changing the size of learning coefficients. Because, in a dynamic returns to scale industry, production (trade) of different generations of product occurs simultaneously, the effect of policy may be different among different generations of products unlike the case where the industry exhibits a constant returns to scale (CRS) production technology. This interesting feature of the industry demands that special attention be given to the effect of trade policies, such as antidumping laws (ADL).
Most previous research on the effect of ADL in an industry with LBD effect is based on trade disputes between the US and Japanese semi-conductor industries. Recent developments in these disputes between US and Japanese firms can be summarised as follows. Petitions based on section 301 and ADL which demand investigation into the alleged market closure of the Japanese domestic market against the US semi-conductor firms and the LFV (less-than-fair-value) sales by Japanese firms in the US market were simultaneously initiated by US firms and by the US Department of Commerce (DOC) against Japanese firms during 1985-1986. As a result, comprehensive arrangements which regulate both the trade of semi-conductor products between Japan and the US and sales by Japanese producers to third country markets were reached between the two governments. The semi-conductor agreements show several distinctive features. First, the arrangements cover not only the trade between Japan and the US but also the trade between Japan and third countries to prevent circumvention by Japanese producers. Second, pending the antidumping investigations on Japanese semi-conductor products, they reached unusual price arrangements for trade of semi-conductor products which include not only those currently traded but also those yet to be produced. As in the case of the Trigger Price Mechanism in the steel industry, MITI of Japan reports the semi-annual accounting data of Japanese firms to the US DOC. The US DOC sets floor prices for each product and reserves the right to initiate an investigation whenever there exists suspicion about dumping by the Japanese firms. In addition, the US government asked the Japanese government for a certain market share of the US products in the Japanese domestic market.

The Japanese domestic market share requirement reflects the suspicious attitude of the US government toward the alleged closed Japanese market against foreign firms. The closed market argument has long been the major source of demand for actions of the US government by the US firms. The overall strategy of the US government seems to

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closely follow the results of the strategic trade policy literature, such as Krugman (1984), Baldwin and Krugman (1988) among others, and if the closed market hypothesis is true, in theory, the arrangements may be seen as an attempt to come closer to free trade compared to the alternative, imposition of dumping duties which might provoke a trade war.

However, considering the nature of the products which are normally sold below the current marginal (average) production cost, the semi-conductor arrangements raise two fundamental questions about the real effect of protection measures:

i) What is the effect of ADL in an industry with a learning-by-doing effect?

ii) How can we reconcile the discrepancy between the evolution of Japanese firms' market share in the US market and the theoretical prediction of firms' production behavior in LBD industries?

The first question is related to the asymmetric rule of competition set by the arrangements. Like price-undertakings, the arrangements regulate the pricing of the Japanese products in the US market. While recent research on price-undertakings by foreign exporters suggests potential gains to exporting firms through rent-shifting (resulting from the price increase), we find that rent-shifting never occurs in an industry which exhibits LBD. Using a simulation approach we show that, when the foreign exporter specialises in exports to the home market, the asymmetric rule fundamentally changes the production strategy of firms with LBD effect. When firms exhibit CRS production technology, the use of the shut out (S/O) production strategy by the home firm in the ADL-enforcing country requires that the home firm has a lower production cost than its rival. But, when the industry exhibits dynamic returns to scale, the home firm will use the S/O production strategy even when there exists no cost differential

79. The conditions for the use of the S/O strategy by the home firm in CRS industry is derived in the appendix.
between them. The home firm enjoys an absolute advantage of production in the one country case by using ADL to put the foreign rival at a cost disadvantage.

When it is extended to the case of two countries with the same domestic market size, a mutual imposition of ADL will be the result. When there is no below-cost dumping between countries, firms are locked in a prisoners' dilemma because of the changed competition rule. Firms are forced to produce beyond the total free trade production level during the current period. This increase in total output raises the social welfare of both countries. The detrimental effect of ADL appears when there exists selling-below-cost dumping. The use of ADL decreases the total output level and a huge redistribution of income occurs from consumers to firms. While ADL may increase social welfare when there is no dumping, the asymmetric nature of ADL, which prohibits the foreign firm from engaging in the normal trade practice of the industry, greatly reduces the potential gains from free trade by reducing the speed of learning in the case where there exists selling-below-cost dumping.

Furthermore, the potential gain from the no below-cost dumping case is likely to be reduced when we allow for the fact that the inclusion of a 'normal profit' into the calculation of the constructed price (floor price) is the general practice adopted by the US DOC. It further reduces total output of firms for the relatively new products that are normally sold below cost during the initial period of their life cycle. Also, for old products where below-cost dumping does not occur, price arrangements above firms' current marginal cost may make firms escape from a prisoners' dilemma by allowing them to produce less while maintaining a monopoly position in their own domestic markets. This, in turn, further distorts the distribution of income in favour of firms. As Gruenspecht (1988) has noted, it looks as if firms are aligned together by successfully implementing ADL in both countries at the expense of consumers.

The second question comes from the discrepancy between the theoretical prediction of the production strategy of firms with learning-by-doing effect and the historical evolution of trade in the semi-conductor industry in the US market. According to the
literature on LBD (eg Spence (1981)) firms with the same production technology will produce at the same level, where marginal revenue of a firm is equated to the most efficient marginal production cost (MEC) which is often below the current marginal production cost at earlier stages of learning. This means a firm with a lower MEC will be a dominant supplier of the good. Also, the dominant incumbent may have a cost advantage to deter the entry of new firms in the industry. Furthermore, the existence of ADL confers a huge strategic advantage on the intertemporal-profit-maximising home firm of the ADL-enforcing country, increasing its market share against its foreign rival even when firms have an identical most efficient cost. But, in the real world, we find that the predicted aggressive production strategy by the US firms has never been observed even when the production technology of the US firms was thought to be superior to that of Japanese\textsuperscript{80}. This contradiction between the theoretical prediction of production behavior and the actual evolution of trade in the real world raises questions about the potential causes of this phenomenon. The current production level of a firm with LBD effect exceeds the optimal output level in the absence of a LBD effect. An increase in its current output beyond the optimal output level that maximises current profit is an investment to reduce future cost. In the real world, although a firm may have a perfect knowledge of its own cost and the demand conditions, it is more likely to have imperfect information about its foreign rival's cost, especially when the industry exhibits dynamic returns to scale. This imperfect information about the foreign firm's cost makes the home firm's choice of optimal production strategy different from that of the perfect information case. That is, the home firm has to adopt a strategy which yields the highest expected profit among various combinations of the foreign firm's current unit cost and the future production cost function. In this chapter, we examine the case where the home firm faces uncertainty about the foreign firm's true most efficient unit production cost (MEC). Using Bayesian equilibrium, we show that the presence of uncertainty and the degree of uncertainty systematically reduce the incentive for the home firm to invest in

\textsuperscript{80} See Baldwin and Krugman (1988) for a summary of changes in the market share of the Japanese firms in the US market.
the future (to increase its current output beyond the short-run profit-maximising output level) for a wide range of learning coefficients. Under uncertainty, the home firm uses a less aggressive production strategy which, in turn, allows the foreign firm to produce more compared to the perfect information case. This result may be seen as an alternative to the closed market hypothesis which assumes that the entry of less competent Japanese firms in the US market and the subsequent upsurge of Japanese firms' market share in the US market was possible mainly because the Japanese market was closed against foreign firms. Our results suggest that the soft entry of Japanese firms into the US market may have been caused by the incomplete information of the US firms about the Japanese firms' true production cost not by the unfair trade practice of Japanese firms (closed market hypothesis).

The plan of this chapter is as follows. In section 2, using a simulation approach, we derive the optimal production level of firms under perfect information. We adopt a revised Gruenspecht (1988) model for our purpose and show how ADL works in the LBD industry. Also, we analyse the effect of the 'normal profit' clause of ADL on the outcome. In section 3, we develop a Bayesian equilibrium model and show how uncertainty affects firms' choice of production strategy. Section 4 contains some concluding remarks.

2. The effect of ADL under perfect information

2.1. Basic model : Gruenspecht's model

In this section, we closely follow Gruenspecht's (1988) model. We analyse the effects of ADL on firms' production using a two-period \((t = 0,1)\) Cournot-Nash duopoly model where two firms (one domestic, one foreign) compete in the home market. We assume the foreign firm specialises in exports. For simplicity, we assume that transportation
cost is zero. Also, we assume that both firms have an identical production cost function as follows.

\[ C_i(0) = C + v \]
\[ C_i(1) = C + v L(Q_i(0)), \ i = H \text{ (home firm)}, \ F \text{ (foreign firm)} \]

where \( C_i(t) = \) unit cost of production for firm \( i \) at time \( t \),

\( C = \) the most efficient (constant) unit production cost (MEC),
\( v = \) cost reduced by learning,
\( Q_i(0) = \) total output of firm \( i \) at period \( 0 \),
\( L = \) learning function: \( L(0) = 1, \ L(\infty) = 0, \ L' < 0, \ L'' > 0. \)

The unit production cost of firm \( i \) at period \( 0 \) is \( C + v \) and, as the cumulative output of a firm approaches infinity, the unit production cost approaches the most efficient unit production cost (MEC) \( C \). The firms' unconstrained intertemporal profit maximisation problem can be written as follows.

\[
\max_{q_{it}, q_{i0}} \Pi_i = \Pi_{i0} (q_{iH0}, q_{iF0}) + \delta \Pi_{i1} (q_{iH1}, q_{iF1}, q_{iH0}, q_{iF0}) \quad (i = H, F) \quad \text{(1)}
\]

where \( \partial^2 \Pi_{it} / \partial q_{it}^2 < 0, \ \partial^2 \Pi_{it} / \partial q_{it} \partial q_{jt} > 0 \ (i \neq j) \)
\( \Pi_{it} (q_{it}) \) is firm \( i \)'s profit (production) at time \( t \) and \( \delta \) is the discount rate.

The first order conditions for the firm \( i \) are

\[
\frac{\partial \Pi_i}{\partial q_{i0}} = \frac{\partial \Pi_{i0}}{\partial q_{i0}} + \delta \left\{ \frac{\partial \Pi_{i1}}{\partial q_{i0}} \right\} = 0 \quad \text{(2)}
\]
\[
\frac{\partial \Pi_i}{\partial q_{i1}} = \frac{\partial \Pi_{i1}}{\partial q_{i1}} = 0 \quad \text{(3)}
\]
From (2) the term \( \frac{\partial \Pi_{i0}}{\partial q_{i0}} \) and \( \delta \frac{\partial \Pi_{i1}}{\partial q_{i0}} \) represent the effect of a unit increase in the current production on the current profit and on the future profit respectively. Because of the learning effect, the sign of \( \frac{\partial \Pi_{i1}}{\partial q_{i0}} \) is always positive. Therefore, firms with LBD will always produce more than the short-run profit-maximising level of output.

2.2. The strategic production choice of firms under ADL

We have solved the optimisation problem of firms under free trade when the rule of competition is equally applied to all the participants in the market. When it comes to international competition, rules governing competition of firms, especially between the home firm and the foreign firm, may not be impartially applied to the foreign competitor. It is well known that the home firm of the ADL-enforcing country has a strategic advantage of production while the foreign firm faces an additional constraint on its production choice regardless of the nature of dumping: price-discriminating dumping or selling-below-cost dumping.

When the home firm has perfect information about the rival’s cost, it can choose the optimal production strategy which yields a higher intertemporal profit between the shut-out strategy and the accommodation strategy. While the production level of firms under the accommodation strategy is the same as the Cournot-Nash equilibrium, the shut-out (S/O) production strategy is a strategy where the home firm supplies all the demand in the home market. Therefore, the price in the home market under the shut-out strategy is the same as the current marginal production cost of the foreign firm. Gruenspecht (1988) and Webb (1992) show that the home firm may use the shut-out strategy by exploiting the price constraint of the foreign firm under ADL. Gruenspecht (1988) introduced another production strategy of the home firm: the mixed strategy where the home firm mixes the shut-out strategy with probability of \( \alpha \) (\( 0 \leq \alpha \leq 1 \)) and the accommodation strategy with probability of \( 1-\alpha \). The similarity of the outcome of the
mixed strategy to that from endogenous protection models\textsuperscript{81} is very interesting. In both cases, the enforcement of ADL may result in reduced outputs of both firms through the threat effect to the foreign firm and, in the case of the endogenous protection model, through spurious injury by the home firm to create protection against the foreign product.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{reaction_curve.png}
\caption{Home firm's reaction curve}
\end{figure}

All the above potential outcomes under ADL are shown in Figure 1 and Figure 2. Figure 1 shows the new reaction curve of the home firm $Q_H (Q_F)$ under ADL. The discontinuity occurs at a point where the home firm is indifferent between point A and the shut-out production level $D^{-1}(C_F(0))$. Let $(Q_H (A), Q_F (A))$ be the outputs of firms at point A. Given the shut-out production level $D^{-1}(C_F(0))$, there exists a point along the home firm's reaction curve which satisfies the following condition.

$$\Pi_H (D^{-1}(C_F(0)), 0) = \Pi_H (Q_H (A), Q_F (A))$$ ---- (4)

\textsuperscript{81} Leidy (1991) and Fischer (1992) show how the prospect of the imposition of the antidumping duties affects the reaction of firms by using a two-period Cournot-Nash model. Using a static model, Webb (1992) also showed the possibility of this outcome when the home firm acts as a Stackelberg leader.
In Figure 1, $D^{-1}(C_F(0))$ and $Q_{HM}(0)$ represent the S/O production level and the monopoly production level of the home firm respectively. The above condition (4) is satisfied at point A. The relative size of the future cost reduction effect ($\delta \frac{\partial \Pi_{H1}}{\partial q_{H0}}$) and the strategic advantage of ADL ($\frac{\partial \Pi_{H0}}{\partial q_{F0}} \cdot \frac{dq_{F0}}{dq_{H0}}$) determine the location of the discontinuity. Thus, the home firm will use the shut-out strategy when the discontinuity occurs before it intersects the foreign firm’s reaction curve. If there exist firm-specific dynamic returns to scale, the home firm may use the shut-out strategy even when both firms have the same cost function. When the shut-out strategy is optimal, ADL increases the intertemporal profit of the home firm by allowing the home firm to increase its current output while dampening the fall in the current profit through the reduction of the foreign firm’s production. The increase of output gives the home firm a two-fold competitive advantage over the foreign firm; through the reduction in its own cost in the future period and, indirectly, through the increase in the future cost of the foreign firm.

(Figure 2) Foreign firm's reaction curve
While ADL gives a strategic advantage to the home firm, the foreign firm faces an additional constraint when the learning effect is present\(^\text{82}\). The foreign firm’s constrained profit maximisation problem becomes

\[
\begin{align*}
\text{Max} & \quad \Pi_F = \Pi_{F0}(q_{H0}, q_{F0}) + \delta \Pi_{F1}(q_{H1}, q_{F1}; q_{H0}, q_{F0}) \\
\text{subject to} & \quad P(t) \geq C_F(t)
\end{align*}
\]

As shown in the price constraint, the existence of ADL makes the foreign firm sell its product in the home market at a price not lower than its current marginal production cost. The price constraint on the foreign firm’s product results in the kinked reaction curve as shown in Figure 2. At point B where the ADL price constraint begins to bind, the foreign firm has to reduce its output so that the market price of the product does not fall below the current unit production cost for a given output level of the home firm. Therefore, the outcome of Gruenspecht’s model can be summarised as follows.

i) Shut-out strategy: As mentioned above, the home firm will use the shut-out strategy when the profit is higher than that of the accommodation strategy. When the home firm’s monopoly production level \(Q_{HM}(0)\) is higher than the shut-out production level \(D^{-1}(C_F(0))\), the home firm produces \(Q_{HM}(0)\) and becomes a natural monopolist in the market.

ii) Accommodation: The equilibrium under the accommodation strategy is determined at the point where the downward sloping portion of the home firm’s reaction curve intersects the constrained reaction curve of the foreign firm.

iii) Mixed strategy: the home firm mixes the above two pure strategies.

2.3. Revised model

\(^{82}\) This comes from our assumption on firms’ cost. Under the identical production costs assumption, if there is no learning effect, the price constraint of the foreign firm under ADL does not bind.
We have seen various outcomes of the Gruenspecht model. Although his use of the mixed strategy by the home firm provides some interesting results, we shall depart from Gruenspecht's approach in two important respects for the following reasons.

i) While the choice of pure production strategies by the home firm - the S/O strategy or the accommodation strategy - gives us the same result as when the foreign firm always abides by ADL (no dumping), the use of the mixed strategy may result in dumping by the foreign firm. In the real world, all the imports during the current period (period 0) can be sold at the market clearing price in the home market even when dumping occurs. Dumping duties proportional to the dumping margin during the current period will be imposed on imports during period 1. In Gruenspecht (1988), this mechanism of ADL is not properly incorporated in the model. He simply assumes that the exported goods can never be sold in the home market when the home firm uses the S/O strategy. Also, those interesting results obtained from his model under mixed strategy can be easily derived by using an endogenous protection model83.

ii) Although Gruenspecht (1988) emphasises the possibility of the use of ADL as a wedge to create a cost differential between the two firms, his model does not include the case where the home firm uses the S/O strategy in period 1 even when the S/O strategy in period 1 yields a higher profit to the home firm.

Therefore, we consider only the first two pure strategies where the foreign firm always abides by ADL (no dumping in period 0) and discard the mixed strategy in our simulation. Instead, we introduce the possibility of the use of the S/O strategy by the home firm in the home market in period 1.

2.4. Simulation results: one-market case

83. See chapter 2 for a more detailed explanation of the endogenous protection model.
In this section, we assume that the foreign firm has no domestic market and specialises in exports to the home market. Using the first order conditions (2), (3), we calculate the equilibrium output, price, cost and the welfare level by simulation. We use the same parameter values used by Gruenspecht (1988) as follows. From the demand function in the home market

\[ P(t) = A - b(t) \sum Q_i(t) \]

where \( i = H, F, t = 0, 1, \) \( A = 1,000, b(0) = 1, b(1) = 0.4 \)

Also, we assume the two firms have identical cost functions as follows.

\[ C_i(0) = C + v \]
\[ C_i(1) = C + v \exp(-\lambda \cdot \sum Q_i(0)) \] where \( C = 200, v = 400 \)

We use 0.9 as the discount rate (\( \delta \)) for the calculation. Our results are different from Gruenspecht's in the sense that, in our simulation, the home firm may adopt the S/O strategy even in period 1 when there is no future cost reduction effect associated with an increase in its production level. That is, even when the two firms have an identical MEC at the beginning of period 0, if the learning effect is large enough for the home firm to adopt a predatory production strategy during period 0, the cost differential between the two firms will be large at the end of period 0. Then the home firm can afford to use the S/O strategy in period 1 and becomes a monopolist in the market. This results in a similar situation to Webb (1992) which shows the role of ADL as a tool for creating domestic monopoly by the home firm when the foreign firm is engaged in price-discriminating dumping.

Table 1 shows the simulation results. For the range of low learning coefficients (in our model 0 - 0.0002), ADL has no effect on the outcome. The equilibrium under ADL is the same as free trade. Because the future cost reduction effect is low, the home firm cannot recoup the loss of period 0 (due to the choice of the S/O strategy in period 0) in
period 1. Selling-below-cost dumping occurs when the learning coefficient is larger than 0.002. But, even when the learning coefficient is lower than 0.002, the home firm will adopt the S/O strategy to create a cost differential in period 1. When the learning coefficient lies between 0.0003 - 0.0007, the home firm will use the S/O strategy in period 0 to create a cost differential and will accommodate the foreign rival in period 1. In other words, the home firm uses the S/O strategy in period 0 to put its rival at a cost disadvantage at period 1 while reducing its own cost. The loss incurred in period 0 by the over-production at the S/O level is more than compensated by the increased profit in period 1. In the 0.0008 - 0.0015 range, the S/O strategy becomes dominant. The home firm uses the S/O strategy in both periods. The reduction in the home firm’s production cost by using the S/O strategy in period 0 is large enough to use the S/O strategy in period 1 even when there is no future cost reduction effect. Interestingly, the ADL-enforcing country benefits from the use of ADL because the output of the home firm increases more than the reduction of the foreign firm’s initial output. For a learning effect sufficiently high to cause selling-below-cost dumping in period 0 ($\lambda \geq 0.002$), price and the home firm’s profit rise under ADL. Our results show that the total welfare of the economy increases in all cases due to the large increase in the home firm’s profit at the expense of the foreign firm and/or consumers (consumers lose only for learning coefficients $\lambda \geq 0.002$). The imposition of ADL reduces the foreign rent to zero and for learning coefficients greater than 0.002 redistributes wealth from domestic consumers to the home firm.

2.5. Simulation results: two-country case

2.5.1. Pay-off table

The above one-market model can easily be extended to the two-country case by including the foreign market. For simplicity, we assume that the size of the domestic market in each country is identical. While, in the one-market case, only the home firm
has the privilege to choose a production strategy between the S/O strategy and the Accommodation strategy, in the two-country case, the home firm faces the possibility of the use of the S/O strategy by the foreign firm in the foreign firm's domestic market. Each firm faces the following pay-off functions as shown in Table 2.

(Table 2) Pay-off table: two-country, perfect information case

<table>
<thead>
<tr>
<th>FOREIGN</th>
<th>HOME</th>
<th>FIRM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accommodation</td>
<td>Shut-out</td>
</tr>
<tr>
<td>FIRM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HOME (Accommodation)</td>
<td>FIRM (Shut-out)</td>
</tr>
<tr>
<td></td>
<td>( \Pi_H^A(Q^F, Q^A) )</td>
<td>( \Pi_H^S(Q^F, Q^A) )</td>
</tr>
<tr>
<td></td>
<td>( \Pi_F^A(Q^H, Q^A) )</td>
<td>( \Pi_F^S(Q^H, Q^A) )</td>
</tr>
<tr>
<td></td>
<td>( \Pi_H^A(Q^F, Q^S) )</td>
<td>( \Pi_H^S(Q^F, Q^S) )</td>
</tr>
<tr>
<td></td>
<td>( \Pi_F^A(Q^H, Q^S) )</td>
<td>( \Pi_F^S(Q^H, Q^S) )</td>
</tr>
</tbody>
</table>

Where \( \Pi_i(Q^j, Q^k) \) represents firm i's combined profit from both markets under the production strategy \( j \) in its domestic market while its rival firm uses the production strategy \( k \) in its domestic market. (\( j = A \) (Accommodation), \( S \) (S/O), \( k = A \) (Accommodation), \( S \) (S/O))

Table 2 shows how the profits of firms change according to the firms' choice of production strategy. For example, the pay-off for the home firm when both firms use the accommodation strategy is \( \Pi_H^A(Q^H, Q^F) \) and the foreign firm's profit is \( \Pi_F^A(Q^H, Q^F) \). As shown in the following simulation results, the Nash equilibrium strategy of firms changes systematically as the value of learning coefficients changes.

2.5.2. Firms in prisoners' dilemma

Table 3 shows the simulation results of the two-country case. Only for the range of the learning coefficient \( 0 - 0.0001 \), is the accommodation strategy the Nash equilibrium
strategy in period 0. While, in the one-country case, a wide range of learning coefficients (0.0008 - 0.005) causes the home firm to act as a monopolist in both periods, in the two-country case the monopoly situation becomes more temporary. Because the two countries are identical, firms do not have any incentive to use the S/O strategy in period 1. Also, a closer look at the results reveals that firms employ the S/O strategy for different reasons in two sub-ranges of learning coefficients; for the range of 0.0002 - 0.0008 where the good is sold well above the current marginal production cost of firms and for the range of 0.001 - 0.003 where dumping occurs. Dumping does not exist in unconstrained equilibrium for the first case, but the existence of the ADL fundamentally changes the competition rule of the firms and, consequently, firms' production choice. For learning coefficients in the range of 0.0002-0.0008, firms face a prisoners' dilemma. When both firms use the accommodation strategy, the expected profit is higher than when both of them use the S/O strategy. But because firms are always better off when they choose the S/O strategy regardless of the rival's choice, both firms are forced to use the S/O strategy when cooperation between firms is not allowed. For this reason, firms produce more than their free trade optimal output level in period 0 and consequently in period 1 through cost reduction. Although firms are in a prisoners' dilemma, this prisoner's dilemma outcome raises consumer surplus and social welfare of both countries due to an increase in the overall production level of firms. Therefore, contrary to the conventional results of redistribution of income from consumers to firms from the enforcement of ADL, income redistribution occurs from firms to consumers. Thus, both governments may be willing to implement ADL even when there is no selling-below-cost dumping.

2.5.3. Governments in prisoners' dilemma

84. Conversely, this shows that firms have an incentive to collude under ADL.
Contrary to the above case without below-cost dumping, when there exists selling-below-cost dumping, firms benefit most from the existence of ADL. ADL allows each firm to become a monopolist in its domestic market at least in period 0 at a higher current price than the free trade level (market splitting). From the simulation results, it is clear that the Nash equilibrium in period 0 is the S/O strategy by both firms. For the range of coefficient 0.001 upward, the S/O strategy prevails and it actually increases the firms' profit compared to the unconstrained equilibrium at the expense of consumers. The two country results differ significantly from the one country case in the sense that the increase in the firms' profit is smaller than the loss of consumer surplus. Consumer surplus decreases because of the decreased overall production level. Therefore, the speed of learning becomes slower under ADL than under free trade. In this range, governments instead of firms now face a prisoners' dilemma. If the home government does not implement ADL when the foreign government adopts it, the loss of national welfare becomes larger because of the reduced output and profit of the home producer. Therefore, once a country implements ADL, the best choice of the other country is to use the same policy to avoid a huge loss caused by the rent-shifting from the home firm to the foreign firm. However in this non-cooperative equilibrium, welfare is lower for both countries than in the absence of ADL.

2.5.4. Floor price scheme and the normal profit provision

Our simulation results show that the real effect of recent semi-conductor price arrangements between the US and Japan followed by a similar arrangement between the EC and Japan cannot be explained by the traditional theory based on CRS production technology. Contrary to the belief that price-undertakings are beneficial to exporters through the rent-shifting effect for relatively new products with high dynamic returns to

85. Our analysis of one-market model in section 2.4 may be interpreted as the effect of ADL between two countries; one with a large domestic market and the other with a market of negligible size. This shows the importance of the market size in determining the outcome.
scale, ADL is just enough to confer an exclusive monopoly power to firms in their domestic markets and raise their (current) profit level through reduction in the current total output.

Apart from the problems arising from the asymmetric competition rule which prohibits foreign firms from engaging in the normal trade practice of the industry (selling-below-cost during initial period of product life cycle), there are other practices which influence the determination of the constructed price of goods under AD investigation. One of them is the use of historical data for the calculation of the constructed value of the product. The US DOC normally uses the cost data of three to six months before the investigation. Considering the dynamic nature of the industry, even a three months time-lag is certain to push up the estimated price. Worse still, in addition to the production cost, general expenses and all other expenses based on the historical data, an amount of profits equal to at least 8% of the sum of production costs and general expenses is included in the estimation of the constructed price. Thus, the estimated cost may exceed the free trade price level of the products. For the first case of no selling-below-cost dumping, any price arrangement by the above constructed value method may make firms escape from the prisoners' dilemma because price arrangements above firms' current marginal production costs reduce the S/O production level. Firms can produce less (close to the optimal production level) without losing monopoly power in their domestic markets at period 0. There is no foreign rent in each market because there is no trade at period 0. But, firms can still raise their profits at the expense of consumers. Table 4 shows how the increase in the trade prices by the inclusion of approximately 8% profit raises firms' profit. These examples show that for the range of 0.0005 - 0.0008 firms are no longer under a prisoner's dilemma because the profit from the S/O strategy becomes larger than the free trade profit level. When there exists selling-below-cost dumping, ADL itself is a price arrangement even without the inclusion of normal profit and firms are happy to use ADL as a tool of increasing its profit at the expense of consumers. In particular, the price arrangements drive the production of a new generation of goods well below the socially optimal production level.
These results suggest that, contrary to the apparently liberal nature of the arrangements, they serve exclusively the producers' interest by allowing them to reduce (total) output below the free trade production level in the case where the foreign firm is selling below cost. Even when there is no dumping, any price arrangement is more likely to reduce the total output of a product with a relatively higher learning effect. As Gruenspecht pointed out, the welfare loss by price arrangement will be greater in the LBD industry because the ADL reduces the speed of learning.

3. Firms' production choice under uncertainty

In the previous section, we analysed the effect of ADL on the home firm's choice of production strategy when both firms have perfect information on the rivals' production cost. In the real world, although a firm may have perfect knowledge about its own production cost and the demand function of its own domestic market, it is more likely to have imperfect information on its rivals' cost. In this section, we analyse the effect of ADL on the strategic production choice of the home firm under incomplete information by using a one-market model. We assume that, while the foreign firm which specialises in export has perfect information about the home firm (incumbent)'s production cost, the home firm faces uncertainty about the foreign firm (new entrant)'s cost. By using this one-market assumption, we abstract from the closed market hypothesis and concentrate on the effect of uncertainty. The source of uncertainty may be the incomplete knowledge of the foreign firm's learning function or of the foreign firm's stage of learning, of the foreign firm's most efficient cost level, etc.

3.1. Two opposing views on the enforcement of ADL on Japanese semi-conductor products
We summarised the history of semi-conductor disputes between the US and Japan in the introduction to this chapter. Apart from the fact that the semi-conductor disputes have been an important source of trade policy debate among economists, the conclusion of the semi-conductor disputes also divided economists into two opposing groups as follows.

Baldwin and Krugman (1988) represent the hawk approach against the alleged market closure of Japan in the debate. They assume that, while the US firms are technologically superior to the Japanese counterparts, the weakening of market power (share) of the US firms in the US market and in the world market is just a reflection of denial of market access of the US firms in the Japanese market by the shrewd Japanese government/industries. This market closure is viewed as implicit tariffs on the US products. Thus, they stipulate that, if the Japanese market were open, then trade disputes would have never arisen. Therefore, instead of analysing the effect of AD actions, they examine the effect of free trade on the firms' market share and world welfare. Their simulation results show that once the Japanese market is open, US firms will regain dominance.

Dick (1991) stands on the opposite side of policy appraisal. In contrast to Baldwin & Krugman (1988), Dick uses statistical cost data of Japanese firms to argue that the reason why Japanese firms are pricing so aggressively and why they have gained supremacy in the markets is simply that they have a higher speed of learning, if not lower minimum costs. Further, he argues that the current AD system is biased in favour of domestic firms because it does not allow foreign firms to engage in common trade practices of the industry. In other words, in an industry with a learning-by-doing effect, it is a common business practice to price below the current marginal production cost at the initial phase of production and no objections are raised when common business

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86. This type of approach, whether it reflects reality or not, may be viewed as an aggressive trade strategy which departs from the traditional defensive measures, such as tariffs, in several aspects. First, it is aimed at directly correcting the alleged cause of the dispute. Secondly, although it looks aggressive, the use of this strategy make it possible to avoid trade warfare which may occur if tariffs are imposed.
practice is exercised by domestic firms whereas the domestic government and firms complain if foreign firms employ the same practice.

The overall outcome of trade disputes seems to closely follow the policy recommendation from the strategic trade policy literature, such as Krugman (1984), Baldwin and Krugman (1988) among others, and if the closed market hypothesis is true, in theory, the arrangements may be seen as an attempt to come closer to free trade compared to the alternative, imposition of dumping duties which might provoke a trade war. But, contrary to the apparently liberal nature of the arrangements, as we have seen in the previous section, the arrangements seem to be strict enough to (temporarily) prohibit trade between the two countries. Also the results of our first case where the foreign firm specialises in exports seem to be at odds with the historical evolution of trade between the two countries. While our simulation results suggest that the home firm in the ADL-enforcing country has an absolute strategic advantage against the foreign exporter and the foreign exporter may never be able to enter the home market, historical changes in market share of Japanese firms in the US market show that such difficulty in entry has never occurred. In the following section, we provide an example which shows that uncertainty (incomplete information) rather than the alleged closed Japanese market may have caused a soft entry of Japanese firms.

3.2. When the home firm has incomplete information about the foreign firm's cost

For convenience of exposition, we deal with the case where the home firm has perfect information about the foreign firm's learning function but has a subjective probability function about the foreign firm's most efficient unit production cost while the foreign firm has perfect information about both its own production cost and the home firm's production cost. Let the subjective probability distribution of the foreign firm's cost (MEC) perceived by the home firm be
\[ \alpha_i = f(C_{F_i}) \] for \( i = 1, 2, \ldots, n \)

where \( C_F \leq C_{F_i} \leq \bar{C}_F, \sum_{i=1}^{n} f(C_{F_i}) \cdot C_{F_i} = C_h, \sum_{i=1}^{n} f(C_{F_i}) = 1 \)

This formulation allows us to see how the optimal production strategy of the home firm differs from the perfect information case when the degree of variance (uncertainty) of the foreign firm's cost changes. As in the previous cases, the basic structure of the home firm's production strategy consists of the accommodation strategy and the shut-out strategy. For each state of the foreign firm's cost \( C_{F_i} \), there exists an optimal production strategy of the home firm. Let \( \bar{Q}_{H0}(C_{F_i}) \) be this optimal production level of the home firm when the foreign firm's MEC is \( C_{F_i} \). In general, the optimal production level is not the same for different MEC of the foreign firm although the nature of the strategy (S/O or Accommodation) may be identical. i.e.

\[ \bar{Q}_{H0}(C_{F_i}) \neq \bar{Q}_{H0}(C_{F_j}), \text{ for } i \neq j. \]

As shown in Table 5, when the home firm faces uncertainty, a risk-neutral home firm's expected profit under the strategy \( (\bar{Q}_{H0}(C_{F_i})) \) is

\[ E(\Pi_H(\bar{Q}_{H0}(C_{F_i}))) = \sum_{j=1}^{n} f(C_{F_i}) \cdot \Pi_H(\bar{Q}_{H0}(C_{F_i}); C_{F_i}) \]

where \( f(C_{F_i}) \) is the probability of the state when the foreign firm’s MEC is \( C_{F_i} \). \( \Pi_H(\bar{Q}_{H0}(C_{F_i}); C_{F_i}) \) is the home firm’s profit from choosing the optimal production level for the state of \( C_{F_i} \) \( (\bar{Q}_{H0}(C_{F_i})) \) when the true state of the foreign firm’s cost is \( C_{F_i} \).

At the beginning of period 0, a risk neutral home firm will choose a production strategy in period 0 which yields the highest expected profit. Although the home firm does not know the true MEC of the foreign firm at the beginning of period 0, it may acquire perfect information about the foreign firm’s MEC at the end of period 0 after
observing the output of the foreign firm in period 0\textsuperscript{87}. In this case, the home firm will choose a state-contingent optimal production strategy in period 1. On the contrary, the home firm cannot observe the output response of the foreign firm when the home firm uses the S/O strategy in period 0 at which production level the foreign firm’s output in period 0 is zero under ADL. In this case, the home firm still faces uncertainty about the foreign firm’s MEC in period 1. Therefore, the home firm’s choice of production strategy in period 1 is the same as the ex-ante optimal output level.

(Table 5) Ex-ante pay-off table: Incomplete information

<table>
<thead>
<tr>
<th>Foreign firm’s cost</th>
<th>Home firm’s Production</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>(C_F^1)</td>
<td>(\Pi_H(Q_H(C_F^1); C_F^1))</td>
<td>(\Pi_H(Q_H(C_F^2); C_F^1))</td>
</tr>
<tr>
<td>(C_F^2)</td>
<td>(\Pi_H(Q_H(C_F^1); C_F^2))</td>
<td>(\Pi_H(Q_H(C_F^2); C_F^2))</td>
</tr>
<tr>
<td>(C_F^n)</td>
<td>(\Pi_H(Q_H(C_F^1); C_F^p))</td>
<td>(\Pi_H(Q_H(C_F^2); C_F^p))</td>
</tr>
</tbody>
</table>

3.3. Simulation results

We experiment on the effect of uncertainty on the production level of the home firm by using the same parameter value as the one country case in section 2.4. The difference here is that, instead of the symmetric cost assumption, we assume that while the true MEC of the foreign firm is the same as the home firm’s MEC (200), the home firm faces a probability distribution for the foreign firm’s MEC; \(C_F\) with probability of 1/2, \(\bar{C}_F\) with probability of 1/2. We use three different sets of \((C_F, \bar{C}_F)\) as follows:

\textsuperscript{87} We adopt a simplifying assumption that the foreign firm always abides by ADL and does not use signal-jamming strategy to affect the home firm’s belief about the foreign firm’s MEC.
These three are chosen to represent the low variance case (i), medium variance case (ii) and the high variance case (iii). Because the average of two different states ($C_F$, $\bar{C}_F$) of the foreign firm's cost are identical for those three cases, the variance of the foreign firm's cost may be interpreted as the degree of uncertainty faced by the home firm. Naturally, the level of home firm's production in period 0 depends on the choice of production strategy and on the degree of variance of the foreign firm's cost.

Table 6 shows that how the ex-ante optimal output of the home firm in period 0 changes when the home firm faces uncertainty about the foreign firm's cost. The simulation results show that the ex-ante optimal production strategy of the home firm in period 0 is changing systematically from the accommodation strategy to the shut-out strategy. An interesting feature is that, as the variance of the uncertainty becomes larger, the ex-ante optimal production level of the home firm in period 0 becomes less aggressive for a wide range of values of the learning coefficient. For the range of learning coefficient 0.0003 - 0.0008 for the low variance case, 0.0003 - 0.001 for the medium variance case, and 0.0003 - 0.0015 for the high variance case, although the foreign firm uses the S/O strategy for both the perfect information case and imperfect information case, the level of S/O output of the home firm under imperfect information is consistently lower than the perfect information case.

While Table 6 shows the ex-ante optimal output levels of the home firm in period 0 under uncertainty, Table 7 shows the actual outcomes for different levels of uncertainty and compares the results with the perfect information case obtained in section 2.4 (Table 1). We find that, under perfect information, the foreign firm cannot enter the home market temporarily (in period 0) for learning coefficients greater than 0.0003 and permanently (in both periods) for learning coefficients greater than 0.0008. But when the home firm faces uncertainty about the foreign firm's MEC, the foreign firm can enter
the home market in both periods up to the point when the value of the learning coefficient reaches 0.0008 for all degrees of uncertainty in our example due to the choice of a less aggressive production strategy by the home firm in period 0. Also, the foreign firm can sell its product in the home market at least in period 1 for higher learning coefficients. For the range of learning coefficients 0.0003 - 0.002, we find that the output of the foreign firm in the home market becomes higher as the degree of uncertainty increases.

From the above simulation results, we found that, for a wide range of learning coefficients, the home firm’s production level becomes lower as the variance of the foreign firm’s MEC increases. When the home firm faces uncertainty about the foreign firm’s cost, the choice of production strategy is similar to an investment decision under uncertainty. When a firm faces a learning curve, part of its current production cost is an investment expenditure to reduce future cost. As this is an irreversible investment, the risk neutral firm’s production choice depends on the expected pay-off from the increase in the current production. It turns out that the loss from the over-production becomes larger for a wide range of learning coefficients as the variance of the foreign firm’s MEC increases. Our results show a similar pattern to Majd and Pindyck (1989) in the sense that the increase in the variance of the foreign firm’s MEC causes the home firm to adopt a less aggressive production strategy during period 0. When we combine these results with our initial assumption about the foreign market (no domestic market for the foreign firm), uncertainty rather than the closed Japanese market may have caused the entry of Japanese firms in the US market easier than when the home firm (the US firm) has perfect information about its foreign rival (Japanese firm).

4. Conclusion

88. In their model, a competitive firm with firm-specific learning-by-doing effect faces the future price uncertainty.
In an industry with dynamic returns to scale, selling-below-cost dumping may occur when the learning effect is high. This turns out to be a normal business practice of the industry at the earlier period of the product life cycle. In other words, it has nothing to do with predatory dumping which seems to be the only economic basis for enforcement of ADL.

The simulation results of the perfect information case show how the existence of ADL changes the rule of competition. The use of ADL to restrict unfair trade practices between countries is often criticised for the following reasons. (i) It prevents foreign firms from engaging in trade practices which are normally allowed to the domestic firms- ie it is an asymmetric competition rule. (ii) The asymmetry gives too much power to domestic firms to exploit the strategic advantage of production for a given demand parameters. Because of the harsh penalty of violating ADL, the home firm's strategy becomes credible. (iii) As usual, there exists the potential abuse of ADL by domestic firms (collusion, spurious injuries, etc) which, in turn, shows the inefficacy of protection policies. The strategic advantage conferred on the home firm is magnified when the industry exhibits dynamic returns to scale due to (i) and (ii).

In a two-country model, when firms sell their product above their marginal production costs, the existence of ADL may make firms produce more than under free trade. But, when the learning coefficient is high enough to make firms engage in selling-below-cost dumping it reduces the overall outputs of firms. The inclusion of normal profit in the calculation of constructed price allows firms to reduce output in their domestic market without worrying about the entry of their foreign rival in the market. Thus, output falls and price rises causing a loss of social welfare of the economy. Because both countries are locked in a prisoners' dilemma, neither country has an incentive to abandon ADL. This casts a serious doubt on the effectiveness of market share agreements which run counter to our results, especially for new products with a high learning effect. As Dick (1991) argued, the revision of the existing antidumping code through GATT to allow the
selling-below-cost practice in the dynamic returns to scale industry is the only way to escape from the dilemma.

Also, we showed that uncertainty and the degree of uncertainty change the production strategy of the firm in the ADL-enforcing country. The prospect of potential loss from over-production makes the firm choose a less aggressive production level for a wide range of learning coefficients. This allows the new entrant (foreign firm) to get a share in the market even when the foreign firm does not have cost advantage over the home firm, which would have been impossible under perfect information. This result suggests that the imperfect information of the US firms about Japanese firms' production costs might have been the reason for the soft entry of Japanese firms in the US market.

Obviously, one problem of our model is that it does not specify the way in which the home firm has specific information about the distribution of the foreign firm's cost. Considering the results, the foreign firm is certain to have an incentive to signal-jam about its true cost especially when it has a high cost. Therefore, it remains to be studied how the information is formed and how the results change when the foreign firm uses a signal-jamming strategy.
(Table 1) Home firm's production strategy under perfect information (one-market case)

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(A) Learning coefficient (B) U: Unconstrained equilibrium C: Constrained equilibrium

* H.F. (F.F.): Home (Foreign) firm, CS: Consumer surplus (unit of profit, CS, and welfare: '000)
* \( Q_{it} \) = firm i's production at period t, \( P_{it} \) = price in market i at period t, \( C_{it} \) = unit production cost at period t
(Table 3) Home firm's production strategy under perfect information (two-country case)

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(A) Learning coefficient
(B) U: Unconstrained equilibrium

C1: Constrained equilibrium when the home country uses the shut-out strategy while the foreign country adopts free trade.
C2: Constrained equilibrium when the home firm uses the shut-out strategy and when the foreign firm uses the accommodation strategy.
C3: Constrained equilibrium with the shut-out strategy by both firms

* Oijt = firm i's production in market j at period t, Pit = price in market j at period t, Ci1 = firm i's unit production cost at period 1

** Unit of profit, CS, and welfare: '000
(Table 4) The effect of floor price (two-country case): the effect of the inclusion of normal profit

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(A) Learning coefficient

* Qijt = firm i's production in market j at period t, Pjt = price at market j at period t, Ci1 = firm i's unit production cost at period 1
** Unit of profit, CS, and welfare: '000
(Table 6) Ex-ante choice of production strategy under incomplete information

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<tr>
<td></td>
<td></td>
<td>b 550</td>
<td>904</td>
<td>0</td>
<td>0</td>
<td>450</td>
<td>638</td>
<td>277</td>
<td>750</td>
<td>211</td>
<td>299</td>
<td>510</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* CL (CH) represents lower (higher) expected MEC of the foreign firm.

** a is the optimal production level under perfect information (i.e., when the true MEC of the foreign firm is CL/CH) and b is the state contingent optimal production under incomplete information.

*** The last column shows the characteristics of the production strategy of the home firm in period 0 under incomplete information. For example, 250 (A) means the home firm's optimal production strategy is the same as the accommodation production level when the MEC of the foreign firm is 250. (A: Accommodation, S: Shut-out, M: monopoly)
(Table 7) Comparison of outputs (perfect information vs incomplete information)

<table>
<thead>
<tr>
<th>Learning coefficient</th>
<th>Perfect information</th>
<th>Incomplete information</th>
<th>Learning coefficient</th>
<th>Perfect information</th>
<th>Incomplete information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low variance</td>
<td>Medium variance</td>
<td>High variance</td>
<td></td>
</tr>
<tr>
<td>0.0001</td>
<td>QH0 137</td>
<td>156</td>
<td>175</td>
<td>193</td>
<td>QH0 400</td>
</tr>
<tr>
<td></td>
<td>QH1 338</td>
<td>339</td>
<td>341</td>
<td>342</td>
<td>QH1 497</td>
</tr>
<tr>
<td></td>
<td>QF0 137</td>
<td>128</td>
<td>118</td>
<td>109</td>
<td>QF0 0</td>
</tr>
<tr>
<td></td>
<td>QF1 338</td>
<td>337</td>
<td>335</td>
<td>334</td>
<td>QF1 252</td>
</tr>
<tr>
<td>0.0002</td>
<td>QH0 141</td>
<td>162</td>
<td>300</td>
<td>250</td>
<td>QH0 400</td>
</tr>
<tr>
<td></td>
<td>QH1 343</td>
<td>345</td>
<td>368</td>
<td>360</td>
<td>QH1 1000</td>
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<tr>
<td></td>
<td>QF0 141</td>
<td>131</td>
<td>61</td>
<td>87</td>
<td>QF0 0</td>
</tr>
<tr>
<td></td>
<td>QF1 343</td>
<td>340</td>
<td>322</td>
<td>329</td>
<td>QF1 0</td>
</tr>
<tr>
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<td>QH0 400</td>
<td>350</td>
<td>300</td>
<td>250</td>
<td>QH0 400</td>
</tr>
<tr>
<td></td>
<td>QH1 408</td>
<td>396</td>
<td>384</td>
<td>372</td>
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<td>41</td>
<td>67</td>
<td>92</td>
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</tr>
<tr>
<td></td>
<td>QF1 296</td>
<td>308</td>
<td>318</td>
<td>327</td>
<td>QF1 0</td>
</tr>
<tr>
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<td>QH0 400</td>
<td>350</td>
<td>300</td>
<td>250</td>
<td>QH0 400</td>
</tr>
<tr>
<td></td>
<td>QH1 432</td>
<td>414</td>
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<td>384</td>
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<tr>
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<td>QF0 0</td>
<td>46</td>
<td>72</td>
<td>98</td>
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<tr>
<td></td>
<td>QF1 284</td>
<td>302</td>
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<td>327</td>
<td>QF1 0</td>
</tr>
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<td>0.0005</td>
<td>QH0 400</td>
<td>350</td>
<td>300</td>
<td>250</td>
<td>QH0 400</td>
</tr>
<tr>
<td></td>
<td>QH1 455</td>
<td>432</td>
<td>414</td>
<td>395</td>
<td>QH1 1000</td>
</tr>
<tr>
<td></td>
<td>QF0 0</td>
<td>50</td>
<td>77</td>
<td>103</td>
<td>QF0 0</td>
</tr>
<tr>
<td></td>
<td>QF1 273</td>
<td>296</td>
<td>312</td>
<td>328</td>
<td>QF1 0</td>
</tr>
</tbody>
</table>

* Notice the changes in firms' outputs between Table 6 and Table 7. These results come from discrepancy between the home firm's expectation about the foreign firm's MEC (CL/CH in Table 6) and the true MEC of the foreign firm (in our model true MEC = 200).
(Appendix) The use of the S/O strategy without LBD

We can show the conditions for the use of the S/O strategy when there is no learning-by-doing effect. We assume that the two firms have different marginal production cost. Also we assume that the demand curve is linear. The profit function of firms are

\[ \Pi_H = (A - C_H - b (Q_H + Q_F)) Q_H \]  
\[ \Pi_F = (A - C_F - b (Q_H + Q_F)) Q_F \]  

----- (A-1)  
----- (A-2)

From (A-1), (A-2) and the first order conditions, outputs and profits of firms under the accommodation strategy can be derived as follows.

\[ Q_H^A = \frac{(A - 2C_H + C_F)}{3b}, \quad Q_F^A = \frac{(A - 2C_F + C_H)}{3b} \]  
\[ \Pi_H^A = \frac{(A - 2C_H + C_F)^2}{9b}, \quad \Pi_F^A = \frac{(A - 2C_F + C_H)^2}{9b} \]  

----- (A-3)  
----- (A-4)

We obtain the output and the profit of the home firm under the S/O strategy as follows.

\[ Q_H^S = \frac{(A - C_F)}{b}, \quad \Pi_H^S = \frac{(A - C_F) (C_F - C_H)}{b} \]  

----- (A-5)

We assume that the home firm's marginal production cost is lower than that of the foreign firm.

Let \( C_F = (1 + \alpha) C_H \)

where \( \alpha \) represents the ratio of cost differential between the two firms \( (\alpha > 0) \).

The condition for using the S/O strategy \( (\Pi_H^S > \Pi_H^A) \) can be obtained in terms of the value of \( \alpha \) by a simple calculation. The home firm will use the S/O strategy when \( \alpha \) satisfies the following condition.
\[
\frac{7 (A C_H - C_H^2)}{20 C_H^2} - B \leq \alpha \leq \frac{7 (A C_H - C_H^2)}{20 C_H^2} + B
\]

where \( B = \sqrt{\frac{-(A - C_H)^2}{10 C_H^2} + \left(\frac{7 (A C_H - C_H^2)}{20 C_H^2}\right)^2} \) ---- (A-6)

The home firm’s production choice when the foreign firm’s cost fall in this range is

\[
\text{MAX}\{ D^{-1}(C_F), Q^{M}(C_H) \}
\]

where \( D^{-1}(C_F) \) is the same as \( Q^{S}_H \), \( Q^{M}(C_H) \) is the monopoly output level for given demand and own production cost.
Chapter 5. Will vertical integration deter antidumping activities?

1. Introduction

A large proportion of international trade consists of trade in intermediate goods. In the wake of several rounds of negotiated tariff reductions import-competing domestic input producers, facing increased competition from imports of the intermediate goods, naturally seek protection from the government in various ways. Antidumping (AD) action has been one of the most frequent resorts for domestic input producers. When there exist antidumping laws (ADL) in the home country, domestic upstream firms may use them as a lever to raise their foreign rivals' cost. Chemical products, steel products, electronic parts and semi-conductors are good examples of those cases with frequent AD actions. Frequent recourse to AD measures and the imposition of AD duties on imports, in turn, will generate conflict with the interest of the economy as a whole. Imposition of AD duties on imported inputs will certainly raise the production cost of domestic final good producers. Consequently, domestic final good producers will lose their market share and profits in the final good market. Although it has long been argued by economists that antidumping measures on intermediate goods should be determined on the basis of their economy-wide effect (national interest), in the real world, the use of 'national interest' criteria in the determination of AD cases has never been active for various reasons.89

In this chapter, we examine the potential role of vertical integration between domestic firms as an alternative to the 'national interest' clause in ADL. This chapter consists of two major parts; the analysis of vertical equilibrium in successive oligopolistic markets

89. See Messerlin (1991) for the case of EC and Gruen (1986) for Australia
and the analysis of the strategic aspects of vertical integration in deterring AD actions by domestic upstream firms.

In the first part, we derive the conditions for various types of vertical equilibrium in successive oligopolistic markets. Although vertical integration has received wide attention in the context of the potential conflict with antitrust law\textsuperscript{90}, relatively few studies have concentrated either on the vertical equilibrium of an industry or the effect of vertical integration in an open economy under some form of trade policy. We extend the previous results by examining the pattern of the vertical equilibrium in successive oligopolistic markets. We find that there are three potential outcomes; no vertical integration, partial vertical integration and full vertical integration. We show that the pattern of vertical equilibrium is crucially dependent on the initial market structure and the relative size of the cost associated with vertical integration\textsuperscript{91}.

In the second part, using the results obtained in the first part, we analyse how the possibility of vertical integration affects the incentive for AD actions of domestic upstream firms in successive oligopolistic markets. While previous studies on vertical integration (equilibrium) have assumed a closed economy, we allow the participation of foreign firms in the domestic markets of both goods. By using a game-theoretic approach, we analyse the interaction between AD actions by domestic upstream firms and the incentive for downstream firms to vertically integrate with upstream firms. This can be seen as a sequential game where the domestic upstream firm is the first mover and has the option of initiating AD actions against imports of the foreign input. After the action of domestic upstream firms, domestic downstream firms decide whether to vertically integrate or not. Faced by the AD actions by domestic upstream firms and the

\textsuperscript{90} Perry (1989) provides a comprehensive review of previous studies on vertical integration. Also, Vickers and Waterson (1991) summarise current developments in this area.

\textsuperscript{91} Another stream of literature related to the present chapter is concerned with the possibility of vertical foreclosure by a more efficient foreign firm, which produces both the input and the final good, to raise the cost of production of the domestic producers of final goods. When the foreign firm is vertically integrated, it will use the output (price) of the input as a strategic variable to maximise the combined profit by affecting the domestic rivals' production cost of the final good. This type of literature analyses optimal trade policy under the threat of vertical foreclosure by the foreign rival. See Spencer & Jones (1989, 1991), Rodrik & Yoon (1989).
consequent loss of profit, domestic downstream firms may be better off to vertically integrate with upstream firms. The question is whether the possibility of an increase in the number of vertically integrated firms lowers the upstream firms' incentive to initiate AD actions through the so-called 'market-thinning effect'. Our results suggest that, the potential welfare loss from AD actions may also be reduced if the cost associated with vertical integration is not too high. At the subgame perfect equilibrium the threat of vertical integration may work as a deterrent to AD actions under certain conditions on the initial market structure and on the degree of AD tariff rates. In addition to that, if AD actions and the prospect of imposition of AD duties can facilitate vertical integration between firms, the welfare loss from AD actions may not be as high as when no vertical integration is induced by AD actions.

However, when either the market share of the imports in each market is relatively high and/or when the expected antidumping tariff rate is high, vertical integration by domestic final good producers may not be viable since the increase in the profit of domestic upstream firms by the imposition of AD duties is very high compared with the gains from vertical integration to final good producers. This explains why AD actions are prevalent in concentrated industries and why vertical integration does not occur in those industries.

While the 'national interest' clause implies active involvement of government\(^{92}\) to minimise the welfare loss from the imposition of AD duties, our results suggest that, under certain conditions, vertical integration may take on a similar role to increase national welfare even without any intervention of government. Alternatively, when the cost associated with vertical integration is high due to strict government regulation (antitrust law), the potential welfare gains from vertical integration will diminish because the number of vertically integrated firms becomes low. This is another source of potential conflict between domestic and international antitrust law.

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\(^{92}\) This is one of the reasons why the 'national interest' clause is not adopted in ADL of Australia. As Gruen\((1986)\) pointed out, the involvement of government in determining the outcome of AD cases on imports of input products may invite excessive lobbying activities by the concerned industries.
The remainder of the chapter is organised as follows. Section 2 provides a brief review of literature on vertical equilibrium. We compare the results of the present chapter with the previous studies. We develop a basic model of vertical integration in section 3. In section 4, we analyse the nature of vertical equilibrium in successive oligopolistic markets. In section 5, we extend the basic model by including foreign firms in the domestic markets. We examine the effect of possible vertical integration on AD activities by domestic upstream firms. The final section summarises the main results of the chapter.

2. Literature

According to Perry (1989), vertical integration between two firms describes the state "... if it encompasses two single output production processes in which either (1) the entire output of the 'upstream' process is employed as part or all of the quantity of one intermediate input into the 'downstream' process, or (2) the entire quantity of one intermediate input into the 'downstream' process is obtained from part or all of the output of the 'upstream' process." The incentives for vertical integration may arise from various sources. The most often cited reasons/incentives for vertical integration are the economies from technological coordination, the gains from the elimination of costs associated with market exchange and the elimination of double mark-up arising from imperfect markets.

Most previous studies on vertical integration have been mainly concerned with the effect of vertical integration on the final good price under various assumptions about (a) underlying market structures; (b) the characteristics of demand functions; and (c) the production technology of firms. The two main streams in this area differ from each other in their assumptions about production technology and market structure. The first
approach\textsuperscript{93} employs a variable-proportions production technology. This approach typically analyses the effect of forward vertical integration of the competitive downstream firms by a monopolist in the upstream industry\textsuperscript{94}. The effect of vertical integration on prices (outputs) and consequently on the social welfare of the economy is ambiguous and crucially dependent on the substitution parameter. The other approach assumes a fixed input proportion technology\textsuperscript{95}. Vertical integration under this production technology generally reduces the price of the final good by eliminating the double mark-up in each stage of production unless the downstream industry is competitive before integration.

Although such studies derive the consequent changes in the final good price after (partial) integration and the implication of vertical integration for social welfare, they do not explicitly consider the source of the incentive for vertical integration and the resulting nature of vertical equilibrium. They do not tell us when vertical integration will occur.

There are few previous studies on the vertical equilibrium of an industry which endogenise vertical integration. Table 1 provides a summary of previous studies in the area including the present chapter. Differences in assumptions lead to different effects on prices and welfare. The starkest contrast is between Perry's model (1984) and that of Carlton (1979). As shown in the table, although they both employ the same competitive market structure, difference in the source of incentive for vertical integration - gains from coordination for Perry and reduction of uncertainty in input supply for Carlton - yields completely opposite price changes. Both models suggest various forms of vertical equilibrium of the industry depending on the relative size of gains from vertical integration. Quirmbach (1986), using general production and demand forms, analyses the vertical equilibrium of an industry where an upstream monopolist integrates forward the competitive downstream firms. The profit-maximising monopolist may integrate


\textsuperscript{94} For exception, Waterson (1982) analyses the effect of vertical integration between oligopolistic input producers and competitive final good producers. Also, Abiru (1988) analyses the effect of vertical integration in successive oligopolistic markets.

partially because of the U-shaped production function of the downstream firms. Salinger (1988, 1989) assumes successive oligopolistic market structures with a fixed-proportions production technology. Contrary to the previous results under fixed-proportions technology by Greenhut and Ohta (1976, 1979), his results show an ambiguous outcome of vertical integration on the final good price. This is due directly to the nature of the vertical integration he employed: non-proportional vertical integration. Also, his model does not provide the conditions and the relationship between the initial market structure and the nature of the resulting vertical equilibrium. In this chapter, we adopt the same assumptions on the market structure and the production technology as Salinger (1988). We derive the same quantitative results on outputs and prices as the traditional fixed production technology literature and also illustrate the nature of the vertical equilibrium and the explicit conditions for that equilibrium to occur given a fixed cost of vertical integration.

3. Vertical integration under free trade

3.1. Basic model

We analyse the effect of vertical integration using a model where domestic firms face competition by foreign rivals both in the input market and in the final goods market. We assume that there are $n_1$ identical non-vertically integrated domestic producers and $n_2$ identical vertically integrated domestic and foreign firms in the downstream market. Initially, the number of vertically integrated domestic firms is zero. By the same token, in the upstream market, there are $m_1$ identical domestic producers and $m_2$ identical foreign producers. We assume that the firms in both markets exhibit Cournot-Nash behavior.
Figure 1 shows the structure of the model. In our model, while domestic final good producers buy inputs from both domestic and foreign input producers, all foreign final good producers are assumed to be vertically integrated. In the final goods market, the domestic downstream firms maximise profits taking the price of the input as given. Following Greenhut-Ohta (1979), we assume that a fixed amount of the input is consumed to produce a unit of the final good. For convenience of exposition, we assume that one unit of the input (x) is required to produce one unit of the final good (y) and the marginal production cost of final good producers is zero. To avoid unnecessary complications, we assume that the marginal costs of domestic firms and foreign firms in the upstream industry are identical. Also the marginal costs of foreign integrated firms are assumed to be identical to the marginal costs of the upstream firms. Assuming a linear demand for the final good, the profit function of downstream firms are

$$\Pi_d^k = (P(Y) - C_d) \cdot y^k \quad \text{for} \quad k = 1, \ldots, n_1$$  \quad (1)
\[ \Pi_d^* = (P(Y) - c) \cdot y^* \text{ for } l = 1, ..., n_2 \] ---- (2)

where \( \Pi_d^* \) (\( \Pi_d^{*1} \)) represents the k (l)'th domestic (foreign) downstream firm's profit and \( C_d (c) \) represents the marginal input cost of the domestic (foreign) firm which the firm takes as a constant. And \( Y = \sum_{k=1}^{n_1} y^k + \sum_{l=1}^{n_2} y^{*l} = n_1 y^k + n_2 y^{*l} \)

We assume that the demand for the final good is linear:

\[ P(Y) = a - b \cdot Y \] ---- (3)

The first order conditions for each domestic firm and foreign firm can be written as

\[ \frac{\partial \Pi_d^k}{\partial y^k} = a - b \cdot (n_1 + 1) \cdot y^k - b \cdot n_2 \cdot y^{*l} - C_d = 0 \] ---- (4)

\[ \frac{\partial \Pi_d^{*l}}{\partial y^{*l}} = a - b \cdot (n_2 + 1) \cdot y^{*l} - b \cdot n_1 \cdot y^k - c = 0 \] ---- (5)

Also, from the equations (4),(5) and from the assumed production technology of the final good producers, we obtain the derived demand function for the input by the domestic downstream firms.

\[ \Phi(X) = A - B \cdot X \quad (= C_d) \] ---- (6)

where \( A = \frac{a + n_2 \cdot c}{(n_2 + 1)} \), \( B = \frac{b \cdot (n_1 + n_2 + 1)}{n_1 \cdot (n_2 + 1)} \), \( X = \sum_{i=1}^{m_1} x^i + \sum_{j=1}^{m_2} x^{*j} = m_1 \cdot x^i + m_2 \cdot x^{*j} \)

By using the derived demand for the input, the profit function of upstream firms can be written as follows.

\[ \Pi_u^i = (\Phi(X) - c) \cdot x^i \text{ for } i = 1, ..., m_1 \] ---- (7)
The first order conditions for upstream firms can be written as

\[ \frac{\partial \Pi_u^i}{\partial x^i} = A - B (m_1 + 1) x^i - B m_2 x^*j - c = 0 \]  \hspace{1cm} (9)

\[ \frac{\partial \Pi_u^j}{\partial x^j} = A - B (m_2 + 1) x^j - b m_1 y^i - c = 0 \]  \hspace{1cm} (10)

From (4), (5), (6), (9), (10), we get the following equilibrium value of outputs and profit levels in terms of the numbers of firms of each type and the parameters of the demand function. We assume that the number of domestic downstream firms is the same as the total number of upstream firms, i.e., \( n_1 = m_1 + m_2 \).

\[ \check{x}^i = \frac{(a - c) n_1}{b (N + 1) (n_1 + 1)} \]  \hspace{1cm} (11)

\[ x^{*j} = \frac{(a - c) n_1}{b (N + 1) (n_1 + 1)} \]  \hspace{1cm} (12)

\[ \Pi_u^i( \check{x}^i, x^{*j} ) = \frac{(a - c)^2 n_1}{b (N + 1) (n_2 + 1) (n_1 + 1)^2} \]  \hspace{1cm} (13)

\[ \Pi_u^j( \check{x}^i, x^{*j} ) = \frac{(a - c)^2 n_1}{b (N + 1) (n_2 + 1) (n_1 + 1)^2} \]  \hspace{1cm} (14)

\[ \check{y}^x = \frac{(a - c) n_1}{b (N + 1) (n_1 + 1)} \]  \hspace{1cm} (15)

\[ \check{y}^{*j} = \frac{(a - c) (n_1 + 1) (n_2 + 1) + n_1}{b (N + 1) (n_1 + 1) (n_2 + 1)} \]  \hspace{1cm} (16)

\[ \Pi_u^k( \check{y}^x, \check{y}^{*j} ) = \frac{(a - c)^2 n_1^2}{b (N + 1)^2 (n_1 + 1)^2} \]  \hspace{1cm} (17)
From the equations (11) - (18) derived above, we examine the effect of vertical integration on the output of firms and the prices of the intermediate good and final good\textsuperscript{96}. Because we have already assumed \( n_1 = m_1 + m_2 \), vertical integration occurs between upstream and downstream firms of identical size\textsuperscript{97}. Also, the simplification of the assumptions on the cost of the firms allows us to interpret an increase in \( n_2 \) as the increase in vertically integrated home firms for a fixed number of foreign final good producers \( (n_2^f) \) in the home final goods market\textsuperscript{98}. Assuming the vertically integrated firms do not participate in the input market\textsuperscript{99}, we have \( \frac{d n_1}{d n_2} = \frac{d m_1}{d n_2} = -1 \textsuperscript{100} \). We now examine the effect of vertical integration on the production of non-integrated firms and market prices.

\[
\frac{\partial x}{\partial n_2} = \frac{c - a}{b (N + 1)(n_1 + 1)^2} < 0 
\]

----- (19)

\textsuperscript{96} In our model, vertical integration occurs due to the existence of double mark-up arising from imperfect markets.

\textsuperscript{97} If we allow non-proportional vertical integration, we have to check whether the profit of the vertically integrated firm is larger than the initial combined profit of non-integrated upstream and downstream firms. This assumption can also be seen as a weak form of capacity constraint of the integrated input producers.

\textsuperscript{98} That is, \( n_1 \) represents the number of non-integrated home final good producers and \( n_2 \) is comprised of vertically integrated home final good producers \( (n_2^d) \) and foreign final good producers \( (n_2^f) \). Therefore, for a given total number of final good producers in the home market \( (N = n_1 + n_2) \) and foreign final good producers in the home market \( (n_2^f) \), the increase in \( n_2 \) means the increase in the number of vertically integrated home firms \( (n_2^d) \).

\textsuperscript{99} Therefore, while the number of firms in the final good market remains the same, the number of domestic input producers after vertical integration is lower than before.

\textsuperscript{100} This can be easily extended to the proportional integration case. In that case, \( \frac{d m_1}{d n_2} \) becomes \( \alpha \). Where, \( \alpha = (m_1 + m_1)/n_2 \). The qualitative result is the same as above.
(19), (21) show the effect of vertical integration on the production and the price of input, respectively. Vertical integration always reduces the production of the non-integrated domestic input producers. But the price of the input may rise or fall depending on the initial market structure. (21) tells us that when the initial number of foreign final good producers plus the integrated domestic final good producers (the latter is initially zero) is smaller than the number of non-integrated input producers (non-integrated domestic final good producers), the price of the input will fall as vertical integration continues, and vice versa. The change in the input price is the net outcome of two opposing effects. One is the change in the structure of the upstream market due to the change in the number of participating firms after vertical integration has occurred. The other is the reduction in market size (residual demand) for non-integrated upstream firms. As vertical integration continues, the residual demand for input producers becomes smaller. This dominates the positive price effect of greater market concentration during the initial phase of integration. As the number of vertically integrated firms and foreign firms increases, the market concentration effect eventually dominates the demand reduction effect.\footnote{A close look at the derived demand curve shows the effect of vertical integration on the size of the residual demand. As vertical integration continues, the intercept term decreases at a decreasing rate, while the slope of the demand curve swivels. That is, when the number of integrated firms ($n_2$) is either small or very large the slope becomes steep.}

In the final good market, an increase in the number of vertically integrated firms certainly causes a fall in the production level of non-integrated final good producers.
(and the foreign final good supplier) for all \( n_2 \) but the overall production of the economy increases. Therefore, the price of the final good always falls as a result of vertical integration\textsuperscript{102}. This is in line with the traditional outcome of vertical integration in a fixed proportion technology industry. The divergence of the price and production changes in the final good industry from the results obtained by Salinger (1989) seems to be related to the nature of the vertical integration. Salinger allowed vertical integration between input and final good producers of different size. In his model, an increase in the price of the final good occurs when the size of the integrated upstream firm is significantly larger than that of the final good producer\textsuperscript{103}.

4. Vertical equilibrium

4.1. Profit differential and incentive for vertical integration

Before analysing the characteristics of vertical equilibrium in successive oligopolistic markets, we clarify the difference between profit differential and incentive for vertical integration. Profit differential means the difference in profits between the vertically integrated firms and the combined profits of each pair of upstream and downstream non-integrated firms \((\Pi^V(n_2) - \Pi^C(n_2))\). While the profit differential does not show the gains from vertical integration, the incentive for vertical integration \((\Pi^V(n_2+1) - \Pi^C(n_2))\) tells us how much a vertically integrated firm gains from the vertical integration at each stage of vertical integration. Given that the profit of vertically integrated firms monotonically decreases as vertical integration progresses, we know that the incentive for vertical integration is always smaller than the profit differential. Although the profit of integrated

\textsuperscript{102} Because we know that foreign firms' production decreases after vertical integration, the price fall of the final good implies that the overall production level of the domestic firms in both markets increases after the vertical integration.

\textsuperscript{103} This raises the question if this type of vertical integration satisfies the profit constraint.
firms monotonically decreases as vertical integration continues, the size of the profit differential may increase due to changes in the combined profit of non-integrated domestic firms. We obtain the changes in the profit differential as follows.

\[
\frac{\partial (\Pi^*(n_2) - \Pi^c(n_2))}{\partial n_2} = \frac{E}{F} \cdot \left[ (N - 2n_1 - 1)(n_1 + 1)(n_2 + 1) + 2n_1(n_2 - n_1) \right]
\]

where

\[
E = (a - c)^2 \\
F = b(N + 1)(n_1 + 1)^3(n_2 + 1)^3
\]

The sign of this expression depends on the sign of the terms in the bracket. When \( n_2 \) lies between 0 and \( \frac{N}{2} \), the sign of (23) is negative. When \( n_2 \) lies between \( \frac{N}{2} + 1 \) and \( N \), the value of the numerator is positive. The sign of the numerator becomes zero when \( n_2 \) lies between \( \frac{N}{2} \) and \( \frac{N}{2} + 1 \). The profit differential monotonically decreases during the process of vertical integration before it reaches the minimum where the number of integrated firms is between \( \frac{N}{2} \) and \( \frac{N}{2} + 1 \). And it monotonically increases afterwards.

How then does the incentive for vertical integration change at each stage of vertical integration? By using a Taylor's series first order expansion, the changes in gains from vertical integration can be approximated as follows.

\[
\frac{\partial (\Pi^*(n_2+1) - \Pi^c(n_2))}{\partial n_2} = \frac{\partial (\Pi^*(n_2) + \frac{\partial \Pi^*(n_2)}{\partial n_2} - \Pi^c(n_2))}{\partial n_2}
\]

Using the results obtained in section 3, we get the following expression which represents the changes in the gains from vertical integration.

\[
\frac{\partial (\Pi^*(n_2) + \frac{\partial \Pi^*(n_2)}{\partial n_2} - \Pi^c(n_2))}{\partial n_2} = \frac{G}{H} \cdot \left[ ((N-3)(n_2-n_1-1) + 4n_1-2)(n_1+1)^2(n_2+1)^2 + (2(n_2-n_1)(N-3)+4n_1)n_1(n_1+1)(n_2+1) + n_1(n_2-n_1)^2(4(n_1+1)(n_2+1) + 6n_1) \right]
\]

-- (25)
where \( G = (a - c)^2 \)

\[
H = b (N + 1)^2 (n_1 + 1)^4 (n_2 + 1)^4
\]

(Figure 2) Profit differential and incentive for vertical integration

(25) tells us that the incentive for vertical integration monotonically increases when the number of vertically integrated firms \( (n_2) \) exceeds that of non-integrated firms \( (n_1) \). As shown in Appendix 1, when the number of integrated firms is smaller than that of non-integrated firms, the sign of this expression may become positive or negative depending on the total number of final good producers and the number of vertically integrated firms. When the total number of final good producers \( (N) \) is not too small\(^{104}\), the incentive for vertical integration increases until the number of vertically integrated firms reaches \( 2^{105} \), and it decreases when the number of vertically integrated firms is larger.

---

104. In our model, when the total number of downstream firms \( (N) \) is not less than 7.
105. Therefore, if vertical integration occurs, there are at least two vertically integrated firms.
than $3^{106}$. This initial rise in incentive for vertical integration is caused by the relatively large fall in the domestic upstream firms' profit after the first vertical integration. Figure 2 shows the results.

4.2. Vertical equilibrium

Assuming a fixed cost of vertical integration $C^v$, the domestic final good producers will begin to vertically integrate with domestic input producers when the following profit constraint is satisfied.

\[ \Pi^v(n_2 = 1) - C^v \geq K (= \Pi^c(n_2 = 0)) \]

----- (26)

where $\Pi^v(n_2 = 1)$ is the profit of the first integrated firm and $\Pi^c(n_2 = 0)$ is the combined profit of a pair of upstream and downstream non-integrated firms when there are no vertically integrated firms.

Once vertical integration has started, the following condition has to be satisfied for vertical integration to continue.

\[ (\Pi^v(n_2 + 1) - \Pi^c(n_2)) - C^v \geq 0 \]

----- (27)

This constraint means that the gains from vertical integration should be larger than the cost of vertical integration at each stage of vertical integration. What will be the final outcome of the process of vertical integration in this industry given a fixed cost of vertical integration? Table 2 shows the characteristics of vertical equilibrium when the number of foreign final good producers is zero. It shows that we potentially have one
interior solution (partial vertical integration) and two corner solutions (no integration and full vertical integration) depending on the relative size of the cost of vertical integration ($C^v$) and the gains from vertical integration. Therefore, if the value of $C^v$ is known, we can specify the nature of vertical equilibrium for a given market structure and demand function.

(Table 2) Characteristics of vertical equilibrium

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No vertical integration</td>
<td>$C^v \geq \Pi^v_{(n_2=1)} - K$</td>
</tr>
<tr>
<td>2. Partial vertical integration</td>
<td>$\Pi^v_{(n_2=1)} - K &gt; C^v &gt; \min{\Pi^v_{(n_2+1)} - \Pi^c_{(n_2)}}$</td>
</tr>
<tr>
<td>3. Full vertical integration</td>
<td>$C^v &lt; \min{\Pi^v_{(n_2+1)} - \Pi^c_{(n_2)}}$</td>
</tr>
</tbody>
</table>

The above characteristics of vertical equilibrium are obtained assuming that the number of foreign firms ($m_2, n_2^f$) is zero in each market. When foreign firms are present in the markets, whether the absolute value of profit of integrated firms at the new vertical equilibrium will decrease or not depends on the number of foreign firms in each market. This is because the initial combined profit level of non-integrated domestic firms ($K$) changes as the number of foreign final good producers in the domestic market changes. If the number of foreign final good producers ($n_2^f$) is not too small, the post-integration profit of integrated domestic firms may not be lower than the initial combined profit of non-integrated domestic firms.

We now turn to the case where there are $m_2$ foreign input producers and $n_2^f$ foreign final good producers in the domestic markets ($m_2 > 0; n_2^f > 0, m_2, n_2^f$ fixed) before and after vertical integration. Vertical integration will start from $n_2^f$, and, if full vertical integration occurs, vertical integration will end at $(N - m_2)$ in Figure 2. Therefore, if the number of foreign final good producer ($n_2^f$) is larger than $N/2$, because the incentive for
vertical integration continues to increase in this range, the possibility of partial vertical equilibrium disappears\textsuperscript{108}.

5. Will vertical integration deter the AD actions by upstream firms?

We have seen the effect of vertical integration on the incentive for non-integrated firms to vertically integrate. Also, from (13), we can show that, for certain initial market structures, vertical integration will reduce the profit of upstream firms. Assuming there are non-integrated firms in the industry under the free trade vertical equilibrium, we examine how AD actions\textsuperscript{109} by upstream firms and the subsequent imposition of antidumping duties on the imported input will affect the incentive for vertical integration and how the possibility of vertical integration affects AD actions. Vertical integration in this industry can be described as a sequential game between domestic upstream firms and domestic downstream firms.

As shown in Figure 3, upstream firms move first by choosing whether to initiate AD actions or not. If there are no AD actions, there will be no change from the initial equilibrium. If AD actions are initiated by upstream firms, downstream firms decide whether to vertically integrate or not. Because the vertical integration process occurs contingent to AD actions by the upstream firms, the consequent changes in profit levels of non-integrated upstream firms crucially depend on the resulting new vertical equilibrium. In this section, we examine how the imposition of AD duties and subsequent changes in the number of vertically integrated firms affect the incentive for AD actions by domestic upstream firms.

\textsuperscript{108} The outcome will be either no vertical integration or full vertical integration.

\textsuperscript{109} Because the main purpose of this paper is to analyse the effect of vertical integration on the AD actions by domestic upstream firms, we abstract from identifying the causes of dumping and from other subtle issues, such as threat effect, etc. We simply assume that, once AD actions are initiated, AD duties will be imposed on the imports of the inputs and the resulting benefits by the AD duties to the domestic upstream firms are greater than the cost of AD actions.
(Figure 3) Outcomes of AD actions and vertical integration

First, on the input producer's side, given a fixed cost to initiate AD actions, the changes in the gains from AD action will determine whether a non-integrated input producer will continue to initiate AD actions as the integration proceeds after the initial AD actions. When the behavior of upstream firms is myopic, they will continue to initiate AD actions if the benefits from these are greater than the fixed cost of AD actions at the initial equilibrium. But as shown in (28), under certain conditions, the absolute profit level of upstream firms may decrease as vertical integration continues.

\[
\frac{\partial \Pi_u^i(x^i, x^j; t)}{\partial n_2} = K \left[ m_2 \left( n_2 + 1 \right) \left( 2n_1 - n_2 - 1 \right) + n_1 N \right] \\
+ \left( a - c \right) \left( 2n_1 \left( n_2 + 1 \right) - \left( n_1 + 1 \right) \left( N + 1 \right) \right) \leq 0 \quad \text{(28)}
\]

110. As shown below, for given number of vertically integrated firms, the imposition AD duties will always increase the profit of domestic upstream firms.

\[
\frac{\partial}{\partial n_2} \left( \frac{\partial \Pi_u^i(x^i, x^j)}{\partial t} \right) = \frac{2 \left( a - c \right) m_2 \left( n_1 - 1 \right)}{b(N + 1)(n_1 + 1)^3} > 0 \text{ for all } n_2
\]
where \( K = \frac{(a - c) + m_2t (n_2 + 1)}{b(N +1)(n_1 + 1)^3(n_2 + 1)^2} \)

While the first term in the bracket is always positive for all \( n_2 \), the sign of the second term depends on the value of \( n_2 \). Therefore, the sign of the whole expression is ambiguous. The value of the first term increases as either the number of foreign input suppliers (\( m_2 \)) is high or the expected AD tariff level (\( t \)) is high for given \( n_2 \). Therefore, for some combination of \( m_2 \) and \( t \), the sign of (28) may become positive for any \( n_2 \). If the market share of the foreign input supplier is high and/or if the expected AD duties on the imported input is high, domestic upstream firms will continue to initiate AD actions because of high returns from such actions at all stages of vertical integration. In this case, vertical integration will stimulate AD activities by domestic upstream firms\(^{111} \), because the gains from AD actions will increase as vertical integration continues.

Secondly, the changes in the incentive for vertical integration due to the imposition of AD duties can be represented by the changes in the difference of the profit levels between integrated downstream firms and non-integrated domestic firms. As shown below, the imposition of (marginal) AD duties on imports of the input good will certainly increase the profit differential, thus enhancing the incentive for the domestic final good producers to vertically integrate with domestic input producers regardless of the initial market structure. If the increase in the profit differential is large enough, there will be more integrated firms under ADL than under free trade.

\[
\frac{\partial (\Pi^V(n_2)) + \frac{\partial \Pi^V(n_2)}{\partial n_2} - \Pi^c(n_2)}{\partial t} = \frac{2m_2(a-c)((N+1)(n_1+1)(n_2+1)-n_1(n_2+n_2)+(n_2+1)))}{b(N +1)^2(n_1 + 1)^3(n_2 + 1)^2} > 0 \quad \text{----- (29)}
\]

\(^{111} \) Because the integrated domestic producers still reserve the right to initiate AD actions against the dumped import of input, the AD actions will certainly continue by the integrated firms to put the non-integrated domestic producers in cost disadvantage (see Salop & Scheffman (1987)) even after there is no non-integrated domestic upstream firms.
As stated, (29) shows the effect of a 'marginal' increase in AD duties (from free trade) on the incentive for vertical integration. Therefore, the sign holds only when the antidumping duty rate is very low. As shown in Appendix 2, when the increase in foreign firms' cost by the AD duties is not marginal (when AD duties are high enough), the sign becomes ambiguous. The sign is more likely to be positive when the AD tariff rate and the market share of foreign producers in both markets is low. Therefore, when the AD duty rate and the market share of foreign firms are high, the imposition of AD duties on the import of inputs may not trigger vertical integration. In this case, gains from vertical integration to the final good producers are not large enough to buy out the interest of domestic upstream firms.

(28), (29) suggest that, for a range of initial vertical equilibria before AD actions, the absolute net profit of non-integrated upstream firms (nominal profit - the cost of AD actions) may decrease due to changes in the number of integrated firms after AD actions. Therefore, AD actions by domestic input producers under myopic behavioral assumption may cause a decrease in the profit of upstream firms due to the subsequent vertical integration process. When upstream firms have perfect information about this sequential response by downstream firms (subgame perfect equilibrium), the game will never produce the above unsatisfactory results because upstream firms would not initiate AD actions when profit under the new vertical equilibrium is lower than the free trade profit level\textsuperscript{112}. Therefore, the possibility of vertical integration triggered by AD actions by domestic upstream firms may work as a strategic tool to deter upstream firms from initiating AD actions under certain conditions. Table 3 shows the simulation results which show the maximum number of vertically integrated firms where the profit of the firms after vertical integration is at least as large as the profit level before the imposition

\textsuperscript{112} This type of threat of AD actions by the domestic upstream firms is called 'noncredible (or empty) threat.
of AD duties. It confirms that, if the number of foreign firms in both markets is small and if the tariff rate is low, the possibility of vertical integration may deter domestic input producers from initiating AD actions. But, the conditions for vertical integration to work as a deterrent seem to be stringent.

In addition to the strategic deterrent value of vertical integration against AD actions, our simulation results show that, when the imposition of AD tariffs on imports of the input good increases the number of vertically integrated firms, the welfare loss from AD actions will be reduced. That is, if AD actions and the imposition of AD duties can facilitate vertical integration between firms, the welfare loss from AD actions may not be as high as when there is no increase in the number of vertically integrated firms.

However, as illustrated in Table 3, the possibility of vertical integration becomes low when the foreign firms' market share in each market is relatively high and when the AD tariff rate is high. In this case, vertical integration by the domestic final good producers may not be viable since the increase in the profit of domestic upstream firms' by the imposition of AD duties is very high compared with the gains from vertical integration to final good producers. This explains why AD actions are prevalent in concentrated industries and why vertical integration does not occur in those industries.

6. Conclusion

In this chapter, we have analysed the determination of vertical equilibrium in successive oligopolistic markets. We are able to show that, although the possibility of vertical integration to deter AD actions is small in some concentrated industries, the

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113. We assumed that, initially, there was no vertically integrated firm in the industry because the cost of vertical integration is marginally higher than the gains from vertical integration.

114. In our model, we have assumed that firms are identical before integration. In the real world, it is hard to find this ideal combination of firms. Rather, the size of the upstream firm(s) is often larger than that of downstream firms. Thus, the incentive for vertical integration for downstream firms may be high but the problems associated with this asymmetric size will make it difficult for vertical integration to occur.
increase in the number of vertically integrated firms triggered by AD actions of non-integrated upstream firms can reduce the potential welfare loss associated with AD actions. This can be seen as another source of welfare gain from vertical integration in addition to the examples given elsewhere in the literature. However when the market share of foreign firms is high and when the AD tariff rate is high, the possibility of vertical integration wanes due to both high returns to domestic upstream firms from AD actions and the relatively low level of gains to domestic final good producers from vertical integration.

These results suggest another source of potential conflict between antitrust law and antidumping law when vertical integration becomes difficult due to the high cost of vertical integration (strict government regulations). In this case, a reduction in the cost of vertical integration by softening the domestic antitrust law may possibly prevent or reduce the loss from frequent AD actions by domestic input producers.
(Table 1) Summary of previous studies

<table>
<thead>
<tr>
<th>Market structure Input</th>
<th>Final product</th>
<th>Source of the incentive for vertical integration</th>
<th>Changes in prices</th>
<th>The characteristics of the vertical equilibrium</th>
<th>Other assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>P(X) P(Y)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carlton(1979)</td>
<td>competitive</td>
<td>competitive</td>
<td>+ +</td>
<td>no vertical integration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>partial vertical integration</td>
<td>* stochastic demand for the final good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>full vertical integration</td>
<td></td>
</tr>
<tr>
<td>Perry(1984)</td>
<td>competitive</td>
<td>competitive</td>
<td>- -</td>
<td>no vertical integration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>partial vertical integration*</td>
<td>* risk neutral firms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>economies of synchronisation (exogenous)</td>
<td></td>
<td></td>
<td>* random exogenous net supply of the input</td>
</tr>
<tr>
<td>Quirmbach(1986)</td>
<td>monopoly</td>
<td>competitive</td>
<td>+ +</td>
<td>partial vertical integration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>full vertical integration</td>
<td>* U-shaped average cost for the downstream firms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>scale distortion</td>
<td>- -</td>
<td></td>
<td>* protected upstream market</td>
</tr>
<tr>
<td>Salinger(1988)</td>
<td>oligopoly</td>
<td>oligopoly</td>
<td>? ?</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>imperfect market</td>
<td></td>
<td></td>
<td>* fixed proportion production linear demand</td>
</tr>
<tr>
<td>Salinger(1989)</td>
<td>oligopoly</td>
<td>oligopoly</td>
<td>? ?</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>imperfect market</td>
<td></td>
<td></td>
<td>* fixed proportion production</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* general demand function</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>* conjectural variation</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>between market</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* non-proportional vertical integration</td>
<td></td>
</tr>
<tr>
<td>The present chapter</td>
<td>oligopoly</td>
<td>oligopoly</td>
<td>? -</td>
<td>no vertical integration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>imperfect market</td>
<td></td>
<td>partial vertical integration</td>
<td>* exogenously given cost for vertical integration</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>full vertical integration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* proportional vertical integration</td>
</tr>
</tbody>
</table>
(Table 3) The effect of AD duties on the incentive for vertical integration and for AD actions under various market structures

<table>
<thead>
<tr>
<th>No. of foreign final goods producers</th>
<th>Anti-dumping tariff rate</th>
<th>No. of foreign input producers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(A)</td>
</tr>
<tr>
<td>1</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2.50%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5.00%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>7.50%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>10.00%</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2.50%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5.00%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>7.50%</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>10.00%</td>
<td>all</td>
</tr>
<tr>
<td>10</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2.50%</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>5.00%</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>7.50%</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>10.00%</td>
<td>all</td>
</tr>
</tbody>
</table>

* This is based on the simulation results where the demand function for the final good is as follows. $P(Y) = 4000 - 0.5Y$

The number of non-integrated domestic final good producers ($n_1$) at the initial equilibrium is 10.

*(A) represents the maximum number of vertically integrated firms where the profit of non-integrated domestic upstream firm under AD duty is as high as the initial profit under free trade.

*(B) represents the maximum number of vertically integrated firms where the incentive for vertical integration is as high as free trade equilibrium level.
(Appendix 1) The conditions for decrease in the incentive for vertical integration when \( n_2 < n_1 \)

As shown in (25), changes in the incentive for vertical integration can be approximated by the following expression.

\[
\frac{\partial (\Pi^\gamma(n_2) + \frac{\partial \Pi^\gamma(n_2)}{\partial n_2} - \Pi^\gamma(n_2))}{\partial n_2} = \frac{G}{H} \left[ ((N-3)(n_2-n_1-1) - 4n_1 - 2)(n_1+1)^2(n_2+1)^2 + 
(2(n_2-n_1)(N-3) - 4n_1)(n_1+1)(n_2+1) + n_1(n_2-n_1)^2(4(n_1+1)(n_2+1) + 6n_1) \right]
\]

where \( G = (a - c)^2 \)

\( H = b(N + 1)^2(n_1+1)^4(n_2+1)^4 \)

We illustrate how to derive the conditions for decrease in the incentive for vertical integration when the total number of downstream firms \( N \) is even. We know that the difference in the number of integrated and non-integrated firms is also even. Therefore,

(A1) \( n_2 - n_1 = -2k \) for \( k = 1, 2, ..., N/2 \)

By using (A1), (25) can be rewritten as follows.

\[
(25') \frac{\partial (\Pi^\gamma(n_2) + \frac{\partial \Pi^\gamma(n_2)}{\partial n_2} - \Pi^\gamma(n_2))}{\partial n_2} = \frac{G}{H} \left[ (-4(k-1)(n_2-3)-2n_2+11)(n_1+1)^2(n_2+1)^2 + 
(-8(k-1)(n_2-3)-4n_1-4k+24)n_1(n_1+1)(n_2+1) + 
(2k)^2(2n_1(n_1+1)(n_2+1) + 6n_1^2 - (n_1+1)^2(n_2+1)^2) \right]
\]
(25') tells us that the sign of this expression is always positive when $n_2 \leq 2$. Also, after a tedious process, we get the conditions for the decrease in the incentive as follows.

$n_2 \geq 3$ under some restrictions on the value of $k$. For example, when $n_2 = 3$, $k$ should be at least as large as 2. As the value of $n_2$ increases, restriction becomes unnecessary.

(Appendix 2) : Changes in the incentive for vertical integration when the AD tariff rate is not negligible.

When the tariff rate is not marginal, changes in the incentive for vertical integration after the imposition of AD tariff can be written as follows;

$$D = \left\{ \Pi^y(n_2) + \frac{\partial \Pi^y(n_2)}{\partial n_2} - \Pi^c(n_2) \right\}_{t=1} - \left\{ \Pi^y(n_2) + \frac{\partial \Pi^y(n_2)}{\partial n_2} - \Pi^c(n_2) \right\}_{t=0}$$

$$= \frac{2m_2(a-c)t}{b(N+1)^2(n_1+1)^3(n_2+1)^2} \left[ (N+1)(n_1-1)(n_1+1)(n_2+1) - n_1(n_1(n_1-n_2) + (n_2+1)) \right]$$

$$- \frac{m_2^2t^2}{b(N+1)^2(n_1+1)^3} \left[ (N+1) (n_1n_2 + n_2 + 1)(n_1+ 1) + 2n_1 \right]$$

The sign of the first term is positive while the sign of the second term is always negative. The sign of the whole expression depends on the relative size of the second term. The absolute size of the second term becomes larger when the number of foreign firms in the markets and the degree of AD tariff rate are high. This means that, if the market share of the foreign firms and the tariff rate are high, profit differential may decrease after the imposition of AD duties. Thus, despite the loss of profit by AD actions, domestic final good producers can not afford to buy out the interest of domestic upstream firms.
Chapter 6. Reciprocal dumping and the consequence of an antidumping war

1. Introduction

Previous studies on the effect of antidumping laws (ADL) have been restricted to the case where ADL is active in one country. Even studies which employ oligopolistic market structures have concentrated on the analysis of the effect of unilateral application of ADL. The rationale for these types of models is that dumping typically occurs due to the existence of high protection in the exporters' domestic market while the importing country adopts a relatively free trade regime. Also, while various studies on political economy of protection and on endogenous trade protection policy have examined either why trade protection measures are prevalent in the real world or why certain types of protection measures are preferred to others by politicians, despite the increasing importance of AD measures in current international trade disputes, there have been few attempts to explain when countries use AD measures instead of maintaining free trade.

115. For example, Dixit (1988), Webb (1992) and Bian & Gaudet (1992). After this chapter was written, an interesting paper by Anderson et.al. (1993) was brought to my attention. Using a two-country model, they analyse the choice of trade policy of governments between free trade and ADL. Anderson et.al. also point out the welfare-improving result of an AD war. However, there are several important features which distinguish my model from Anderson et.al. First, while Anderson et.al. assume that AD cases are settled by price-undertakings, I assume that AD duties proportional to dumping margins are imposed on imports. Second, while the analysis of Anderson et. al. ends with the welfare-improving result of an AD war, using a smart government assumption, I compare the results of the cooperative and non-cooperative game between governments in determining the degree of AD duties. Using simulation results, I find that the degree of AD duties under the non-cooperative Nash equilibrium is always higher than that of cooperative Nash equilibrium. I argue that social welfare of countries can be improved through international agreements by restricting the use of more protectionist AD clauses which yield a higher AD duty rates.

116. As is well known by the work of Brander and Krugman (1983), when trade incurs positive transportation costs, reciprocal dumping occurs if marginal production costs of firms in each country are not too different.

117. The prevalence of non-tariff temporary protection measures (see, for example, Nogues et.al. (1986)) stimulated empirical and theoretical research on the rationale and the effect of the measures. Explanations of the prevalence of protection are either based on political economy models (eg Findlay and Wellisz (1982), Mayer (1984a) and Magee, Brock and Young (1989)) or by appealing to the idea of the 'conservative welfare function' (Corden (1986)). Another explanation is based on adjustment costs of labor (see eg Leamer (1980), Staiger and Tabellini (1987)).
In this chapter we are concerned with the following questions; i) what trade policy do governments prefer between free trade and ADL in the presence of market imperfections (oligopolistic market structure and the existence of transportation cost)? ii) If ADL is preferred to free trade, what is the outcome of the resulting AD war between countries?

We analyse the trade policy choice problem of governments (ADL vs. free trade) using a two-country partial equilibrium model where firms engage in trade of a homogeneous good with positive transportation costs. We examine how Nash equilibrium trade policies of governments arise when each country faces the possibility of AD action by the other country for two different cases: (i) when the two governments play cooperatively in determining the degree of AD duties; and that of (ii) when they play non-cooperatively.

We analyse the welfare consequence of two polar cases, an impartial aggregate-welfare-maximising government and the other extreme in which the politicians' choice of trade policy depends only on the gains to the protected firms. Although we abstract from the political process in which the policy maker's decision is influenced by the lobbying activities of various interest groups, the assumptions employed in our model may be a reasonable approximation to the real world political economy of protection. Following the spirit of the smart government model of Feenstra and Bhagwati (1982), we assume as follows. (i) A policy which maximises the policy maker's objective function (political support function) will be chosen as a trade policy of the country. (ii) Although policy makers may grant protection - in our model ADL - to firms, they can still choose the degree of protection at a level where social welfare - not political support - of the economy is maximised under the protection measure. When ADL is chosen by each country and if the two countries can cooperate by some types of binding international arrangement, the degree of AD duties will be determined at the level where the social welfare level of each country is maximised.

Assuming the two countries can choose the degree of AD duties cooperatively at the same level, we analyse the nature of cooperative Nash equilibrium. In our model,
different Nash equilibrium strategies arise for each type of government. (i) When the
government is impartial, the Nash equilibrium trade policy depends on the relative size
of transportation cost. If the transportation cost is relatively low, a free trade strategy by
both countries is the Nash equilibrium. For an intermediate range of transportation
costs, the Nash equilibrium strategy becomes sensitive to the rival's strategy. On the
other hand, if transportation cost is relatively high, both countries will choose AD
strategy (AD war). (ii) When the firms' lobbying power is dominant in the policy
choice of governments, an AD war occurs because AD policy always provides higher
pay-offs to the firms. Surprisingly, the consequence of an AD war is a mutual
improvement in the social welfare of the two countries regardless of the size of
transportation costs. This result comes from the endogenous tariff characteristic of AD
duties which forces firms to concentrate on the sales in the more profitable market. The
changes in sales destination, in turn, reduce the waste from the transportation cost.
Despite the overall welfare improvement, there exists redistribution of income from
consumers to producers. When the optimal trade policy is an ADL, the optimal degree of
AD duties (k) also depends on the relative size of transportation cost; when the
transportation cost is small, the optimal k is large and vice versa.

Using a simulation approach, we derive the Nash equilibrium when the two
governments play a non-cooperative game. In the non-cooperative game, each country
chooses the degree of AD duties independently, regarding the rival's AD duty rates as
given. We find that the non-cooperative Nash equilibrium AD duties are always higher
than those under the cooperative game. This leaves much room for both countries to
improve social welfare through international negotiations on AD matters.

The remainder of this chapter can be summarised as follows. In section 2, we analyse
how ADL changes the sales of firms to each market when the two countries impose the
same degree of AD duties (cooperative game). In section 3, we examine the policy
choice problem of governments between free trade strategy and AD strategy and show
how the Nash equilibrium strategies differ between the two cases. In section 4, we
compare the changes in social welfare between free trade and an AD war. It turns out
that the optimal level of AD duty in the cooperative game crucially depends on the relative size of transportation costs. In section 5, we derive a non-cooperative Nash equilibrium using numerical examples. The final section provides a brief conclusion and discussion of the results.

2. The effect of ADL: cooperative Nash equilibrium

The traditional model of international dumping assumes an exporter which engages in price discrimination between its domestic market and the export market. Dumping occurs when the price elasticity of demand in the export market is higher than that of its domestic market. Dumping becomes viable when arbitrage between the two markets is impossible. Naturally, it is assumed that the exporter's domestic market is protected by some form of government-imposed trade barrier.

An increase in intra-industry trade among countries and the subsequent development in the theory of intra-industry trade has enabled us to show 'how dumping arises for systematic reasons associated with oligopolistic behavior'\textsuperscript{118} of firms. Brander and Krugman (1983) introduced the 'reciprocal dumping' model which shows that two-way dumping may occur due to the existence of above-normal profits in each market and of positive transportation costs\textsuperscript{119}.

While previous studies have concentrated on the analysis of unilateral application of ADL, we analyse the effect of ADL on firms' output in each market when both countries may implement ADL. For simplicity, we assume that there is only one firm in each country. Firms are identical in their production technology and exhibit Cournot-Nash

\textsuperscript{118} See Brander and Krugman (1983)
\textsuperscript{119} Using a more general demand function, Weinstein (1992) shows how reciprocal dumping occurs and argues that unilateral dumping may occur from the more competitive market when the autarky price of the market is not high enough to cover the marginal cost and transportation cost due to high competition. Contrary to the traditional dumping model where unilateral dumping occurs due to the protection by the exporters' government in their domestic market, if unilateral dumping occurs, lack of competition and the resulting above-normal profit in that market will invite dumping from the more competitive country.
behavior. Each firm produces a homogeneous product and faces identical linear demand for its product in each market. Assuming the marginal cost of production of each firm is constant and identical, when the autarky price of the product in each market is larger than the sum of marginal cost and transportation cost, firms engage in reciprocal dumping. When ADL is in place, firms face the possibility of imposition of an AD duty proportional to the dumping margin of their export to the other market. When ADL is active in both countries (mutual precommitment), we assume the two countries adopt the same degree of dumping duty ($k$)\textsuperscript{120} cooperatively. Each firm’s profit maximisation problem becomes

$$
\max_{x, y} \Pi = P(X) x + P(Y) y - c x - (c + t) y - k (P(X) + t - P(Y)) y - F
$$

----- (1)

$$
\max_{x^*, y^*} \Pi^* = P(X) x^* + P(Y) y^* - c x^* - (c + t) y^* - k (P(Y) + t - P(X)) x^* - F
$$

--- (2)

Where $\Pi$ ($\Pi^*$) represents the combined profit of the home (foreign) firm

$x$ ($x^*$) represents the home (foreign) firm’s sales in the home market

$y$ ($y^*$) represents the home (foreign) firm’s sales in the foreign market

$P(X) = a - X$ is the demand function of the good in the home market

$P(Y) = a - Y$ is the demand function of the good in the foreign market

$X = x + x^*$

$Y = y + y^*$

$t$ is the unit transportation cost of exports.

$F$ represents fixed cost of production.

$k$ : dumping duty coefficient $0 < k \leq 1$

$P(Y) + t - P(X) (P(X) + t - P(Y))$: dumping margin of the foreign (home) firm in the home (foreign) market

\textsuperscript{120} It may look artificial to assume that the two countries impose the same degree of AD duties on imports. But it can be accomplished if there exists a credible and binding institutional arrangement between the two countries to check and control any deviation of the use of ADLs by any part of the two countries. If the arrangement is credible, and if it is mutually beneficial they will have an incentive to act cooperatively in the choice of $k$.\hfill
As shown in the firms' profit functions, the difference between the free trade regime and ADL regime is that, under ADL, the expected antidumping duty is included as a cost component of firms. Dumping occurs when the dumping margin is positive. $k$ represents the degree of AD penalties and tells us that antidumping duties proportional to the actual dumping margin will be imposed.

The first order conditions of firms under ADL becomes

$$\frac{\partial \Pi}{\partial x} = a - 2x - x^* + k y - c = 0 \quad -----(3)$$

$$\frac{\partial \Pi}{\partial y} = a + k x + k x^* - 2(k+1)y - (k+1)y^* - (c+t) - k t = 0 \quad -----(4)$$

$$\frac{\partial \Pi^*}{\partial x^*} = a - (k+1)x - 2(k+1)x^* + k y + k y^* - (c+t) - k t = 0 \quad -----(5)$$

$$\frac{\partial \Pi^*}{\partial y^*} = a + k x^* - y - 2y^* - c = 0 \quad -----(6)$$

As shown in (3) - (6), ADL has a different effect on firms' output decision to tariffs. While imposition of traditional tariffs does not affect the output in the exporters' domestic market, under ADL the expected tariff (AD duty) rate becomes endogenous and the output decision of firms in each market influences the expected AD tariff rate. In this sense, when ADL is active, the two markets are not separable any more.

Assuming that trade continues after the imposition of AD duties, outputs of firms and prices in each market under unilateral imposition of ADL and under mutual imposition of ADL can be calculated from the above f.o.c's. The solutions for outputs and prices for each case are set out in Appendix 1.

Faced by the possibility of the imposition of AD duties on its exports by the importing country, firms adjust their outputs in both markets. As shown in Appendix 1, when only one country (in our example the home country) imposes ADL (unilateral
precommitment), \( k \) in the home firm's profit function (1) becomes zero. Under the unilateral precommitment regime, price rises and the overall consumption of the home country decreases because the increase in the sales of the home firm in the home market is not large enough to cover the decrease in imports from the foreign country.

\[ x \] (Figure 1) Equilibrium outputs: AD war vs. tariff war

But, the price in the foreign country, which adopts a free trade policy, falls and consumption increases. In the foreign country, its domestic consumption increases due to the large increase in the foreign firm's sales in its domestic market as a result of the effort to reduce its dumping margin.

Under the mutual precommitment regime, price (overall consumption) rises (falls) in both markets. Trade volume between the two countries falls more than the increase in the sales in each firm's own domestic market. Interestingly, because demand functions in both countries and marginal production costs of both firms are identical, dumping
margin (t) can never be reduced ex-post. Consequently, AD duties (kt) will be imposed on imports. Figure 1 shows the difference in outputs between an AD war and a tariff war. In Figure 1, \( x^f(x^f) \) (or \( x^*(x^f) \)) represents home (foreign) firm's reaction curve under free trade and \( x^*(x^f) \) represents the foreign firm's reaction curve under a tariff war. F and T represent the equilibrium point under free trade and under an import tariff of kt, respectively. Here, we compare the outcome of an AD war with a tariff war. From the results shown in Appendix 1, when the same degree of import tariff (kt) is imposed on imports, the AD equilibrium point lies on the line TT' which is a 45 degree line to the north-west from the point T. While the total output of each firm is the same as when a specific tariff of kt is imposed on imports by both countries, the relative proportion (and absolute volume) of sales by firms in their domestic market under ADL is larger than that under the specific tariff regime\(^{121}\).

3. Choice of trade policy: free trade or AD war

In this section, we analyse the characteristics of the equilibrium trade strategy when the two countries have the option to choose their trade policy between free trade and ADL. Each government is assumed to choose a trade policy which maximises its country's political support function for given trade policies of the rival country yielding a Nash equilibrium in policies. To show how the difference in the political support function of the government affects the choice of trade policy, we compare the policy choice of two polar cases and analyse the welfare effect of the two cases. To provide a framework for analysing both cases, we assume that the objective of the government is increasing the political support\(^{122}\) from the electorate which is represented by the electorate.

---

\(^{121}\) Therefore, trade volume between the two countries shrinks more under an AD war than under a specific tariff regime.

\(^{122}\) Grossman and Helpman (1992) provide a micro-foundation for this type of linear Stigler-Peltzman political support function. Although the political support function in our model does not have any lobbying contribution term in it, following two cases in our model can be seen as two extreme cases of their general model.
weighted average of consumer surplus, domestic firm's combined profit from each market and the expected tariff revenue from AD duties.

\[ W = \alpha CS + \beta \pi + \gamma T \]

where

- \( CS = \) consumer surplus
- \( \pi = \) the combined profit of the domestic firm in both markets
- \( T = \) the tariff revenue from AD actions
- \( 0 \leq \alpha, \beta, \gamma \)

3.1 Impartial government (\( \alpha = \beta = \gamma = 1 \))

If the government is impartial, the value of each coefficient (\( \alpha, \beta, \gamma \)) becomes identical. This can be interpreted that either there are no lobbying activities from the concerned industries to influence the politicians' choice of trade policy or consumers are as much aware of the consequence of the policy outcome and engage in lobbying activities as efficiently as the firms (no organisation cost, no free rider problem). In this case, the government faces a welfare bimatrix of the economy as given in Table 1. Governments will choose the trade policy which maximises the sum of \((CS + \pi + T)\).

(Table 1) Trade policy pay-off (social welfare) bimatrix

<table>
<thead>
<tr>
<th>Strategy for foreign government</th>
<th>Strategy for home government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free trade</td>
<td>Free trade</td>
</tr>
<tr>
<td>(( W_f(f), W_f^*(f) ))</td>
<td>(( W_A(f), W_f^*(A) ))</td>
</tr>
<tr>
<td>ADL</td>
<td>(( W_f(A), W_A^*(f) ))</td>
</tr>
</tbody>
</table>

where \( W_i(j) \) (\( W_i^*(j) \)) represents the social welfare of the home (foreign) country from choosing strategy \( i \) given the foreign(home) government's strategy \( j \)

\( i = \{ f \ (\text{free trade}), A \ (\text{ADL}) \} \), \( j = \{ f \ (\text{free trade}), A \ (\text{ADL}) \} \)
Using the equilibrium values obtained in section 2 and summarised in Appendix 1, we can show that, for each country, the Nash equilibrium of the game crucially depends on the relative size of transportation cost. Four different types of trade strategies emerge as Nash equilibrium strategies\(^{123}\) as follows.

i) If transportation cost is low, AD strategy is dominated by the free trade strategy. Whatever strategy the rival chooses, the optimal strategy is free trade. \( W_f (f) > W_A(f), \quad W_f(A) > W_A(A), \quad W_f^*(f) > W_A^*(f), \quad W_f^*(A) > W_A^*(A) \)

Therefore, free trade by both countries becomes the Nash equilibrium strategy.

ii) if transportation cost is in an intermediate range, there are potentially two different outcomes. The choice of optimal strategy by each government becomes sensitive to the rival's choice. The resulting Nash equilibrium is either

\[ \text{ii-1} \] when the following inequalities hold, free trade is optimal when the rival government chooses AD strategy and AD strategy is optimal when the rival chooses free trade strategy. (2 Nash equilibria)

\[ W_f (f) < W_A(f), \quad W_f (A) > W_A(A), \quad W_f^*(f) < W_A^*(f), \quad W_f^*(A) > W_A^*(A) \]

or

\[ \text{ii-2} \] when following inequalities hold, free trade is optimal when the rival government chooses free trade strategy and AD strategy is optimal when the rival chooses AD strategy. (2 Nash equilibria)

\[ W_f (f) > W_A(f), \quad W_f (A) < W_A(A), \quad W_f^*(f) > W_A^*(f), \quad W_f^*(A) < W_A^*(A) \]

iii) if transportation cost is relatively high, free trade is dominated by AD strategy.

\[ W_f (f) < W_A(f), \quad W_f (A) < W_A(A), \quad W_f^*(f) < W_A^*(f), \quad W_f^*(A) < W_A^*(A) \]

In this case, AD war will be the result.

\(^{123}\) See Appendix 2 for the proof.
These results suggest that there is a large range of parameter values for which there will be either free trade or an AD war between the two countries and the Nash equilibrium strategy of each government shifts from free trade strategy to AD strategy as the relative size of transportation cost increases.

3.2. Extreme protectionist government \((\alpha = \gamma = 0, \beta = 1)\)

We have seen the policy choice by an impartial government. But, in the actual world, the behavior of politicians in those matters may be more directed towards securing support from an influential industry lobby\(^{124}\).

In addition, GATT allows countries use ADL legitimately against imports from foreign countries which cause injury to domestic industries provided that the imported goods are sold below the 'normal price' and when it can be proved that the domestic industries are injured by the imports (causality). Also, it is well documented in the several rounds of hearings on the review of the Australian ADL\(^{125}\) how Australian domestic industries argued for more restrictive ADL's to provide them with a 'level playing field'. Therefore, when other countries have already adopted the policy, democratic governments may not be able to precommit themselves to maintain a free trade regime.

To reflect these considerations, we analyse the polar case, where the coefficient of consumer surplus \((\alpha)\) and tariff revenue \((\gamma)\) is zero and \(\beta = 1\). This means the policy choice of government is the same as the firm's choice between free trade and AD strategy. We examine the firms' choice of strategy problem. Given the availability of ADL as protection policy, firms have to choose whether to initiate AD petition or not. Assuming the cost of AD petition is zero and assuming that, once AD petition is initiated, AD duties proportional to the dumping margin will be imposed on the imports, firms face a profit bimatrix as set out in Table 2.

---

\(^{124}\) For a detailed survey of this literature on politically endogenous protection, see Baldwin (1984) and Vousden (1990).

\(^{125}\) See Gruen (1986) and Banks (1990) and various editions of the annual report of Industry (Assistance) Commission.
(Table 2) Firm's pay-off (profit) bimatrix

<table>
<thead>
<tr>
<th>Strategy for foreign firm</th>
<th>Strategy for home firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free trade</td>
<td>(π_1(f), π_1*(f))</td>
</tr>
<tr>
<td>AD petition</td>
<td>(π_1(A), π_1*(A))</td>
</tr>
<tr>
<td>Free trade</td>
<td>(π_2(f), π_2*(f))</td>
</tr>
<tr>
<td>AD petition</td>
<td>(π_2(A), π_2*(A))</td>
</tr>
</tbody>
</table>

where π_i(j) (π_i*(j)) represents the profit of the home (foreign) firm from choosing strategy i given the foreign (home) firm's strategy j

i = {f (free trade), A (AD petition)}, j = {f (free trade), A (AD petition)}

Using the equilibrium values obtained in Appendix 1, we can show that, for each firm, the following inequalities hold regardless of the size of transportation cost.

π_1(f) < π_1(A), π_1*(f) < π_1*(A), π_2(f) < π_2(A), π_2*(f) < π_2*(A)

That is, when the foreign firm adopts a free trade strategy, the home firm's profit from an AD action is always larger than from a free trade strategy. Also, when the foreign firm chooses an AD strategy against the home firm's exports, AD strategy of the home government yields a higher profit for the home firm. Because the two firms are identical, the same result applies to the foreign firm. When the policy choice of the government is determined solely by the firms' profit level, free trade is dominated by AD strategy. In other words, for any given strategy of the other country, the optimal strategy of each firm is AD.

4. Welfare comparison and the optimal AD duties
In the previous section, we analysed the outcome of the game between the two countries under two alternative assumptions about the objective function of the government. We showed that there are different outcomes depending on the assumptions made about the size of transportation cost and the form of the government's objective functions. We now consider the effect of an AD war between the two countries on the welfare of the economy compared to free trade regime. We define the social welfare (W) of the economy as follows.

\[ W = CS + \pi + T \]

where \( CS = \) consumer surplus

\( \pi = \) the combined profit of the domestic firm in both markets

\( T = \) the tariff revenue from AD actions

Under free trade, the price of the good is \( P_f \) and the overall consumption is \( X^f \). \( X^f \) consists of \( x^f \) and \( x^*f \), which represents the free trade sales of home firm in the home market and import from the foreign country respectively. Using the symmetry of the two countries, the social welfare under a mutual free trade regime is the sum of the area aCL, CEQi, and IMPL in Figure 2. The triangle aCL is the consumer surplus of the economy and CEQi, IMPL represent the profit from the home market and from the export market respectively. By definition, tariff revenue \( T \) is zero under free trade.

Under a mutual precommitment regime, consumer surplus shrinks to the small triangle aBH. Using the symmetry of the two countries, we know that BERG is the firm's profit in the home market and that GNOH is the sum of profit in the export market and the tariff revenue.

By comparing the social welfare level between the two regimes, we find that the net changes in the social welfare of each country under mutual AD regime from free trade regime is the difference between the areas MQRN (+) and HOPL (-).
(Figure 2) Welfare comparison between free trade and AD war

It can be easily identified that

\[ QR = x^A - x^f : \text{increase in the domestic sales under ADL} \]
\[ MQ = t : \text{transportation cost} \]
\[ OP = x^f - X^A : \text{decrease in the overall consumption of the good} \]
\[ HK = P^A - P^f : \text{increase in price under ADL} \]
\[ KO = P^f - c - t : \text{unit margin of export under free trade} \]

\[ \Delta W = W_A(A) - W_f(f) = (x^A - x^f) t - \frac{(x^f - X^A)^2}{2} - (X^f - X^A)(P^f - c - t) \]
\[
kt \left\{ \frac{(6+3k-7k^2+2k^3)(a-c) - \left(1+\frac{1}{2}k\right)(3+6k+k^2-2k^3)}{9 (3+6k+k^2-2k^3)} \right\}
\]

From the assumption about the size of transportation cost \((a - c - 4t > 0)\) and \(k(0 < k \leq 1)\), we know that
\[(a - c) > 2 (1+k) t, \quad 2 \left( 6+3k-7k^2+2k^3 \right) > (3+6k+k^2-2k^3), \quad (3+6k+k^2-2k^3) > 0
\]

Therefore, \(\Delta W > 0\)

Surprisingly, contrary to the results for a traditional tariff war between countries, our result shows that an AD war (whether it results from the overall social welfare consideration by the government as in the relatively high transportation cost case in 3.1 or from the reasons illustrated in 3.2) in our model will result in welfare improvement to both countries. Also, the above result suggests that mutual imposition of ADL improves the social welfare of (both) countries regardless of the size of the transportation cost. Where does this beneficial effect come from? As Brander and Krugman (1983) argued, the cross hauling between countries may cause unnecessary waste of resources in the form of transportation cost. The gains from the mutual imposition of ADL comes directly from the changes in the destination of sales toward domestic markets which, in turn reduces the waste from the cross hauling. As we have seen in the previous section, the existence of ADL (endogenous tariff) makes firms sell a relatively higher proportion of their product in their domestic market compared to a specific tariff regime. This is because, when ADL is in place, a firm's reaction function in its domestic market shifts outward while the reaction function in its export market shifts in due to the endogenous characteristics of AD duty rates. The consequent

\(^{126}\) This assumption says that transport costs are not too large to prohibit trade between the two countries.

\(^{127}\) There are several differences between the 'traditional tariff war' and an 'AD war' in this chapter. The first difference is that while in traditional tariff war, at best, only one of the two countries can be better off compared to free trade, both countries are better off by an AD war. Secondly, while welfare gains of a large country in the traditional optimal tariff literature come from the improvement in terms of trade, welfare gains from AD war come from the relocation of sales.
increase in the profit of firms which comes from higher price and from more sales in the more profitable market (domestic market) always exceeds the decrease in consumer surplus by the reduction in overall production of the firms\textsuperscript{128}. However, despite this increase in social welfare, consumers always lose due to the price rise.

So far, we have analysed the effect of ADL on firms' profit and welfare for a given level of\( k \) for both countries. As mentioned, we assume a smart government which may grant protection to firms but still reserves the right to choose the degree of protection at socially optimal level for given nature of protection measures. When the game between the two governments is cooperative, governments will choose the optimal degree of AD duties,\( k \), which maximises the social welfare of both countries. Using the symmetry of the two countries, this can be done by choosing the optimal degree of AD duty (\( k \)) which maximises the difference in social welfare between an AD war and free trade within the range of\( 0 < k \leq 1 \). Therefore, by differentiating the changes in welfare with respect to \( k \), we get the optimal level of AD duties (\( k \)) from the following condition.

\[
\frac{\partial (W_A(A) - W_f(f))}{\partial k} = 0
\]

From the expression of \((W_A(A) - W_f(f))\) shown in (7), we know that the optimal \( k \) is dependent on the relative size of \((a-c)\) and \( t \). Simple numerical calculations reveal that the optimal \( k \) changes systematically from a higher value to a lower value as the relative size of transportation cost increases. The optimal \( k \) for lower \( t \) is around 0.7, and, for higher \( t \), the optimal \( k \) is around 0.5. When we consider the absolute size of AD duties, it becomes clear that for low \( t \), a large \( k \) is required to change firms' sales destination while a smaller threat is enough to have desired reallocation effect for higher transportation costs.

\textsuperscript{128} Conventionally, the possibility of trade diversion under NTB's is thought to be a factor that makes those measures less stringent in restricting trade flows and less welfare-reducing than traditional tariff measures. Although there is no room for trade diversion in our model, we have shown that an AD war reduces the volume of trade more than a comparable level of a specific tariff war. But, social welfare under an AD war is higher than under a specific tariff (and free trade) because of the reduction of waste.
5. Non-cooperative Nash equilibrium: numerical solutions

In the previous sections, we assumed that, when ADL is chosen as a trade policy, the degree of AD duties can be determined cooperatively between the two governments. Because we assumed that the degree of antidumping duties (k) is fixed at the mutually optimal level, an AD war in a cooperative game simply means that both governments choose ADL at the optimal level of k. Now we consider what will be the outcome of the game when each government plays non-cooperatively. When the game becomes non-cooperative, AD war looks more like the traditional tariff warfare in the sense that each government will choose the optimal k (k*) for given rival's choice of k*(k)\textsuperscript{129}.

Because the outcome of an AD war under a non-cooperative game is too complex and non-tractable, we solve the game numerically by using a simple grid method. As shown in Appendix 3, k (k*) of each country is subdivided into eleven cases; increasing from 0 to 1 by 0.1. Appendix 3 and Figure 3 show how the Nash equilibrium trade policy changes systematically as the relative size of transportation cost changes. Not surprisingly, the choice of trade policy for each type of government under the non-cooperative game is similar to the results of the cooperative game. When firms are dominant in the determination of trade policy, an AD war between the two countries is always the outcome. For impartial governments, the optimal policy changes from free trade to ADL as the relative size of transportation cost becomes larger. What is different from the cooperative game is that, when ADL is chosen as a trade policy, the equilibrium level of AD duties (k, k*) under the non-cooperative game is almost always higher than those of the cooperative game. For example, when an AD war occurs, the Nash equilibrium AD duties (k, k*) of the non-cooperative game is (1,1) for all sizes of transportation cost except when t/(a-c) is 0.025. But, as shown in the previous section,

\textsuperscript{129} Still, there is difference between the term 'AD war' in this chapter and traditional tariff war. While the traditional tariff war may result in imposition of tariffs at any level within the prohibitive tariff rates, AD duties can be imposed only when dumping exists and only within the range of the actual dumping margins.
the corresponding $k = k^*$ in the cooperative game ranges from 0.5 to 0.7. This implies that, when the game is non-cooperative, each government will choose a more protectionist ADL which will restrict trade flows more than under the cooperative game. This may be another good example where each government faces prisoners' dilemma in the choice of international trade policy when governments cannot cooperate with each other. The evolution of ADLs among countries during past decades which shows convergence of ADLs among countries to a more protectionist regime\textsuperscript{130} reflects this situation.

6. Conclusion

We have seen how the policy choice of government may change, free trade vs. ADL, using two polar assumptions about the form of the objective function of governments. Both free trade and an AD war arise as the potential policy equilibrium depending on the relative size of transportation costs in the impartial government case. But, when we adopt the opposite case which seems to be closer to the results from the literature on the political economy of protection, i.e., when firms (industries) are the dominant force in shaping the trade policy of governments, an AD war arises as the only equilibrium policy by both governments. Surprisingly, an AD war results in welfare gains to both countries. The source of welfare gains from an AD war turns out to be the endogenous tariff characteristics of ADL which make firms concentrate more on the sales in their domestic markets. When firms face ADL on their exports and the prospect of imposition of AD duties, they reduce sales in their export market and sell more in their domestic market. Although an AD war increases prices of the good (by the reduction of overall sales) at the expense of consumers, the increase in firms' profit, mainly from the

\textsuperscript{130} The evolution of ADLs among countries shows that many of the critical components of ADL, such as inclusion of below-cost dumping and regulation on the DFI etc., do converge in the long-run to a more protectionist regime.
reduction of waste of transportation cost and from the concentration of sales in a more profitable market, outweighs the loss.

Although the above results are derived from very restrictive assumptions, we may be able to extract various policy implications from the results. First, our results predict that, under impartial government, ADL will be chosen as a trade policy only when the relative size of transportation cost is very large. When we compare this with the prevalence of AD actions against almost all the manufacturing products (regardless of the size of transportation cost), in the actual world, industries seem to be the major force driving the policy implementation of governments. Second, although protection of domestic industries may be the major factor which explains the existence of ADLs among countries, it is easy to show that ADL is a superior trade policy to traditional protection measures, such as tariffs and/or quotas, which provide the same degree of protection (same degree of tariff rates) to domestic industries. This suggests that, in a democratic society, although politicians are more likely to provide some types of protection measures under pressure from industries, they may be smart enough to choose less stringent protection measures among various alternatives. Finally, when we compare the results between the cooperative game and the non-cooperative game, we know that both countries can be better off by cooperation. This suggests that there exists considerable room for mutual gains through negotiations about AD matters. Although there have been suspicions about the ability of GATT to control international trade disputes, GATT seems to be the only institution available which can lead participating countries to constructive solutions through cooperation rather than to inferior AD war.
(Figure 3) Reaction curves and the non-cooperative Nash equilibrium antidumping duties \((k,k^*)\) under various transportation costs

(1) When firms are dominant

\[
\begin{align*}
&k=1 \\
&0 \quad k^*=1 \\
&k^*(k) \quad k^*(k*) \quad k^*(k) \\
&\frac{t}{a-c} = 0.025 \\
&\frac{t}{a-c} = 0.05, 0.075 \\
&\frac{t}{a-c} = 0.1, 0.125, 0.15, 0.175, 0.2
\end{align*}
\]

(2) Impartial government

\[
\begin{align*}
&k=1 \\
&0 \quad k^*(k) \quad k^*(k) \quad k^*(k) \\
&k^*(k) \quad k^*(k) \quad k^*(k) \quad k^*(k) \\
&\frac{t}{a-c} = 0.025, 0.05, 0.075 \\
&\frac{t}{a-c} = 0.1 \\
&\frac{t}{a-c} = 0.125 \\
&\frac{t}{a-c} = 0.15, 0.175, 0.2
\end{align*}
\]
(Appendix 1) Outputs and prices under different strategies

From the f.o.c's, the following results on outputs and prices of each firm can be obtained.

<table>
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<th>Unilateral ADL</th>
<th>Mutual ADL</th>
</tr>
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<tr>
<td>$\tilde{x}$</td>
<td>$(3+4k+4k^2)(a-c)+ (3+4k)t$</td>
</tr>
<tr>
<td>$\tilde{y}$</td>
<td>$(3+2k-k^2)(a-c)- (6+4k-4k^2)t$</td>
</tr>
<tr>
<td>$\tilde{z}$</td>
<td>$(3+k)(a-c) - (6+8k)t$</td>
</tr>
<tr>
<td>$\tilde{y}$</td>
<td>$(3+5k)(a-c)+(3-k-6k^2)t$</td>
</tr>
<tr>
<td>$P(X)$</td>
<td>$(3+4k-k^2)(a-c)+(3+4k)t + c$</td>
</tr>
<tr>
<td>$P(Y)$</td>
<td>$(3+2k-k^2)(a-c)+(3+5k+2k^2)t + c$</td>
</tr>
</tbody>
</table>

where $D_u = 9 + 9k - 2k^2$

$D_m = 9 + 18k + 3k^2 - 6k^3$
(Appendix 2) Nash equilibrium strategy under impartial government

The cooperative Nash equilibrium strategy depends on the relative size of transportation cost ($\delta = t/(a-c)$). From the expressions obtained in Appendix 1, we can show that the following relationships hold for given $k$.

i) $\lim_{\delta \to 0} W_f(A) - W_A(A) > 0$, $\lim_{\delta \to 0.25} W_f(A) - W_f(f) < 0$

ii) As the size of $\delta$ increases, the value of $W_f(A) - W_f(f)$ monotonically decreases.

iii) $\lim_{\delta \to 0} W_A(f) - W_f(f) < 0$, $\lim_{\delta \to 0.25} W_A(f) - W_f(f) > 0$

iv) As the size of $\delta$ increases, the value of $W_A(f) - W_f(f)$ monotonically increases.

v) As shown in section 4, $W_A(A) > W_f(f)$ for all $\delta$.

Using these results, we obtain different Nash equilibrium strategies shown in section 3.1 depending on the size of $\delta$. 
(Derivation of Nash equilibrium strategy)

I. Impartial government

I-1. Welfare under an AD war: see section 4 for details

I-2. Welfare under unilateral precommitment

I-2-1. ADL-enforcing country

As shown in Figure 4-1 and 4-2, changes in social welfare of the ADL-enforcing (home) country can be written as follows.

\[ W_A(f) - W_i(f) = (x^A - x^i) (P_f(X) - c) + x^A \left\{ k \left( P^A(Y) + t - P^A(X) \right) - (P^A(X) - P^A(Y)) \right\} \\
- y^i (P_f(Y) - P^A(Y)) - (P^A(Y) - c - t) (y^i - y^A) - \frac{(X_f - X)^2}{2} \]

By using the expressions obtained from Appendix 1, it can be reduced to the following expression.

\[ \frac{(k - \frac{1}{3} k^2) (a - c) + (k + \frac{2}{3} k^2) t}{\frac{D_U}{2}} + \frac{a-c - 2t}{3} \left\{ \frac{(2k + \frac{2}{3} k^2) (a-c) + (13k + 15 \frac{1}{3} k^2) t}{D_U} \right\} \]

\[ + \varepsilon_1 + \varepsilon_2 + \varepsilon_3 \]

where \( \varepsilon_1 = \frac{(2k - \frac{2}{3} k^2) (a-c) + (2k + 1 \frac{1}{3} k^2) t}{D_U} \left\{ \frac{(k + \frac{2}{3} k^2) (a-c) - (8k + 15 \frac{1}{3} k^2) t}{D_U} \right\} \geq 0 \)

\[ \varepsilon_2 = - \left\{ \frac{(k - \frac{1}{3} k^2) (a-c) + (k + \frac{2}{3} k^2) t}{D_U} \right\}^2 < 0 \]

\[ \varepsilon_3 = - \left\{ \frac{(k + \frac{1}{3} k^2) (a-c) - (2k + 2 \frac{2}{3} k^2) t}{D_U} \right\}^2 < 0 \]
\[ \lim_{\delta \to 0} W_A(f) - W_f(f) = \frac{a-c}{3} \left\{ \frac{(2k + 2\frac{2}{3}k^2)(a - c)}{D_u} \right\} \]

\[ + \left\{ \frac{(2k - \frac{2}{3}k^2)(a-c)}{D_u} \right\} \left\{ \frac{(k+1\frac{2}{3}k^2)(a-c)}{D_u} \right\}^2 - \left\{ \frac{(k+\frac{2}{3}k^2)(a-c)}{D_u} \right\}^2 \]

The signs of the last two terms are always negative. We compare the first two terms.

From \( D_u \geq 9 \), we know that \( \frac{a-c}{3} > \frac{(2k - \frac{2}{3}k^2)(a-c)}{D_u} \), \( \frac{(k+2\frac{2}{3}k^2)(a-c)}{D_u} > \frac{(k+1\frac{2}{3}k^2)(a-c)}{D_u} \)

Therefore, \( \lim_{\delta \to 0} W_A(f) - W_f(f) < 0 \) for all \( k \).

\[ \lim_{\delta \to 0.25} W_A(f) - W_f(f) = t \left\{ \frac{(5k - \frac{2}{3}k^2)}{D_u} \right\} + \frac{2}{3} t \left\{ \frac{(5k + 4\frac{2}{3}k^2)}{D_u} \right\} \]

\[ - \left\{ \frac{(10k-1\frac{2}{3}k^2)}{D_u} \right\} \left\{ \frac{(4k+2\frac{2}{3}k^2)}{D_u} \right\}^2 - \left\{ \frac{(5k-\frac{2}{3}k^2)}{D_u} \right\}^2 - \left\{ \frac{(2k-\frac{1}{3}k^2)}{D_u} \right\}^2 \]

\[ = \frac{(225k + 121\frac{1}{3}k^2 - 22k^3 - 10k^4)t^2}{3D_u^2} > 0 \text{ for all } k \]

Therefore, \( \lim_{\delta \to 0.25} W_A(f) - W_f(f) > 0 \) for all \( k \).
\[
(20k + 19\frac{2}{3}k^2)(a - c) - (4(13k + 15\frac{1}{3}k^2) - 6k - 4k^2)t
= \frac{k^2}{3D_U}\{(11 + 2\frac{1}{3}k - 10\frac{4}{9}k^2)(a - c) + (41 + 81\frac{1}{3}k + 39\frac{5}{9}k^2)t\}
\]

Using \(a - c - 4t > 0, 0 < k \leq 1\), and \(D_U = 9 + 9k - 2k^2\), the sign of the whole expression becomes positive for all \(k\).

\underline{1-2-2. Free trade country}

As shown in Figure 4-1 and 4-2, changes in social welfare of the free trade country can be written as follows.

\[
W^*_t(A) - W^*_t(f) = (y^*_A - y^*_f) (P^A(Y) - c) + y^f (P^f(Y) - P^A(Y)) - (P^f(X) - c - t) (x^*_f - x^*_A)
+ x^*_A \{(P^A(X) - P^f(X) - k (P^A(Y) + t - P^A(X))) + \frac{(Y^A - Y^f)^2}{2}\}
\]

\[
= \frac{a - c - 2t (-k + k^2)(a - c) - (4k + 4k^2)t}{3D_U} + \frac{(3 + k)(a - c) - (6 + 8k)t}{D_U} D_U
\]

\[
+ \{(3 + 2k - k^2)(a - c) + (3 + 5k + 2k^2)t\} \frac{(2k + \frac{2}{3}k^2)(a - c) - (4k + 5\frac{1}{3}k^2)t}{D_U}
\]

\[
\frac{(k + \frac{2}{3}k^2)(a - c) - (2k + \frac{2}{3}k^2)t}{D_U}^2
\]

\[
\lim_{\delta \to 0} W^*_t(A) - W^*_t(f) = \frac{a - c}{3D_U} (-k + k^2)(a - c) + \frac{(3 + k)(a - c)(k + \frac{2}{3}k^2)(a - c)}{D_U}
\]
\[ (3+2k-k^2) (a-c) \frac{(2k+\frac{2}{3}k^2) (a-c)}{D_U} + \frac{(k + \frac{1}{3} k^2) (a - c)}{D_U} \frac{2}{2} + \frac{1}{2} \]

The last two terms are positive. And,

\[ \frac{a-c}{3} \frac{(-k+k^2) (a-c)}{D_U} + \frac{(3+k)(a-c)}{D_U} \frac{(k+1\frac{2}{3}k^2) (a-c)}{D_U} = \frac{(18k^2+16k^3-2k^4) (a-c)^2}{3D_U^2} > 0 \]

where, as shown in section 4, \( \lim \limits_{\delta \to 0} W^*_A(A) - W^*_f(f) = 0 \)

Therefore, \( \lim \limits_{\delta \to 0} W^*_A(A) > W^*_f(f) \)

\[ \lim \limits_{\delta \to 0.25} W^*_f(A) - W^*_f(f) = -2t \frac{8k}{3} \frac{t}{D_U} - \frac{(6 - 4 k) t}{D_U} \frac{(4k+2\frac{2}{3}k^2) t}{D_U} \]

\[ + \frac{(15+13k-2k^2) t}{D_U} \frac{(4k - 2\frac{2}{3}k^2) t}{D_U} \frac{(2k-1\frac{2}{3}) t}{D_U} \frac{2}{2} \]

\[ = -\frac{(36k +102k^2 + 72 k^3 - 18\frac{2}{3} k^4) t^2}{3D_U^2} < 0 \text{ for all } k \]

\[ \lim \limits_{\delta \to 0} \frac{\partial}{\partial t} (W^*_f(A) - W^*_f(f)) = \frac{a - c}{3} - 2t \frac{2}{3} \frac{(-k+k^2) (a-c) - (4k+4k^2) t}{D_U} \]

\[ - \frac{(3+k)(a-c)}{D_U} - \frac{(6+8k) t}{D_U} \frac{(8 k + 9\frac{2}{3} k^2)}{D_U} - \frac{(6+8k)}{D_U} \frac{(k + \frac{1}{3} k^2) (a-c) - (8k+9\frac{1}{3}k^2) t}{D_U} \]

\[ + \frac{(3+5k+2k^2) (2k+\frac{2}{3}k^2) (a-c) - (4k+5\frac{1}{3}k^2) t}{D_U} \]

\[ - \frac{(4 k+5\frac{1}{3}k^2)}{D_U} \frac{(3+2k-k^2)(a-c)+(3+5k+2k^2)t}{D_U} \frac{(k+\frac{1}{3}k^2) (a-c) - (2k+2\frac{2}{3}k^2)t}{D_U^2} \]
By using \( a - c - 4t > 0 \), the sign of the whole expression can be shown to be negative for all \( t \).

## II. Extreme protectionist government

### II-1. Mutual precommitment (AD war)

\[
\pi_A(A) = \frac{a-c+(1+k)t}{3} \left\{ \frac{a-c+t}{3} + \frac{(3k+3k^2-2k^3)(a-c)-k(3+6k+k^2-2k^3)t}{D_m} \right\} \\
+ \frac{a-c-2(1+k)t}{3} \left\{ \frac{a-c-2t}{3} - \frac{(3k+3k^2-2k^3)(a-c)}{D_m} \right\}
\]

Using \((1+k)(3k+3k^2-2k^3) = 3 + 6k + k^2 - 2k^3 = \frac{D_m}{3}\), we get following result.

\[
\pi_A(A) - \pi_f(f) = \frac{(a-c)t}{3} - \frac{(kt)^2}{9} - \frac{2kt(a-c-2t)}{9} \geq 0
\]

### II-2. Unilateral precommitment

We assume that the home country imposes ADL while the foreign country maintains free trade.

#### II-2-1. Changes in profits of the home (ADL-enforcing country) firm

\[
\pi_A(f) = \left\{ \frac{a-c+t}{3} + \frac{(k - \frac{1}{3}k^2)(a-c) + (k + \frac{2}{3}k^2)t}{D_U} \right\}^2 \\
+ \left\{ \frac{a-c-2t}{3} - \frac{(k + \frac{1}{3}k^2)(a-c) - (2k + \frac{2}{3}k^2)t}{D_U} \right\}^2
\]

\[
\pi_A(f) - \pi_f(f) = \frac{2(a-c+t)\{(k - \frac{1}{3}k^2)(a-c) + (k + \frac{2}{3}k^2)t\}}{3D_U} \\
- \frac{2(a-c-2t)\{(k + \frac{1}{3}k^2)(a-c) - (2k + \frac{2}{3}k^2)t\}}{3D_U}
\]
We know that \((a - c + t) > (a - c - 2t)\). And from the price constraint \(P^A(Y) + t - P^A(X) \geq 0\) under ADL, we get following inequality.

\[-2k(a - c) + (9 + 10k)t \geq 0\]

Using this we can show that following inequality holds for all \(t\).

\[(k - \frac{1}{3}k^2)(a - c) + (k + \frac{2}{3}k^2)t \geq (k + \frac{1}{3}k^2)(a - c) - (2k + \frac{2}{3}k^2)t\]

Therefore, \(\pi_A(f) - \pi_f(f) > 0\)

II-2-2. Changes in profits of the foreign (free trade country) firm

\[
\pi_f^*(A) = \frac{a-c+t}{3} + \left( \frac{\frac{2}{3}k^2(a-c)-(4k+5\frac{1}{3}k^2)t}{DU} \right) + \frac{(k+\frac{1}{3}k^2)(a-c) - (2k+\frac{2}{3}k^2)t}{DU}
\]

\[
\pi_t^*(A) - \pi_t^*(f) = \left( \frac{a-c-2t}{3} \right) \left( \frac{\frac{2}{3}k^2(a-c)-(12k+13\frac{1}{3}k^2)t}{DU} \right)
\]

\[+ t \left( \frac{(k+\frac{1}{3}k^2)(a-c) - (2k+\frac{2}{3}k^2)t}{DU} \right) + \gamma_1 + \gamma_2\]

where \(\gamma_1 = -\left( \frac{(2k+\frac{2}{3}k^2)(a-c)-(4k+5\frac{1}{3}k^2)t}{DU} \right) \left( \frac{(k+\frac{1}{3}k^2)(a-c) - (2k+\frac{2}{3}k^2)t}{DU} \right) < 0\)
From the price constraint, we know that
\[
\gamma_2 = -\left(\frac{(k + \frac{2}{3}k^2)(a - c) - (8k + \frac{9}{3}k^2)t}{\text{D}_U}\right)\left(\frac{(2k - \frac{2}{3}k^2)(a - c) + (2k + \frac{1}{3}k^2)t}{\text{D}_U}\right) < 0
\]

Also, from \( k > \left(\frac{a - c - 2t}{3}\right) \)

\[
\frac{2}{3}k^2(a - c) - (12k + 13 \frac{1}{3}k^2)t \leq 0 \text{ for all } t.
\]

Also, from \( k > \left(\frac{a - c - 2t}{3}\right) \) and

\[
(k + \frac{2}{3}k^2)(a - c) - (8k + \frac{9}{3}k^2)t - \left(\frac{2}{3}k(a - c) - (12 + 13 \frac{1}{3}k)t}{\text{D}_U}\right) > 0 \text{ for all } t,
\]

we know that the sum of \( \left(\frac{a - c - 2t}{3}\right) \)

\[
\frac{2}{3}k^2(a - c) - (12k + 13 \frac{1}{3}k^2)t
\]

is always negative for all \( t \). Also, for given range of \( k \),

\[
\left(\frac{k + \frac{1}{3}k^2)(a - c) - (2k + 4k^2)t}{\text{D}_U}\right) < \left(\frac{k t (a - c - 2t)}{9}\right)
\]

Therefore, by comparing \([\pi_f^*(A) - \pi_f^*(f)]\) with \([\pi_A^*(A) - \pi_f^*(f)]\), we know that the profit under mutual AD regime \( (\pi_A^*(A)) \) is always higher than the profit under unilateral free trade \( (\pi_f^*(A)) \).

\( \pi_A^*(A) - \pi_f^*(A) \geq 0 \)
(The effect of unilateral AD enforcement)

(Figure 4-1) The effect of ADL in the ADL enforcing country

(Figure 4-2) The effect of ADL in the free trade country
(Appendix 3) Non-cooperative Nash equilibrium; numerical solutions

1) \( t(a-c) = 0.025 \)

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* \( k(k^*) \) represents the degree of AD duties of home(foreign) country. Payoffs in thick(double lined) boxes are the non-cooperative(cooperative) Nash equilibrium.

* H: home country, F: foreign country, \( \pi \): firm's combined profit, W: social welfare

* The above results are obtained by assuming; \( P(X) = 2000 - X \), \( P(Y) = 2000 - Y \), each firm's marginal production cost = 500

* The lower half of the table is omitted because they are symmetric.
2) $\nu(a-c) = .05$

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5) \(v(a-c) = 0.125\)

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- \(k = 0\)  
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  - W: 8964 8964 8970 9001 8967 9024 8958 9039 8945 9050 8929 9058 8910 9068 8890 9076 8866 9085 8842 9096 8815 9107  
- \(k = 0.1\)  
  - H: 4616 4616 4715 4556 4797 4497 4867 4443 4927 4392 4977 4345 5019 4301 5055 4261 5086 4224 5111 4190  
  - W: 9014 9014 9019 9040 9017 9057 9013 9068 9004 9074 8993 9080 8982 9086 8969 9091 8953 9095 8937 9101  
- \(k = 0.2\)  
  - H: 4662 4662 4753 4610 4830 4561 4897 4514 4955 4471 5005 4431 5049 4394 5087 4359 5119 4327  
  - W: 9050 9050 9052 9068 9053 9078 9050 9084 9045 9088 9039 9090 9031 9092 9023 9093 9013 9094  
- \(k = 0.3\)  
  - H: 4707 4707 4791 4662 4864 4620 4927 4580 4984 4543 5033 4509 5077 4477 5116 4447  
  - W: 9073 9073 9076 9085 9076 9091 9075 9092 9072 9091 9070 9090 9065 9089 9060 9085  
- \(k = 0.4\)  
  - H: 4751 4751 4829 4713 4897 4676 4958 4642 5013 4610 5062 4580 5106 4552  
  - W: 9088 9088 9090 9094 9090 9096 9091 9093 9089 9089 9088 9084 9087 9078  
- \(k = 0.5\)  
  - H: 4794 4794 4867 4761 4932 4730 4991 4700 5044 4671 5092 4645  
  - W: 9066 9096 9098 9099 9094 9099 9094 9099 9098 9099 9084 9087 9078  
- \(k = 0.6\)  
  - H: 4837 4837 4905 4808 4967 4780 5024 4754 5075 4729  
  - W: 9099 9099 9099 9095 9101 9088 9102 9077 9103 9068  
- \(k = 0.7\)  
  - H: 4879 4879 4943 4853 5003 4828 5057 4805  
  - W: 9095 9095 9096 9087 9098 9076 9099 9064  
- \(k = 0.8\)  
  - H: 4920 4920 4981 4897 5038 4875  
  - W: 9087 9087 9089 9076 9090 9061  
- \(k = 0.9\)  
  - H: 4960 4960 5019 4939  
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- \(k = 1\)  
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\[ v(a-c) = 0.15 \]

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Chapter 7. Further research

We have seen various aspects of problems associated with the current AD system: the political economy of protection, the abuse of the AD system through the incentive effect, and conflicts with other regulations. The essays in this dissertation cover only a small part of issues related to this area. I would now like to mention a number of possible extensions of the current research.

1. The effects of AD clauses

As we have seen in chapter 3 and chapter 4, AD clauses, such as the injury criteria, normal profit provision, and changes in the investigation time schedule, give import-competing firms a considerable strategic advantage over exporters. Interestingly, there has been little effort to formally analyse the effect of (changes in) the sunset provision on AD activities and of the local content rule on exporters’ decision for DFI under ADL. For the first case, we have seen that the timing of a large increase in AD petitions in Australia during 1991/92 period coincides with the change in the sunset provision. It is obvious that there are interactions between the incentive for AD actions for import-competing firms and the incentive for country hopping by importers. A large increase in AD activities may result from seemingly small changes in the sunset provision. Also, Bhagwati et al. (1987) and Beldevous (1992) illustrated the effect of (the prospect of future) tariff protection on DFI by exporters. In their model, the DFI decision is made purely by the expected changes in exporters’ profit in the importing country. But, as mentioned, the existence of ADL affects exporters’ profits in both markets. Thus, when there are many exporters, the DFI decision of exporters under ADL may be affected by a different more complicated comparison of profits between the two states.
2. Optimal AD policy under more general assumptions

In Chapter 6 we have shown that an AD war results in welfare improvement for both countries. Assumptions employed in the model are very restrictive in various aspects from demand function to firms' production technology. One of the interesting questions is, when there are many countries (exporters), how the possibility of trade diversion changes the policy outcomes. Also, we were not able to identify the optimal policy among various alternative policies. Therefore, it seems to be natural to extend our analysis to a more general model and to identify the optimal trade policy when there exists dumping.

3. Signal-jamming strategy

In chapter 4 we analysed the effect of incomplete information on firms' choice of production strategy. The simulation results suggest that, for a large range of learning coefficients, the exporter would have an incentive to signal-jam its production cost to reduce the home firm's protection level. Therefore, once we introduce the possibility of signal jamming by the exporter during the current period (period 0), the home firm may have incomplete information about the exporter's cost even in period 1. Presumably, the optimal production strategy of the home firm will depend on the size of variance of the exporter's cost.

4. Empirical study

In most of our dissertation essays, we simplified the market structure to the duopoly case. Therefore, the question of under what conditions there is an incentive for firms to undertake AD actions has never arisen. Previous studies on AD activities, mainly in the US, focused on the determinants of AD activities. Those results show an inconclusive
outcome for the relationship between market structure and the tendency for AD actions. It may be interesting to compare those results with Australian AD cases provided that information required for those type of study is available. Also, as we argued in chapter 3, the effect of AD actions on trade flows may be significantly different between countries of different size. Therefore, it may be worthwhile to do comparative studies of the effect of AD actions between different countries.
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