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# Essays on International Trade Policy

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A thesis submitted in partial fulfillment of the requirements for  
the degree of Doctor of Philosophy in Economics

The Department of Economics, The University of Warwick

March 2012

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# Acknowledgments

First and foremost, I am deeply thankful to my supervisor, Professor Carlo Perroni, for his patient advice and supervision, his time, kindness and all the help he has given me since I started my PhD. It has been invaluable.

I am also extremely grateful to the Royal Thai Government for giving me the great opportunity to do this research, and for the financial support during my studies.

I would like to express my sincerest thanks to my office, the Department of Foreign Trade, Ministry of Commerce for granting me study leave.

Last, but not least, my deepest thanks goes to my family, my father Surachai Bumrungsuk, my mother Maneerat Bumrungsuk and my brother Rattasak Bumrungsuk, for listening, encouraging, and spiritually guiding me throughout my life, for being with me, and never letting me down. I hope I make you proud.

# Declaration

I declare the following:

The material contained in this thesis is my own work.

This thesis has not been submitted for a degree at any another university.

## Abstract

This thesis consists of three chapters of independent studies.

In Chapter 1, I develop a finite two-stage game model where consumers in new export markets lack information about their own valuation for the quality of a new product. The model is then used to examine firms' quality choices. With asymmetric information, the need to establish a quality reputation may not be sufficient to induce firms to choose high quality. The likelihood that a firm will choose to export a high-quality product rather than a lower-quality variant increases with the number of experienced consumers. However, it decreases with the number of competing firms. A policy of subsidising exporters can encourage firms to select high quality and promote consumer experience, and thus establish an independently viable high-quality export market. Nevertheless, this will only work if the subsidy is conditional on quality choice. That is, the administrative monitoring of quality is required. Beside, the government may temporarily limit the number of competing firms. If consumers in new export markets possess information about their own valuation, it may be possible to promote the transition to a viable high-quality export market by competition policy alone.

In Chapter 2, I employ a simple take-it-or-leave-it bargaining game with two-sided asymmetric information to reconcile the theoretical results with observation. With two-sided asymmetric information, the probability of bargaining failure is positive. The likelihood that the domestic and foreign firm will collude increases with the probability of a high-type foreign firm but decreases with the bargaining power and concentration level of the domestic firm. The small number of private settlements indicates the inefficient outcome of the bargaining game with asymmetric information rather than evidence of the antidumping measure being less misused as a collusive tool.

In Chapter 3, I examine the behaviour of firms after the implementation of an FTA by paying attention to the impacts of rules of origin on preferential trade flows and economic activities within the FTA region. It is found that a tightening of the rules of origin increases the volume of final goods import from RoW but decreases the volume of intermediate goods and raw material import from RoW, given the dominance of the final goods rules of origin effects. However, if the intermediate goods rules of origin effects dominate, the volume of intermediate goods import from RoW turns to increase, rather than decrease. These imply that preferential trade flows and economic activities among the member countries of an FTA may increase or decrease when the rules of origin are tightened. The findings, *inter alia*, suggest that the product-specific rules of origin that impose the restrictive rules to final goods but the loose rules to intermediate goods are more efficient in promoting preferential trade and economic activities within the region and also inducing investments from outside.

# Introduction

This thesis *Essays on International Trade Policy* consists of three independent studies. These are (i) Quality Reputation and Export Promotion, (ii) Why is it so difficult to settle a private agreement in an antidumping case? and (iii) Do the Rules of Origin make a difference? Here, an introduction to each chapter is addressed.

## 1 Quality Reputation and Export Promotion

With asymmetric information, the quality of a product is unobservable before purchasing, firms have an incentive to sell low quality products at high-quality prices. Shapiro (1983) shows that the returns of establishing a reputation are a crucial role, inducing firms to choose high quality. Similarly, Allen (1984) argues that firms have an incentive to offer a high-quality product although they earn negative profits in order to signal consumers that their product is high quality; the acquisition of reputation encourages firms to select high quality. On the contrary, Shapiro (1982) finds that if consumers do not learn about

the quality of a product, firms always choose to provide a minimum-quality product. This is consistent with Donnenfeld and Mayer's findings (1987), firms will choose to produce lower quality than socially optimal. The relationship between reputation and quality choice is ambiguous.

This chapter is motivated by the following arguments: (i) Is the need to establish a quality reputation sufficient to induce home firms to export a high-quality product to new foreign markets?; (ii) Do home firms behave differently in the different types of markets?; and (iii) If the need to establish a quality reputation alone is insufficient, what are the roles of government to help to establish the quality reputation of a product in target foreign markets? A finite two-stage game model is developed to examine the quality choices of firms when entering to the different types of foreign markets, which are (a) the new markets where consumers lack information about their own valuation about the quality of a product; (b) the mature markets where consumers know their own valuation; and (c) the mixed markets where consist of consumers who know their own type and consumers who do not, in order to answer the above questions.

It is found that the need to establish the quality reputation of a new product and a firm itself is insufficient to persuade a home firm to upgrade the quality of a product. Home firms are the most likely to export a high-quality product to mature markets while they are the most likely to milk reputation by exporting a low-quality product as a high-quality product in new markets. Consequently, the likelihood of establishing a quality reputation increases with the number of

experienced consumers.

However, if the probability that consumers in foreign markets assign a high valuation on a high-quality product is sufficient large, the gains of establishing a reputation are the largest in new markets. Hence home firms are the most likely to export a high-quality product when entering to new markets. Consumers in new markets cannot distinguish between a product is ill-match to their tastes or a product is low quality then they will be deluded by a low-quality product. These deluded consumers will not be interested in a high-quality product for the future transactions anymore. As a result, home firms face a larger opportunity loss if they milk their reputation in new markets than in mature markets where consumers can distinguish between being ill-match and being low quality. This can explain why the quality of an exported product is higher than a product sold in domestic markets.

These results, especially the results in the case of new markets, may be changed if the model is extended to be longer or infinite. With a long time horizon, the expected payoff of establishing a quality reputation in new markets increases. Home firms, thus, have more incentive to upgrade the quality of their product. At the same time, consumers in new markets have other chances to learn their true type after being deluded by a low-quality product resulting in a decreasing in the opportunity losses from cheating. Hence, home firms have more incentive to milk their reputation. The result are ambiguous; the likelihood of exporting a high-quality product will either improve or fall depending on many

factors such as the discount factor, the specification of market learning, the speed of consumer learning.

Since the acquisition of reputation is not sufficient to induce home firms to upgrade the quality of their product, the government intervention then is needed to support firms to do that. The following policies are discussed: (i) export promotion policy; (ii) export subsidies policy; and (iii) competition policy.

Since the likelihood of establishing a quality reputation increases with the number of experienced consumers, the home government may help to improve the incentive of home firms to do that by educating consumers in these markets to know their own valuation about the quality of a product. Nevertheless, this will be effective only if a high-quality product is introduced to inexperienced consumers. For example, Thai government has run a campaign of Thai Jasmine Rice in order to establish the quality reputation of Jasmine rice in the world market. Not only the high quality of Jasmine rice has been provided for trailing, how to cook rice properly, and Jasmine rice recipes have also been introduced to consumers who are not familiar with rice before. Now Thai rice especially Jasmine rice is considered as a high-quality rice in the world market and can enjoy the premiums.

Moreover, the government can promote quality upgrading by giving home firms export subsidies. When every units of a high-quality product that being exported to foreign markets are subsidised, the gains (costs) of choosing the choice of a high-quality product increase (decrease). However, export subsidies

will be inefficient if the government cannot perfectly monitor the quality of a subsidized product. Therefore, the government has to assure that the subsidies are only given to products with high quality. This is consistent with Grossman and Horn (1988). They suggest that subsidies do not alter incentives for choosing high quality; in contrast, they may actually lower the average quality of a product if subsidies are rewarded both reputable firms and hit-and-run firms equally.

A relationship between the number of competing firms and the gains of establishing a quality reputation is found to be negative in the case of new markets; this is consistent with Donnefeld and Mayer (1987), and Chiang and Masson (1988). Hence, the government should limit the number of competing firms, but just temporarily. Once the quality reputation of a product is established and consumers in new markets become experienced in a product, the government should permit free entry. Since the gains of establishing a quality reputation will improve when the number of competing firms increases in the case of mature market. When consumers in new export markets possess information about their valuation, it may be possible to promote the transition to a viable high-quality export market by competition policy alone.

To complete the study of this chapter, the welfare implications of establishing a quality reputation is made. Many studies argue that establishing the quality reputation of a new product by quality upgrading is a desirable outcome of exporting countries because the production of a high-quality product

is often considered as a pre-condition for export success and, ultimately, the economic development. However, the findings suggests differently; the choice of a high-quality product may causes a loss in the welfare in exporting countries. Establishing a quality reputation will improve the welfare in the home countries if, and only if, a fraction of consumers, whose tastes is a good match to a product, is large enough.

## **2 Why is it so difficult to settle a private agreement in an antidumping case ?**

In recent decades, economists have sought to uncover how an antidumping policy influences competition behaviour. The antidumping measure, which was originally designed to defend against unfair competition and remedy the injuries, imparts obvious short-run advantage to domestic industries by raising import costs or limiting import quantities; in some cases, this measure can also benefit foreign industries. Prusa (1992), Veugelers and Vandebussche (1999), and Zanardi (2004) all note that the antidumping policy generates an increase in the set of collusive outcomes. Nowadays, the antidumping measure and its true application have been widely questioned: whether this measure has been serving the collusive purpose or for the defensive objection, as originally intended.

If the antidumping measure has been frequently used as a collusive device, the number of private settlements should be high. However, according to actual

data, only one-quarter of total antidumping cases result in a price-undertaking agreement. Does the small number of private agreements support the argument that the antidumping measure has been employed as a defensive tool? It is too optimistic to make such a conclusion. At the same time, if domestic industries have employed the antidumping measure to threaten and induce foreign industries to collude, what is the reason for the small number of private agreements?

Prusa (1999) shows that, theoretically, domestic and foreign firm always collude, and agree to settle private agreements with certainty; however, his model fails to explain why not all antidumping cases conclude with private settlements. Zanardi (2004) introduces coordination costs and bargaining power to reconcile Prusa's results with actual data. His model suggests that the probability of reaching a private agreement decreases with coordination costs and non-linearly increases with bargaining power.

I have developed a simple take-it-or-leave-it bargaining model with two-sided asymmetric information where the probability of an affirmative outcome<sup>1</sup> is influenced by the type of the domestic and foreign firm and is considered as private information for each party. This differs from Prusa and Zanardi, they assume that the probability of an affirmative outcome is exogenously determined and public information for both domestic and foreign firms. The model is then used to examine the behaviour of firms and why domestic and foreign firms fail to collude.

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<sup>1</sup>Refers to an outcome in which antidumping duties are levied on products imported from the dumpers' country in response to a petitioning by domestic firms.

The following results are found. Firstly, with two-sided asymmetric information where the domestic and foreign firm are uncertain about the type of each other, collusion will be reached with certainty if, and only if, the domestic firm employs a pooling strategy and the probability of a low-type foreign firm is significant small. Otherwise, collusion will be broken down with a positive probability. Secondly, the likelihood that the domestic and foreign firm will collude increases with the probability of a high-type foreign firm and the probability of a low-type domestic firm. However, it decreases with the bargaining power and concentration level of the domestic firm. The lower the bargaining power of the domestic firm is, the larger the probability that the foreign firm will collude because the domestic firm is more likely to offer a larger share of the collusive profits to the foreign firm. With the high concentration level, on the contrary, the domestic and foreign firm are less likely to settle the private agreement since the domestic firm tends to offer a smaller share of the collusive profits to the foreign firm.

Thirdly, information asymmetry between the domestic and foreign firm is the main cause of bargaining failure. The bargaining game is less likely to admit efficient outcome under two-sided asymmetric information than one-sided asymmetric information. This implies that the small number of price-undertaking agreements is not evidence to support a decline in the use of the antidumping measure as a collusive device. In contrast, it indicates the bargaining inefficiency caused by asymmetric information. If domestic industries have often used the

antidumping measure as a collusive device, should this behaviour be supported?

The welfare implications of antidumping outcomes suggest that the antidumping measure may not improve welfare or even deteriorate it. In order to minimise the welfare losses of the antidumping measure, this measure must be only used for the defensive purpose. Hence, the antidumping laws should be harmonised. In other word, the same standard and practices for the antidumping measure will be applied across countries. The government authorities have to be objective when making the decision. Moreover, a lump sum payment for the antidumping penalties from the dumpers should be used in steady of levying the antidumping duties on products imported from the dumpers. This alternative approach causes neither a market distortion nor a negative impact on the economy at large, while imposing the duties does.

### **3 Do the Rules of Origin make a difference?**

During the past two decades, the number of free trade agreements has been rapidly growing from around 110 in 1990 to 511 now. All member countries of WTO, with the exception of Mongolia, are members of at least one FTA. The booms in FTAs have sparked a discussion on the impacts of the FTA on trends and patterns of trade. Generally, a country expected a considerable increase in exports after joining the FTA because of a preferential treatment and market enlargement; however, the expectation may never come true in the presence of

rules of origin. Rules of Origin are the rules that determine whether or not goods are eligible for preferential treatment under the FTA. Therefore, rules of origin are a central market-access tool governing over preferential trade flows and economic activities within the FTA region.

Krishna and Krueger (1995), Falvey and Reed (1998) and Ju and Krishna (2005) all argue that the more restrictive rules of origin either decrease or increase preferential trade flows within the FTA region, depending on the degree of competition in the final goods and the intermediate goods sectors on which they are applied. They are consistent with the empirical studies of Estervadeordal and Suominen (2003) and Cadot, Estervadeordal and Akiko (2005), demonstrating a negative relationship between the restrictiveness of rules of origin and preferential trade flows among the FTA members. The policy makers, however, seem to have different opinions. From their point of view, the more restrictive rules of origin induce the regional firms to employ more regional inputs and increasing preferential trade flows and economic activities within the FTA regions. The restrictive rules of origin always generate the benefit outcomes to domestic industries.

This chapter is motivated by the following arguments: Firstly, do the restrictive rules of origin promote preferential trade flows and economic activities within the region? Secondly, how does the degree of restrictiveness of rules of origin affect the behaviour of firms and the volume of goods import from the Rest of the World? Then, what should the rules of origin be? I extend the

model of Ju and Krishna (2005) by allowing a production of intermediate goods and introducing the intermediate goods rules of origin to make the model close to the real situation.

The results show that, with the dominance of final goods rules of origin effects, the tightening rules of origin increases the volume of final goods import from RoW but decreases the volume of intermediate goods and raw material import from RoW for the homogeneous regime. This is consistent with Ju and Krishna (2005) and the empirical studies by Estervadeordal and Suominen (2003) and Cadot et al (2005). Nevertheless, for the heterogeneous regime, a result is reversed.

If the intermediate goods rules of origin effects are dominant, the tightening rules of origin increases the volume of final goods and intermediate goods import from RoW, but decreases the volume of raw material import from RoW for the homogeneous regime; it contradicts to Ju and Krishna (2005). On the contrary, the result will be opposite for the heterogeneous regime. The rules of origin impacts on preferential trade flows and economic activities are ambiguous, depending on the degree of competition among the final goods, the intermediate goods and the raw material sectors on which they are applied, whether the final goods or the intermediate goods rules of origin effects dominate and whether the upstream-input industries are comparative advantage or comparative disadvantage compared to RoW.

Accordingly, the product-specific rules that specify a specific criteria to each

product and vary from product to product is preferable. The tight final goods rule of origin and the loose intermediate goods rules of origin are more efficient to promote preferential trade flows and economic activities within the FTA region. When the final goods rules of origin are tight, the regional intermediate goods and raw material are more required resulting in an increasing in the costs of producing the final goods. At the same time, the loose intermediate goods rules of origin relax an increasing in the cost of producing the intermediate goods and then the final goods.

Since the preferential rules of origin are substantially different from agreement to agreement and from country to country. Therefore, the proliferation of overlapping FTAs causes the higher administrative cost and the higher burden on manufacturers to comply with the rules of origin for many FTAs. In order to achieve significant benefits in terms of lower administrative costs and relax a burden on manufacturers, harmonisation of preferential rules of origin is introduced. From my point of view, the main purpose of rules of origin is not to be the simple rule; in contrast, they should be an efficient device to reach the country's objectives in establishing the FTA that varies from agreement to agreement and from country to country. Hence, a variation across preferential rules of origin regimes is preferable to a harmonised of preferential rules of origin.

The remainder of the thesis consists of three chapters of independent studies. Chapter 1: Quality Reputation and Export Promotion, Chapter 2: Why is it so

difficult to settle a private agreement in an antidumping case? And Chapter 3:  
Do the Rules of Origin make a difference? The conclusions of each chapter and  
the entire thesis are addressed in the Conclusion.

# Chapter 1: Quality Reputation and Export Promotion

Chutamas Bumrungsuk\*

## Abstract

This paper develops a finite two-stage game model where consumers in new export markets lack information about their own valuation for the quality of a new product. The model is then used to examine firms' quality choices. With asymmetric information, the need to establish a quality reputation may not be sufficient to induce firms to choose high quality. The likelihood that a firm will choose to export a high-quality product rather than a lower-quality variant increases with the number of experienced consumers. However, it decreases with the number of competing firms. A policy of subsidising exporters can encourage firms to select high quality and promote consumer experience, and thus establish an independently viable high-quality export market. Nevertheless, this will only work if the subsidy is conditional on quality choice. That is, the administrative monitoring of quality is required. Beside, the government may limit the number of competing firms that exports to new foreign markets in order to increase the incentive to export a high-quality product; this policy has to be temporary. When consumers in new export markets possess information about their own valuation, it may be possible to promote the transition to a viable high-quality export market by competition policy alone.

**JEL Classification:** F13; C72

**Keywords:** quality reputation; subsidy policy; competition policy; asymmetric information

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# 1 Introduction

When the quality of a product is unobservable before purchasing, firms have to decide whether providing a low-quality product with a high-quality price to earn short-term gains or providing a high-quality product to establish a quality reputation. Is the acquisition of reputation sufficient to induce firms to choose the choice of a high-quality product? If not, how can one overcome this problem and encourage firms to choose high quality ? Do firms behave differently in new export markets with the different types of consumers? These are the main focuses of this paper.

This paper examines the decision of home firms on quality choices by developing a finite two-stage game model where consumers in new foreign markets lack information about their own valuation for the quality of a new product. One finds that the acquisition of reputation is not sufficient to induce firms to choose the choice of a high-quality product when information is asymmetric. Therefore, the government intervention is needed.

Secondly, the likelihood that a firm will choose to export a high-quality product rather than a low-quality variant increases with the number of experienced consumers, who know their own valuation for the quality of a product. That is, firms are the least likely to export a high-quality product to new markets where consumers are inexperienced. However, firms may be the most likely to choose the choice of high-quality product for exporting to new markets if the proba-

bility that consumers in such markets assign a high valuation to a high-quality product is sufficient large.

Thirdly, a negative relationship is found between the number of competing firms and the gains from establishing a quality reputation in markets where consumers are inexperienced. In other word, the larger number of competing firms causes home firms to be less likely to export a high-quality product to new markets. This is consistent with Donnefeld and Mayer (1987) and Chiang and Masson (1988). Conversely, a positive relationship is found in the case of mature markets. The larger number of competing firms increases the likelihood of exporting a high-quality product to mature markets where consumers have experience about their own valuation and the quality of a product.

Accordingly, the home government should increase the number of experienced consumers in target foreign markets and decrease the number of competing firms in order to improve the gains from establishing a quality reputation. With a high-quality product, consumers in foreign markets not only learn whether such a product is a good match but they also have information about a high-quality product. With a low-quality product, however, consumers may be deluded about their tastes. To open up a foreign market of a new product, the home government has to educate consumers in such market by providing them an experienced on a high-quality product.

Beside educating consumers in new foreign markets, the home government can increase the firms' expected payoff from exporting a high-quality product by

limiting the number of exporting firms. Nevertheless, this policy should not be permanent. Once consumers in target foreign markets have experienced about a product and know their own valuation, competition can induce both incumbent firms and new entrants to choose the choice of a high-quality product. Moreover, the government can motivate home firms to export a high-quality product by a policy of subsidising a high-quality product. For effective implementation, the government has to closely monitor the quality of an exported product that being subsidised.

Last but not least, a welfare analysis of establishing a quality reputation is made. Establishing a quality reputation by upgrading the quality of a product will lead to a welfare gain or loss depending on a fraction of consumers whose tastes match to a home product. If the fraction is large enough, the choice of a high-quality products will improve the welfare in the home country.

This paper is organised as follows. The next section reviews related literature about the relationship between reputation and firms' quality choices. In Section 3, a basic model of a finite two-stage game, where consumers in new markets lack information about their valuation for the quality of a new product, is introduced to examine firms' quality choices. Section 4 shows what the government should do to induce firms to upgrade the quality of their products. A discussion on export promotion policy, export subsidies policy and competition policy is made in this section. In Section 5, a welfare analysis of establishing a quality reputation is provided. Finally, the conclusion is presented in Section 6.

## 2 Literature Review

When the product quality is unobservable or unidentifiable, a consumer's expectation of the product quality is according to an average quality sold in the market. With asymmetric information, firms will choose to produce below the average quality level in order to earn short-term gains. Shapiro (1982) analyses how a profit-maximising firm chooses the quality of products when the quality is unobservable before purchasing. With a static model, he finds that a producer only provides a minimum-quality product to the market if prices are determined by the average quality in the market. Moreover, with a dynamic model, given that consumers do not learn about the product quality of each individual firm over time, the market is overrun by minimum-quality products.

Shapiro (1983) studies the relationship between reputation and the behaviour of firms under perfect competitive environment. Since products are difficult to observe before purchasing, then consumers may plausibly use the quality of products produced by a firm in the past as an indicator of present or future quality. His findings show that the premium, which is the returns from building up the reputation of firms, plays a crucial role in inducing firms to keep their reputation high by offering a high-quality product. Moreover, if consumers learning process about the quality of a product is slow, the high premium will be required to encourage firms to establish his reputation.

According to Allen (1984), consumers in his model reassure themselves about

a high-quality product of each firm by verifying the price charged and the quantity produced. These consumers will refuse to buy any products from firms that offer a lower price because they reasonably believe that such products are low quality. Hence, firms may choose to suffer losses by offering a high-quality product at the outset in order to build their quality reputation and subsequently earn profits afterward. That is, building up a reputation encourages firms to select high quality.

When consumers update their belief about firms according to their performance, firms will harm their reputation with a poor performance, but they will improve their reputation with a good performance. Tadelis (1999) argues that the reputation of firms fluctuates. With a good news learning environment, low-reputation firms will offer a high-quality product to build their own reputation or buy the reputation from reputable firms. On the other hand, with a bad news learning environment, the high-reputation firms have an incentive to maintain a high-quality level in order to keep their reputation high, as suggested by Diamond (1989).

Issac (2003) assumes that consumers have a slow learning process about the quality of a product and they learn about it by observing an ex-post outcome. His results show that, if firms learn about their own quality at the same rate as consumers, sufficiently bad luck can induce firms to stop trading in the markets. On the contrary, if firms know that the quality of their products is high, they will trade and obtain more gains from continuing trade because their reputation

is relatively more likely to improve.

Boardyand and Veh (2010) examines how the reputation of firms affects investment incentives, given that the quality of a product is persistent and determined by the past investment. They find that reputational incentives are determined by the specification of market learning. With perfect good news signals, which indicate high quality, the reputational payoff decreases in the reputation of firms. Accordingly, low-reputation firms have more investment incentives to produce a high-quality product. In contrast, with perfect bad news signals, which indicate low quality, the reputation payoff increases in the reputation of firms. Hence, high-reputation firms are more likely to produce a high-quality product.

Across all imperfect learning processes with Brownian and Poisson signals, If firms with a low reputation are believed to invest for high quality, their reputation increases and reputational returns are high. Therefore, a high-quality product is sustainable when markets believe that the quality of a product is low. Conversely, when markets believe that the product's quality is high, a high-quality product is not sustainable as a result of the low reputational returns.

When a new domestic product is introduced to the foreign market, foreign consumers, who know nothing about such a product except the country of origin, will identify a product by country, not by firm and learn about the quality through consumption. If a domestic firm exports a high-quality product to the

foreign market, a reputation is then built not only for the firm itself but also for the country as a whole. In other word, all exporting products from the same country of origin enjoy the same reputation. For this reason, the government intervention may be needed. Mayer (1984) suggests that the government should subsidise export firms to encourage them to establish the reputation of a country by exporting a high-quality product. However, Grossman and Horn (1988) find that subsidies may lower the average quality of a product if they reward both reputable and hit-and-run firms equally.

Should the government limit the number of firms to increase the quality of a product from its country? The relationship between the number of firms and the quality level is unclear. Regarding to Donnefeld and Mayer (1987), they develop a general equilibrium setting with an endogenous determining the number of firms. Their results suggest that the government should decrease the number of firms and control the size of firms in order to upgrade the quality of a product and the efficiency of firms; without intervention, firms produce lower quantities and lower quality than socially optimal.

Chiang and Masson (1988) employ a partial equilibrium model, with the endogenous determining the number of firms and find the inverse relationship between the number of firms and the quality level. Firms raise the quality of a product when the number of firms falls. This finding is consistent with Donnenfeld and Mayer (1987). In contrast, Horner (2002) argues that competition induces reputable firms to maintain their quality at high level. Without

competition, when consumers cannot perfectly monitor the quality of a product, firms are less likely to keep their product quality high. Competition, on the other hand, endogenously generates outside options for disappointed consumers. Consumers can leave the firms whenever they do not satisfy with the quality of a product. Therefore, a reputation is valuable.

Dana and Fong (2008) finds that firms in an oligopoly market are able to more easily maintain their reputation for a high-quality experience product than firms in a competitive market or a monopolist. This finding is consistent with empirical evidence by McMaster (1995) and Domberger and Sherr (1989). On the one hand, McMaster (1995) argues that introducing competitive bidding for some health services in the UK lowers their quality. On the other hand, Domberger and Sherr (1989) show that the British government's decision to liberalise the conveyancing monopoly in 1984 improves the quality of conveyancing services in England and Wales.

### **3 The Finite Two-Stage Model**

Assume competitive  $n$  home sellers export a homogeneous product to the foreign market, but they can choose between a high- or low-quality variant of it. The seller incurs a cost  $c_H$  or  $c_L < c_H$  in exporting a high- or low-quality product, respectively. There is a large population of risk-neutral buyers who are either type  $A$ , assigning a valuation of  $v_H$  on a unit of high-quality product ( $q_H$ ) and a

valuation of  $v_L < v_H$  on a unit of low-quality product ( $q_L$ ), or type  $B$ , assigning a valuation  $v_L$  on both variants. Assuming that a fraction  $\theta$  of the buyers are type  $A$  and the following inequality equation holds:

$$v_H - c_H \equiv \pi_H > v_L - c_L \equiv \pi_L > \theta v_H + (1 - \theta)v_L - c_H \equiv \tilde{\pi} > 0$$

The inexperienced buyer does not know his own type. In other word, he does not know whether a product exported by the seller is a good match to his subjective tastes. However, he can learn about this through his consumption. The buyer is assumed to place no weight on future payoffs, or  $\delta^B = 0$ . This implies that the buyer does not incorporate the experimental effect on future payoff into his valuation for each period. At the same time, the seller is assumed to discount her future payoff according to a positive factor, that is,  $\delta^S > 0$ .

This model considers a short-run game where players are active in the market for two periods. During the first period, a potential buyer and seller are randomly assigned to each other. The seller presents a price and a quality offer to the buyer. That is, she offers a high-quality product,  $q_H$ , with price  $p_H$  or a low-quality product,  $q_L$ , with price  $p_L$ . The buyer decides to either accept offer or reject them both; if he rejects the offer, no transaction takes place and there is zero payoff to both the seller and buyer in this period. However, if the buyer accepts the offer, his payoff is realised after consuming and depending on his own type and product quality.

Given that the buyer accepts the offer of a high-quality product, the seller can choose to outsource either a high-quality product or a low-quality product from its outsourcing manufacturers because the product quality is unobservable at the time of purchase. Hence, the seller decides whether to cheat or be honest. If the seller cheats by exporting a low-quality product to her buyer, she will get a short-run gain. In contrast, if the seller is honest, she can establish her reputation in the market as well as the buyer can realise his own type.

At the beginning of the second period, the buyer has two choices. Firstly, participating in a lottery draw that randomly assigns him to the seller, or secondly, attempting to buy again from the same seller whom he purchased from in the first period. Assume that the separation of buyer and seller occurs, with probability  $\omega$ , with the buyer being randomly assigned to the seller. Therefore, a new transaction with the first-period seller takes place with probability  $1 - \omega$ , where  $\omega > \pi_L/\pi_H$ .

In the second period, the seller again presents a combination of price and quality offer; however, in this round, the quality is assumed to be observable and enforceable. Consequently, the seller certainly exports the promised quality to her buyer. If the buyer experiences  $v_H$  in the first round, he will choose the second choice, that is, trying to buy again from the same seller. At the same time, if the buyer experiences  $v_L$ , he will employ the first choice.

Now the behaviour of home sellers in the different types of foreign markets is examined. The home seller decides whether to establish her reputation in

the foreign market depending on the size of reputation gains. The behaviour of home sellers when enter to new markets, mature markets and mixed market are presented in the rest of this section.

## The New Markets

In new markets where all buyers have no experience of the product introduced by the home seller, the buyer holds an initial belief  $\beta_A^0 = \theta$ . That is, the buyer believes with probability  $\theta$  that the product bough from the seller is a good match to his subjective tastes. Accordingly, the expected valuation to the buyer, when the seller delivers a high-quality product in the first period, is:

$$\tilde{v} = \theta v_H + (1 - \theta)v_L$$

The buyer will never accept the offer from the seller if the product price exceeds his expected valuation; therefore, it is optimal for charging a price that exactly equals the expected valuation of the buyer. In other word,  $p_H = \tilde{v}$  for a high-quality product and  $p_L = v_L$  for a low-quality product.

If the seller offers and exports a high-quality product to new markets, her payoff in the first period is:

$$\tilde{\pi} = \tilde{v} - c_H$$

On the contrary, if the seller promises a high-quality product but exports a

low-quality product instead, her payoff from cheating is:

$$\tilde{\pi}^D = \tilde{v} - c_L > \tilde{\pi}$$

Now, the seller who offers a high-quality product faces the temptation to cheat, which equals  $\tilde{\pi}^D - \tilde{\pi}$ , or:

$$\Omega \equiv c_H - c_L$$

When the seller exports a high-quality product as promised, the type  $A$  buyer will experience  $v_H$  and will update his belief to  $\beta_A^1 = 1$ . This type  $A$  buyer will be willing to pay up to  $p_H = v_H$  for a high-quality product and try to buy again from the same seller in the second period. Thus, given a strategy adopted by the buyer and a probability of separation, the type  $A$  buyer will buy again from the seller, who exported a high-quality product in the first period, with probability  $\eta_A \equiv (1 - \omega) + \frac{\omega}{n}$ . On the other hand, the type  $B$  buyer will experience  $v_L$ . This type  $B$  buyer will then update his belief to  $\beta_B^1 = 1$  and will purchase only a low-quality product at  $p_L = v_L$  in the second period. According to the assumptions, the buyer will participate in lottery draw if he experiences  $v_L$ , a transaction in the second period will take place with the same seller in the first period with probability  $\eta_B \equiv \frac{1}{n}$ .

Therefore, the expected payoff in the second period to the seller, who keeps

her promise by exporting a high-quality product in the first period, is:

$$\theta\eta_A\pi_H + (1 - \theta)\eta_B\pi_L$$

If the seller breaks her promise by exporting a low-quality product instead, the buyer will update his belief to  $\beta_A^1 = 0$ , regardless of what true type he is. The buyer will then be believed that he is the type  $B$  buyer whose subjective tastes do not match to a product bought from the seller in the first period. The expected payoff to the seller, who cheats in the first period, is:

$$\frac{1}{n}\pi_L$$

Offering and exporting a high-quality product is the best response to the seller when enters into new markets, if the expected payoff from exporting a high-quality product is not less than the expected payoff from deviation. That is:

$$\tilde{\pi} + \delta^S [\theta\eta_A\pi_H + (1 - \theta)\eta_B\pi_L] \geq \tilde{\pi}^D + \delta^S \left(\frac{1}{n}\right) \pi_L$$

A condition for the seller to establish her reputation in new markets can be stated as:

$$\Omega \leq \delta^S \theta (\eta_A\pi_H - \eta_B\pi_L) \equiv \Omega_1^* \tag{1}$$

The seller will choose to export a high-quality product to new markets, where

all buyers are inexperienced in her product, in the first period to establish her reputation, if the reputation gains are larger than the short-run benefits from cheating.

If the seller offers to deliver a low-quality product with price  $p_L = v_L$  and the buyer accepts it, the buyer will experience  $v_L$  and learn nothing about his own type, that is,  $\beta_A^1 = \theta$ . Thus, the buyer, in the second period, will be willing to pay for a high-quality product at price  $\tilde{p} = \tilde{v}$ , whereas the seller will not offer a high-quality product at that price because of  $\pi_L > \tilde{\pi}$ . The expected payoff to the seller who offers a low-quality product in the first period is:

$$\pi_L + \delta^S \left( \frac{1}{n} \right) \pi_L$$

The seller will not choose to offer a low-quality product rather than a high-quality one in the first round, if the following condition holds:

$$\tilde{\pi} + \delta^S [\theta \eta_A \pi_H + (1 - \theta) \eta_B \pi_L] \geq \pi_L - \delta^S \left( \frac{1}{n} \right) \pi_L$$

or:

$$\Omega \leq \delta^S \theta (\eta_A \pi_H - \eta_B \pi_L) + (\tilde{v} - v_L) \equiv \Omega_2^* \quad (2)$$

Due to the fact that  $(\tilde{v} - v_L) > 0$ , then  $\Omega_1^* < \Omega_2^*$ . If condition (1) is satisfied, condition (2) is also satisfied. In other words, the seller always chooses to establish her reputation in new markets. On the contrary, when condition (2) holds,

it does not guarantee that condition (1) will hold. If condition (1) is violated, the seller's promise to export a high-quality product is incredible. The buyer never accepts the offer on a high-quality product in the first period, since he knows that the seller always breaks promise by exporting a low-quality product. Consequently, the seller always chooses to export a low-quality product to the buyer in both period. If the reputation gains are not large enough, the seller is less likely to export a high-quality product to settle her reputation in new markets.

**Proposition 1** If a condition  $\Omega \leq \Omega_1^*$  holds, the seller will export a high-quality product in order to establish a quality reputation in new markets. However, if  $\Omega > \Omega_1^*$ , the seller will only export a low-quality product to new markets.

This implies that the likelihood of establishing a quality reputation in new markets increases with the number of the type  $A$  buyers. With a larger probability of a product being matched to consumers' tastes, the home firms are more likely to export a high-quality product to new markets. Consumers in new markets may be deluded about their true tastes if the home firms sell a low-quality product as a high-quality product. As a result, these consumers will not be interested in purchasing a high-quality product again even though a product is a good match to their tastes.

For example, if a Thai firm would like to bring Pad-Thai frozen meal to the Western markets, where consumers are not familiar with Thai food, the

firm must provide a high-quality Pad-Thai frozen meal to consumers in these markets. If the firm provides a low-quality product, consumers will be misunderstood that Pad-Thai frozen meal is ill-matched to their tastes and Pad-Thai frozen meal may fail in the Western market. A bad first impression due to a low-quality product may cause a product failure in new markets. Accordingly, the government should have a policy to support firms to export a high-quality product to new markets because other firms, who sell the same product from the same country, will be also benefits from establishing a quality reputation of a pioneering firm. The policy discussion is made in the next section.

If the model is extended to be a longer or an infinite game, the results may be changed because the buyer has the opportunity to learn about his true type after being deluded by a low-quality product. On the one hand, with a long time horizon, the seller may be more likely to export a high-quality product rather than a low-quality one at the beginning as a consequence of the larger gains from establishing the quality reputation of a product. On the other hand, with a possibility of consumer learning process, the seller may be more likely to cheat by exporting a low-quality product as a high-quality variant since she has a second chance to introduce a high-quality product to the buyer whom is deluded.

Accordingly, with a long time horizon and a possibility of consumer learning, the seller may have either more or less incentive to choose high quality for establishing her reputation in new markets depending on many factors such as

the discount factor, the specification of market learning, or the speed of consumer learning. Regarding to Shapiro (1983), with infrequent sale of products, long lags in detection of quality, slow updating of reputations, or difficulty in detecting quality attribution, the premiums for a high-quality product must be larger in order to compensate for the investment in reputation. This can be interpreted that firms are less likely to choose the choice of a high-quality product if there is a small probability of the firm being chosen or there is a slow updating of reputations.

Tadelis (1999) suggests that, with a good news learning, low-reputation firms will have more incentives to offer a high-quality product to build their reputation. Conversely, Boardyand and Veh (2010) argue that, with Brownian and Poisson learning process, if consumers believe that the quality of a product is low, low-reputation firms are more likely to upgrade the quality of their product. These studies indicate that the specification of market learning plays a crucial role in determining whether firms choose the choice of a high-quality product.

## **The Mature Markets**

When the home seller enters into mature markets where all buyers know their own type and have experience about a product, she knows that the type  $A$  buyer prefers to purchase a high-quality product at price  $p_H = v_H$ , whereas the type  $B$  buyer prefers to purchase a low-quality product at price  $p_L = v_L$ . Hence, in the first period, the home seller will offer either a high-quality product or

a low-quality product to her buyer depending on the type of the buyer being assigned to her. Now let focus on the case of the type  $A$  buyer.

In the first period, the seller offers a high-quality product at price  $p_H = v_H$  and this offer is accepted by the type  $A$  buyer. If the seller cheats by exporting a low-quality product as a high-quality product, the buyer will suddenly realise after consuming that he is cheated by the seller. Accordingly, in the second period, this type  $A$  buyer will still prefer to purchase a high-quality product at price  $p_H = v_H$  but he will participate in a lottery draw rather than attempting to buy again from the same seller. In contrast, if the seller chooses to be honest, the buyer will try to buy a high-quality product again from her in the second period.

As far as the following equation holds, the seller will export a high-quality product to establish a quality reputation in mature markets:

$$(v_H - c_H) + \delta^S \eta_A \pi_H \geq (v_H - c_L) + \delta^S \eta_B \pi_H$$

or:

$$\Omega \leq \delta^S (\eta_A - \eta_B) \pi_H \equiv \Omega_3^* \quad (3)$$

The expected payoff from establishing a quality reputation in these markets is generally higher than in new markets, except  $\theta > \theta^* \equiv \left[ \frac{\eta_A \pi_H - \eta_B \pi_H}{\eta_A \pi_H - \eta_B \pi_L} \right]$ . An increase in the probability of the type  $A$  buyer causes the more opportunity losses from cheating in new markets because the true type  $A$  buyers will never be inter-

ested in purchasing a high-quality product with a high price any more. Hence, if the probability that the buyer in the new market is type  $A$  is significant large, the seller is more likely to export a high-quality product when enters to new markets than mature markets.

**Proposition 2** The seller is more likely to export a high-quality product in order to establish a quality reputation when enters into new markets than mature markets if the probability that the buyer assigns a high valuation to a high-quality product is sufficient large. That is,  $\theta > \theta^* \equiv \left[ \frac{\eta_A \pi_H - \eta_B \pi_H}{\eta_A \pi_H - \eta_B \pi_L} \right]$ .

While consumers in mature markets can distinguish between a product is low quality and it is ill-match for their tastes, consumers in new markets cannot. Therefore, if the seller chooses the short-run gains from exporting a low-quality product as a high-quality product to new markets, this choice not only ruins her own quality reputation, it also condemns the quality reputation of other sellers who sell the same product from the same country. This explains why the government is more concerned with the quality of an exported product than a product sold in its own market. For example, Chinese government has tightened export regulations to comply with the international standard and has offered firms with a good record more preferential policy in order to encourage them to export a high-quality product to the world market.

## The Mixed Markets

Now consider the case that the seller enters into the markets where consist of experienced and inexperienced consumers. Assuming that the buyer is a member of the experienced consumers, who have information about their own valuation for the quality of a product, with probability  $\lambda$  and this probability is independent of the probability that the buyer is type  $A$ .

In the first period, the probability that the seller will be randomly assigned to the buyer, who will prefer to purchase a high-type quality at price  $p_H = v_H$ , is  $\lambda\theta$ . In other word, only the experienced type  $A$  buyer will be willing to buy a high-quality product at high price. On the contrary, with probability  $1 - \lambda$ , the seller will be assigned to the inexperienced buyer, who will accept the offer of a high-quality product if, and only if, the price does not exceed his expected valuation, or  $p_H = \tilde{v}$ . If the seller keeps a promise by exporting a high-quality product to the buyer, the type  $A$  buyer will buy a high-quality product at price  $p_H = v_H$  from her again in the second period with probability  $\eta_A$ , whereas the type  $B$  buyer will buy a low-quality product at price  $p_L = v_L$  from her with probability  $\eta_B$ . Accordingly, the expected payoff to the seller, who exports a high-quality product can be shown as:

$$\lambda\theta\pi_H + (1 - \lambda)\tilde{\pi} + \delta^S [\eta_A\theta\pi_H + \eta_B(1 - \theta)\pi_L]$$

If the seller chooses the short-run gains from exporting a low-quality product

as a high-quality product, the experienced buyers will realise that the buyer cheats on him while the inexperienced buyer will not. Therefore, the experienced type  $A$  buyer will participate in a lottery draw and buy a high-quality product, whereas the inexperienced buyer will buy a low-quality product because he is believed that he is the type  $B$ . The expected payoff to the seller, who exports a low-quality product as a high-quality product, is equal to:

$$\lambda\theta(v_H - c_L) + (1 - \lambda)(\tilde{v}_H - c_L) + \delta^S [\eta_B\lambda\theta\pi_H + \eta_B(1 - \lambda)\pi_L]$$

As long as the expected payoff from establishing a quality reputation is greater than the expected payoff from cheating, the seller will choose to establish her reputation. In other word, the seller will export a high-quality product to mixed markets when the following condition holds:

$$\Omega < \frac{\delta^S\theta}{1 - \lambda + \lambda\theta} [\eta_A\pi_H - \eta_B\pi_L - \eta_B\lambda(\pi_H - \pi_L)] \equiv \Omega_4^* \quad (4)$$

The seller is the most likely to export a high-quality product when she enters into mature markets as a result of the largest gains in this type of market. That is,  $\Omega_3^* > \Omega_4^* > \Omega_1^*$ . Nevertheless, if a probability of a product being matched to buyers' tastes is significant large, or  $\theta > \theta^* \equiv \left[ \frac{\eta_A\pi_H - \eta_B\pi_H}{\eta_A\pi_H - \eta_B\pi_L} \right]$ , the result will be changed. The incentives to export a high-quality product in new markets is the largest.

These indicate that the seller who chooses the short-run gains from cheating may change to enjoy the long-run gains from establishing a quality reputation when experienced buyers are present in markets. According to equation 4, an increase in a probability of experienced buyers raises the expected payoff from exporting a high-quality product. The effects of a probability of experienced buyers on the reputation gains can be described as:

$$\frac{\partial \Omega_4^*}{\partial \lambda} = \left[ \frac{\delta^S \theta}{(1 - \lambda + \lambda \theta)^2} \right] (\eta_A - \eta_B) \pi_H - \theta (\eta_A \pi_H - \eta_B \pi_L) \quad (5)$$

As far as  $\theta < \left[ \frac{\eta_A \pi_H - \eta_B \pi_H}{\eta_A \pi_H - \eta_B \pi_L} \right]$ , the gains from establishing a quality reputation increases with the number of experienced buyers, or  $\frac{\partial \Omega_4^*}{\partial \lambda} > 0$ . Thus, the reputation gains in mature markets are larger than in mixed markets and the reputation gains in mixed markets are larger than in new markets. In contrast, if  $\theta > \left[ \frac{\eta_A \pi_H - \eta_B \pi_H}{\eta_A \pi_H - \eta_B \pi_L} \right]$ , the result will be reversed. As the number of experienced buyers increases, the reputations gains are declined. The seller is the most likely to establish a quality reputation when she enters into new markets, if the probability of the type  $A$  buyer is sufficient large.

**Proposition 3** The likelihood that the seller will choose to export a high-quality product to establish a quality reputation increases with the number of experienced buyers, if a condition  $\theta < \left[ \frac{\eta_A \pi_H - \eta_B \pi_H}{\eta_A \pi_H - \eta_B \pi_L} \right]$  holds. However, it decreases with the number of experienced buyers, if otherwise.

## 4 Policy Discussion

As shown in section 3, in the presence of asymmetric information, the need to establish a quality reputation may be insufficient to induce firms to choose the choice of a high-quality product. Therefore, the government intervention is needed to encourage firms to establish a quality reputation. Basically, the government has to improve the incentive of firms to export a high-quality product and reduce the cost of exporting it. Export promotion policy, Export subsidising policy and Competition policy are discussed as follows.

### Export Promotion Policy

Regarding to equation 5, the gains from establishing a quality reputation increases with the number of experienced consumers, a private firm which is not interested in establishing a quality reputation in new markets may change to export a high-quality product when experienced consumers are present in market. Accordingly, the government could increase the incentive of firms by raising the number of experienced consumers in new export markets. A free product trial is a simple and straightforward approach for introducing a product to new export markets and informing new consumers about the quality of a product.

As already discussed, introducing a low-quality product to consumers in new market deludes inexperienced consumers into believing that a product is ill-matched to their subjective tastes. Hence, if firms would like to establish the

quality reputation of an introduced product, they must introduce a high-quality product, not a low-quality variant. However, firms have less incentive to do that because of a free rider problem. The government should assume responsibility for doing so instead of private firms.

For example, the Thai government has run a campaign *Thai Jasmine Rice*<sup>1</sup> to introduce Thai Jasmine rice to new export markets where consumers are not familiar with rice. This campaign gives consumers an experience based on the real taste, texture and flavour of a high-quality Thai Jasmine rice. A high-quality Jasmine rice gives a good first impression to consumers in new markets and is a key factor in successful opening and establishing a quality reputation of Jasmine rice in international markets, especially the Chinese and Hong Kong market.

When a high-quality product is provided and trailed, consumers in new markets become experienced ones and can distinguish between a high-quality product and a low-quality variant. Consequently, consumers, whose tastes match to a product introduced by the government, are willing to pay a premium price for a high-quality product. The incentive of choosing a high-quality product will be improved from this policy and then the quality reputation of a new product can be settled.

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<sup>1</sup>Or Kao Hom Mali: a long-grain variety of rice that has a nutty aroma, a subtle pandan-like flavor and originally from Thailand only.

## Export Subsidies Policy

If a firm exports a low-quality product as a high-quality one to new markets, where consumers lack information about their own valuation for the quality of a product, none of consumers will accept the offer of a high-quality product at a premium price in the future. As a result, the new entry firms may lose opportunities to establish a quality reputation in such markets although they will provide a high-quality product. This implication is consistent with Mayer (1984), the poor performance of one firm ruins the quality reputation not only for itself but also for the country. The experience with Toyota also determines the quality of other Japanese brands, for instance.

The consumers' first impression of a product is a key factor to determine the success or failure of a product in new markets. The performance of pioneering firms is more important; the government, hence, has to motivate firms to export a high-quality product rather than a low-quality variant into new markets. Subsidising a high-quality product is a direct and efficient instrument to reduce the cost of establishing a quality reputation.

Assume that the government subsidises  $s_H$  to every unit of a high-quality product that firms export to new markets. The expected payoff to home firms when export a high-quality product can be written as:

$$(\tilde{v} - c_H + s_H) + \delta^s [\eta_A \theta (\pi_H + s_H) + \eta_B (1 - \theta) \pi_L]$$

With a perfect monitoring, if firms do not export a high-quality product, they will not be subsidised by the government. Thus, the gains from exporting a high-quality product increases whereas the gains from cheating do not change. A condition for firms to establish a quality reputation when the government subsidises to a high-quality product is:

$$\Omega \leq s_H(1 + \delta^S \theta \eta_A) + \delta^s \theta [\eta_A \pi_H - \eta_B \pi_L] \equiv \Omega_{S_H}^* \quad (6)$$

A comparison between  $\Omega_1^*$  and  $\Omega_{S_H}^*$  indicates that the gains from exporting a high-quality product to new markets with export subsidies are greater than the gains without subsidies. Therefore, a policy of subsidising a high-quality product can motivate firms to upgrade the quality of their export product in new markets.

If the government cannot perfectly monitor the quality of an export product, this policy may inefficiently induce firms to upgrade the quality of their product. Beside an increasing in the gains from exporting a high-quality product, subsidies also raise the short-run gains from cheating. Hence, a condition for firms to establish a quality reputation when the government subsidises to a high-quality product but it cannot perfectly monitoring can be stated as:

$$\Omega \leq s_H \delta^S \theta \eta_A + \delta^s \theta [\eta_A \pi_H - \eta_B \pi_L] \equiv \Omega_{s_H}^* \quad (7)$$

The gains from exporting a high-quality product when the government subsidises to a high-quality product are always greater than the gains when the government does not. Nevertheless, without a perfect monitoring, export subsidies provide firms the less incentive to export a high-quality product than subsidies with a perfect monitoring. Accordingly, the government has to closely monitor the quality of a subsidised product to ensure that such product is a high-quality product.

This is consistent with Grossman and Horn (1988). They argue that subsidies, which reward both reputable and hit-and-run firms equally, do not offer an incentive for choosing high quality. In fact, subsidies may lower the average quality of a product being exported to new markets. Hence, the administrative monitoring of quality should be implemented, together with subsidies to ensure that firms will not cheat by exporting a low-quality product rather than a high-quality variant.

With respect to Mayer (1984), as long as the product familiarisation process works through the consumption of an export product, the subsidisation of exports for market cultivation is the first-best policy.<sup>2</sup> In accordance with Mayer's study, the quality of a product is not a necessary condition for receiving the export subsidies. This contradicts the findings of the finite two-stage game model.

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<sup>2</sup>If inexperienced consumers are cultivated through other activities such as advertising, then subsidisation of these activities rather than exporting would be the first-best policy.

## Competition Policy

The competition impacts on the quality of a product is ambiguous. According to Donnefeld and Mayer (1987) and Chiang and Masson (1988), firms will upgrade the quality of their product when the number of firms falls. Therefore, the government should control the number of firms. On the contrary, Horner (2002) argues that a competition induces firms to maintain the quality of their product at a high level. These indicate that a competition policy plays a crucial role to determine product quality. Whether the government should decrease or increase the number of competing firms?

The number of firms impacts on the gains from exporting a high-quality product to new markets can be shown as:

$$\frac{\partial \Omega_1^*}{\partial n} = - \left[ \frac{\omega \pi_H - \pi_L}{n^2} \right] \theta \delta^S$$

Accordingly, firms are more likely to export a high-quality product rather than a low-quality variant when the number of firms falls, given that a condition  $\omega > \frac{\pi_L}{\pi_H}$  holds.<sup>3</sup> With the large number of firms and the existence of a separation of buyer and seller, firms face a small probability that they will be chosen again in the

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<sup>3</sup>In contrast, if  $\omega < \frac{\pi_L}{\pi_H}$ , the likelihood that a firm chooses to export a high-quality product to new markets increases with the number of firms, since:

$$\frac{\partial \Omega_1^*}{\partial \omega} = - \left( \frac{n-1}{n} \right) \theta \delta^S \pi_H$$

When consumers are more loyal to firms that export a high-quality product, then firms have more incentives to establish a quality reputation.

next transaction so the expected payoff from establishing a quality reputation falls. This gives a similar result to Donnefeld and Mayer (1987) and Chiang and Masson (1988) and is consistent with empirical findings of MacMaster (1995) and Crespi and Marette (2006).<sup>4</sup>

The number of firms will have different effects on the reputation gains if firms enter into mature markets. That is:

$$\frac{\partial \Omega_3^*}{\partial n} = \left[ \frac{\pi_H - \omega \pi_H}{n^2} \right] \theta \delta^S$$

The relationship between the number of firms and the expected payoff from exporting a high-quality product is positive in mature markets. Firms are more likely to choose a high-quality product to establish their reputation in order to keep their consumers for the future transactions.<sup>5</sup> The larger the number of firms is, the more pressure on firms to choose a high-quality product because firms face the larger probability of losing their future profits when cheating.

This is consistent with Horner (2002) and the empirical evidences provided by

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<sup>4</sup>MacMaster (1995) finds empirical evidence that allowing competitive bidding for some health services in the UK resulted in a lower quality of these services. Moreover, Crespi and Marette (2006) presents empirical evidences of a positive relationship between product quality and market concentration.

<sup>5</sup>If firms choose the short-run gains from cheating, they will lose out on profit  $\pi_H$  with probability  $\left[ \frac{(1-\omega)(n-1)}{n} \right]$ . Denote  $\varphi \equiv (\eta_A - \eta_B) = \left[ \frac{(1-\omega)(n-1)}{n} \right]$ , then:

$$\frac{\partial \varphi}{\partial n} = \frac{1-\omega}{n^2}$$

The probability that firms will lose their opportunities to earn a larger profit,  $\pi_H$ , in the next transaction when exporting a low-quality product increases with the number of competing firms.

Mazzaeo (2003) and Cohen and Mazzeo (2004).<sup>6</sup>

**Proposition 4** The likelihood that a firm will choose to establish a quality reputation by exporting a high-quality product decreases with the number of competing firms in new markets, given a separation of buyer and seller  $\omega > \frac{\pi_L}{\pi_H}$ . However, it increases with the number of competing firms in mature markets.

Firms are more likely to export a high-quality product to establish their reputation in new markets when the number of competing firms is small. However, in mature markets, they are more likely to export a high-quality product rather than a low-quality one when the number of competing firms are large. Hence, if the government wants firms to export a high-quality product to new markets, it should temporarily limit the number of competing firms.

Once the reputation of a product is established and consumers possess information about their own valuation, competition induces both incumbent firms and new entrants to choose the choice of a high-quality product. The government then should remove all barriers to entry. In mature markets, a competition alone is sufficient to promote the transition to the viable high-quality export markets but it is not in new markets.

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<sup>6</sup>Mazzaeo (2003) showed that on-time flight performance increases dramatically when a second no-stop carrier serves a route. Again in 2004, Cohen and Mazzeo explored service quality in the banking industry, finding a positive relationship between the number of firms and the quality of a service.

## 5 Welfare Implications

This section studies the welfare implications of establishing a quality reputation. In view of the analysis in Section 3, establishing a quality reputation does not always provide the largest benefits for firms; on the contrary, firms, in some situations, may be better off by choosing the choice of a low-quality product. Is the choice of a high-quality product always the best choice for the country of export?

Basically, the welfare measure used is aggregate consumer surplus plus firm profits; nevertheless, the former is not taken into consideration in this analysis because this study focuses on the behaviour of home firms in foreign markets. Neither home consumer surplus nor foreign consumer surplus affects the welfare in the home country. In accordance with the assumptions of a model, the expected welfare of establishing a quality reputation in the home country can be defined as:

$$W_H^e = \tilde{\Pi} + \delta\theta\Pi_H$$

Where  $\Pi = \sum_{i=1}^n \pi^i$ . In spite of the fact that a high-quality product is provided to foreign consumers who lack information about their own valuation, it is not necessary that all foreign consumers will give a high valuation to a high-quality product. Only consumers whose tastes match to a product will purchase a high-quality product with a high price in the next transactions.

In contrast, if home firms decide not to position their product as high quality,

the expected welfare of exporting a low-quality product in the home country can be shown as:

$$W_L^e = \Pi_L + \delta\Pi_L$$

When home firms offer and provide a low-quality product to foreign consumers, these consumers will update nothing about their own type. Therefore, consumers are unwilling to pay a premium for a high-quality product while home firms are unwilling to lower the price of a high-quality product. The future transactions will only occur in a low-quality product only.

Due to  $\tilde{\Pi} < \pi_L < \Pi_H$  and  $\theta \leq 1$ , the home country will gain from positioning its exported product as high quality if, and only if, the following condition holds:

$$\theta \geq \left[ \frac{(1 + \delta)\Pi_L - \tilde{\Pi}}{\delta\Pi_H} \right] \quad (8)$$

This indicates that if a fraction of consumers, whose tastes match to a product, is large enough, establishing the quality reputation of an exported product will lead to a welfare improvement. Otherwise, it will cause a welfare reduction.

Now let consider the case that consumers in foreign markets know their own valuation for the quality of a product. The expected welfare of quality upgrading in the home country is equal to:

$$W_H^e = \theta\Pi_H + \delta\theta\Pi_H$$

If home country choose to export a low-quality product, the expected welfare in the home country is:

$$W_L^e = (1 - \theta)\Pi_L + \delta(1 - \theta)\Pi_L$$

Accordingly, the quality upgrading of an export product will improve the home country's welfare only if:

$$\theta \geq \left[ \frac{\Pi_L}{\Pi_H + \Pi_L} \right] \quad (9)$$

These results suggest that establishing the quality reputation of a new home product in foreign markets may improve or reduce the welfare in the home country depending on a parameter  $\theta$ . In other word, with a large fraction of consumers whose tastes match to a new product, establishing a reputation in foreign markets by offering and delivering a high-quality product will improve the home country's welfare. Similarly, upgrading the quality of an existing product will lead to a welfare gain when a fraction  $\theta$  is large.

The parameter  $\theta$  may be interpreted as a proportion of high-income consumers. Consumers may satisfy and prefer a high-quality product to a low-quality product but a high-quality product may be unaffordable for low-income consumers. No one rejects that German cars are one of the best automobiles in the world; however, being the best quality automobiles does not means that they are suitable for all consumers. For example, some consumers choose Japanese cars for reasons of economy. Some prefer German cars but purchase cheap Ko-

rean cars since they cannot afford to buy the best quality cars with every high price. Therefore, if target markets are satisfied with a standard-quality product with moderate price, why firms will need to offer a high-quality product with high production cost to such markets.

The production of a high-quality product is often considered as a pre-condition for export success and, ultimately, for economic development. Hence, establishing the quality reputation of a new product by upgrading the quality of an export product seems to be a desirable outcome for the exporting countries. Nevertheless, it is found that it may cause a reduction in the welfare in exporting countries if the parameter  $\theta$  is small.

## 6 Conclusion

This paper develops a finite two-stage game model where consumers lack information about their own valuation for the quality of a new product to study firms' quality choices. With the presence of asymmetric information, the need to establish a quality reputation may not be sufficient to induce firms to choose a high-quality product. It is found that the likelihood that a firm will choose to establish a quality reputation by upgrading the quality of an export product increases with the number of experienced consumers. However, it decreases with the number of competing firms in a concerning industry.

Accordingly, home firms are less likely to export a high-quality product to

new markets, where none of consumers are experienced, than mixed markets and mature markets. However, if the probability that consumers will assign a high valuation to a high-quality product is sufficient large, the result will be reversed. That is, home firms are the most likely to export a high-quality product when they enter into new markets. Therefore, the larger number of experienced consumers causes home firms have more incentive to upgrade the quality of their product.

To improve a probability of a high-quality product being exported, the home government has to increase the number of experienced consumers in target foreign markets. When the government introduces and provides a high-quality product to inexperienced consumers, these consumers become experienced consumers. As a result, home firms will gain more from choosing the choice of a high-quality product. Furthermore, the government can support home firms to establish the quality reputation of an exported product by subsidising firms directly, but it has to be specific to products with high quality only.

Since the likelihood of establishing a quality reputation decreases with the number of competing firms in the case of new markets; the government then has to limit the number of competing firms to improve the expected payoff from choosing high quality. However, when the quality reputation of a product is established in target foreign markets and foreign consumers possess information about their own valuation, the government should remove all entry restrictions because, in mature markets, competition is sufficient to promote the transition

to the viable high-quality export markets.

However, these results may be changed if the model is extended to be longer or infinite since consumers in new markets have opportunities to learn about their true type after being deluded. With a long time horizon, home firms may have either more or less incentive to export a high-quality product depending on many factors. On the one hand, given the large discount factor, home firms may be more likely to choose the choice of a high-quality product for establishing the quality reputation of a product and themselves when start entering new foreign markets because of the larger expected gains from doing that. On the other hand, home firms may be more likely to milk their reputation to earn short-run gains if consumers in markets are fast learning or they frequently update their belief about the quality reputation of a product.

Finally, the welfare implications of establishing a quality reputation is examined. It is found that the welfare of exporting a high-quality product in the home country may be improved or reduced depending on a fraction of consumers whose tastes are a good match with a home product,  $\theta$ . The choice of a high-quality product will lead to a welfare gains if, and only if, the parameter  $\theta$  is large enough.

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# Chapter 2: Why is it so difficult to settle a private agreement in an antidumping case ?

Chutamas Bumrungsuk\*

## Abstract

Many research papers argue that the antidumping measure has become one of the most important instruments for protection in the international trade system; domestic industries are more likely to employ this measure to threaten and induce foreign industries to collude. Recent evidence, however, reveals that only one-quarter of antidumping cases actually conclude with a price-undertaking agreement, or a private settlement. This paper employs a simple take-it-or-leave-it bargaining game with two-sided asymmetric information to reconcile the theoretical results with observation. With two-sided asymmetric information, the probability of bargaining failure is positive. The likelihood that the domestic and foreign firm will collude increases with the probability of a high-type foreign firm and the probability of a low-type domestic firm. However, it decreases with the bargaining power and concentration level of the domestic firm. The small number of private settlements indicates the inefficient outcome of the bargaining game with asymmetric information rather than evidence of the antidumping measure being less misused as a collusive tool.

**JEL Classification:** F13; C72

**Keywords:** antidumping; asymmetric information; signaling game

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\*Contact information: The Department of Economics, The University of Warwick, Coventry, CV4 7AL, United Kingdom; email c.bumrungsuk@warwick.ac.uk. I would like thank my supervisor, Professor Carlo Perroni, for his valuable comments, patient guidance and his time. All remaining errors are mine. This paper was presented at the 3th International Doctoral Meeting of Montpellier held in May 2010.

# 1 Introduction

From a mostly unused and troublesome trade policy instrument, an antidumping measure has become a preferable means for obtaining protection from the government. Frequently, the domestic industry misuses the antidumping measure to threaten and induce foreign industry to collude. There has been suspicion that the antidumping measure has been used as a collusive device rather than a defensive tool against unfair competition or a trade remedy, as the original objective. If arguments that the domestic industry often misuses the antidumping measure as a credible threat to induce foreign firms to collude and that collusion is a preferable outcome for both are valid, the number of firms settling with a private agreement will be high. However, the actual number of price-undertaking agreements during these recent years has not been high as expected.

This paper is inspired by an inconsistency between the previous theoretical results and actual observations. While theoretical works such as Prusa (1992), Veugelers and Vandebussche (1999), and Zanardi (2004) argue that the antidumping measure supports collusive outcomes, the actual data tells a different story; only one-fourth of total antidumping cases around the world result in a price-undertaking settlement. This study applies a simple take-it-or-leave-it bargaining game with two-sided asymmetric information to examine the behaviour of firms in an attempt to answer the following questions. Firstly, does the bargaining game guarantee the existence of collusion with certainty? Secondly, if a

bargaining failure exists, what is the main cause of this failure? Thirdly, what determines the likelihood of collusion? Finally, does the small number of price-undertaking agreements indicate a decline in the misuse of the antidumping measure during recent years?

With two-sided asymmetric information, the domestic and foreign firm will fail to collude with a positive probability. That is the private agreement will be settled with a positive probability but not certainty, except in the case that the domestic firm employs a pooling strategy and the probability of a low-type foreign firm is significant small. This is inconsistent with Prusa (1992), whose model predicts that collusion is preferable. In other word, settling a private agreement is a strategic dominance for both domestic and foreign firms. With one-sided asymmetric information, the probability to collude is higher than cases involving two-sided asymmetric information. This indicates that the asymmetry of information between the domestic and foreign firm is the main cause of bargaining failure.

The likelihood of collusion is found to increase with the probability of a high-type foreign firm and the probability of a low-type domestic firm. However, the possibility of settling the private agreement is more likely to decrease when the bargaining power and concentration level of the domestic firm increases, this contradicts the results of Zanardi (2004). Hence, the small number of price-undertaking agreements is evidence of bargaining inefficiency caused by asymmetric information, not a decline in the use of the antidumping measure as

a collusive device.

The findings also show that the efficient outcome does not guarantee to improve the social welfare in home country where a dump occurs; in contrast, it may deteriorate the welfare. The settlement outcome will be socially optimal if, and only if, a share of the collusive profits for the foreign firm is significant small. Otherwise, it only improves the profit of the domestic firm, not the social welfare. Moreover, the antidumping duty outcome, which raises the profit of the domestic firm, is more likely to have a negative effect on the home country's welfare. Therefore, the antidumping measure as a collusive device or a protective tool should not be allowed to happen.

To prevent the misuse of the antidumping measure, the antidumping laws have to be clear and transparent. The same standards and practices of the antidumping measure have to be applied across countries to ensure that the decision of antidumping cases is determined in accordance with rules and actual evidence and not be interfered by political and economic pressures from both inside and outside the country. Thus, a harmonisation of the antidumping laws across countries is needed.

This paper is organised as follows. The literature relating to the relationship between antidumping and collusion is reviewed in the next section. Section 3 introduces a bargaining model with two-sided asymmetric information. The equilibrium of the simple take-it-or-leave-it bargaining game when the domestic firm employs (i) a pooling strategy, (ii) a separating strategy, and (iii) a semi-

separating strategy is shown in Section 4. Section 5 employs a bargaining game with one-sided asymmetric information to examine whether a simple take-it-or-leave-it procedure is a cause of bargaining failure. The welfare implications of antidumping outcomes is considered in Section 6. Section 7 discusses on whether the antidumping laws should be harmonised. Finally, the conclusion is presented in Section 8.

## **2 Literature Review**

An expansion in the utilisation of antidumping measures around the world has motivated both theoretical and empirical studies on the antidumping argument; one strand of literature, which includes Dixit (1988), Anderson (1992, 1993), Reitzes (1993), Prusa (1994) and Blonigen and Jee-Hyeong (2004), deals with the impact of measures on the decision of firms. Anderson (1992, 1993) examines the potential interdependence of antidumping with voluntary export restraints (VERs); his results suggest that foreign firms have an incentive to dump in order to gain a larger market share. In contrast, Prusa (1994) claims that foreign firms will increase their price in a domestic market even though domestic firms will reduce their price because they do not want to be duped into dumping.

Reitze (1993) argues that the strategic behaviour of firms is altered under the antidumping measure, since this measure represents a credible threat to impose future duties based on the current price differential between the domes-

tic and foreign market. His results show that under Cournot competition, the threat of antidumping enforcement by the domestic country induces domestic output increases and foreign export decreases. Under Bertrand competition and imperfect substitutes, the antidumping measure induces foreign firms to raise their export price and lower their local price. If the game is extended to more than two periods, the antidumping measure may cause foreign firms to employ a hit-and-run strategy and also encourage the entry of new domestic firms.

Blonigen and Jee-Hyeong (2004) find that with uncertain enforcement of the antidumping measure, a foreign firm will increase its price in a domestic market if there is a large probability that the antidumping duty will be exercised. However, it will decrease its price if there is a large probability that the VER will be exercised. This finding is consistent with Anderson's results.

Another strand deals more specifically with the relationship between antidumping and collusion; almost all studies suggest that the antidumping measure is used for a collusive purpose. With a repeated game model, Staiger and Wolak (1989) show that a domestic industry can use the antidumping measure as a credible threat if a foreign industry deviates from collusion. Moreover, Veugelers and Vandebussche (1999) studied the possibility that the European antidumping measure causes collusion amongst firms. Their findings suggest that the antidumping measure cartelises the market. Similar to Tivig and Walz (2000), the antidumping measure acts as an anti-competitive measure.

In 1992, Prusa introduced a bargaining model with common knowledge on

the probability of an affirmative outcome,  $\rho$ .<sup>1</sup> His results suggest that the antidumping petition serves as a tool to achieve collusion. The threat of antidumping duties induces foreign firms to negotiate with domestic firms. Both domestic and foreign firms almost always prefer to withdraw a petition and reach a private agreement, regardless of the value of  $\rho$ . This model succeeds in explaining why many antidumping petitions are withdrawn before reaching a final decision. However, it fails to explain why not all petitions are withdrawn. According to the data presented in his paper, on average petitions were withdrawn only 38 per cent of the US antidumping cases during 1980-1985.

In order to reconcile Prusa's results with the observation that only some petitions are withdrawn, Zanardi (2004) modifies Prusa's model by introducing coordination costs and bargaining powers of domestic and foreign firms. His theoretical and empirical results, consistently with other studies, support a hypothesis that the antidumping measure is used as a collusive device. The probability of petition withdrawal decreases with coordination costs and non-linearly increases with bargaining power. The lower the concentration is, the less likely the private agreement will be settled.<sup>2</sup> Zanardi employs the U.S. data from 1980 to 1997 and finds a statistically significant negative relationship between the probability of withdrawal and the industry concentration index, which rep-

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<sup>1</sup>Refers to a situation where an antidumping duty is levied in response to petition from domestic firms.

<sup>2</sup>Coordination costs are sunk costs that are positively related to the number of firms, as the larger the number of firms, the more difficult it is to find a common strategy. Thus, the coordination costs are high.

resents the measurement of coordination costs, but a positive relationship with employment and the number of previously filed petitions, which is the proxies of bargaining power.

### 3 The Model

Assuming that a domestic market features one domestic firm and one foreign firm, each firm is risk-neutral, produces homogeneous goods, competes in quantity in a home market, and faces the same demand function and marginal cost. A status-quo equilibrium is determined by Cournot competition between the domestic and foreign firm. Under these assumptions, there exists a unique equilibrium where both the domestic and foreign firm enjoy the same profits.

$$\Pi^C = \Pi^{*C} = \left( \frac{a - c}{3} \right)^2$$

Where  $\Pi^C$  and  $\Pi^{*C}$  are the Cournot equilibrium profit of the domestic and foreign firm respectively.

*Proof.* See Appendix.

If the foreign firm dumps its product into the home market, the game begins. In the first stage, the domestic firm decides whether to file an antidumping petition. If the domestic firm does not file the petition, the game ends and the payoff to the domestic and foreign firm are defined as  $\tilde{\Pi}$  and  $\tilde{\Pi}^*$ , respectively.

The more the foreign products are dumped, the more the domestic price falls.<sup>3</sup> Hence, the profit of the domestic firm when a dump occurs is less than the Cournot profit. That is  $\tilde{\Pi} < \Pi^C$ .

On the contrary, if the domestic firm files the petition, the antidumping investigation starts and the game progresses to the second stage. Now both the domestic and foreign firm simultaneously decide whether to negotiate for the private agreement. If not, the payoff to the domestic and foreign firm will be determined by the final decision. If authorities decide to levy an extra duty on products from the foreign firms as a penalty for dumping, that is an affirmative outcome, the payoff to the domestic and foreign firm are  $\Pi^D$  and  $\Pi^{*D}$ , respectively. However, if authorities decide not to levy extra duty or impose any restriction on foreign products, that is a negative outcome, the payoff to the domestic and foreign firm are assumed to be the Cournot profit as a status-quo equilibrium.

**Lemma 1**  $\Pi^D > \Pi^C$  and  $\Pi^{*D} < \Pi^{*C}$

*Proof.* See Appendix.

**Proposition 1** A domestic firm always files a petition when dumping occurs.

*Proof.* See Appendix.

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<sup>3</sup>The impact of the quantity of the foreign firm on the profit of the domestic firm is:

$$\frac{\partial \Pi}{\partial q^*} = \frac{\partial \Pi}{\partial P} \frac{\partial P}{\partial q^*} < 0$$

The profit of the domestic firm is a decreasing function of the quantity of the foreign firm.

The lowest expected payoff to the domestic firm if it files the petition is  $\Pi^C > \tilde{\Pi}$ , then filling the petition is a strictly dominant strategy for the domestic firm. When the foreign products are dumped into the home market, the domestic firm always files the antidumping petition.

If the domestic and foreign firm agree to negotiate, the game reaches the bargaining stage. Assume that a take-it-or-leave-it procedure is employed. That is, the domestic firm makes an offer, the foreign firm decides whether accepts or rejects it, and the game ends. If the foreign firm accepts, the payoff to the domestic and foreign firm are defined as  $\Pi^S$  and  $\Pi^{*S}$ , respectively. However, if it rejects, the payoff for the domestic (foreign) firm is either  $\Pi^D$  ( $\Pi^{*D}$ ) or  $\Pi^C$  ( $\Pi^{*C}$ ), depending on the final outcome.

## **Take-it-or-Leave-it Bargaining Game**

Consider a bargaining game with two-sided asymmetric information. For simplification, assume that there are two types of firms: a high-type firm ( $H$ ) and a low-type firm ( $L$ ). A high-type firm refers to a firm where strongly influences the final outcome whereas a low-type firm refers to a firm where lacks significant influence over the final outcome. Generally, the final outcome is more likely to favour a high-type firm than a low-type firm. If the domestic firm is the high type, authorities are more likely to decide to levy antidumping duties on the foreign products. In contrast, if the foreign firm is the high type, authorities are more likely to decide not to levy antidumping duties on those.

Denote  $k$  and  $k^*$  as the type of domestic and foreign firm; the domestic (foreign) firm is either  $k = H$  ( $k^* = H$ ) or  $k = L$  ( $k^* = L$ ). The domestic firm has a prior belief  $(\eta_H, \eta_L)$  over the type of foreign firm, and the foreign firm has a prior belief  $(\gamma_H, \gamma_L)$  over the type of domestic firm; these probability distributions are common knowledge. Each party cares about the identity of its opponent because the different types of firms will generally affect the final outcome.<sup>4</sup>

Rather than assuming that the probability of an affirmative outcome ( $\rho$ ) is exogenously determined and known by both domestic and foreign firms, as Prusa (1992) and Zanardi (2004) claim, this paper assumes the type of domestic and foreign firm involved will influence  $\rho$ . The probability of an affirmative outcome, regardless of the type of foreign firm, is higher for the high-type domestic firm than the low-type. On the other hand, the probability of an affirmative outcome, is lower for the high-type foreign firm than the low-type one.

Let  $\rho_{k,k^*}$  be the probability of an affirmative outcome when the domestic firm is  $k$  type and the foreign firm is  $k^*$  type. The following inequality equations

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<sup>4</sup>Theoretically, the final decision should be purely determined by the rules and procedures according to the regulations. However, empirical studies suggest that the characteristic of the industry affects the final result. For example, the larger-sized industries generally receive more protection from the government than the smaller-sized industries, since they can provide more votes and more money to support political campaigns. Similar to the industry concentration, the more concentrated the industries are, the more protection is provided because of fewer free-rider problems, fewer communication problems, more opportunities to reach a consensus, effective organisation and better pressuring of the decision makers.

are assumed to hold throughout the paper:

$$\rho_{LH} < \rho_{LL} < \rho_{HL}$$

$$\rho_{LH} < \rho_{HH} < \rho_{HL}$$

These imply that the probability of antidumping duties being levied is the largest when the domestic firm is the high type and the foreign firm is the low type. In contrast, if the domestic firm is the low type and the foreign firm is the high type, the probability of antidumping duties of being levied is the lowest. In other word, the probability of a negative outcome is the highest.

Before arrival of a final decision, assume that the domestic and foreign firm choose to bargain over a fraction  $\alpha$  of the monopoly profits when  $\alpha \in (0, 1)$ . If the domestic firm makes an offer  $\alpha$  and the foreign firm accepts it, the payoff to the domestic and foreign firm from settling the private agreement is  $\Pi^S = (1 - \alpha)\Pi^M$  and  $\Pi^{*S} = \alpha\Pi^M$ , respectively. The foreign firm updates its belief in accordance with Bayes' rule after observing an offer  $\alpha$ . The foreign firm's posterior belief on the  $k$ -type domestic firm ( $\mu_k^*$ ) when  $\alpha$  is offered is:

$$\mu_k^* = \frac{\gamma_k s_k(\alpha)}{\gamma_L s_L(\alpha) + \gamma_H s_H(\alpha)}$$

Where  $s_k(\alpha)$  is the probability that the  $k$ -type domestic firm offers term  $\alpha$ .

If both parties fail to reach an agreement, the expected payoff to the  $k$ -type domestic firm is:

$$\begin{aligned}\bar{\Pi}_k &= \eta_L \bar{\Pi}_{kL} + \eta_H \bar{\Pi}_{kH} \\ &= \eta_L [\rho_{kL} \Pi^D + (1 - \rho_{kL}) \Pi^C] + \eta_H [\rho_{kH} \Pi^D + (1 - \rho_{kH}) \Pi^C]\end{aligned}\quad (1)$$

Similarly, the expected payoff to the  $k^*$ -type foreign firm is:

$$\begin{aligned}\bar{\Pi}_{k^*}^* &= \mu_L^* \bar{\Pi}_{Lk^*}^* + \mu_H^* \bar{\Pi}_{Hk^*}^* \\ &= \mu_L^* [\rho_{Lk^*}^* \Pi^{*D} + (1 - \rho_{Lk^*}^*) \Pi^{*C}] + \mu_H^* [\rho_{Hk^*}^* \Pi^{*D} + (1 - \rho_{Hk^*}^*) \Pi^{*C}]\end{aligned}\quad (2)$$

If the foreign firm accepts term  $\alpha$  with probability  $a(\alpha)$ , where  $a(\alpha) = \eta_L a_L(\alpha) + \eta_H a_H(\alpha)$ , the expected payoff to the  $k$ -type domestic firm when it makes the offer  $\alpha$  and the foreign firm accepts it with probability  $a(\alpha) \leq \eta_L$ , that is, only the low-type foreign firm accepts the offer, is:

$$\Pi_k^S(\alpha, a \leq \eta_L) = \eta_L a_L (1 - \alpha) \Pi^M + \eta_L (1 - a_L) \bar{\Pi}_{kL} + \eta_H \bar{\Pi}_{kH} \quad (3)$$

If term  $\alpha$  is accepted with probability  $a(\alpha) > \eta_L$ , that is, only the high-type foreign firm rejects the offer, the expected payoff to the  $k$ -type domestic firm is:

$$\Pi_k^S(\alpha, a > \eta_L) = \eta_L (1 - \alpha) \Pi^M + \eta_H a_H (1 - \alpha) \Pi^M + \eta_H (1 - a_H) \bar{\Pi}_{kH} \quad (4)$$

**Lemma 2** In equilibrium, the domestic firm never makes an offer  $\alpha$ , which

results in:  $\Pi_k^S(\alpha, a(\alpha)) < \bar{\Pi}_k$ .

*Proof.* See Appendix.

As the term  $\alpha$  increases, the possibility that the foreign firm will accept the offer increases but the expected payoff from settling the private agreement to the domestic firm decreases. The domestic firm faces a trade off between the possibility of reaching an agreement and gaining a share of the collusive profits. If the domestic and the foreign firm fail to reach an agreement, the expected payoff to the domestic firm will be  $\bar{\Pi}_k$ . Therefore, the domestic firm will never offer any terms  $\alpha$  if  $(1-\alpha)\Pi^M \equiv \Pi_k^S < \bar{\Pi}_k$ , although such terms will be certainly accepted by the foreign firm.

## 4 The Equilibrium

When the domestic and foreign firm are uncertain about the type of each other and a take-it-or-leave-it procedure is adopted, the private agreement will be certainly reached if, and only if, the domestic firm employs a pooling strategy and the probability of a low-type foreign firm is significant small. Otherwise, the private agreement will fail with a positive probability.

The rest of the section presents the set of Bayesian equilibria of a take-it-or-leave-it game as follows: (i) pooling equilibrium, (ii) separating equilibrium and (iii) semi-separating equilibrium.

## Pooling Equilibrium

Assuming that the domestic firm offers the same term  $\alpha$ , irrespective of its type, the foreign firm learns nothing more about the domestic firm's type after receiving the offer  $\alpha$ . The posterior belief of the foreign firm is the same as the corresponding prior belief,  $\mu_L^*(\alpha) = \gamma_L$  and  $\mu_H^*(\alpha) = \gamma_H$ . The  $k^*$  type foreign firm's outside option when it rejects term  $\alpha$  is  $\bar{\Pi}_{k^*}^*$ . Hence, the foreign firm will choose to take a risk on the final outcome if  $\Pi^{*S} < \bar{\Pi}^*$ . Irrespective of the type of domestic firm, the expected payoff to the high-type foreign firm is always higher than the low-type firm. That is,  $\bar{\Pi}_H^* > \bar{\Pi}_L^*$ . Consequently, when the low-type foreign rejects the offer, none of the foreign firms will accept it. At the same time, if the high-type foreign firm accepts the offer, all foreign firms will accept it.

With a sequentially rational response, none of the foreign firms will accept the domestic firm's offer if  $\alpha\Pi^M < \bar{\Pi}_L^*$  or  $a(\alpha) = 0$ , whereas the foreign firm will certainly accept the offer when  $\alpha_H\Pi^M \geq \bar{\Pi}_H^*$  or  $a(\alpha_H) = 1$ . At least some of the low-type foreign firm will accept the offer if  $\alpha_L\Pi^M = \bar{\Pi}_L^*$  or  $a(\alpha_L) \leq \eta_L$ . Hence, the expected payoff to the  $k$  type domestic firm when offers (i)  $\alpha < \alpha_L$ ,

(ii)  $\alpha = \alpha_L$  and (iii)  $\alpha = \alpha_H$  can be shown as:

$$\begin{aligned}\Pi_k^S(\alpha\Pi^M < \bar{\Pi}_L^*, 0) &= \bar{\Pi}_k \\ \Pi_k^S(\alpha_L\Pi^M = \bar{\Pi}_L^*, a(\alpha_L)) &= \eta_L a(\alpha_L)(\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{kL}) + \bar{\Pi}_k \\ \Pi_k^S(\alpha_H\Pi^M = \bar{\Pi}_H^*, 1) &= \Pi^M - \bar{\Pi}_H^*\end{aligned}\tag{5}$$

**Proposition 2** Pooling equilibria are characterised as follows, depending on

which one of these three payoffs:  $\Pi_k^S(\alpha\Pi^M < \bar{\Pi}_L^*, 0)$ ,  $\Pi_k^S(\alpha_L\Pi^M = \bar{\Pi}_L^*, a(\alpha_L))$ ,

$\Pi_k^S(\alpha_H\Pi^M = \bar{\Pi}_H^*, 1)$  - is the largest

(i) If  $\Pi_k^S(\alpha\Pi^M < \bar{\Pi}_L^*, 0)$  is the largest, a pooling equilibrium exists in which both the domestic and foreign firm prefer to take a risk on the final result;

(ii) If  $\Pi_k^S(\alpha_L\Pi^M = \bar{\Pi}_L^*, a(\alpha_L))$  is the largest, a pooling equilibrium exists in which the private agreement is settled with a positive probability but not certainty;

(iii) If  $\Pi_k^S(\alpha_H\Pi^M = \bar{\Pi}_H^*, 1)$  is the largest, a pooling equilibrium exists in which the private agreement is settled with certainty.

*Proof.* See Appendix.

According to Proposition 2, the private agreement will be settled with certainty if, and only if, a condition  $a(\alpha_L) \leq \left( \frac{\Pi^M - \bar{\Pi}_H^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{HL}} \right)$  is satisfied. The private agreement between the domestic and foreign firm will fail with a positive probability, otherwise. This implies that the smaller the probability of a low-type

foreign firm is, the more likely the domestic firm offers a larger share of the collusive profits, which is rarely rejected by the foreign firm.

When condition (a)  $\Pi^M > \bar{\Pi}_L^* + \bar{\Pi}_{HL}$  and (b)  $a(\alpha_L) \geq \left( \frac{\Pi^M - \bar{\Pi}_H^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{LL}} \right)$  hold, the private agreement will be settled with a positive probability but not certainty. If the domestic firm has a strong prior belief that the foreign firm is the low type, it will offer only a smaller share of the collusive profits, which is likely rejected by the high-type foreign firm. However when condition (a) is violated, the high-type domestic firm prefers to take a risk on the final outcome.

Before leaving this part, consider who gains from the existence of a pooling equilibrium. Whether (ii) or (iii) exists, the low-type domestic firm gains from the presence of the high type, whereas the high-type domestic firm losses from the presence of the low type.<sup>5</sup> In the presence of the high-type domestic firm, the foreign firm is willing to accept a smaller share of the collusive profits compare to the case of absence. At the same time, the high-type domestic firm has to offer a larger share of the collusive profits to induce the foreign accepts the offer when its type is not conclusively known.

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<sup>5</sup>These cases are similar to adverse selection models such as the insurance market.(see Rothschild and Stiglitz (1976) and Wilson (1977))

## Separating Equilibrium

If the different types of domestic firms choose a different offer term, the domestic firm's type is fully revealed. Assume that the high-type domestic firm offers  $\alpha_H$  with probability  $s_H(\alpha_H) = 1$  and the low-type domestic firm offers  $\alpha_L$  with probability  $s_L(\alpha_L) = 1$ . The foreign firm's posterior belief of the high-type domestic firm, when it receives the offer term  $\alpha_H$ , is  $\mu_H^*(\alpha_H) = 1$  and its posterior belief on the low-type domestic firm, when it receives the offer term  $\alpha_L$ , is  $\mu_L^*(\alpha_L) = 1$ . Hence, if the  $k^*$  type foreign firm rejects the offer  $\alpha_H$ , its expected payoff will be:

$$\bar{\Pi}_{Hk^*}^*(\alpha_H) = \rho_{Hk^*}^* \Pi^{*D} + (1 - \rho_{Hk^*}^*) \Pi^{*C}$$

Similarly, the expected payoff for the  $k^*$  foreign firm when rejects the offer  $\alpha_L$  is equal to

$$\bar{\Pi}_{Lk^*}^*(\alpha_L) = \rho_{Lk^*}^* \Pi^{*D} + (1 - \rho_{Lk^*}^*) \Pi^{*C}$$

Among all separating equilibria, if the high-type domestic firm offers the foreign firm  $\alpha_{HL} \Pi^M = \bar{\Pi}_{HL}^*$ , the low-type foreign firm will accept with probability  $a_L(\alpha_{HL})$  but the high-type foreign firm will certainly reject it. The expected payoff to the high-type domestic firm when offers  $\alpha_{HL}$  can be shown as:

$$\begin{aligned} \Pi_H^S(\alpha_{HL}, a(\alpha_{HL})) &= \eta_L a_L(\alpha_{HL}) \left( \Pi^M - \bar{\Pi}_{HL}^* \right) \\ &+ \eta_L (1 - a_L(\alpha_{HL})) \bar{\Pi}_{HL} + \eta_H \bar{\Pi}_{HH} \end{aligned} \tag{6}$$

When the low-type domestic firm offers  $\alpha_{LH}\Pi^M = \bar{\Pi}_{LH}^*$ , none of the foreign firms will reject this offer,  $a(\alpha_{LH}) = 1$ . The expected payoff to the low-type domestic firm is:

$$\Pi_L^S(\alpha_{LH}, 1) = \Pi^M - \bar{\Pi}_{LH}^* \quad (7)$$

The high-type domestic firm will not deviate from its choice when a condition  $a(\alpha_{HL}) \geq \left(\frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}}\right)$  is satisfied. Similarly, the low-type domestic firm will not deviate if a condition  $a(\alpha_{HL}) \leq \left(\frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL}}\right)$  holds. Hence, the low-type domestic firm will offer a larger fraction of  $\alpha_{LH}$ , which none of the foreign firms reject it and the high-type firm will offer a smaller fraction of  $\alpha_{HL}$ , which only some of the low-type foreign firms accept it when  $\left(\frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}}\right) \leq a(\alpha_{HL}) \leq \left(\frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL}}\right)$  is satisfied.

**Proposition 3** When the different types of domestic firms choose to make a different offer, the domestic firm's private information is fully transmitted to the foreign firm. When a condition  $\left(\frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}}\right) \leq a(\alpha_{HL}) \leq \left(\frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL}}\right)$  holds, a separating equilibrium where the low-type domestic firm offers  $\alpha_{LH}$  and the high-type domestic firm offers  $\alpha_{HL}$  exists. As a result, the private agreement will fail with a positive probability.

*Proof.* See Appendix.

This result shows that the expected payoff from settling the private agreement to the high-type domestic firm increases, whereas the expected payoff to

the low-type domestic firm decrease when the domestic firm's type is fully revealed to the foreign firm. The low-type firm losses from signalling the foreign firm that it is the low type because it must offer a larger share of the collusive profits to induce the foreign firm to accept its offer. In contrast, the high-type domestic firm gains from signalling that it is the high type.

## Semi-separating Equilibrium

If the domestic firm employs a mixed strategy, the semi-separating equilibrium may exist. Firstly, the high-type domestic firm adopts a mixed strategy. Assume that the high-type domestic firm offers  $\hat{\alpha}$  with probability  $s_H(\hat{\alpha}) = \beta$  and  $\acute{\alpha} < \hat{\alpha}$  with probability  $s_H(\acute{\alpha}) = 1 - \beta$ , while the low-type domestic firm offers  $\hat{\alpha}$  with probability  $s_L(\hat{\alpha}) = 1$ . After receiving the offer  $\hat{\alpha}$ , the foreign firm's posterior belief is  $\mu_L^*(\hat{\alpha}) > \gamma_L$  and  $\mu_H^*(\hat{\alpha}) < \gamma_H$ , respectively. In addition, when the foreign firm receives the offer  $\acute{\alpha}$ , its posterior belief of the high-type domestic firm is  $\mu_H^*(\acute{\alpha}) = 1$ .

The expected payoff to the  $k^*$  type foreign firm when it rejects the offer  $\hat{\alpha}$  is:

$$\begin{aligned} \bar{\Pi}_{k^*}^*(\mu_L^*(\hat{\alpha}), \mu_H^*(\hat{\alpha})) &= \mu_L^* \bar{\Pi}_{Lk^*}^* + \mu_H^* \bar{\Pi}_{Hk^*}^* \\ &> \bar{\Pi}_{k^*}^*(\gamma_L, \gamma_H) \end{aligned}$$

While if it rejects the offer  $\acute{\alpha}$ , the expected payoff to the  $k^*$  foreign firm is:

$$\bar{\Pi}_{Hk^*}^*(\mu_H^*(\acute{\alpha}) = 1) = \rho_{Hk^*}^* \Pi^{*D} + (1 - \rho_{Hk^*}^*) \Pi^{*C}$$

When the domestic firm offers  $\hat{\alpha}$  where  $\hat{\alpha}\Pi^M = \bar{\Pi}_H^*(\hat{\alpha}) > \bar{\Pi}_H^*$ , the foreign firm will certainly accept it. On the contrary, if the domestic firm makes the offer  $\acute{\alpha}$  where  $\acute{\alpha}\Pi^M = \bar{\Pi}_{HL}^*$ , only the low-type foreign firm will accept this offer. In other word, the foreign firm accepts the offer  $\acute{\alpha} = \alpha_{HL}$  with probability  $a(\acute{\alpha}) \leq \eta_L$ .

Given the best response of the foreign firm, the expected payoff to the low-type domestic firm, when it certainly offers  $\hat{\alpha}$  is:

$$\Pi_L^S(s_L(\hat{\alpha}) = 1) = \Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) \quad (8)$$

The expected payoff to the high-type domestic firm when offers  $\hat{\alpha}$  with probability  $\beta$  and  $\acute{\alpha}$  with probability  $1 - \beta$  is:

$$\begin{aligned} \Pi_H^S(s_H(\hat{\alpha}) = \beta, s_H(\acute{\alpha}) = 1 - \beta) &= \beta \left( \Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) \right) \\ &+ (1 - \beta) \left\{ a(\acute{\alpha})(\Pi^M - \bar{\Pi}_{HL}^*) \right\} \\ &+ (1 - \beta) \left\{ (\eta_L - a(\acute{\alpha}))\bar{\Pi}_{HL} + \eta_H\bar{\Pi}_{HH} \right\} \end{aligned} \quad (9)$$

The low-type domestic firm has no incentive to deviate from offering  $\hat{\alpha}$  with certainty when a condition  $a(\acute{\alpha}) \leq \left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_L} \right)$  holds. Similarly, the high-type domestic firm will not deviate from offering  $\hat{\alpha}$  with probability  $\beta$  and  $\acute{\alpha}$  with probability  $1 - \beta$ , if a condition  $a(\acute{\alpha}) = \left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right)$  is satisfied. Hence, neither the low-type nor the high-type domestic firm will deviate from its choice when  $a(\acute{\alpha}) = \left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right)$  holds. Now a type I semi-equilibrium, where the high-type domestic firm adopts a mixed strategy, is established.

**Proposition 4** If a separating equilibrium, as stated in Proposition 3, exists, it guarantees that a type I semi-separating equilibrium, where the high-type domestic firm employs a mixed strategy, will exist.

*Proof.* See Appendix.

Secondly, the low-type domestic firm employs a mixed strategy. The low-type domestic firm is assumed to randomly offer  $\tilde{\alpha}$  with probability  $s_L(\tilde{\alpha}) = \lambda$  and  $\hat{\alpha} > \tilde{\alpha}$  with probability  $s_L(\hat{\alpha}) = 1 - \lambda$ , whereas the high-type domestic firm certainly offers  $\tilde{\alpha}$ , or  $s_H(\tilde{\alpha}) = 1$ . The foreign firm updates its belief about the type of domestic firm in accordance with Bayes' rule. It believes with certainty that the domestic firm is the low type, that is,  $\mu_L^*(\hat{\alpha}) = 1$  after receiving the offer  $\hat{\alpha}$ . It also believes with probability  $\mu_L^*(\tilde{\alpha}) < \gamma_L$  and  $\mu_H^*(\tilde{\alpha}) > \gamma_H$  that the domestic firm is the low type and the high type respectively, after receiving the offer  $\tilde{\alpha}$ .

The expected payoff to the  $k^*$  type foreign firm, when it rejects the offer  $\tilde{\alpha}$ , is equal to:

$$\begin{aligned} \bar{\Pi}_{k^*}^*(\mu_L^*(\tilde{\alpha}), \mu_H^*(\tilde{\alpha})) &= \mu_L^* \bar{\Pi}_{Lk^*}^* + \mu_H^* \bar{\Pi}_{Hk^*}^* \\ &< \bar{\Pi}_{k^*}^*(\gamma_L, \gamma_H) \end{aligned}$$

If the  $k^*$  type foreign firm rejects the offer  $\hat{\alpha}$ , its expected payoff will be:

$$\bar{\Pi}_{Lk^*}^*(\mu_L^*(\hat{\alpha}) = 1) = \rho_{Lk^*}^* \Pi^{*D} + (1 - \rho_{Lk^*}^*) \Pi^{*C}$$

If the domestic firm offers  $\tilde{\alpha}$  where  $\tilde{\alpha}\Pi^M = \bar{\Pi}_L^*(\tilde{\alpha}) < \bar{\Pi}_L^*$ , only the low-type foreign firm will accept this offer. That is  $a(\tilde{\alpha}) \leq \eta_L$ . In contrast, when the domestic firm offers  $\hat{\alpha}$  where  $\hat{\alpha}\Pi^M = \bar{\Pi}_{LH}^*$ , none of the foreign firms will reject it.

Given the best response of the foreign firm, the expected payoff to the low-type domestic firm, when offers  $\tilde{\alpha}$  with probability  $\lambda$  and  $\hat{\alpha}$  with probability  $1 - \lambda$ , can be shown as:

$$\begin{aligned} \Pi_L^S(s_L(\tilde{\alpha}) = \lambda, s_L(\hat{\alpha}) = 1 - \lambda) &= \lambda \left\{ a(\tilde{\alpha})(\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha})) \right\} \\ &\quad + \lambda \left\{ (\eta_L - a(\tilde{\alpha}))\bar{\Pi}_{LL} + \eta_H\bar{\Pi}_{LH} \right\} \quad (10) \\ &\quad + (1 - \lambda)(\Pi^M - \bar{\Pi}_{LH}^*) \end{aligned}$$

The expected payoff to the high-type domestic firm when certainly offers  $\hat{\alpha}$ , can be written as:

$$\begin{aligned} \Pi_H^S(s_H(\hat{\alpha}) = 1) &= a(\hat{\alpha})(\Pi^M - \bar{\Pi}_L^*(\hat{\alpha})) \\ &\quad + (\eta_L - a_L(\hat{\alpha}))\bar{\Pi}_{HL} + \eta_H\bar{\Pi}_{HH} \end{aligned} \quad (11)$$

The low-type domestic firm will not deviate from offering  $\tilde{\alpha}$  with probability  $\lambda$  and  $\hat{\alpha}$  with probability  $1 - \lambda$  when a condition  $a(\tilde{\alpha}) = \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL}} \right)$  is satisfied. Likewise, the high-type domestic firm has no incentive to deviate from offering  $\hat{\alpha}$  with certainty if  $\Pi^M > \bar{\Pi}_L^* + \bar{\Pi}_{HL}$  and  $a(\hat{\alpha}) \geq \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_L^*(\hat{\alpha}) - \bar{\Pi}_{HL}} \right)$  hold. Therefore, a type II semi-separating equilibrium, where the low-type domestic

firm employs a mixed strategy, is now established when (a)  $\Pi^M > \bar{\Pi}_L^* + \bar{\Pi}_{HL}$  and (b)  $a(\tilde{\alpha}) = \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL}} \right)$  hold.

**Proposition 5** Neither the existence of a separating equilibrium in Proposition 3 nor the existence of a pooling equilibrium in Proposition 2 can guarantee the existence of a type II semi-separating equilibrium, where the low-type domestic firm employs a mixed strategy. This semi-equilibrium exists if, and only if,  $\Pi^M > \bar{\Pi}_L^* + \bar{\Pi}_{HL}$  and  $a(\tilde{\alpha}) = \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL}} \right)$  hold.

*Proof.* See Appendix.

The existence of a type I or a type II semi-separating equilibrium indicates that when the domestic firm employed a mixed strategy, the private agreement between the domestic and foreign firm will fail with a positive probability. Now consider whether the high-type or the low-type domestic firm will benefit from adopting a mixed strategy.

In accordance with the type I semi-separating equilibrium, when the high-type domestic firm employs a mixed strategy to signal the foreign firm about its type, the low-type and the high-type domestic firm worse off compared to a pure pooling case. The domestic firm has to offer a larger share of the collusive profits to induce the foreign firm to accept the offer. However, the low-type domestic firm is better off when compared to a pure separating case.

For the type II semi-separating equilibrium, when the low-type firm adopts a mixed strategy to signal its type to the foreign firm, the expected payoff to

the high-type domestic firm is larger than a pure pooling cases whereas the expect payoff to the low-type domestic firm is indifferent. Nevertheless, the high-type domestic firm worsens off compared to a pure separating case. These show that the high-type domestic firm will gain the largest benefit when all private information is fully transmitted to the foreign firm.

## 5 Efficiency

In the presence of the two-sided asymmetric information, a simple take-it-or-leave-it bargaining game, where the domestic firm makes an offer, admits an efficient equilibrium, that is an equilibrium where the private agreement is settled with certainty, only if, the domestic firm employs a pooling strategy and the probability of a low-type foreign firm is significant small. Otherwise, it does not. If the domestic firm employs either a pure separating strategy or a mixed strategy, the bargaining fails with a positive probability.

A question arises of whether a simple take-it-or-leave-it procedure or other fundamental problems causes the bargaining failure. To explore this issue, suppose the type of the foreign firm involved is public information, whereas the type of domestic firm still retains private information. The domestic firm can be either the high type with probability  $\gamma_H$  or the low type with probability  $\gamma_L$ . The other assumptions remain the same.

When the domestic firm adopts a pooling strategy, the foreign firm's posterior

belief is the same as the corresponding prior belief,  $\mu_L^*(\alpha) = \gamma_L$  and  $\mu_H^*(\alpha) = \gamma_H$ .

The expected payoff to the  $k^*$  foreign firm, when the bargaining fails, can be shown as:

$$\bar{\Pi}_{k^*}^* = \gamma_L \bar{\Pi}_{Lk^*}^* + \gamma_H \bar{\Pi}_{Hk^*}^*$$

If the domestic firm offers  $\alpha_L \Pi^M = \bar{\Pi}_L^*$  and  $\alpha_H \Pi^M = \bar{\Pi}_H^*$  to the low-type and high-type foreign firm respectively, the foreign firm is indifferent between taking an offer or taking a risk on the final decision.

The low-type foreign firm will accept the offer  $\alpha_L$  and reject any offers that  $\alpha < \alpha_L$ . Thus, the expected payoff from settling the private agreement to the domestic firm is:

$$\Pi^S(\alpha_L) = \Pi^M - \bar{\Pi}_L^*$$

Since the expected payoff to the high-type firm is always higher than the low-type firm, so neither the high-type nor the low-type domestic firm will deviate from this choice if the following condition holds:

$$\Pi^S(\alpha_L) = \Pi^M - \bar{\Pi}_L^* > \bar{\Pi}_{HL} \tag{12}$$

Similarly, the high-type foreign firm will accept the offer  $\alpha_H$  and reject any offers that  $\alpha < \alpha_H$ . Hence, the expected payoff to the domestic firm when settles

the private agreement is:

$$\Pi^S(\alpha_H) = \Pi^M - \bar{\Pi}_H^*$$

None of the domestic firms will deviate from offering  $\alpha_H$  when the following condition is satisfied:

$$\Pi^S(\alpha_H) = \Pi^M - \bar{\Pi}_H^* > \bar{\Pi}_{HH} \quad (13)$$

Due to  $\Pi^M > \bar{\Pi}_H^* + \bar{\Pi}_H$  and  $\bar{\Pi}_H > \bar{\Pi}_{HH}$ , the the above condition is automatically satisfied.

A pooling equilibrium, where the domestic firm offers  $\alpha_L$  to the low-type foreign firm and  $\alpha_H$  to the high-type foreign firm, is established if the condition stated in equation (12) holds. The existence of a pooling equilibrium here guarantees that the private agreement will be settled with certainty. In other word, the game admits an efficient outcome. Efficiency in this bargaining game could be improved if the type of the foreign firm is fully revealed. If the domestic firm employs a pooling strategy, with two-sided asymmetric information, the private agreement between the domestic and foreign firm may fail when the probability of a low-type foreign firm is significant large. However, with one-sided asymmetric information, the private agreement will be certainly settled.

The bargaining is more likely to fail under two-sided asymmetric information

than under one-sided asymmetric information. This implies that the asymmetric information between the domestic and the foreign firm is the main cause of bargaining failure. As the asymmetric information decreases, bargaining efficiency is improved. A take-it-or-leave-it bargaining game will admit efficient equilibrium outcomes as long as the type of the domestic and foreign firm are fully revealed. This is consistent to Prusa (1992), settling the private agreement is a preferable choice to both the domestic and foreign firm.

In the presence of the two-sided asymmetric information, the efficient equilibrium outcomes tend to increase with the probability of a high-type foreign firm and the probability of a low-type domestic firm. The larger the probability of a high-type foreign firm is, the smaller the probability of an affirmative outcome is. Therefore, the domestic firm will offer a larger share of the collusive profits, which the foreign firm will rarely reject it. On the contrary, if the domestic firm is the high type, the equilibrium outcomes are less likely to be efficient. The high-type domestic firm is more likely to offer a smaller share of the collusive profits to the foreign firm; as a result, the foreign firm, especially the high type, may reject the offer and the private agreement may not be reached.

The bargaining power of the domestic firm increases with the probability of an affirmative outcome but decreases with the probability of a negative outcome. Therefore, the probability of efficient equilibrium outcomes decreases with the bargaining power of the domestic firm. The higher the concentration level of the domestic firm is, the larger the probability that the domestic firm offers a smaller

share of the collusive profits. Hence, the probability of efficient equilibrium outcomes decrease with the concentration level of the domestic firms. These imply that the likelihood of collusion decreases with the bargaining power and the concentration level of the domestic firm, which is inconsistent with Zanardi (2004). His theoretical and empirical results suggest that the probability of collusion increases with the bargaining power and the concentration level.

## 6 Welfare Implications

In this section, the welfare implications of antidumping outcomes are considered. Welfare in Home country, denoted as  $W$ , is defined as the sum of consumer surplus, domestic firm profit and antidumping-duty revenue, if any. The consumer surplus in home country is:

$$CS = \frac{1}{2} (a - P) Q$$

Where  $P$  is the price in the home country and  $Q = q + q^*$  is the total quantities purchased in the home country, which is the sum of quantities sold by the domestic and the foreign firm respectively. The profit of the domestic firm is equal to:

$$\Pi = (P - c) q$$

and the antidumping-duty revenue can be defined as:

$$DR = tq^*$$

Where  $t$  is an antidumping duty per unit that the home government levies on the foreign firm's products in response to petitioning by the domestic firm.

Thus, welfare in the home country under Cournot competition is:

$$W^C = \frac{1}{2} \left( \frac{2a - 2c}{3} \right)^2 + \left( \frac{a - c}{3} \right)^2 \quad (14)$$

When the antidumping duty  $t$  is levied on the foreign firm's products, welfare in the home country is then equal to:

$$W^D = \frac{1}{2} \left( \frac{2a - 2c - t}{3} \right)^2 + \left( \frac{a - c + t}{3} \right)^2 + t \left( \frac{a - c - 2t}{3} \right) \quad (15)$$

If the domestic and foreign firm agree to settle the private agreement, welfare in the home country will be:

$$W^S = \frac{1}{2} \left( \frac{a - c}{2} \right)^2 + (1 - \alpha) \left( \frac{a - c}{2} \right)^2 \quad (16)$$

Besides affecting the consumer surplus and the profit of the domestic firm, the duty outcome also affects the revenue collected by the home government. The welfare implications of the duty outcome may be positive or negative, but

it is always inferior to the Cournot competition case. The net welfare effects of the duty outcome will be positive if, and only if,  $\left(\frac{t}{a-c}\right) \leq \left(\frac{\sqrt{7}-1}{3}\right)$ . In other word, an increase in the antidumping duty  $t$  leads to a greater deterioration of consumer surplus.

On the contrary, the welfare under settlement outcome could be higher or lower than the welfare under Cournot competition depending on a parameter  $\alpha$ , that is a collusive share of the foreign firm. The welfare of the settlement outcome is superior to any other outcome if the domestic firm get a significant large share of the collusive profits and leaves a small share of the foreign firm. In other word,  $\alpha \leq \frac{1}{6}$ . If a gain in the domestic firm's profit due to a collusion is large enough to offset a loss in consumer surplus caused by a rising in the price. The private agreement is the socially desirable choice to the home country.

Now consider the welfare implications of antidumping outcomes in foreign country. Since antidumping outcomes affect neither consumer surplus nor duty revenue in the foreign country, then welfare in the foreign country is equivalent to the profit of the foreign firm. The welfare of Cournot competition, the duty outcome and the settlement outcome in the foreign firm can be shown as follows:

$$W^{*C} \equiv \Pi^{*C} = \left(\frac{a-c}{3}\right)^2 \quad (17)$$

$$W^{*D} \equiv \Pi^{*D} = \left(\frac{a-c-2t}{3}\right)^2 \quad (18)$$

$$W^{*S} \equiv \Pi^{*S} = \alpha \left( \frac{a-c}{2} \right)^2 \quad (19)$$

The welfare of the settlement outcome in the foreign country is superior to any other outcome when  $\alpha > \frac{4}{9}$ . That is, if a share of the collusive profits to the foreign firm is significant large, the settlement outcome guarantees the welfare improvement in the foreign country. However, if  $\alpha < \left[ \frac{16}{9} \left( \frac{t}{a-c} \right)^2 - \frac{16}{9} \left( \frac{t}{a-c} \right) + \frac{4}{9} \right]$ , paying the duty will provide a higher level of welfare than settling the private agreement. In other word, the welfare of the settlement outcome is inferior to any other outcome when a share of the collusive profits to the foreign firm is very small. These suggest that the settlement outcome will only occur when  $\left[ \frac{16}{9} \left( \frac{t}{a-c} \right)^2 - \frac{16}{9} \left( \frac{t}{a-c} \right) + \frac{4}{9} \right] \leq \alpha \leq \frac{4}{9}$ .<sup>6</sup>

The analysis above shows that if  $\left[ \frac{16}{9} \left( \frac{t}{a-c} \right)^2 - \frac{16}{9} \left( \frac{t}{a-c} \right) + \frac{4}{9} \right] > \frac{1}{6}$ , there never exists the settlement outcome, which results in the welfare improvement. Since the domestic firm concerns about its expected profit, not the social welfare. Therefore, as long as the settlement payoff is not less than the expected payoff, the domestic firm will choose the settlement outcome although it causes welfare deterioration. The efficient outcomes are not equally socially desirable.

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<sup>6</sup>The  $k^*$  type foreign firm will compare the welfare of the settlement outcome to its expected welfare, which is defined as:

$$\bar{W}_{k^*}^* = \rho_{kk^*} W^{*D} + (1 - \rho_{kk^*}) W^{*C}$$

The  $k^*$  type foreign firm will agree to settle the private agreement if the welfare from settling the private agreement is not less than its expected welfare from rejecting it. None of the foreign firms will accept any offer terms  $\alpha$  where  $W^{*S}(\alpha) < W^{*D}$  but all of them will accept the offer term  $\alpha$ , in which it provides  $W^{*S}(\alpha) = W^{*C}$ . Since the small probability of an affirmative outcome improves the expected welfare of the foreign firm, that is  $\left( \frac{\partial \bar{W}_{k^*}^*}{\partial \rho_{kk^*}} \right) < 0$ . Therefore, a share of the collusive profit to the foreign firm,  $\alpha$ , is a decreasing function of the probability of an affirmative outcome.

## 7 Discussion

The results in previous sections indicate that the small number of price-undertaking agreements during these recent years is not evidence of a decline in the use of the antidumping measure as a collusive device. On the contrary, it reflects bargaining inefficiency as a result of the asymmetric information. Now the question is whether the collusion outcome really benefits the social welfare. If not, improving the efficiency of bargaining becomes a trivial concern.

The home country's welfare effects of the collusion outcome is ambiguous depending on a collusive share of the foreign firm. If a collusive share of the foreign firm is not significant small, the collusion outcome will not be the socially desirable outcome to the home country. Similarly, the duty outcome may cause the deterioration of welfare in the home country, if the antidumping duty is significant large. Hence, the collusion outcome or the duty outcome should be avoided if the home government aims to maximise the social welfare. The use of antidumping as a collusive device or a protective tool is not desirable.

Besides, the antidumping measure also weakens the competitiveness of downstream firms. When the antidumping measure restricts imports of intermediate goods and raw materials used in the production of final products, the cost of production for domestic downstream firms is increased and, in consequence, their capacity to compete with foreign producers inside and outside the country decreases. While the antidumping duties please the petitioning domestic upstream

firms who can subsequently increase their price and gain greater profits, these duties are costly to domestic downstream firms. The profit of domestic downstream firms is squeezed by higher production costs, due to antidumping duties, and lower revenues, due to lost market share. As a result, domestic downstream firms in the home country face a decreasing in profit or even a loss.

Therefore, the antidumping measure has to be used as needed only. No matter what the antidumping measure is used as a collusive device or as a protective tool, it worsens the social welfare of its own country. In order to minimise losses from the antidumping measure, the government should apply such measure only to defend against unfair competition and remedy the material injury to the domestic industries caused by dumping and be objective when making decision. The decision on whether to impose antidumping duties on products imported from the dumpers' country should be made in accordance with rules and actual evidence and independent of political and economic pressures from both inside and outside the country.

Nowadays each country sets its own antidumping rules and practices as long as they do not violate *Article VI of GATT 1994*, these rules and practices are allowed by WTO. Consequently, the antidumping measure has become very complicated, less transparent and varies from country to country. A possible way to eliminate these problems is the harmonisation of the antidumping laws across countries. Rules, regulations and procedures of the antidumping measure across the WTO members will be the same without variation. The antidumping

laws, then, will become clearer, more transparent and more consistent than they are now.

As mentioned, when antidumping duties are imposed on products imported from the dumper's countries in order to penalise the dumpers and remedy the injury to the domestic industries, these may harm the economy at large due to a market distortion. Should levying the antidumping duties on products imported from the dumpers be changed to collecting the antidumping penalties in a lump sum? When the dumpers pay the antidumping penalties in a lump sum to compensate the domestic industry where is injured from dumping, the market will not be distorted. Under this alternative approach, the petitioning domestic industries can be remedied without damaging other related industries.

## **8 Conclusion**

This paper is motivated by an inconsistency between Prusa's results and recent observations. I employ a simple take-it-or-leave-it bargaining game with two-sided asymmetric information, that is, both the domestic and foreign firm are uncertain about the type of each other, to investigate the possibility of settling a private agreement in an antidumping case.

The results show that, firstly, the private agreement will be settled with certainty if, and only if, the domestic firm employs a pooling strategy and the probability of a low-type foreign firm is significant small. Otherwise, there will exist

the positive probability of bargaining failure. This contradicts Prusa (1999), whose model predicts that the private agreement is always settled. Secondly, the likelihood of settling the private agreement increases with the probability of a high-type foreign firm and the probability of a low-type domestic firm. This finding also implies that the likelihood of collusion decreases with the bargaining power and the concentration level of the domestic firm, which is inconsistent with Zanardi (2004).

According to previous theoretical studies, collusion is preferable. If this argument is valid, the number of price-undertaking agreements should be large. Nevertheless, only one-quarter of antidumping cases around the world result in a price-undertaking agreement. It is overly optimistic to conclude that domestic industries have recently employed the antidumping measure to defend against unfair competition and remedy their injuries; they no longer use this measure for collusive objection.

On the contrary, the small number of price-undertaking agreements indicates bargaining inefficiency as a result of asymmetric information. The domestic and the foreign firm are more likely to proceed with antidumping cases in the case of two-sided asymmetric information than one-sided asymmetric information or complete information. The domestic industries may still use the antidumping measure as a collusive device. However, in the presence of the asymmetric information, the bargaining game admits the inefficient equilibrium outcomes with a positive possibility.

The home country's welfare of the settlement outcome is superior to any other outcome only if a collusive share of the domestic firm is large enough to offset a loss in consumer surplus caused by an increasing in the price. Since the domestic firm only concerns about its expected payoff, not the social welfare. Therefore, with the small probability of an affirmative outcome, the domestic firm may choose the settlement choice even though it may cause the welfare deterioration. Frequently, the efficiency outcomes are not equally socially desirable.

These findings suggest that the antidumping laws should be reformed. The final outcome has to be solely determined by rules and regulations and remain independent of political and economic pressures from inside and outside the country. Nowadays, each country can set its own antidumping laws independently. Thus, the antidumping laws have become very complicated, less transparent and varied from country to country. To promote a clear and transparent antidumping measure, the harmonisation of antidumping rules, regulations and procedures is needed. The same standards and practices on the antidumping measure have to be applied across countries.

## Appendix

*Proof of  $\Pi^C = \Pi^{*C}$*

The inverse demand function for the domestic and foreign firm is defined as:

$$P = (a - q - q^*)$$

The domestic firm chooses  $q$  to maximise its profit given by:

$$\Pi = q(a - q - q^* - c)$$

Similarly, the foreign firm chooses  $q^*$  in order to maximise:

$$\Pi^* = q^*(a - q - q^* - c)$$

The best-response function of the domestic and foreign firm can be written as:

$$q = \left( \frac{a - q^* - c}{2} \right)$$
$$q^* = \left( \frac{a - q - c}{2} \right)$$

At equilibrium, the domestic and foreign firm supply their products in the home market at:

$$q^C = q^{C*} = \left( \frac{a - c}{3} \right)$$

The Cournot equilibrium price and profit in the home market are:

$$P^C = \left( \frac{a + 2c}{3} \right)$$

$$\Pi^C = \Pi^{*C} = \left( \frac{a - c}{3} \right)^2$$

***Proof of Lemma 1***

If an antidumping duty  $t$  is levied on foreign products when imported into the Home market, the foreign firm will choose  $q^*$  to maximise a new profit function:

$$\Pi^{*D} = q^*(a - q - q^* - c - t)$$

The best-response function of the foreign firm when the antidumping duty  $t$  is imposed is:

$$q^{*D} = \left( \frac{a - q^D - c - t}{2} \right)$$

Conversely, the domestic firm faces the same profit function when the antidumping measure is applied, so the best-response function of the domestic firm is:

$$q^D = \left( \frac{a - q^{*D} - c}{2} \right)$$

At equilibrium when the antidumping duty is levied on the foreign firm's products in response to petitioning by the domestic firm, the domestic firm supplies more products, whereas the foreign firm supplies less products compared to the

Cournot equilibrium.

$$q^D = \left( \frac{a - c + t}{3} \right) > q^C$$

$$q^{*D} = \left( \frac{a - c - 2t}{3} \right) < q^{*C}$$

The price in the home market and the profit of the domestic and foreign firm when the antidumping duty is levied are:

$$P^D = \left( \frac{a + 2c + t}{3} \right) > P^C$$

$$\Pi^D = \left( \frac{a - c + t}{3} \right)^2 > \Pi^C$$

$$\Pi^{*D} = \left( \frac{a - c - 2t}{3} \right)^2 < \Pi^{*C}$$

***Proof of Proposition 1***

With a prior belief that an antidumping duty will be levied on the foreign firm's products with probability  $\rho$ , the expected payoff to the domestic firm from filing an antidumping petition is:

$$\begin{aligned} \bar{\Pi} &= \rho\Pi^D + (1 - \rho)\Pi^C \\ &= \rho(\Pi^D - \Pi^C) + \Pi^C \end{aligned}$$

Due to the fact that  $\Pi^D > \Pi^C$  and  $\Pi^C > \tilde{\Pi}$ , the result is  $\bar{\Pi} > \tilde{\Pi}$ , even if  $\rho = 0$ . Regardless of the domestic firm's belief of the final outcome, the domestic firm always chooses to file a petition if a dump occurs.

***Proof of Lemma 2***

Given the best-response of the foreign firm  $a(\alpha)$ , the domestic firm will offer  $\alpha$ , which yields it the largest expected payoff. Therefore, the following condition must hold in equilibrium:

$$\pi_H^S \geq \bar{\Pi}_H \quad \text{and} \quad \pi_L^S > \bar{\Pi}_L$$

Let  $\pi_k^S$  be the highest payoff to the  $k$ -type domestic firm when making the offer, so  $\pi_k^S \geq \Pi_k^S(\alpha, a(\alpha))$  for all  $\alpha$ . Since the expected payoff to the high-type domestic firm if the domestic and foreign firm fail to reach a private agreement is  $\bar{\Pi}_H$ , then  $\pi_H^S \geq \bar{\Pi}_H^S$ , as stated.

In contrast, if the low-type domestic firm offers  $\alpha_{LL}\Pi^M = \bar{\Pi}_{LL}^*$  and this offer is accepted with probability  $a(\alpha_{LL}) = \eta_L$ , then:

$$\begin{aligned} \pi_L^S &\geq \Pi_L^S(\alpha_{LL}, \eta_L) = \eta_L \left( \Pi^M - \bar{\Pi}_{LL}^* \right) + \eta_H \bar{\Pi}_{LH} \\ &= \eta_L \left( \Pi^M - \bar{\Pi}_{LL}^* \right) + \eta_H \bar{\Pi}_{LH} + \eta_L \bar{\Pi}_{LL} - \eta_L \bar{\Pi}_{LL} \\ &= \bar{\Pi}_L + \eta_L \left( \Pi^M - \bar{\Pi}_{LL} - \bar{\Pi}_{LL}^* \right) \end{aligned}$$

Since  $\Pi^M > \bar{\Pi}_{LL} + \bar{\Pi}_{LL}^*$ , the result is  $\Pi_L^S(\alpha_{LL}, \eta_L) > \bar{\Pi}_L$ . Now the condition  $\pi_L^S > \bar{\Pi}_L$  is established.

The  $k$ -type domestic firm never offers  $\alpha$ , which results in a lower payoff than  $\bar{\Pi}_k$ , i.e.  $\Pi_k^S(\alpha, a(\alpha)) \geq \bar{\Pi}_k$  if  $s_k(\alpha) > 0$ . Assuming that, in equilibrium, the domestic firm makes the offer  $\alpha$  and  $s_L(\alpha) + s_H(\alpha) > 0$ , the following three

cases must be distinguished according to whether:

$$(i) \quad a(\alpha) = 0$$

If (i) then  $\Pi_k^S = \bar{\Pi}_k$ ; however, in equilibrium,  $\pi_L^S > \bar{\Pi}_L$  must hold, so  $s_L(\alpha) = 0$ .

Only the high-type domestic firm makes the offer. Thus, the payoff to the low-type foreign firm when it rejects the offer is  $\bar{\Pi}_{HL}^*$ . As  $a(\alpha) = 0$ ,  $\alpha\Pi^M < \bar{\Pi}_{HL}^*$  and  $\Pi^M > \bar{\Pi}_{HL} + \bar{\Pi}_{HL}^*$ , so  $\Pi^M > \alpha\Pi^M + \bar{\Pi}_{HL}$ . As a result,  $(1 - \alpha)\Pi^M > \bar{\Pi}_{HL} > \bar{\Pi}_H$ ; now  $\Pi_k^S \geq \bar{\Pi}_k$  is settled in this sub-case.

$$(ii) \quad a_H(\alpha) = 0 \text{ but } a_L(\alpha) > 0$$

If (ii), then only the low-type foreign firm accepts the offer in which  $\alpha\Pi^M = \bar{\Pi}_{kL}^*$ ; the payoff to the k-type domestic firm when making the offer is:

$$\begin{aligned} \Pi_k^S(\alpha, a(\alpha)) &= \eta_L a_L (1 - \alpha) \Pi^M + \eta_L (1 - a_L) \bar{\Pi}_{kL} + \eta_H \bar{\Pi}_{kH} \\ &= \eta_L a_L \left( \Pi^M - \bar{\Pi}_{kL} - \bar{\Pi}_{kL}^* \right) + \eta_L \bar{\Pi}_{kL} + \eta_H \bar{\Pi}_{kH} \\ &= \bar{\Pi}_k + \eta_L a_L \left( \Pi^M - \bar{\Pi}_{kL} - \bar{\Pi}_{kL}^* \right) \\ &> \bar{\Pi}_k \end{aligned}$$

Now  $\Pi_k^S \geq \bar{\Pi}_k$  is settled in sub-case (ii).

$$(iii) \quad a_H(\alpha) > 0 \text{ and } a_L(\alpha) = 1$$

If (iii), then only the high-type foreign firm rejects the offer  $\alpha\Pi^M = \bar{\Pi}_{kH}^*$ . Thus,

the payoff to the  $k$ -type domestic firm when making this offer is:

$$\begin{aligned}\Pi_k^S(\alpha, a(\alpha)) &= \eta_L(1 - \alpha)\Pi^M + \eta_H a_H(1 - \alpha)\Pi^M + \eta_H(1 - a_H)\bar{\Pi}_{kH} \\ &= \bar{\Pi}_k + \eta_H a_H(\Pi^M - \bar{\Pi}_{kH} - \bar{\Pi}_{kH}^*) + \eta_L(\Pi^M - \bar{\Pi}_{kL} - \bar{\Pi}_{kH}^*)\end{aligned}$$

As long as  $\Pi^M > \bar{\Pi}_{kL} + \bar{\Pi}_{kH}^*$ , it guarantees that  $\Pi_k^S \geq \bar{\Pi}_k$  is settled in this sub-case (iii).

### ***Proof of Proposition 2***

When the domestic firm offers  $\alpha_L \Pi^M = \bar{\Pi}_L^*$  to the foreign firm, only the low-type foreign firm accepts, whereas the high-type certainly rejects it or  $a(\alpha_L) \leq \eta_L$ . Therefore, the payoff to the  $k$ -type domestic firm is:

$$\begin{aligned}\Pi_k^S(\alpha_L, a(\alpha_L) \leq \eta_L) &= a(\alpha_L)\eta_L(\Pi^M - \bar{\Pi}_L^*) + (1 - a(\alpha_L))\eta_L\bar{\Pi}_{kL} + \eta_H\bar{\Pi}_{kH} \\ &= a(\alpha_L)\eta_L(\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{kL}) + \bar{\Pi}_k\end{aligned}$$

On the contrary, if the domestic firm offers  $\alpha_H \Pi^M = \bar{\Pi}_H^*$ , the foreign firm will accept this offer with certainty or  $a(\alpha_H) = 1$ . Hence, the payoff to the  $k$ -type domestic firm is:

$$\Pi_k^S(\alpha_H, a(\alpha_H) = 1) = \Pi^M - \bar{\Pi}_H^*$$

Given the best-response of the foreign firm, the expected payoff to the low-

type domestic firm when offers  $\alpha_L$  is:

$$\Pi_L^S(\alpha_L, a(\alpha_L) \leq \eta_L) = a(\alpha_L)\eta_L(\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{LL}) + \bar{\Pi}_L$$

Since  $\Pi^M > \bar{\Pi}_{LL}^* + \bar{\Pi}_{LL}$  and  $\bar{\Pi}_L^* < \bar{\Pi}_{LL}^*$ , the result is  $\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{LL} > 0$ . This guarantees that the low-type domestic firm does not deviate from  $\alpha_L$  to  $\alpha < \alpha_L$ .

Moreover, the low-type domestic firm has no incentive to offer  $\alpha_H$  rather than  $\alpha_L$  if the following condition holds:

$$\Pi^M - \bar{\Pi}_H^* \leq a(\alpha_L)\eta_L(\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{LL}) + \bar{\Pi}_L$$

or:

$$a(\alpha_L) \geq \left( \frac{\Pi^M - \bar{\Pi}_H^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{LL}} \right)$$

The expected payoff to the high-type domestic firm if it offers  $\alpha_L$  is:

$$\Pi_H^S(\alpha_L, a(\alpha_L) \leq \eta_L) = a(\alpha_L)\eta_L(\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{HL}) + \bar{\Pi}_H$$

If  $\Pi^M > \bar{\Pi}_L^* + \bar{\Pi}_{HL}$  holds, the high-type domestic firm does not deviate from  $\alpha_L$  to  $\alpha < \alpha_L$ . Otherwise it does.

The high type domestic firm does not deviate to  $\alpha_H$ , if, and only if,:

$$\Pi^M - \bar{\Pi}_H^* \leq a(\alpha_L)\eta_L(\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{HL}) + \bar{\Pi}_H$$

or:

$$a(\alpha_L) \geq \left( \frac{\Pi^M - \bar{\Pi}_H^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{HL}} \right)$$

Since  $\left( \frac{\Pi^M - \bar{\Pi}_H^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{LL}} \right) \geq \left( \frac{\Pi^M - \bar{\Pi}_H^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{HL}} \right)$ , then if condition (a)  $\Pi^M > \bar{\Pi}_L^* + \bar{\Pi}_{HL}$  and (b)  $a(\alpha_L) \geq \left( \frac{\Pi^M - \bar{\Pi}_H^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{LL}} \right)$  hold, there exists a pooling equilibrium in which the domestic firm offers  $\alpha_L$  and the foreign firm accepts this offer with probability  $a(\alpha_L) \leq \eta_L$ . On the contrary, if a condition  $a(\alpha_L) \leq \left( \frac{\Pi^M - \bar{\Pi}_H^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{HL}} \right)$  holds, there exists a pooling equilibrium, which the domestic firm offers  $\alpha_H$  and the foreign firm accepts with certainty.

### ***Proof of Proposition 3***

When a pure separating strategy is applied, the different types of domestic firms choose to make a different offer. If the high-type domestic firm offers  $\alpha_{HL} \Pi^M = \bar{\Pi}_{HL}^*$ , only the low-type foreign firm will accept this offer. Then, if the low-type foreign firm accepts the offer  $\alpha_{HL}$  with probability  $a_L(\alpha_{HL})$ , the offer  $\alpha_{HL}$  will be accepted by the foreign firm with probability  $a(\alpha_{HL}) = \eta_L a_L(\alpha_{HL})$ . The expected payoff to the high-type domestic firm when offering  $\alpha_{HL}$  is:

$$\begin{aligned} \Pi_H^S(\alpha_{HL}, a(\alpha_{HL})) &= \eta_L a_L(\alpha_{HL}) \left( \Pi^M - \bar{\Pi}_{HL}^* \right) \\ &\quad + \eta_L (1 - a_L(\alpha_{HL})) \bar{\Pi}_{HL} + \eta_H \bar{\Pi}_{HH} \\ &= \eta_L a_L(\alpha_{HL}) \left( \Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL} \right) + \bar{\Pi}_H \end{aligned}$$

Since  $\Pi_H^S(\alpha_{HL}, a(\alpha_{HL})) > \bar{\Pi}_H$ , the high-type domestic firm has no incentive to offer  $\alpha < \alpha_{HL}$  which the foreign firm will certainly reject.

On the other hand, if the offer  $\alpha_{LH}\Pi^M = \bar{\Pi}_{LH}^*$  is made, the foreign firm will accept it with certainty. Therefore, the high-type domestic firm will not deviate from offering  $\alpha_{HL}$  if the following condition holds:

$$\Pi^M - \bar{\Pi}_{LH}^* \leq \eta_L a_L(\alpha_{HL}) \left( \Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL} \right) + \bar{\Pi}_H$$

or:

$$a(\alpha_{HL}) \geq \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right)$$

As long as above condition holds, offering  $\alpha_{HL}$ , which the foreign firm accepts with probability  $a(\alpha_{HL})$ , is the high-type domestic firm's best-response.

When the low-type domestic firm chooses to offer  $\alpha_{LH}\Pi^M = \bar{\Pi}_{LH}^*$ , which the foreign firm will certainly accept it, the expected payoff to the low-type domestic firm is:

$$\Pi_L^S(\alpha_{LH}, 1) = \Pi^M - \bar{\Pi}_{LH}^*$$

If sub-case (iii) in Lemma 2 holds,  $\Pi_L^S(\alpha_{LH}) = \Pi^M - \bar{\Pi}_{LH}^* > \bar{\Pi}_{LL} > \bar{\Pi}_L$ . The low-type domestic firm will not offer any terms  $\alpha < \alpha_{HL}$ , which is certainly rejected by the foreign firm.

Whether the low-type domestic firm mimics the high-type domestic firm by

offering  $\alpha_{HL}$ . If it does, its expected payoff will be:

$$\begin{aligned}\Pi_L^S(\alpha_{HL}, a(\alpha_{HL})) &= \eta_L a_L(\alpha_{HL}) \left( \Pi^M - \bar{\Pi}_{HL}^* \right) \\ &\quad + \eta_L (1 - a_L(\alpha_{HL})) \bar{\Pi}_{LL} + \eta_H \bar{\Pi}_{LH} \\ &= \eta_L a_L(\alpha_{HL}) \left( \Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL} \right) + \bar{\Pi}_L\end{aligned}$$

The low-type domestic firm will not mimic the high-type domestic firm if the following condition is satisfied:

$$\Pi^M - \bar{\Pi}_{LH}^* \geq \eta_L a_L(\alpha_{HL}) \left( \Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL} \right) + \bar{\Pi}_L$$

or:

$$a(\alpha_{HL}) \leq \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL}} \right)$$

If a condition  $\left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL}} \right) \leq a(\alpha_{HL}) \leq \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL}} \right)$  holds, there exists at least one equilibrium where the domestic firm will reveal its own type truthfully. The low-type domestic firm will offer  $\alpha_{LH}$ , which the foreign firm will certainly accept it and the high-type domestic firm will offer  $\alpha_{HL}$ , which will be accepted with probability  $a(\alpha_{HL})$ . This result implies that if the domestic firm adopts a pure separating strategy, the bargaining failure will occur with a positive probability.

***Proof of Proposition 4***

Consider the case in which the high-type domestic firm employs a mixed strategy. Assume that the high-type domestic firm offers  $\hat{\alpha}$  with probability  $\beta$  and  $\acute{\alpha} < \hat{\alpha}$  with probability  $1 - \beta$ , whereas the low-type domestic firm offers  $\hat{\alpha}$  with certainty. By updating the belief in accordance with the Bayes' rule, the foreign firm accepts the offer  $\hat{\alpha}\Pi^M = \bar{\Pi}_H^*(\hat{\alpha}) > \bar{\Pi}_H$  with certainty and the offer  $\acute{\alpha}\Pi^M = \bar{\Pi}_{HL}^*$  with probability  $a(\acute{\alpha}) \leq \eta_L$ .

The expected payoff to the high-type domestic firm, when it offers  $\hat{\alpha}$  with probability  $\beta$  and  $\acute{\alpha}$  with probability  $1 - \beta$ , is:

$$\begin{aligned} \Pi_H^S(s_H(\hat{\alpha}) = \beta, s_H(\acute{\alpha}) = 1 - \beta) &= \bar{\Pi}_H + \beta \left( \Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H \right) \\ &\quad + a(\acute{\alpha})(1 - \beta) \left( \Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL} \right) \end{aligned}$$

If a condition  $\Pi^M > \bar{\Pi}_H^*(\hat{\alpha}) + \bar{\Pi}_H$  holds, the high-type domestic firm prefers this mixed strategy rather than taking risk on the final result. Moreover, the high-type domestic firm will not deviate to a pure pooling strategy, or  $s_H(\hat{\alpha}) = 1$ , if:

$$\begin{aligned} \Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) &\leq \bar{\Pi}_H + \beta \left( \Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H \right) \\ &\quad + a(\acute{\alpha})(1 - \beta) \left( \Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL} \right) \end{aligned}$$

or:

$$a(\acute{\alpha}) \geq \left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right)$$

Similarly, it has no incentive to employ a pure separating strategy where  $s_H(\hat{\alpha}) = 1$ , if the following condition holds:

$$\begin{aligned} \bar{\Pi}_H + a(\hat{\alpha})(\Pi^M - \bar{\Pi}_{HL}^* + \bar{\Pi}_{HL}) &\leq \bar{\Pi}_H + \beta \left( \Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H \right) \\ &\quad + a(\hat{\alpha})(1 - \beta) \left( \Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL} \right) \end{aligned}$$

or:

$$a(\hat{\alpha}) \leq \left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right)$$

Therefore, if (a)  $\Pi^M > \bar{\Pi}_H^*(\hat{\alpha}) + \bar{\Pi}_H$  and (b)  $a(\hat{\alpha}) = \left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right)$  hold, this mixed strategy is preferable to the high-type domestic firm.

The expected payoff to the low-type domestic firm, when it certainly offer  $\hat{\alpha}$ , is equal to:

$$\Pi_L^S(s_L(\hat{\alpha}) = 1) = \Pi^M - \bar{\Pi}_H^*(\hat{\alpha})$$

Since  $\bar{\Pi}_H^*(\hat{\alpha}) < \bar{\Pi}_{LH}^*$  and  $\bar{\Pi}_L < \bar{\Pi}_{LL}$ , then if sub-case (iii) in Lemma 2 holds, the low-type domestic firm prefers settling the private agreement to taking the final result. Furthermore, it will not deviate from  $\hat{\alpha}$  to  $\hat{\alpha}$  as long as:

$$a(\hat{\alpha}) \left( \Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL} \right) + \bar{\Pi}_L \leq \Pi^M - \bar{\Pi}_H^*(\hat{\alpha})$$

or:

$$a(\hat{\alpha}) \leq \left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL}} \right)$$

Since  $\left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL}} \right) > \left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right)$ , so if (a)  $\Pi^M > \bar{\Pi}_H^*(\hat{\alpha}) + \bar{\Pi}_H$  and

(b)  $a(\hat{\alpha}) = \left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right)$  are satisfied, neither the high-type nor the low-type domestic firm deviate from this strategy. A type I semi-separating equilibrium, where the high-type firm adopts a mixed strategy, is established.

Due to  $\bar{\Pi}_{LH}^* > \bar{\Pi}_H^*(\hat{\alpha})$  then  $\left( \frac{\Pi^M - \bar{\Pi}_H^*(\hat{\alpha}) - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right) > \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{HL}} \right)$ . The existence of a separating equilibrium in Proposition 3 is sufficient to guarantee that the type I semi-separating equilibrium will exist. This result implies that the private agreement will fail to be settled with a positive probability.

### ***Proof of Proposition 5***

When the low-type domestic firm adopts a mixed strategy, a semi-separating equilibrium may exist. Assume that the low-type firm offers  $\tilde{\alpha}$  with probability  $\lambda$  and  $\hat{\alpha} > \tilde{\alpha}$  with probability  $1 - \lambda$ , but the high-type domestic firm offers  $\tilde{\alpha}$  with probability one. The foreign firm updates its belief in accordance with Bayes' rules; therefore, if the offer  $\tilde{\alpha}\Pi^M = \bar{\Pi}_L^*(\tilde{\alpha}) < \bar{\Pi}_L^*$  is made, the foreign firm will accept with probability  $a(\tilde{\alpha}) \leq \eta_L$ . On the contrary, if the offer  $\hat{\alpha}\Pi^M = \bar{\Pi}_{LH}^*$  is made, none of the foreign firms will reject it.

The expected payoff to the low-type domestic firm, when it offers  $\tilde{\alpha}$  with probability  $\lambda$  and  $\hat{\alpha}$  with probability  $1 - \lambda$ , can be shown as:

$$\begin{aligned} \Pi_L^S(s_L(\tilde{\alpha}) = \lambda, s_L(\hat{\alpha}) = 1 - \lambda) &= \bar{\Pi}_L + a(\tilde{\alpha})\lambda \left( \Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL} \right) \\ &\quad + (1 - \lambda) \left( \Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L \right) \end{aligned}$$

Since  $\bar{\Pi}_L^*(\tilde{\alpha}) < \bar{\Pi}_{LL}^*$  and  $\bar{\Pi}_{LL} > \bar{\Pi}_L$ , then if sub-case (iii) in Lemma 2 holds, the

low-type domestic firm prefers to settle the private agreement. Similarly, it will not deviate to a pure pooling strategy, or  $s_L(\tilde{\alpha}) = 1$ , if:

$$\begin{aligned} \bar{\Pi}_L + a(\tilde{\alpha}) \left( \Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL} \right) &\leq \bar{\Pi}_L + a(\tilde{\alpha}) \lambda \left( \Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL} \right) \\ &\quad + (1 - \lambda) \left( \Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L \right) \end{aligned}$$

or:

$$a(\tilde{\alpha}) \leq \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL}} \right)$$

In addition, the low-type domestic firm will not deviate from this mixed strategy to a pure separating strategy, or  $s_L(\hat{\alpha}) = 1$ , when:

$$\begin{aligned} \Pi^M - \bar{\Pi}_{LH}^* &\leq \bar{\Pi}_L + a(\tilde{\alpha}) \lambda \left( \Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL} \right) \\ &\quad + (1 - \lambda) \left( \Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L \right) \end{aligned}$$

or:

$$a(\tilde{\alpha}) \geq \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL}} \right)$$

Hence, the low-type domestic firm prefers to employ this mixed strategy when a condition  $a(\tilde{\alpha}) = \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL}} \right)$  is satisfied.

When the high-type domestic firm offers  $\tilde{\alpha}$  with certainty, its expected payoff is defined as:

$$\Pi_H^S(s_H(\tilde{\alpha}) = 1) = \bar{\Pi}_H + a(\tilde{\alpha}) \left( \Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{HL} \right)$$

As long as  $\Pi^M > \bar{\Pi}_L^* + \bar{\Pi}_{HL}$  holds, the high-type domestic firm prefers establishing the private agreement rather than taking risk on the final outcome. Moreover, it has no incentive to offer  $\lambda$  instead of  $\tilde{\alpha}$  if the following condition is satisfied:

$$\Pi^M - \bar{\Pi}_{LH}^* \leq \bar{\Pi}_H + a(\tilde{\alpha}) \left( \Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{HL} \right)$$

or:

$$a(\tilde{\alpha}) \geq \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_H}{\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{HL}} \right)$$

A type II semi-separating equilibrium exists when  $\Pi^M > \bar{\Pi}_L^* + \bar{\Pi}_{HL}$  and  $a(\tilde{\alpha}) = \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL}} \right)$  are satisfied. Since  $\left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_{HL}^* - \bar{\Pi}_{LL}} \right) < \left( \frac{\Pi^M - \bar{\Pi}_{LH}^* - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^*(\tilde{\alpha}) - \bar{\Pi}_{LL}} \right) < \left( \frac{\Pi^M - \bar{\Pi}_H - \bar{\Pi}_L}{\Pi^M - \bar{\Pi}_L^* - \bar{\Pi}_{LL}} \right)$ , the existence of a separating equilibrium in Proposition 3 or a pooling equilibrium in Proposition 2 cannot guarantee the existence of the type II semi-separating equilibrium.

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# Chapter 3: Do the Rules of Origin make a difference?

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## Abstract

The larger growing number of FTAs during these two decades has motivated a policy debate on the effects of FTAs on preferential trade and patterns of trade. This paper examines the behaviour of firms after the implementation of an FTA by paying attention to the impacts of rules of origin on preferential trade flows and economic activities within the FTA region. It is found that a tightening of the rules of origin increases the volume of final goods import from RoW but decreases the volume of intermediate goods and raw material import from RoW, given the dominance of the final goods rules of origin effects. However, if the intermediate goods rules of origin effects dominate, the volume of intermediate goods import from RoW turns to increase, rather than decrease. These imply that preferential trade flows and economic activities among the member countries of an FTA may increase or decrease when the rules of origin are tightened. The findings, *inter alia*, suggest that the product-specific rules of origin that impose the restrictive rules to final goods but the loose rules to intermediate goods are more efficient in promoting preferential trade and economic activities within the region and also inducing investments from outside.

**JEL Classification:** F13; F15

**Keywords:** rules of origin; FTA; preferential trade flows; trade diversion

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# 1 Introduction

The proliferation of Free Trade Agreements during the past two decades has spawned a discussion over the implications of FTAs on preferential trade flow and economic integration among the members, especially the impacts of rules of origin. Rules of Origin consist of mechanisms and schemes specifying conditions for goods to gain a preferential treatment under the FTAs. They are a central market-access tool governing over the preferential trade and the pattern of economic activities within FTA region.

According to Duttagupta and Panagariya (2007), in the presence of the rules of origin, the joint welfare of the FTA members may be inferior to the status quo.<sup>1</sup> However, the rules of origin could make the FTAs politically more acceptable. This paper, therefore, treats the formation of an FTA as given and limits an attention to the impacts of a restrictiveness of the rules of origin on preferential trade flows among the member countries.

This paper is motivated by the question do the more restrictive rules of origin really increase preferential trade flows and promote economic activities within the FTA region? as argued by policy makers. Based on the concept of content

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<sup>1</sup>The classic analysis of the welfare impacts of an FTA is that of Viner (1950), who established the concepts of trade creation and trade diversion. Trade creation is one in which a member country imports more from its lower-cost FTA partner to replace its own higher cost domestic production; results in a gain of welfare. On the contrary, trade diversion occurs when a member country switches its import from an efficient nonmember to a less efficient member because of the FTA's tariff preferences; causes a loss of welfare. An FTA will improve the joint welfare of its members if the benefits of trade creation dominate the losses from trade diversion. The bigger the trade volume diverted from the RoW is, the more likely that the joint welfare of the FTA members decreases, then rules of origin may negatively affect on welfare.

protection schemes,<sup>2</sup> Krishna and Krueger (1995), Falvey and Reed (1998) and Ju and Krishna (2005) argue that the more restrictive rules of origin either decrease or increase trade flows within the region, depending on the degree of competition in the final goods and the intermediate goods sectors on which they are applied. The more restrictive rules of origin may not result in an increasing in preferential trade flows among member countries as expected.

This paper extends the model of Ju and Krishna (2005) by introducing the intermediate goods rules of origin to examine the behaviour of firms when the degree of restrictiveness of rules of origin is changed, in attempt to answer the following questions: Firstly, do the more restrictive rules of origin increase preferential trade flows and promote activities within the FTA region? Secondly, what type of rules of origin should be employed? Thirdly, what should the degree of restrictiveness of the rules of origin be? Finally, should preferential rules of origin be harmonised?

In a homogeneous regime that all firms choose to produce the originating goods, the more restrictive rules of origin decrease final goods trade flows but increase intermediate goods and raw material trade flows within the FTA region if the final goods rules of origin effects are dominant. This is consistent with Ju and Krishna (2005) and empirical results of Estervadeordal and Suominen (2003)<sup>3</sup> and Cadot, Estervadeordal and Akiko (2005).<sup>4</sup> However, if the interme-

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<sup>2</sup>Such as Grossman (1981), Hollander (1987) and Mussa (1984).

<sup>3</sup>A negative relation between the rules of origin restriction and the trade flow between the FTA members.

<sup>4</sup>The more restrictive rules of origin cause the less preferential import within the NAFTA.

intermediate goods rules of origin effects are dominant, the more restrictive the rules of origin are, intermediate goods trade flows within the region are more likely to decrease, rather than increase as predicted by Ju and Krishna (2005).

If the objectives of establishing the FTA are to promote preferential trade flows and economic activities within the region and induce new investments from outside, the final goods rules of origin should be tightened whereas the intermediate goods rules of origin should be loosened. In contrast, if a member country is not ready to open its final goods market and would like to limit preferential market access, it has to tighten both the final goods and intermediate goods rules of origin.

These suggest that the product-specific rules of origin are preferable to the general rules. The product-specific rules specify a specific criterion to each product and vary from product to product, while the general rules set a single criterion to all product lines. Therefore, the product-specific rules are more flexible and a more efficient device because these can assign a different requirement to different products in response to the different characteristics and sensitivity of each industry.

Last but not least, the growing number of overlapping FTAs, whose rules of origin substantially differ from agreement to agreement and from country to country, has spun a complex web of rules of origin. Thus, the administrative costs and the burden for manufacturers to comply with the rules of origin are higher. Harmonisation of preferential rules of origin is purposed to solve these

problems. In my point of view, however, a variation across preferential rules of origin is preferable to harmonised rules of origin because the main objective of rules of origin is to be an efficient device to reach the country's objectives in establishing the FTA, not being the simple rule.

This paper is organised as follow. The following section reviews related literature about the relationship among the rules of origin, the behaviour of firms and the change in the trade volume from the Rest of the World, hereafter called RoW. In Section 3, an extended model of Ju and Krishna (2005) by introducing a production of intermediate goods to examine the behaviour of firms when the implementation of an FTA with rules of origin. The effects of degree of restrictiveness of rules of origin on preferential trade flows within the FTA region are presented in Section 4. Section 5 discusses what the rules of origin should be. Finally, the conclusion is presented in Section 6.

## **2 Literature Review**

Much of the literature on the impacts of Rules of Origin on the preferential trade flows and the pattern of economic activities among the FTA parties is based on the concept of content protection and content preference. Both schemes require a given percentage of domestic value added, or domestic component to be embodied in a final goods. A content protection program is a combination between tariff protection for the intermediate goods and subsidy to the final

goods producer. Similarly, a content preference scheme acts like a foreign subsidy to final goods producers in the exportable industry, and may or may not provide protection to the domestic intermediate goods producers.

Grossman (1981) investigates the effects of content protection and content preference schemes on resource reallocation. His results show that if domestic and foreign inputs are perfect substitutes, producers will revert from foreign inputs to domestic ones, then the domestic intermediate inputs price and production costs increase. The excess of the domestic intermediate inputs price over the world price depends on the substitutability between domestic and foreign intermediate inputs, the supply condition in the domestic intermediate inputs industry and the market structure of those inputs. However a content preference scheme may cause a decrease in the outputs of the exportable industry if the requirement is binding.

Dixit and Grossman (1982) employ a multistage protection model to analyse the effects of factor accumulation and protection on resource allocation. They find that the final goods producers have an incentive to produce upstream goods domestically rather than to import them from outside. The content protection leads to an expansion in intermediate activities. Lloyd (1993) extends this model to the FTA with rules of origin and finds similar results to Grossman (1991). The formation of an FTA with rules of origin causes a trade creation of intermediate input, and it eliminates the overlap in the range of goods produced by the FTA members. Rodriguez (2001) argues that the restrictive rules of origin may

lead to the inefficiency of product reallocation within the FTA region. This is consistent with Kruger (1999), the NAFTA with rules of origin causes the Mexican producers to shift their purchase from the lower cost sources outside to the higher cost sources inside the region.

Ju and Krishna (2005) examine the effects of rules of origin on the behaviour of firms and market access from RoW. Their results suggest that when the restrictive rules of origin increases, imports of final goods from RoW first increase and then decrease whereas imports of intermediate goods from RoW first fall and then rise. The more restrictive the rules of origin are, it is more likely that the domestic producers lower imports of intermediate goods from RoW, because rules of origin require higher domestic contents to be embodied. However, if rules of origin are too restrictive, the domestic producers give up to comply with them so they switch back to choose the intermediate goods from the cheapest sources, consequently an increasing in imports of intermediate goods from RoW.

Just because, the rules of origin seem to be protective, it does not mean they are. Appiah (1999) applies a multi-sector Computable General Equilibrium (CGE) model to analyse the NAFTA effects and finds that the rules of origin distort trade flows, divert resources from the most efficient users and undercut global welfare. Estevadeordal (2000) examines the relationship between the preferential tariff phase-outs and the accompanying rules of origin. His estimated results suggest that rules of origin are used to prevent trade deflection, as the sectors that have the larger differences in the tariff are those where rules of origin

are more restrictive. Beside, that protection and the extent of rules of origin are positively correlated.

With respect to Estervadeordal and Suominen (2003), they incorporate virtually all rules of origin regimes around the world and employ a gravity model to study the effects of rules of origin on trade flows. Their results show that the restrictiveness rules of origin negatively and significantly affects trade flows between countries as suggested by theoretical studies. Secondly, the restrictiveness and complexity of rules of origin have an adverse effect on aggregate trade flows. Finally, the more restrictiveness of final goods rules of origin results in the larger trade in intermediate goods within the region.

Cadot et al (2005) re-examine the effects of rules of origin on trade flows by employing a restrictiveness index, as conducted by Estervadeordal and the gravity model on cross section data. As predicted by theoretical works, they find a negative relation between the restrictiveness rules of origin and trade flows between members. Furthermore, Cadot, Estervadeordal and Akiko (2005) conduct an empirical study of the NAFTA rules of origin impacts on preferential trade within the region, their results suggest that the more restrictive are rules of origin, the more negative are the impacts on preferential trade flows.

### 3 The Model

The model of Ju and Krishna (2005) is modified here to analyse the behaviour of firms and preferential trade flow within the FTA region in the presence of final goods and intermediate goods rules of origin. Rather assuming that an originating intermediate goods is exogenously determined, this assumption is relaxed now. Intermediate goods firms can employ either a raw material within the region or from RoW to produce an intermediate goods. However, an intermediate goods produced by firms within the FTA region can be counted as originating content only if it meets the intermediate goods rules of origin.

Assume that the world consists of country  $A$ ,  $B$ , and  $C$ ; country  $A$  and  $B$  form an FTA, excluding  $C$  which can be considered as RoW and both of them are sufficiently large for ensuring that both members are welfare improving.<sup>5</sup> There are three kinds of goods, a final goods ( $x$ ), an intermediate goods ( $y$ ), and a raw material ( $z$ ), in addition to a numeraire consumption good. Let  $B$  has a comparative advantage in the final goods relative to  $A$ , but not relative to RoW and  $A$  has a comparative advantage to the intermediate goods relative to  $B$ , but not relative to RoW.<sup>6</sup>

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<sup>5</sup>According to Bond, Riezman and Syropoulos (2004), the formation of an FTA results in two opposing effects on member countries. On one hand, their terms of trade vis-a-vis RoW decline and this is welfare-decreasing. On the other hand, the internal liberalisation causes trade expansion among the members and this is welfare-increasing. The latter effect will dominate and the formation of an FTA will improve welfare for member countries if, and only if, member countries are sufficiently large.

<sup>6</sup>A trade diversion in the final goods from RoW to  $B$  improves the welfare in  $B$  but reduces the welfare in  $A$ . At the same time, the intermediate goods and raw material relocation from RoW to  $A$  causes the welfare improvement in  $A$  and let the welfare losses from a trade diversion in  $A$  be not larger than the welfare gains from expansion of trade in the intermediate goods.

Define  $p_j^w$  as the world price of goods  $j$  when  $j \in \{x, y, z\}$  then the price of goods  $j$  in country  $i \in \{A, B\}$  before forming the FTA is equal to  $p_j^{i0} = (1+t_j^i)p_j^w$  where  $t_j^i$  is imported tariff of goods  $j$  in country  $i$ . Assume throughout this paper that the tariff rates of final goods in  $A$  are higher than in  $B$ , but the tariff rates of intermediate goods and raw material in  $A$  are lower than  $B$ . That is  $t_x^A > t_x^B, t_y^A < t_y^B$  and  $t_z^A < t_z^B$ .

After establishing the FTA,  $A$  and  $B$  eliminate their imported tariff to each other's goods. However, prices in  $A$  and  $B$  are different because a simple transshipment cannot occur in the presence of the rules of origin. The raw material rules of origin here are assumed to be very restrictive and prohibitively expensive to comply, the price of raw material from RoW in  $A$  and  $B$  is  $p_{z^*}^{A1} = (1+t_z^A)p_z^w$  and  $p_{z^*}^{B1} = (1+t_z^B)p_z^w$  respectively, and these prices are not equalised. In contrast, the regional raw material in both countries has the same price,  $p_z^1$  where  $p_z^1 \geq p_{z^*}^{B1} > p_{z^*}^{A1}$ .<sup>7</sup> Although the price  $p_z^1$  is higher than the price of raw material from RoW, the FTA intermediate goods firm may still choose it because it can contribute to originating cost share whereas the raw material from RoW cannot.

Country  $A$  can import the final goods from either  $C$  or  $B$  with zero tariff on condition that such goods meets the origin requirements. The final goods price in  $A$  after the FTA will never be higher than the price before the FTA. That is  $p_{x^*}^{B0} \leq p_x^{A1} \leq p_{x^*}^{A0}$ . Since the final goods price in  $B$  is initially lower than  $A$ , the final goods firm in  $A$  has no incentive to comply with the origin requirements

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<sup>7</sup>Defines  $p_j$  as the price of originating goods  $j$  and  $p_{j^*}$  as the price of goods  $j$  from RoW.

and export to  $B$ . The final goods price in  $B$  remains unchanged,  $p_{x^*}^{B0} = p_{x^*}^{B1}$ .

What happens to the intermediate goods market in country  $A$  and  $B$  after forming the FTA? In the presence of the rules of origin, the intermediate goods produced within the FTA region and meets the requirements, hereafter called originating intermediate goods, and the intermediate goods from RoW are physically indifferent but they differ in the sense that the former can contribute to the cost share that the final goods rules require, while the latter cannot. There is a trade diverting in the intermediate goods from RoW to the preferential regional market. A higher demand for originating intermediate goods increases its price and this price is always higher than the price of intermediate goods from RoW. That is  $p_y^1 \geq p_{y^*}^{B1} > p_{y^*}^{A1}$ .

## A Final Goods Firm Behaviour

Let  $F_X^i(Y, k)$  be a constant return to scale production function of final goods in country  $i$  where  $i \in \{A, B\}$ ,  $k$  is a capital used in which treated as given in a short run and  $Y$  is the intermediate goods used by a firm to produce the final goods, which can either be the originating intermediate goods ( $y$ ) or intermediate goods from RoW ( $y^*$ ).<sup>8</sup>

A final goods firm in country  $A$  has no incentive to comply with the origin requirements and export to  $B$  because the final goods price there is lower. The

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<sup>8</sup>This also refers to the intermediate goods produced within the FTA region but fails to meet the origin requirements or imported from outside.

final goods firm in  $A$  will choose the intermediate goods from the cheapest sources to produce the final goods for its own market. The final goods supply of a typical firm in  $A$  after the FTA can be written as:

$$s_{x^*}^A(p_x^{A1}, \min(p_y^1, p_{y^*}^{A1}))$$

At the same time, a final goods firm in country  $B$  decides to comply the origin requirements and export the originating final goods to  $A$  with price  $p_x^{A1}$  or ignore them and sell its products domestically with price  $p_{x^*}^{B0}$  where  $p_{x^*}^{B0} < p_x^{A1}$ , depending on which choice is more profitable. If the former choice is more profitable, all firms will choose to produce the originating goods. This refers to a Homogeneous Regime. In contrast, If there is indifferent between the former and the latter choice, some firms will choose to produce the originating goods whereas others will not. This refers to a Heterogeneous Regime.

Assume that rules of origin require at least  $\alpha$  percent of the originating cost share to the total variable costs. That is:

$$\frac{p_y^1 y}{p_y^1 y + p_{y^*}^{B1} y^*} \geq \alpha$$

If the price of originating intermediate goods is not higher than the price of intermediate goods from RoW in  $B$ ,  $p_y^1 \leq p_{y^*}^{B1}$ , all final goods firms in  $B$  will choose the originating intermediate goods and will automatically comply with

the origin requirements. The rules of origin do not affect the behaviour of final goods firms in  $B$ . On the contrary, at  $p_y^1 > p_{y^*}^{B1}$ , the final goods firms are forced to use the originating intermediate goods at least  $\alpha$  percent if they would like to sell their products with price  $p_x^{A1}$  in  $A$ .

With  $p_y^1 > p_{y^*}^{B1}$ , the more the originating intermediate goods is used, the higher extra production costs the final goods firms face. The firms reasonably chooses to meet the origin requirement at exactly level, then:

$$y^* = \frac{p_y^1(1 - \alpha)}{\alpha p_{y^*}^{B1}} y$$

The quantity of intermediate goods used to produce the originating final goods is:

$$Y = y + y^* = \left\{ \frac{p_y^1(1 - \alpha) + \alpha p_{y^*}^{B1}}{\alpha p_{y^*}^{B1}} \right\} y$$

Therefore, the cost of intermediate goods used is equal to:

$$\begin{aligned} p_y^1 y + p_{y^*}^{B1} y^* &= p_y^1 y + p_{y^*}^{B1} \left\{ \frac{p_y^1(1 - \alpha)}{\alpha p_{y^*}^{B1}} y \right\} = \frac{p_y^1}{\alpha} y \\ &= \left\{ \frac{p_y^1 p_{y^*}^{B1}}{p_y^1(1 - \alpha) + \alpha p_{y^*}^{B1}} \right\} (y + y^*) \end{aligned}$$

Denote  $\varphi(\alpha, p_y^1) = \frac{p_y^1 p_{y^*}^{B1}}{p_y^1(1 - \alpha) + \alpha p_{y^*}^{B1}}$  as a variable cost of producing the final goods when the rules of origin are met.

A demand for the originating intermediate goods of a typical firm can be shown as:

$$y^B(p_x^{A1}, p_y^1, \alpha) = \phi(\alpha, p_y^1) Y^B(p_x^{A1}, \varphi(\alpha, p_y^1))$$

Where  $\phi(\alpha, p_y^1) = \frac{\alpha p_y^{B1}}{p_y^1(1-\alpha) + \alpha p_y^{B1}}$  or  $\frac{y^B(p_x^{A1}, p_y^1, \alpha)}{Y^B(p_x^{A1}, \varphi(\alpha, p_y^1))}$ . This can be interpreted as a share of originating intermediate goods used to total intermediate goods used.

**Lemma 1** (i)  $\frac{\partial \phi(\alpha, p_y^1)}{\partial \alpha} > 0$ , (ii)  $\frac{\partial \varphi(\alpha, p_y^1)}{\partial p_y^1} > 0$ , (iii)  $\frac{\partial \phi(\alpha, p_y^1)}{\partial \alpha} > 0$  and  
 (iv)  $\frac{\partial \phi(\alpha, p_y^1)}{\partial p_y^1} < 0$

*Proof.* See Appendix.

The more restrictive the final goods rules of origin are, the more the originating intermediate goods is required. As a result, an increase in the demand for the originating intermediate goods, the price of the originating intermediate goods and then the production cost of the originating final goods. Hence, the product cost of the originating goods is an increasing function of the restrictive final goods rules of origin and the price of the originating intermediate goods as specified in (i) and (ii) respectively.

When the final goods rules of origin are tightened, the share of the quantity of originating intermediate goods used increases as a result of the originating intermediate goods being more required. In contrast, if the price of the originating intermediate goods increases, the final goods producers need less the originating intermediate goods to meet the requirements. Therefore, the share

of the quantity of originating intermediate goods used is an increasing function of the restrictive rules of origin but a decreasing function of the price of the originating intermediate goods as specified in (iii) and (iv) respectively.

A profit function of the final goods firms that produce the originating final goods in  $B$  is:

$$\Pi_x^B(p_x^{A1}, p_{x^*}^{B1}, \varphi(\alpha, p_y^1), p_{y^*}^{B1}) = p_x^{A1} F_X^B(Y, k) - \varphi(\alpha, p_y^1) Y - k \quad (1)$$

On the contrary, if the firms choose to sell its products domestically, it is reasonable that they ignore the origin requirements and employs the intermediate goods from RoW, which price is lower,  $p_y^{B1} < p_y^1$ , to produce the final goods. Since country  $B$  can import the final goods and the intermediate goods from RoW at price  $p_{x^*}^{B1}$  and  $p_{y^*}^{B1}$  respectively. Thus, a profit function of the final goods firm that choose to not comply with the final goods rules of origin is fixed at:

$$\bar{\Pi}_{x^*}^B(p_{x^*}^{B1}, p_{y^*}^{B1}) = p_{x^*}^{B1} F_X^B(y^*, k) - p_{y^*}^{B1} y^* - k \quad (2)$$

All final goods firms in country  $B$  will produce the originating final goods and export under the preferential treatments with price  $p_x^{A1}$  to  $A$  if this choice is more profitable, or  $\Pi_x^B(p_x^{A1}, p_{x^*}^{B1}, \varphi(\alpha, p_y^1), p_{y^*}^{B1}) > \bar{\Pi}_{x^*}^B(p_{x^*}^{B1}, p_{y^*}^{B1})$ . This is known as the homogeneous regime. According to Lemma 1, the production cost of the originating final goods increases when the final goods rules of origin are tightened,

the more restrictive rules of origin lead to a decrease in the profit for producing the originating goods. At  $\alpha = \alpha^*$  where  $\alpha^*$  is the smallest value of  $\alpha$  such that  $\Pi_x^B(p_x^{A1}, p_{x^*}^{B1}, \varphi(\alpha, p_y^1), p_{y^*}^{B1}) = \bar{\Pi}_{x^*}^B(p_{x^*}^{B1}, p_{y^*}^{B1})$ , some final goods firms in  $B$  switch back to supply for their own domestic market. This is known as the heterogeneous regime.

## An Intermediate Goods Firm Behaviour

Assume that a production function of intermediate goods in country  $i$ ,  $F_Y^i(Z, k)$  is a constant return to scale.  $Z$  is the raw material used to produce the intermediate goods, which can either be the originating raw material ( $z$ ) or the raw material ( $z^*$ ) from RoW. The originating intermediate goods, not only gains preferential treatment when exported to another member but that goods can contribute to the originating cost share. Therefore, after the FTA, the price of the originating intermediate goods and raw material are equalised across the member countries and higher than the price of these goods from RoW.

Let the intermediate goods rules of origin require the originating raw material cost share at least  $\beta$  percent of the total variable cost, or:

$$\frac{p_z^1 z}{p_z^1 z + p_{z^*}^{i1} z^*} \geq \beta \quad \text{where } i \in \{A, B\}$$

This paper allows the originating intermediate goods to be produced by using a combination of regional raw material and raw material from RoW. However, if

the originating intermediate goods price falls to be equal to the imported price, none of the intermediate goods firms complies with the rules of origin.

Since the price of regional raw material is higher than the price of raw material from RoW; therefore, the intermediate goods firm will employ the regional raw material only at exactly level  $\beta$  requires. The cost of raw material used can be written as:

$$p_z^1 z + p_{z^*}^{i1} z^* = \left\{ \frac{p_z^1 p_{z^*}^{i1}}{p_z^1 (1 - \beta) + \beta p_{z^*}^{i1}} \right\} (z + z^*)$$

Denote  $\gamma^i(\beta, p_z^1) = \frac{p_z^1 p_{z^*}^{i1}}{p_z^1 (1 - \beta) + \beta p_{z^*}^{i1}}$  as a variable cost of producing the intermediate goods when the rules of origin are met in country  $i$ .

A demand for the regional raw material of a typical intermediate goods firm that produces the originating intermediate goods in country  $i$  is:

$$z^i(p_y^1, \beta, p_z^1) = \eta^i(\beta, p_z^1) Z(p_y^1, \gamma^i(\beta, p_z^1))$$

Where  $\eta^i(\beta, p_z^1) = \frac{\beta p_{z^*}^{i1}}{p_z^1 (1 - \beta) + \beta p_{z^*}^{i1}}$  or  $\frac{z^i(p_y^1, \beta, p_z^1)}{Z(p_y^1, \gamma^i(\beta, p_z^1))}$ . This is a share of originating raw material used to total raw material used.

**Lemma 2** (i)  $\frac{\partial \gamma^i(\beta, p_z^1)}{\partial \beta} > 0$ , (ii)  $\frac{\partial \gamma^i(\beta, p_z^1)}{\partial p_z^1} > 0$ , (iii)  $\frac{\partial \eta^i(\beta, p_z^1)}{\partial \beta} > 0$  and

(iv)  $\frac{\partial \eta^i(\beta, p_z^1)}{\partial p_z^1} < 0$

*Proof.* See Appendix.

Similar to Lemma 1, the tightening of the intermediate goods rules of origin leads to the more the regional raw material is required. As a result, an increasing in the price of the regional raw material, the share of the quantity of regional raw material used and the production cost of the originating intermediate goods. As the price of the regional raw material increases, the production cost of the originating intermediate goods increases but the quantity of regional raw material used decreases.

According to an assumption that  $t_z^B > t_z^A$ , the cost of producing the originating intermediate goods between a firm in  $A$  and  $B$  are different. This finding suggests that a competitiveness of domestic industry can be improved by reduction or elimination the external tariff of upstream materials.<sup>9</sup>

A profit function of the intermediate goods firms in country  $i$  that produce the originating intermediate goods is equal to:

$$\Pi_y^i(p_y^1, p_{y^*}^{i1}, \gamma^i(\beta, p_z^1), p_{z^*}^{i1}) = p_y^1 F_Y^i(Z, k) - \gamma^i(\beta, p_z^1)Z - k \quad (3)$$

A profit for producing the intermediate goods is an increasing function of the originating intermediate goods price,  $p_y^1$ , but a decreasing function of the regional raw material price,  $p_z^1$ . In contrast, if the intermediate goods firms supply their goods domestically, these firms will not need to comply with the origin

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<sup>9</sup>If a member country reduces its external tariff, not only its competitiveness is improved but the terms of trade and welfare of nonmember countries are also improved as suggested by Bond et al (2004).

requirement. Therefore, only the cheaper raw material from RoW is used. A profit function of the intermediate goods firms in country  $i$  that chooses to not comply the intermediate goods rules of origin is constant as:

$$\bar{\Pi}_{y^*}^i(p_{y^*}^{i1}, p_{z^*}^{i1}) = p_{y^*}^{i1} F_Y^i(z^*, k) - p_{z^*}^{i1} z^* - k \quad (4)$$

All intermediate goods firm will produce the originating intermediate goods to sell this goods in  $B$  if this choice is more profitable. In other word, a condition  $\Pi_y^i(p_y^1, p_{y^*}^{i1}, \gamma^i(\beta, p_z^1), p_{z^*}^{i1}) > \bar{\Pi}_{y^*}^i(p_{y^*}^{i1}, p_{z^*}^{i1})$  holds. This is the homogeneous regime. Referring to Lemma 2, the tightening the intermediate goods rules of origin causes a decrease in the profits for producing the originating intermediate goods. At  $\beta = \beta_B^*$  where  $\beta_B^*$  is the smallest value of  $\beta$  such that  $\Pi_y^B(p_y^1, p_{y^*}^{B1}, \gamma^B(\beta, p_z^1), p_{z^*}^{B1}) = \bar{\Pi}_{y^*}^B(p_{y^*}^{B1}, p_{z^*}^{B1})$ , some intermediate goods firms in  $B$  choose to not comply with the intermediate goods rules of origin and sell their product at the same price as the intermediate goods from RoW.<sup>10</sup> This is the heterogeneous regime.

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<sup>10</sup>At  $\beta = \beta_A^*$  where  $\Pi_y^i(p_y^1, p_{y^*}^{A1}, \gamma^A(\beta, p_z^1), p_{z^*}^{A1}) = \bar{\Pi}_{y^*}^A(p_{y^*}^{A1}, p_{z^*}^{A1})$  and  $\beta_A^* > \beta_B^*$ , only some intermediate goods firm  $A$  produces the originating intermediate goods while none of intermediate goods firms in  $B$  does.

## 4 The Results

This section will present the impacts of the restrictiveness of the rules of origin on preferential trade flows among the FTA members. The net change in preferential trade flows within the region can be captured by a change in the volume of import from RoW. If country *A* trade is diverted from RoW to country *B*, there is a drop in the volume of import from RoW. In other word, the more preferential trade flows among the member countries are, the more the volume of import from RoW drops.

In the absence of the rules of origin, establishing the FTA causes a large change in trade flows within the region. The nonmember countries export their products to a member country that has the lowest imported duties, and circulate such products to other member countries with free duties. The price in other member countries will fall and converge to the price in the member country that has the lowest import duties. Hence, the volume of import from Row increases and the external imported duties of the member countries will converge to zero.

In the presence of the rules of origin, results are different. The more restrictive rules of origin is expected to increase preferential trade flows among the member countries. The findings show that the high degree of restrictiveness of the rules of origin does not guarantee more preferential trade flows within the region. In contrast, it either increases or decreases preferential trade flows, depending on the degree of competition among the final goods, the intermediate

goods and the raw material sectors on which they are applied and whether the final goods or the intermediate goods rules of origin effects dominate.

The tightening of the rules of origin decreases final goods trade flows but increases intermediate goods and raw material trade flows, given the dominance of the final goods rules of origin effects. On the contrary, if the intermediate goods rules of origin effects dominate, the more restrictive rules of origin reduce final goods and intermediate goods trade flows while improve raw material trade flows.

Above results suggest that if the member countries aim to promote preferential trade and economic activities among themselves and induce the investments from outside, the final goods rules of origin should be tightened whereas the intermediate goods rules of origin should be softened. If the intermediate goods rules of origin are tightened as well as the final goods rules of origin, the preferential trade flows of final goods and intermediate goods tend to decrease, rather than increase as argued by policy makers.

The rest of the section, the restrictiveness of rules of origin impacts on a change in the volume of import from RoW, in which implies the preferential trade flows within the FTA region, are presented in detail.

## **A Change in The Volume of Final Goods Import**

The impacts of the FTA with rules of origin on the final goods preferential trade flows can be studied via a change in the volume of final goods import from

RoW, between, before and after implementing the FTA. Now let consider the final goods demand and supply in  $A$  and  $B$

Since the final goods price in  $B$  remains unchanged, so the demand for the final goods in  $B$  is not affected, or:

$$D_X^B(p_{x^*}^{B1}) = D_X^B(p_{x^*}^{B0})$$

The higher final goods price in  $A$  encourages the final goods firms in  $B$  to produce more the originating final goods and export under the preferential treatment to  $A$ ; causes a decrease in the final goods price in  $A$ . However, if the final goods price in  $A$  falls to  $p_{x^*}^{B0}$ , none of the final goods firms in  $B$  export the originating final goods to  $A$ . At the same time, country  $A$  can import the final goods from RoW at price  $p_{x^*}^{A0}$ ; therefore, the originating final goods in  $A$  will be  $p_{x^*}^{B0} \leq p_x^{A1} \leq p_{x^*}^{A0}$ .

For simplification, assume that the originating final goods from  $B$  is not sufficient to meet the whole demand in  $A$ . The final goods price and demand in  $A$  remain unchanged,<sup>11</sup> then:

$$D_X^A(p_{x^*}^{A1}) = D_X^A(p_{x^*}^{A0})$$

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<sup>11</sup>On the contrary, if then final goods firms in  $B$  can supply all originating final goods demands from  $A$ , the final goods price in  $A$  falls to below  $p_x^1$  and the final goods demand rises to  $D_X^A(p_x^{A1}) > D_X^B(p_{x^*}^{A0})$ .

The final goods price in  $B$  is lower than the price in  $A$ , which is assumed to be unchanged. Then none of the final goods firms in  $A$  choose to produce the originating final goods and the final goods supply in  $A$  remains unchanged, or:

$$S_X^A(p_x^{A1}, p_{y^*}^{A1}) = N_X^A s_{x^*}^A(p_x^{A1}, p_{y^*}^{A1})$$

Where  $N_X^A$  is the fixed number of final goods firms in country  $A$ .<sup>12</sup>

While the formation of the FTA affects neither the final goods demand in  $A$  and  $B$  nor the final goods supply in  $A$ , it directly affects on the final goods supply in  $B$ . With  $p_{y^*}^{B1} < p_y^1 < \tilde{p}_y(\alpha^*)$ ,<sup>13</sup> all final goods firms in  $B$  produce the originating final goods and export to  $A$ . Their supply increases with the price of the originating final goods but decreases with the price of the originating intermediate goods. Under the homogeneous regime, the final goods supply in  $B$  can be written as:

$$S_X^B(p_x^{A1}, p_{x^*}^{B1}, \varphi(\cdot), p_{y^*}^{B1}) = N_X^B s_x^B(p_x^{A1}, \varphi(\cdot))$$

If the price of the originating intermediate goods increases to  $p_y^1 = \tilde{p}_y(\alpha^*)$ , some final goods firms in  $B$  produce the originating final goods while others do

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<sup>12</sup> $N_j^i = n_j^i + n_{j^*}^i$  where  $i \in \{A, B\}$ ,  $J \in \{X, Y\}$  and  $j, j^*$  indicate originating and non-originating goods  $j$  respectively.

<sup>13</sup>Where  $\tilde{p}_y(\alpha)$  is the originating intermediate goods price in which makes the final goods firms in  $B$  are indifferent between exporting the originating final goods to  $A$  and selling their products in domestic market with the same price as the final goods from RoW.

not.<sup>14</sup> Under the heterogeneous regime, the final goods supply in  $B$  is:

$$S_X^B(p_x^{A1}, p_{x^*}^{B1}, \varphi(\cdot), p_{y^*}^{B1}) = n_x^B s_x^B(p_x^{A1}, \varphi(\cdot)) + n_{x^*}^B s_{x^*}^B(p_{x^*}^{B1}, p_{y^*}^{B1})$$

Now a change in the volume of final goods import from RoW can be shown as:

$$\begin{aligned} VI_{x^*} &= \{D_X^A(p_x^{A1}) - D_X^A(p_{x^*}^{A0})\} + \{D_X^B(p_{x^*}^{B1}) - D_X^B(p_{x^*}^{B0})\} \\ &\quad - \{N_X^A s_{x^*}^A(p_x^{A1}, p_{y^*}^{A1}) - N_X^A s_{x^*}^A(p_{x^*}^{A0}, p_{y^*}^{A0})\} \\ &\quad - \{s_x^B(p_x^{A1}, \varphi(\cdot)) - s_x^B(p_{x^*}^{B0}, p_{y^*}^{B0})\} n_x^B \\ &\quad - \{s_{x^*}^B(p_{x^*}^{B1}, p_{y^*}^{B1}) - s_{x^*}^B(p_{x^*}^{B0}, p_{y^*}^{B0})\} n_{x^*}^B \end{aligned} \tag{5}$$

Only the final goods supply in  $B$  is affected by the FTA. Therefore, the impacts of the restrictiveness of the final goods rules of origin on the change in the volume of final goods imported from RoW can be examined by differentiating the final goods supply in  $B$  with respect to the final goods rules of origin, or  $\frac{\partial S_X^B}{\partial \alpha}$ .

For the homogeneous regime, all final goods firm in  $B$  choose to produce and export the originating final goods, the tightening of the final goods rules of origin causes a decrease in the final goods supply in  $B$ . Therefore, the volume of final goods import from RoW increases with the restrictiveness of the final

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<sup>14</sup>In contrast, if  $p_y^1 > \tilde{p}_y(\alpha^*)$ , none of the final goods firms in  $B$  produces the originating final goods; therefore, the final goods supply in  $B$  is the same as before forming an FTA, or:

$$S_X^B(p_{x^*}^{B0}, p_{y^*}^{B0}) = S_X^B(p_{x^*}^{B1}, p_{y^*}^{B1})$$

goods rules of origin. On the contrary, if some final goods firms in  $B$  produce the originating final goods whereas the others do not, the heterogeneous regime, the result is different. The more restrictive final goods rules of origin increases the number of firms that choose not to produce the originating final goods and reduces the price of the originating intermediate goods. As a result, the final goods supply in  $B$  increases when the rules of origin are tightened. These results are consistent with Ju and Krishna (2005).

**Proposition 1** If rules of origin are not binding, the formation of an FTA reduces the volume of final goods import from RoW. If rules of origin are binding, a tightening of the final goods rules of origin increases the volume of final goods import from RoW under the homogeneous regime but decreases it under the heterogeneous regime.

*Proof.* See Appendix.

As already mentioned, a drop in the volume of imports from RoW implies an increase in preferential trade flows among the member countries. Hence, Proposition 1 implies that the higher the degree of restrictiveness of the final goods rules of origin is, the more likely that the preferential trade flows of final goods among the member countries decrease.

## A Change in The Volume of Intermediate Goods Import

Now let consider a change in the volume of intermediate goods import from RoW when the FTA with rules of origin is implemented. Since the final goods supply in  $A$  remains unchanged, so the derived demand for the intermediate goods from RoW in  $A$  does not change and only the intermediate goods from RoW is used. The intermediate goods demand in  $A$  is:

$$D_{y^*}^A(p_x^{A1}, p_{y^*}^{A1}) = D_Y^A(p_{x^*}^{A0}, p_{y^*}^{A0})$$

The higher price of the originating final goods in  $A$  increases the derived demand for the intermediate goods by the final goods firms in  $B$  as a result of an increase in the originating final goods supply. In the presence of the final goods rules of origin, the originating intermediate goods must be embodied in the final goods; hence, the demand for the intermediate goods in  $B$  can be written as:

$$\begin{aligned} D_Y^B(p_y^1(\alpha), p_{y^*}^{B1}, p_x^1, p_{x^*}^{B1}) &= n_x^B [y^B(p_y^1(\alpha), p_x^1) + y^{*B}(p_{y^*}^{B1})] \\ &+ n_{x^*}^B y^{*B}(p_{y^*}^{B1}) \end{aligned}$$

**Lemma 3** The demand for the originating intermediate goods is an increasing function of the restrictiveness of the final goods rules of origin,  $\alpha$ , when  $\epsilon_\varphi < \frac{1}{\lambda}$  where  $\lambda = \frac{\alpha(p_y^1 - p_{y^*}^{B1})}{p_y^1} < 1$ .

*Proof.* See Appendix.

On the one hand, the final goods rules of origin increases the originating intermediate goods price and then the originating intermediate goods supply in  $A$  and  $B$ . On the other hand, the intermediate goods rules of origin decrease the originating intermediate goods supply in both countries because the origin requirements raise the production cost. The intermediate goods supply in  $i$  can be written as:

$$S_Y^i = n_y^i s_y^i(p_y^1, \gamma^i(p_z^1, \beta)) + n_{y^*}^i s_{y^*}^i(p_{y^*}^{i1}, p_{z^*}^{i1})$$

If  $p_z^1 < \tilde{p}_z^B(\beta_B^*)$ , where  $\tilde{p}_z^B(\beta_B^*)$  is the regional raw material price that makes the intermediate goods firms in  $B$  earn the indifferent profit between complying and not complying with the intermediate goods rules of origin, or  $\beta < \beta_B^*$ , all intermediate goods firms in both  $A$  and  $B$  produce the originating intermediate goods to sell in  $B$ . That is the homogeneous regime.

When  $p_z^1 = \tilde{p}_z^B(\beta_B^*)$ , or  $\beta_B^* \leq \beta < \beta_A^*$ , all intermediate goods firms in  $A$  and only some intermediate goods firms in  $B$  produce the originating intermediate goods. If  $p_z^1 = \tilde{p}_z^A(\beta_A^*)$  where  $\tilde{p}_z^A(\beta_A^*) > \tilde{p}_z^B(\beta_B^*)$ , or  $\beta \geq \beta_A^*$ , only some intermediate goods firms in  $A$  produce the originating intermediate goods choice but none of the intermediate goods firms in  $B$  produce that. These latter two cases represent as the heterogeneous regime. Since the price of the originating intermediate goods and the regional raw material play a crucial role to determine the demand and supply for the intermediate goods. Therefore, the rules of origin impacts on the price of the originating intermediate goods and the regional raw

material are necessarily examined. The tightening of the rules of origin increases the demand for the originating intermediate goods and the regional raw material and so do the price of them. In other word,  $\frac{\partial p_y^1}{\partial \alpha} > 0$  and  $\frac{\partial p_z^1}{\partial \beta} > 0$ .

However, if the rules of origin are too restrictive, the tightening of the rules of origin has an inverse result. It would be too costly to comply with the rules of origin. As a result, the demand and the price of the originating intermediate goods and the regional raw material fall.

**Lemma 4** (i)  $\frac{\partial \tilde{p}_y}{\partial \alpha} < 0$ , (ii)  $\frac{\partial \tilde{p}_z}{\partial \beta} < 0$

*Proof.* See Appendix.

A change in the volume of intermediate goods import from RoW is:

$$\begin{aligned}
VI_{y^*} = & \{ D_{y^*}^A(p_x^{A1}, p_{y^*}^{A1}) - D_Y^A(p_{x^*}^{A0}, p_{y^*}^{A0}) \} \\
& + \{ n_x^B [y^B(p_x^{A1}, \varphi(\cdot)) + y^{*B}(p_{y^*}^{B1})] + n_{x^*}^B y^{*B}(p_{y^*}^{B1}) - D_Y^B(p_{x^*}^{B0}, p_{y^*}^{B0}) \} \\
& - \{ n_y^A s_y^A(p_y^1, \gamma^A(\cdot)) + n_{y^*}^A s_{y^*}^A(p_{y^*}^{A1}, p_{z^*}^{A1}) - N_Y^A s_Y^A(p_{y^*}^{A0}, p_{z^*}^{A0}) \} \\
& - \{ n_y^B s_y^B(p_y^1, \gamma^B(\cdot)) + n_{y^*}^B s_{y^*}^B(p_{y^*}^{B1}, p_{z^*}^{B1}) - N_Y^B s_Y^B(p_{y^*}^{B0}, p_{z^*}^{B0}) \}
\end{aligned} \tag{6}$$

The restrictiveness of the rules of origin effects on the change in the volume of intermediate goods import from RoW can be classified into 4 cases as follows:

Firstly, at  $\alpha < \alpha^*$  and  $\beta < \beta_B^*$ , all firms produce the originating goods. That is the homogeneous regime. The tightening of the rules of origin increases the price of the originating intermediate goods and the regional raw material. There

are two opposite effects on the volume of intermediate goods import from RoW. On the one hand, the supply of the originating intermediate goods increases because of an increase in its own price. On the other hand, the supply of the originating intermediate goods decreases due to an increase in its input price. Hence, the tightening of the rules of origin decreases the volume of intermediate goods import from RoW, given that the final goods rules of origin effects dominant. On the contrary, if the intermediate goods rules of origin effects dominate, the tightening of the rules origin improves the volume of intermediate goods import from RoW.

Secondly, at  $\alpha \geq \alpha^*$  and  $\beta < \beta_B^*$ , some final goods firms in  $B$  produce the originating final goods and all intermediate goods firms produce the originating intermediate goods. That is the heterogeneous regime in the final goods but the homogeneous regime in the intermediate goods. When rules of origin are tightened, the demand for the intermediate goods increase because some of the final goods firms in  $B$  switch to produce products for their domestic market. At the same time, the supply for the intermediate goods decreases because of a decrease in its own price and the higher cost of production. Therefore, the volume of intermediate goods import from RoW improves as the rule of origin are more restrictive.

Thirdly, at  $\alpha < \alpha^*$  and  $\beta_B^* \leq \beta \leq \beta_A^*$ , all final goods firms in  $B$  produce the originating final goods and some of the intermediate goods firms produce the originating intermediate goods. That is the homogeneous regime in the

final goods but the heterogeneous regime in the intermediate goods. The more restrictive the rules of origin are, the more likely that the volume of intermediate goods import from RoW decreases. Since the demand for the intermediate goods decrease whereas the supply for the intermediate goods increases when the rules of origin are tightened.

Finally, at  $\alpha \geq \alpha^*$  and  $\beta_B^* \leq \beta \leq \beta_A^*$ , only some firms produce the originating goods. That is the heterogeneous regime. The tightening of the rules of origin causes firms change to produce more products for their domestic market regardless of the rules of origin. As a result, the demand and supply for the intermediate goods increase. The volume of intermediate goods import from RoW increases as the restrictiveness of rules of origin increases, given the dominance of the final goods rules of origin effects but it decreases if the intermediate goods rules of origin effects dominate.

**Proposition 2** A tightening of the rules of origin improves (reduces) the volume of the intermediate goods import from RoW under the homogeneous regime but reduces (improves) it under the heterogeneous regime if the intermediate (final) goods rules of origin effects dominate.

*Proof.* See Appendix.

Proposition 2 implies that the tightening of the rules of origin either improves or reduces intermediate goods trade flows among the member countries, depending on whether the final goods or the intermediate goods rules of origin

effects dominate. The restrictiveness of the final goods rules of origin has a positive impact on intermediate goods trade flows but the restrictiveness of the intermediate goods rules of origin has a negative impact.

## A Change in The Volume of Raw Material Import

In the presence of the rules of origin, the higher price of the originating intermediate goods in  $B$  increases the derived demand for the regional raw material.

The demand for the raw material in country  $i$  can be written as:

$$D_Z^i(p_z^1(\beta), p_{z^*}^{i1}, p_y^1(\alpha), p_{y^*}^{i1}) = n_y^i [z^i(p_z^1(\beta), p_y^1(\alpha)) + z^{*i}(p_{z^*}^{i1})] \\ + n_{y^*}^i z^{*i}(p_{z^*}^{i1})$$

**Lemma 5** The demand for the regional raw material rises as the intermediate goods rules of origin are tightened if  $\epsilon_\gamma < \frac{1}{\kappa}$  where  $\kappa = \frac{\beta(p_z^1 - p_{z^*}^{i1})}{p_z^1} < 1$ .

*Proof.* See Appendix.

Assume that the raw material is a natural resource or primary product and cannot be produced from imported raw material. In other words, a wholly obtained requirement. The supply of raw material in  $i$  is solely determined by its own price. Since the price of the regional raw material is higher than the price of the raw material from RoW; the supply of the raw material in  $i$  after

the FTA will not be less than the supply of the raw material before the FTA.

$$S_z^i(p_z^1) \geq S_z^i(p_z^{i0})$$

A change in the volume of raw material import from RoW can be defined as:

$$\begin{aligned} VI_{z^*} = & \{n_y^A [z^A(p_y^1, p_z^1) + z^{*A}(p_{z^*}^{A1})] + n_{y^*}^A z^{*A}(p_{z^*}^{A1}) - N_Y^A Z^A(p_{y^*}^{A0}, p_{z^*}^{A0})\} \\ & + \{n_y^B [z^B(p_y^1, p_z^1) + z^{*B}(p_{z^*}^{B1})] + n_{y^*}^B z^{*B}(p_{z^*}^{B1}) - N_Y^B Z^B(p_{y^*}^{B0}, p_{z^*}^{B0})\} \quad (7) \\ & - \{S_z^A(p_z^1) - S_z^A(p_{z^*}^{A0})\} - \{S_z^B(p_z^1) - S_z^B(p_{z^*}^{B0})\} \end{aligned}$$

For the homogeneous regime, the tightening of the intermediate goods rules of origin increases the demand for the regional raw material but decreases the demand for the raw material. At the same time, the supply of the regional raw material increases as a result of an increase in the regional raw material price. Hence, as the restrictiveness of the intermediate goods rules of origin increases, the volume of raw material import from RoW is more likely to reduce.

For the heterogeneous regime, on the contrary, the price of the regional raw material decreases as the intermediate goods rules of origin are tightened. The supply of the regional raw material falls while the demand for the raw material increases because of a switching from producing the originating intermediate goods to the other. Thus, the volume of raw material import from RoW improves as the intermediate goods rules of origin are tightened.

**Proposition 3** A tightening of the intermediate goods rules of origin reduces

the volume of raw material import from RoW under the homogeneous regime but improves it under the heterogeneous regime.

*Proof.* See Appendix.

This proposition implies that the restrictiveness of the rules of origin positively affects on the preferential trade flows of raw material among the FTA members. An increases in the restrictiveness of the intermediate goods rules of origin causes a rising in raw material trade flows.

## 5 What the Rules of Origin should be

The main objectives of the FTAs are to promote trade liberalisation among the member countries, enlarge the market and increase economic integration among themselves. Rules of Origin are intentionally designed to prevent trade deflection,<sup>15</sup> a failure to satisfy the rules, disqualifies the products for preferential tariff treatment. The rules of origin have been considered as a central market-access tool governing over the preferential trade within the FTA region.

This section examines what rules of origin can encourage preferential trade flows, promote economic integration within the region and attract the investments from outside. The following issues are discussed: whether the general rules of origin or the product-specific rules of origin should be employed; what

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<sup>15</sup>Refer to import from the nonmember countries into the member country with the lowest most favoured tariffs for trans-shipment to other member countries.

the degree of rules of origin restrictiveness should be. And finally, should rules of origin be harmonised.

## **Either General Rules Or Product-Specific Rules**

Which is the more efficient device to prevent trade deflection and encourage preferential trade flows among the member countries, the general rules of origin or the product-specific rules of origin? The general rules of origin refer to a single criteria applied to all products. For example, AFTA<sup>16</sup> rules of origin require at least 40 percent of the regional value content, this requirement is applied to all kinds of product from canned tuna, apparel, electronic products and parts to automobiles and parts. On the other hand, the product-specific rules of origin that specify a specific criteria to each product, vary from product to product. For example, NAFTA<sup>17</sup> rules of origin where require a change in chapter (CC) for a ceramic product, a change in tariff sub-heading (CTSH) and at least 50 percent of regional content for an automobile.

The general rules are simple and easy to negotiate but it lacks flexibility and efficiency to serve the FTA objectives. When a single requirement is applied to all products, it does not mean that all products face the same degree of rules of origin restrictiveness. For example, the automotive rule of origin in AFTA is less restrictive than the garment and apparel rule of origin even though both require

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<sup>16</sup>Asean Free Trade Area founded in 1993; members of this agreement are Bruni Darussalam, Burma, Cambodia, Indonesia, Laos, Malaysia, The Philippines, Singapore, Thailand and Viet Nam.

<sup>17</sup>North America Free Trade Agreement founded 1994.

at least 40 percent of regional content. The ASEAN automotive industry has no trouble complying with 40 percent regional content because it is a high value-added industry, and ASEAN countries are the world's leading manufacturers of automotive parts and components.

On the contrary, the ASEAN garment and apparel industry finds it is hard to comply with the 40 percent requirement even though ASEAN countries are a major garment and apparel manufacturer. Since the garment and apparel industry is a low value-added industry, and ASEAN countries do not have enough raw material, they have to import cotton and synthetic fiber, which are the upstream inputs from outside. The 40 percent regional content requirement may be the efficient tool to prevent trade deflection, promote preferential trade among the member countries, and attract the investments from outside for one industry, but it may become a trade barrier of another.

The product-specific rules that allow a rule to vary from product to product, on the one hand, are complex and take a long time to negotiate. On the other hand, these are more flexible and efficient than the general rules. A country can design the rules of origin to be compatible with its comparative advantage and its objectives.

For example, if a member of the FTA would like to promote preferential trade flows and economic activities in automotive sector, the more restrictive rules of origin for automobiles and the less restrictive rules of origin for parts and components are needed. The tightening of the downstream-product rules

of origin induce the more preferential trade of originating inputs whereas the softening of the upstream-input rules of origin places fewer burdens on upstream producers, and attracts the investments from outside. In contrast, if a country would like to protect its automotive sector, the tightening of the automobile rules of origin is not sufficient, rules of origin for parts and component must also be tightened.

The product-specific rules of origin are more effective device to promote preferential trade and economic activities within the region or even protect the domestic industries because each industry has different characteristics and sensitivity. The general rules of origin are simple and straightforward but lack flexibility to serve the objectives of the FTA. Recently, almost all the preferential rules of origin are the product-specific rules, whereas some regimes such as COMESA<sup>18</sup> and AFTA that employed the general rules have been initiatives to renegotiate for the product-specific rules of origin.

### **Either Tight Rules Or Loose Rules**

The weak and non-binding rules of origin encourage more preferential trade flows within the FTA region. However, the regional industries may not fully benefit from this because the weak and non-binding rules cannot prevent trade deflection and circumvention. While the loose rules succeed to promote preferential trade flows within the region, they cannot guarantee that all benefits will only occur

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<sup>18</sup>Common Market for Eastern and South Africa founded in 1994.

to the member countries and they may fail to promote economic activities and economic integration among the FTA members.

Nevertheless, the tightening of the rules of origin requires more originating inputs to be embodied, but it guarantees neither more trade flows nor more economic integration among the member countries. In the presence of the very tight rules of origin, firms choose export their products under non-preferential treatment because it is too costly to comply with rules of origin.

According to the findings, the restrictive final goods rules of origin will induce more preferential trade among the member countries only if the intermediate goods rules of origin are loose. A loosening of the intermediate goods rules of origin could reduce the complying costs; as a result, an increase in producing the downstream products and the upstream inputs. On the contrary, if a country would like to protect its domestic industries, the tightening of the final goods and the intermediate goods rules of origin is needed. The tightening only the final goods rules of origin may be insufficient to protect the domestic market from other FTA members if the loose intermediate goods rules of origin are applied.

## **Harmonisation of Preferential Rules of Origin**

Recently, the number of FTAs notified to the WTO, about 500 and all member countries of WTO, with the exception of Mongolia, have been participating in at

least one FTA.<sup>19</sup> An important issue of an increasing in the number of the FTAs is the growing number of overlapping agreements, the spaghetti-bowl.<sup>20</sup> The larger number of overlapping FTAs has spun a complex web of rules of origin; a manufacturing process that complies with origin requirement of one particular FTA, may fail to comply with origin requirement of other FTAs. This causes an increase in administrative costs and is more difficult for production planners.

In order to achieve significant benefits in terms of lower administrative costs and a more efficient implementation, should the preferential rules of origin be harmonised? It seems rational to harmonise the preferential rules of origin because it would help to promote transparency and trade facilitation, reduce administrative costs and most importantly decrease the burden on manufacturers to comply with the rules of origin for many FTAs.

However, each country-pair has concerns in different industries and has different comparative advantages,<sup>21</sup> a single set of rules of origin cannot take account for the difference that varies from country-pairs to country-pairs.

The question now arises, what would a country like the rules of origin to be?

If a country would like the simple set of rules of origin with the low administrative

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<sup>19</sup>As of 15 January 2012, 511 agreements were notified to WTO and 319 agreements were already in force. Source: WTO, Regional Trade Agreement Database.

<sup>20</sup>For example, Thailand is now party to 10 FTAs: AFTA, ASEAN-Australia-New Zealand, ASEAN-China, ASEAN-India, ASEAN-Japan, ASEAN-Korea, Thailand-Australia, Thailand-Japan, Thailand-Laos and Thailand-New Zealand. At the same time Japan is party to 13 FTAs: ASEAN-Japan, Japan-Bruni Darussalam, Japan-Chile, Japan-India, Japan-Indonesia, Japan-Malaysia, Japan-Mexico, Japan-Peru, Japan-Philippines, Japan-Singapore Japan-Switzerland, Japan-Thailand and Japan-Viet Nam.

<sup>21</sup>For example Japan may not concern with opening a processed chicken market to Bruni Darussalam, but may concern to open it to Thailand; therefore, the rules of origin between these should be different.

costs, harmonising the preferential rules of origin is a good alternative. If a country would like the rules of origin that are compatible with its comparative advantage and its sensitivity, the rules of origin regimes that vary across the preferential agreements are a more interesting and attractive choice. In my point of view, the main purpose of rules of origin is to be a device to reach the objectives of the FTA; therefore, a variation across rules of origin regimes is preferable to harmonised rules of origin.

## 6 Conclusion

This paper extended the model of Ju and Krishna (2005) by allowing a production of intermediate goods and a variation in rules of origin. In other word, intermediate goods rules of origin ( $\beta$ ) are introduced into the model and these rules are not necessary to have the same degree of restrictiveness of the final goods rules of origin ( $\alpha$ ). This model is then used to examine the behaviour of firms when the FTA with rules of origin is implemented and the rules of origin impacts on a change in the volume of import from RoW and preferential trade flows among the member countries.

The results show that, with the dominance of final goods rules of origin effects, the tightening of the rules of origin improves the volume of final goods import from RoW but reduces the volume of intermediate goods and raw material import from RoW for the homogeneous regime. This is consistent with Ju

and Krishna (2005) and the empirical studies by Estervadeordal and Suominen (2003) and Cadot et al (2005). However, for the heterogeneous regime, when the rules of origin are tightened, the volume of final goods import from RoW drops while the volume of intermediate goods and raw material from RoW improve.

On the contrary, if the intermediate goods rules of origin effects dominate, the tightening of the rules of origin increases the volume of final goods and intermediate goods import from RoW whereas decreases the volume of raw material import from RoW for the homogeneous regime. If there is in the heterogeneous regime, the result is opposite. The volume of final goods and intermediate goods import from RoW fall but the volume of raw material import from RoW rises.

These findings implies that the more restrictive rules of origin do not guarantee more preferential trade flows and economic integration among the member countries. They can either increase or decrease trade flows within the FTA region, depending on the degree of competition among the final goods, the intermediate goods and the raw material sectors on which they are applied, whether the final goods or the intermediate goods rules of origin effects dominate and whether the upstream-input industries are comparative advantage or comparative disadvantage compared to RoW.

If the member countries aim to promote preferential trade, economic activities and economic integration among themselves and attract new investments from outside, the tightening of the final goods rules of origin but a loosening of the intermediate goods rules of origin are needed. In other word, the high

value of  $\alpha$  and the low value of  $\beta$ . If a member country would like to protect its final goods industry, it has to negotiate for the restrictive final goods and its upstream inputs rules of origin.

For these reasons, the product-specific rules of origin are preferable to the general rules of origin since they are more flexible and efficient device in reaching the FTA objectives. With the product-specific rules of origin, the member countries can design an origin requirement to be compatible with a sensitivity and characteristic of each product.

Recently, the preferential rules of origin are substantially different from agreement to agreement and from country to country. The proliferation of overlapping FTAs has caused the higher administrative costs and the higher burdens on manufacturers to complying with the rules of origin for many FTAs. Should the preferential rules of origin be harmonised in order to solve such problems? Generally, the main purposes of rules of origin are to prevent trade deflection and promote preferential trade and economic integration among the member countries, rather than being the simple rules. Therefore, a variation across preferential rules of origin regimes is preferable to a harmonisation of preferential rules of origin.

## Appendix

### *Proof Lemma 1*

$$(i) \quad \frac{\partial \varphi(\alpha, p_y^1)}{\partial \alpha} > 0$$

A production cost when rules of origin are met is  $\varphi(\alpha, p_y^1) = \frac{p_y^1 p_{y^*}^{B1}}{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}}$ . When  $\alpha$  increases,  $p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}$  decreases, thereby there is a positive relation between  $\varphi(\alpha, p_y^1)$  and  $\alpha$ .

$$(ii) \quad \frac{\partial \varphi(\alpha, p_y^1)}{\partial p_y^1} > 0$$

Divide both numerator and denominator in  $\varphi(\cdot)$  by  $p_y^1$ , and get:

$$\varphi(\alpha, p_y^1) = \frac{p_{y^*}^{B1}}{\frac{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}}{p_y^1}}$$

A rising in  $\alpha$  causes a falling in  $\frac{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}}{p_y^1}$  then  $\alpha$  positively affects on  $\varphi(\alpha, p_y^1)$ .

$$(iii) \quad \frac{\partial \phi(\alpha, p_y^1)}{\partial \alpha} > 0$$

Divide both numerator and denominator of  $\phi(\alpha, p_y^1) = \frac{\alpha p_{y^*}^{B1}}{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}}$  by  $\alpha p_{y^*}^{B1}$ , yields:

$$\phi(\alpha, p_y^1) = \frac{1}{\frac{p_y^1(1-\alpha)}{\alpha p_{y^*}^{B1}} + 1}$$

As  $\alpha$  increases,  $\frac{p_y^1(1-\alpha)}{\alpha p_{y^*}^{B1}}$  decreases, then  $\phi(\alpha, p_y^1)$  increases.

$$(iv) \quad \frac{\partial \phi(\alpha, p_y^1)}{\partial p_y^1} < 0$$

When  $\alpha$  rises, the denominator of  $\phi(\alpha, p_y^1)$ ,  $p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}$  increases then  $\phi(\alpha, p_y^1)$  falls.

**Proof Lemma 2**

$$(i) \quad \frac{\partial \gamma^i(\beta, p_z^1)}{\partial \beta} > 0$$

A cost of producing the intermediate goods when complying with rules of origin is  $\gamma^i(\beta, p_z^1) = \frac{p_z^1 p_{z^*}^{i1}}{p_z^1(1-\beta) + \beta p_{z^*}^{i1}}$ , if  $\beta$  increases, the denominator term,  $p_z^1(1-\beta) + \beta p_{z^*}^{i1}$ , decreases, so  $\gamma^i(\beta, p_z^1)$  is an increasing function of  $\beta$ .

$$(ii) \quad \frac{\partial \gamma^i(\beta, p_z^1)}{\partial p_z^1} > 0$$

Divide both numerator and denominator of  $\gamma^i(\beta, p_z^1)$  by  $p_z^1$ , and get:

$$\gamma^i(\beta, p_z^1) = \frac{p_{z^*}^{i1}}{\frac{p_z^1(1-\beta) + \beta p_{z^*}^{i1}}{p_z^1}}$$

A rising in  $p_z^1$  results in a falling in  $\frac{p_z^1(1-\beta) + \beta p_{z^*}^{i1}}{p_z^1}$  then  $\gamma^i(\beta, p_z^1)$  is an increasing function of  $p_z^1$ .

$$(iii) \quad \frac{\partial \eta^i(\beta, p_z^1)}{\partial \beta} > 0$$

Divide the numerator and denominator of  $\eta^i(\beta, p_z^1)$  by  $\beta p_{z^*}^{i1}$ , provides:

$$\eta^i(\beta, p_z^1) = \frac{1}{\frac{p_z^1(1-\beta)}{\beta p_{z^*}^{i1}} + 1}$$

Therefore, an increasing in  $p_z^1$  causes a rising in  $\eta^i(\beta, p_z^1)$  because when  $p_z^1$  increases; the term  $\frac{p_z^1(1-\beta)}{\beta p_{z^*}^{i1}}$  decreases.

$$(iv) \quad \frac{\partial \eta^i(\beta, p_z^1)}{\partial p_z^1} < 0$$

As  $p_z^1$  increases, the denominator of  $\eta^i(\beta, p_z^1)$ ,  $p_z^1(1-\beta) + \beta p_{z^*}^{i1}$  rises, so  $\eta^i(\beta, p_z^1)$  is a decreasing function of  $p_z^1$ .

***Proof Proposition 1***

When rules of origin are not binding, i.e.  $\alpha < \hat{\alpha}$ , the rules do not affect on the originating intermediate goods price,  $p_y^1 = p_y^{B1}$ . All final goods firms in  $B$  automatically meet the origin requirements without bearing any extra complying costs. Therefore, with a higher final goods price in  $A$ , the final goods firms in  $B$  supply more final goods to  $A$ , the volume of final goods import from RoW drops.

If the final goods rules are binding but not exceed  $\alpha^*$ , i.e.  $\hat{\alpha} \leq \alpha < \alpha^*$ , all final goods firms in  $B$  produce the originating final goods. In other word, a homogeneous regime. The effects of the degree of restrictiveness on the final goods supply in  $B$  can be shown as:

$$\frac{\partial S_X^B(\cdot)}{\partial \alpha} = N_x^B \left\{ \frac{\partial s_x^B(\cdot)}{\partial \varphi(\cdot)} \frac{\partial \varphi(\cdot)}{\partial \alpha} \right\}$$

According to Lemma 1,  $\frac{\partial \varphi(\cdot)}{\partial \alpha} > 0$ , and  $\frac{\partial s_x^B}{\partial \varphi} < 0$ , then  $\frac{\partial S_x^B}{\partial \alpha} < 0$ . The more restrictive the final goods rules of origin are, the more likely that the final goods supply in  $B$  decreases. Hence, the tightening of the final goods rules of origin increases the volume of final goods import from RoW for the homogeneous regime.

In contrast, if the final goods rules of origin are very tight, i.e.  $\alpha \geq \alpha^*$ , some final good firms in  $B$  switch back to produce the final goods for the domestic market. That is a heterogeneous regime. Now the tightening of the final goods

rules of origin effects on the final goods supply in  $B$  can be written as:

$$\begin{aligned}
\frac{\partial S_X^B(\cdot)}{\partial \alpha} &= \frac{\partial}{\partial \alpha} \{n_x^B s_x^B(p_x^{A1}, \varphi(\tilde{p}_y, \alpha)) + n_{x^*}^B s_{x^*}^B(p_{x^*}^{B1}, p_{y^*}^{B1})\} \\
&= \frac{\partial n_x^B}{\partial \alpha} s_x^B(\cdot) + n_x^B \frac{\partial s_x^B(\cdot)}{\partial \varphi(\cdot)} \frac{\partial \varphi(\cdot)}{\partial \tilde{p}_y} \frac{\partial \tilde{p}_y}{\partial \alpha} - \frac{\partial n_{x^*}^B}{\partial \alpha} s_{x^*}^B(p_{x^*}^{B1}, p_{y^*}^{B1}) \\
&= \frac{\partial n_x^B}{\partial \alpha} [s_x^B(p_x^{A1}, \varphi(\cdot)) - s_{x^*}^B(p_{x^*}^{B1}, p_{y^*}^{B1})] + n_x^B \frac{\partial s_x^B(\cdot)}{\partial \varphi(\cdot)} \frac{\partial \varphi(\cdot)}{\partial \tilde{p}_y} \frac{\partial \tilde{p}_y}{\partial \alpha}
\end{aligned}$$

An increase in  $\alpha$  reduces the number of firms who produce the originating final goods,  $\frac{\partial n_x^B}{\partial \alpha} < 0$ , in order to equate demand and supply. The outputs of firms who comply with rules of origin are less than the outputs of those who do not,  $[s_x^B(p_x^{A1}, \varphi(\cdot)) - s_{x^*}^B(p_{x^*}^{B1}, p_{y^*}^{B1})] < 0$ ; therefore, the first term is positive. Due to  $\frac{\partial \tilde{p}_y}{\partial \alpha} < 0$  (detail show in proof of Lemma 3), and  $\frac{\partial s_x^B}{\partial \varphi} < 0$ , the second term is also positive. For the heterogeneous regime, an increase in the degree of restrictiveness improves the final goods supply in  $B$ . As a result, the volume of final goods import from RoW falls.

***Proof Lemma 3***

The originating intermediate goods demand of a firm is defined as:

$$y(p_x^{A1}, p_y^1, \alpha) = \phi(\alpha, p_y^1) Y(p_x^{A1}, \varphi(\alpha, p_y^1))$$

Differentiate  $y$  with respect to  $\alpha$  yields:

$$\begin{aligned}
\frac{\partial y(p_y^1, \alpha)}{\partial \alpha} &= \frac{\partial \phi(\cdot)}{\partial \alpha} Y(\cdot) + \phi(\cdot) \frac{\partial Y(\cdot)}{\partial \varphi} \frac{\partial \varphi}{\partial \alpha} \\
&= \frac{p_y^1 p_{y^*}^{B1}}{(p_y^1(1-\alpha) + \alpha p_{y^*}^{B1})^2} Y(\cdot) + \frac{\alpha p_{y^*}^{B1}}{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}} \frac{\partial Y(\cdot)}{\partial \varphi} \frac{p_y^1 p_{y^*}^{B1} (p_y^1 - p_{y^*}^{B1})}{(p_y^1(1-\alpha) + \alpha p_{y^*}^{B1})^2} \\
&= \frac{\varphi(\cdot) Y(\cdot)}{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}} + \frac{\varphi(\cdot)}{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}} \frac{\partial Y(\cdot)}{\partial \varphi} \frac{\alpha p_{y^*}^{B1} (p_y^1 - p_{y^*}^{B1})}{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}} \frac{p_y^1}{p_y^1} \\
&= \frac{\varphi(\cdot) Y(\cdot)}{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}} \left\{ 1 + \frac{\varphi(\cdot)}{Y(\cdot)} \frac{\partial Y(\cdot)}{\partial \varphi} \frac{\alpha (p_y^1 - p_{y^*}^{B1})}{p_y^1} \right\} \\
&= \frac{\varphi(\cdot) Y(\cdot)}{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}} (1 - \epsilon_\varphi \lambda) > 0 \quad \text{if } \epsilon_\varphi < \frac{1}{\lambda}
\end{aligned}$$

Where  $\lambda = \frac{\alpha(p_y^1 - p_{y^*}^{B1})}{p_y^1} < 1$ .

The originating intermediate goods demand is an increasing function of the restriction of the final goods rules of origin,  $\alpha$ , when  $\epsilon_\varphi < \frac{1}{\lambda}$ .

**Proof Lemma 4**

(i)  $\frac{\partial \tilde{p}_y}{\partial \alpha} < 0$

A production cost, when the final goods rules of origin are met, is:

$$\varphi(\alpha, p_y^1) = \frac{p_y^1 p_{y^*}^{B1}}{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}}$$

With implicit differentiation when  $p_y^1 = \tilde{p}_y$ :

$$\frac{\partial \tilde{p}_y}{\partial \alpha} = - \left[ \frac{\partial \varphi(\cdot) / \partial \alpha}{\partial \varphi(\cdot) / \partial p_y^1} \right]$$

With respect to Lemma 1,  $\frac{\partial \varphi(\alpha, p_y^1)}{\partial \alpha} > 0$  and  $\frac{\partial \varphi(\alpha, p_y^1)}{\partial p_y^1} > 0$ , then  $\frac{\partial \tilde{p}_y}{\partial \alpha} < 0$ . For the

heterogeneous regime, the tightening of the final goods rules of origin causes a falling in the originating intermediate goods price.

$$(ii) \quad \frac{\partial \tilde{p}_z^i}{\partial \beta} < 0$$

A production cost when the intermediate goods rules of origin are met is:

$$\gamma^i(\beta, p_z^1) = \frac{p_z^1 p_{z^*}^{i1}}{p_z^1(1 - \beta) + \beta p_{z^*}^{i1}}$$

With implicit differentiation when  $p_z^1 = \tilde{p}_z^i$ :

$$\frac{\partial \tilde{p}_z^i}{\partial \beta} = - \left[ \frac{\partial \gamma^i(\cdot) / \partial \beta}{\partial \gamma^i(\cdot) / \partial p_z^1} \right]$$

According to Lemma 2,  $\frac{\partial \gamma^i(\cdot)}{\partial \beta} > 0$ , and  $\frac{\partial \gamma^i(\cdot)}{\partial p_z^1} > 0$ , then  $\frac{\partial \tilde{p}_z^i}{\partial \beta} < 0$ . The restrictiveness of the intermediate goods rules of origin has a negative effect on the regional raw material for the heterogeneous regime.

### ***Proof Proposition 2***

For the homogeneous regime in the final goods, or  $\alpha < \alpha^*$

An increase in the level of  $\alpha$  leads to the following results, given that  $\epsilon_\varphi < 1/\lambda$ :

- (i)  $\frac{\partial y(p_y^1, \alpha)}{\partial \alpha} > 0$  as shown in Lemma 3
- (ii)  $\frac{\partial p_y^1}{\partial \alpha} > 0$

The final goods rules of origin impacts on the originating intermediate goods price can be written as:

$$\frac{\partial p_y^1}{\partial \alpha} = - \left[ \frac{\partial y(\cdot) / \partial \alpha}{\partial y(\cdot) / \partial p_y^1} \right]$$

Due to  $y(\cdot) = \phi(\cdot)Y(\cdot)$  and  $Y(\cdot) = \frac{p_y^1(1-\alpha) + \alpha p_{y^*}^{B1}}{p_y^1(1-\alpha)} y^*$ , then:

$$\frac{\partial y(\cdot)}{\partial p_y^1} = \frac{\partial \phi(\cdot)}{\partial p_y^1} Y + \phi(\cdot) \frac{\partial Y}{\partial p_y^1}$$

With respect to Lemma 1,  $\frac{\partial \phi(\cdot)}{\partial p_y^1} < 0$  and  $\frac{\partial Y(\cdot)}{\partial p_y^1} = -\frac{\alpha p_{y^*}^{B1}}{p_y^1(1-\alpha)} < 0$ , then  $\frac{\partial y(\cdot)}{\partial p_y^1} < 0$ .

The originating intermediate goods price increases with the level of  $\alpha$ .

$$(iii) \quad \frac{\partial Y(\cdot)}{\partial \alpha} < 0$$

The tightening of the final goods rules affects on the intermediate goods demand as:

$$\frac{\partial Y(\cdot)}{\partial \alpha} = \frac{\partial Y(\cdot)}{\partial p_y^1} \frac{\partial p_y^1}{\partial \alpha}$$

As shown in (ii),  $\frac{\partial p_y^1}{\partial \alpha} > 0$  and  $\frac{\partial Y(\cdot)}{\partial p_y^1} < 0$ , then  $\frac{\partial Y(\cdot)}{\partial \alpha} < 0$ . The tightening of the final goods rules of origin causes a decrease in the intermediate goods demand.

For the heterogeneous regime in the final goods, or  $\alpha \geq \alpha^*$

The strengthening of the final goods rules of origin provides:

$$(iv) \quad \frac{\partial \tilde{p}_y(\alpha)}{\partial \alpha} < 0 \quad \text{as shown in Lemma 4}$$

$$(v) \quad \frac{\partial Y(\cdot)}{\partial \alpha} > 0 \quad \text{when } p_y^1 = \tilde{p}_y$$

With Envelope theorem:

$$\frac{\partial Y(\cdot)}{\partial \alpha} = \frac{\partial Y(\cdot)}{\partial p_y^1} \frac{\partial p_y^1}{\partial \alpha}$$

At  $p_y^1 = \tilde{p}_y$ ,  $\frac{\partial Y(\cdot)}{\partial p_y^1} < 0$  and  $\frac{\partial \tilde{p}_y}{\partial \alpha} < 0$  as shown in Lemma 4, then  $\frac{\partial Y(\cdot)}{\partial \alpha} > 0$ . An increase in the degree of restrictiveness causes a rising in the demand for the intermediate goods.

For the homogeneous regime in the intermediate goods, or  $\beta < \beta_B^*$

When the intermediate goods rules of origin are tightened, it yields:

$$(vi) \quad \frac{\partial S_Y(p_y^1, \gamma(\beta, p_z^1))}{\partial \beta} < 0$$

The effects of the intermediate goods rules of origin on the intermediate goods supply can be shown as:

$$\begin{aligned} \frac{\partial S_Y(p_y^1, \gamma(\beta, p_z^1))}{\partial \beta} &= \left[ \frac{\partial s_y(p_y^1, \gamma(\beta, p_z^1))}{\partial \beta} \right] N_Y \\ &= \left[ \frac{\partial s_y(\cdot)}{\partial \gamma} \frac{\partial \gamma}{\partial p_z^1} \frac{\partial p_z^1}{\partial \beta} \right] N_Y \end{aligned}$$

Due to  $\frac{\partial s_y(\cdot)}{\partial \gamma} < 0$ ,  $\frac{\partial \gamma}{\partial p_z^1} > 0$  as shown in Lemma 2 and  $\frac{\partial p_z^1}{\partial \beta} > 0$  as shown in (iii), then  $\frac{\partial s_y(p_y^1, \gamma(\beta, p_z^1))}{\partial \beta} < 0$ . The tightening of the intermediate goods rules of origin decreases the intermediate goods supply.

For the heterogeneous regime in the intermediate goods, or  $\beta \geq \beta_B^*$

A rising in the degree of restrictiveness of the intermediate goods rules of origin results in:

$$(vii) \quad \frac{\partial S_Y(p_y^1, p_z^1)}{\partial \beta} > 0$$

When the intermediate goods rules of origin are strengthened, the intermediate goods supply is affected by:

$$\frac{\partial S_Y(p_y^1, p_z^1)}{\partial \beta} = \frac{\partial n_y}{\partial \beta} (s_y - s_{y^*}) + n_y \frac{\partial s_y}{\partial \beta}$$

The strengthening of the intermediate goods rules of origin reduces the number of

firms who produce the originating intermediate goods in order to equate demand and supply. That is  $\frac{\partial n_y}{\partial \beta} < 0$ . The outputs of firms who comply with the rules of origin are always less than the outputs of those who do not. Therefore, the first term is positive. At  $p_z^1 = \tilde{p}_z$ ,  $\frac{\partial s_y}{\partial \beta} > 0$ , so the second term is also positive. For these reasons, The tightening of the intermediate goods rules of origin increases the intermediate goods supply when there is in the heterogeneous regime.

Given (i)-(vii), the tightening of the rules of origin decreases the demand and supply of the intermediate goods in the homogeneous regime but increase in the heterogeneous regime. Therefore,

(1) For the homogeneous regimes in both goods, the volume of intermediate goods import from RoW drops if the final goods rules effects dominate. However, it improves if the intermediate goods rules effects dominate.

(2) For the heterogeneous regime in the final goods but the homogeneous regime in the intermediate goods, the volume of intermediate goods import from RoW increases.

(3) For the homogeneous regime in the final goods but the heterogeneous regime in the intermediate goods, the volume of intermediate goods import from RoW falls.

(4) For the heterogeneous regime in both goods, the volume of intermediate goods import from RoW increases if the final goods rules effect dominate. Nevertheless, it decreases if the intermediate goods rules effects dominant.

**Proof Lemma 5**

The originating intermediate goods demand of a firm in country  $i$  is:

$$z^i(p_z^1, p_y^1, \beta) = \eta^i(\beta, p_z^i) Z(p_y^1, \gamma^i(\beta, p_z^1))$$

Differentiate  $z^i$  with respect to  $\beta$  yields:

$$\begin{aligned} \frac{\partial z^i(\cdot)}{\partial \beta} &= \frac{\partial \eta^i(\cdot)}{\partial \beta} Z(\cdot) + \eta^i \frac{\partial Z(\cdot)}{\partial \gamma^i} \frac{\partial \gamma^i}{\partial \beta} \\ &= \frac{p_z^1 p_{z^*}^{i1}}{(p_z^1(1-\beta) + \beta p_{z^*}^{i1})^2} Z(\cdot) + \frac{\beta p_{z^*}^{i1}}{p_z^1(1-\beta) + \beta p_{z^*}^{i1}} \frac{\partial Z(\cdot)}{\partial \gamma^i} \frac{p_z^1 p_{z^*}^{i1} (p_z^1 - p_{z^*}^{i1})}{(p_z^1(1-\beta) + \beta p_{z^*}^{i1})^2} \\ &= \frac{\gamma^i(\cdot) Z(\cdot)}{p_z^1(1-\beta) + \beta p_{z^*}^{i1}} + \frac{\gamma^i(\cdot)}{p_z^1(1-\beta) + \beta p_{z^*}^{i1}} \frac{\partial Z(\cdot)}{\partial \gamma^i} \frac{\beta p_{z^*}^{i1} (p_z^1 - p_{z^*}^{i1})}{p_z^1(1-\beta) + \beta p_{z^*}^{i1}} \frac{p_z^1}{p_z^1} \\ &= \frac{\gamma^i(\cdot) Z(\cdot)}{p_z^1(1-\beta) + \beta p_{z^*}^{i1}} \left\{ 1 + \frac{\gamma^i(\cdot)}{Z(\cdot)} \frac{\partial Z(\cdot)}{\partial \gamma^i} \frac{\beta (p_z^1 - p_{z^*}^{i1})}{p_z^1} \right\} \\ &= \frac{\gamma^i(\cdot) Z(\cdot)}{p_z^1(1-\beta) + \beta p_{z^*}^{i1}} (1 - \epsilon_{\gamma^i} \kappa) > 0 \quad \text{if } \epsilon_{\gamma^i} < \frac{1}{\kappa} \end{aligned}$$

Where  $\kappa = \frac{\beta(p_z^1 - p_{z^*}^{i1})}{p_z^1}$ .

Hence, the tightening of the intermediate goods rules of origin,  $\beta$  increases the originating intermediate goods demand for a country  $i$  given that  $\epsilon_{\gamma^i} < \frac{1}{\kappa}$ .

***Proof Proposition 3***

For the homogeneous regime, or  $\beta < \beta_B^*$

The tightening of the intermediate goods rules of origin results in the following results, given that  $\epsilon_{\gamma^i} < \frac{1}{\kappa}$

- (i)  $\frac{\partial z^i(p_z^1, \beta)}{\partial \beta} > 0$  as shown in Lemma 5
- (ii)  $\frac{\partial p_z^1}{\partial \beta} > 0$

With implicit differentiation:

$$\frac{\partial p_z^1}{\partial \beta} = - \left[ \frac{\partial z(\cdot) / \partial \beta}{\partial z(\cdot) / \partial p_z^1} \right]$$

Due to  $z(\cdot) = \eta(\cdot)Z(\cdot)$  and  $Z = \frac{p_z^1(1-\beta) + \beta p_{z^*}^1}{p_z^1(1-\beta)} z^*$ , then:

$$\frac{\partial z(\cdot)}{\partial p_z^1} = \frac{\partial \eta(\cdot)}{\partial p_z^1} Z + \eta(\cdot) \frac{\partial Z(\cdot)}{\partial p_z^1}$$

According to Lemma 2,  $\frac{\partial \eta(\cdot)}{\partial p_z^1} < 0$ , and  $\frac{\partial Z(\cdot)}{\partial p_z^1} = -\frac{\beta p_{z^*}^1}{p_z^1(1-\beta)} < 0$ , so  $\frac{\partial z(\cdot)}{\partial p_z^1} < 0$ . The regional raw material is an increasing function of the level of  $\beta$ . That is  $\frac{\partial p_z^1}{\partial \beta} > 0$ .

- (iii)  $\frac{\partial Z(\cdot)}{\partial \beta} < 0$

The strengthening of the intermediate goods rules of origin effects on the intermediate goods demand can be written as:

$$\frac{\partial Z(\cdot)}{\partial \beta} = \frac{\partial Z(\cdot)}{\partial p_z^1} \frac{\partial p_z^1}{\partial \beta}$$

As shown in (ii),  $\frac{\partial Z(\cdot)}{\partial p_z^1} < 0$  and  $\frac{\partial p_z^1}{\partial \beta} > 0$ , then  $\frac{\partial Z(\cdot)}{\partial \beta} < 0$ . The raw material demand

decreases as the degree of restrictiveness of the intermediate goods rules of origin increases.

$$(iv) \quad \frac{\partial S_z(p_z^1)}{\partial \beta} > 0$$

The intermediate goods rules affect on the raw material supply as:

$$\frac{\partial S_z(p_z^1)}{\partial \beta} = \frac{\partial S(\cdot)}{\partial p_z^1} \frac{\partial p_z^1}{\partial \beta}$$

Due to  $\frac{\partial S(\cdot)}{\partial p_z^1} > 0$  and  $\frac{\partial p_z^1}{\partial \beta} > 0$  as shown in (ii), then  $\frac{\partial S_z(p_z^1)}{\partial \beta} > 0$ . When the intermediate goods rules of origin are tightened, the raw material supply increases.

Given (iii)-(iv), the tightening of the intermediate goods rules of origin decreases the raw material demand but increases the raw material supply. As a result, the volume of raw material import from RoW drops.

For the heterogeneous regime, or  $\beta \geq \beta_B^*$  The tightening of the intermediate goods rules of origin provides:

$$(v) \quad \frac{\partial \tilde{p}_z}{\partial \beta} < 0 \quad \text{as shown in Lemma 4}$$

$$(vi) \quad \frac{\partial Z(\cdot)}{\partial \beta} > 0, \quad \text{when } p_z^1 = \tilde{p}_z.$$

With Envelope theorem:

$$\frac{\partial Z(\cdot)}{\partial \beta} = \frac{\partial Z(\cdot)}{\partial p_z^1} \frac{\partial p_z^1}{\partial \beta}$$

At  $p_z^1 = \tilde{p}_z$ ,  $\frac{\partial Z(\cdot)}{\partial p_z^1} < 0$  and  $\frac{\partial \tilde{p}_z}{\partial \beta} < 0$  as shown in Lemma 4, then  $\frac{\partial Z(\cdot)}{\partial \beta} > 0$ . An increase in the degree of restrictiveness of the intermediate goods rules of origin improves the raw material demand.

$$(vii) \quad \frac{\partial S_z(\tilde{p}_z)}{\partial \beta} < 0$$

The tightening of the intermediate goods rules of origin impacts on the raw material supply can be shown as:

$$\frac{\partial S_z(p_z^1)}{\partial \beta} = \frac{\partial S(\cdot)}{\partial p_z^1} \frac{\partial p_z^1}{\partial \beta}$$

At  $p_z^1 = \tilde{p}_z$ ,  $\frac{\partial \tilde{p}_z}{\partial \beta} < 0$  as shown in (v), then  $\frac{\partial S_z(\tilde{p}_z)}{\partial \beta} < 0$ . The more restrictive the intermediate goods rules of origin, the more likely that the raw material supply reduces.

Given (vi)-(vii), when the intermediate goods rules of origin are tightened in the heterogeneous regime, the demand for the raw material increases whereas the supply for the raw material decreases. Hence the volume of raw material import from RoW improves.

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# Conclusion

This thesis consists of three independent studies. These are (i) Quality Reputation and Export Promotion, (ii) Why is it so difficult to settle a private agreement in an antidumping case? and (iii) Do the Rules of Origin make a difference? Here, the conclusions of each chapter and the entire thesis are addressed.

In Chapter 1: Quality Reputation and Export Promotion, provides answers to questions concerning the relationship between the reputation and behaviour of home firms in foreign markets. With a finite two-stage game model where consumers in new foreign markets lack information about their own valuation for the quality of a new product, three main findings emerge.

Firstly, with asymmetric information, the need to establish a quality reputation is not sufficient to induce home firms to export a high-quality product to foreign markets. Secondly, the likelihood of establishing a quality reputation increases with the number of experienced consumers. In other word, home firms is the least likely to establish their reputation in new markets. However, if the probability that consumers assign a high valuation to a high-quality product

is sufficient large, home firms will be the most likely to establish the quality reputation of a product in new markets. And thirdly, the gains of establishing a quality reputation falls with the number of competing firms in the case of new markets but improves with the number of competing firms in the case of mature markets.

If the model is extended to be longer and infinite, the behaviour of home firms, especially in new markets, may be changed because consumers, whom are deluded by a low-quality product at the beginning, have other opportunities to learn their true type. Home firms may have either more or less incentive to upgrade the quality of their product depending on many factors such as the discount factor, the specification of market learning, the speed of consumer learning.

According to the findings, the government can encourage home firms to export a high-quality product by increasing the payoff from doing that. Since home firms are more likely to export a high-quality product to markets with the larger number of experienced consumers. Therefore, the government should introduce a new product to consumers in new markets in order to transform inexperienced consumers into experienced ones. A free product trail is a simple and straightforward tool but it will be effective only if a high-quality product is provided as a sample to consumers.

The government may choose an export subsidisation to increase (decrease) the gains (costs) of establishing a quality reputation in foreign markets. How-

ever, a policy of subsidising exporters will efficiently support home firms to choose high quality, promote consumer experience, and establish an independently viable high-quality export market if, and only if, it is conditional on high quality. Thus, the administrative monitoring of quality is required to ensure that firms will not cheat by exporting a low-quality product as a high-quality variant.

Since the gains of exporting a high-quality product decrease with the number of competing firm in the case of new market. The government then should limit firm entry, albeit temporarily. Once the quality reputation of a product is established and consumers become experienced, the government should free the entry of home firms. Competition is sufficient to induce reputable firms to keep product quality high as well as convince new entrants to choose the choice of a high-quality product for establishing a quality reputation.

The welfare implications of establishing a quality reputation is also provided. The results show that establishing the quality reputation of a export product will improve the welfare in the exporting country if, and only if, a fraction of consumers whose tastes match well with their product is large enough. Hence, establishing a quality reputation by quality upgrading may not be a desirable choice for the exporting country. This contradicts to many studies which suggest the production of a high-quality product is a pre-condition for export success and, ultimately, the economic development.

In Chapter 2: Why is it so difficult to settle a private agreement in an antidumping case, this is motivated by an inconsistency between the theoretical results and recent observations. Whereas many research papers argue that domestic industries frequently employ the antidumping measure to threaten and induce foreign industries to collude, recent observations show different results. That is, only one-quarter of total antidumping cases result in price-undertaking agreements. I employed a simple take-it-or-leave-it bargaining game with two-sided asymmetric information, where the domestic and the foreign firm are uncertain about the type of each other, to investigate the possibility of settling the private agreement.

Results from this model show that the private agreement between the domestic and foreign firm will be settled with certainty if, and only if, the domestic firm applies a pooling strategy and the probability of a low-type foreign firm is significant small. Otherwise, the private agreement will fail with a positive probability. This contradicts Prusa (1999), whose model predicts that both domestic and foreign firms always prefer to withdraw an antidumping petition and reach a private agreement.

The likelihood of settling the private agreement increases with the probability of a high-type foreign firm and the probability of a low-type domestic firm. However, it decreases with the bargaining power and concentration level of the domestic firm. This is inconsistent with Zanardi (2004), who claims that the probability of collusion increases with the bargaining power and concentration

level. It is also found that the domestic and foreign firm are more likely to proceed with antidumping cases with two-sided asymmetric information than one-sided asymmetric information or completed information. Hence, the small number of price-undertaking agreements indicates the inefficiency of bargaining game due to asymmetric information, not a decline in the use of the antidumping measure as a collusive device.

In the view of the welfare analysis, the settlement outcome only improve the profit of the petitioning domestic firm, not the social welfare. Therefore, if the government aims to maximise the social welfare, it has to limit the use of the antidumping measure as a collusive device rather than supporting it. The antidumping laws are needed to harmonised to increase transparency of the antidumping measure. Furthermore, the levying the antidumping duties on products imported from the dumper's country should be changed to a lum sum payment. Since the latter does not distort the market and damage other related industries but the former does.

In Chapter 3: Do the Rules of Origin make a difference, while the theoretical studies and empirical works argue that the more restrictive rules of origin causes a decreasing in preferential trade flows within the FTA region, the policy makers have a different opinion. They consider the more restrictive rules of origin as a device to induce firms to employ more regional upstream inputs and then promote preferential trade and attract investments from outside. In order to

provide the better understanding about the rules of origin impacts on preferential trade and economic activities within the FTA region, I extend the model of Ju and Krishna (2005) by allowing a production of intermediate goods and a variation of origin requirement across products. In other words, the intermediate goods and the final goods rules of origin are not necessarily the same. This model is closer to the real situation and then is used to examine the behaviour of firms.

The findings show that the rules of origin impacts on preferential trade flows and economic integration are ambiguous. They can either increase or decrease trade flows within the FTA region depending on many factors. If the final goods rules of origin effects dominate, a tightening of the rules of origin increases the volume of final goods import from RoW but decreases the volume of intermediate goods and raw material import from RoW for the homogeneous regime. Hence, the rules of origin will positively affects on preferential trade flows and economic integration when the impacts of the final goods sector are dominated.

These suggest that if a country aims to promote preferential trade flows and economic activities within the FTA region, the tight final goods rules of origin and the loose intermediate goods rules of origin will be required. In contrast, if a country aims to limit preferential access and protect its final goods industry, the tightening of the concerning goods rule of origin will not be sufficient. The rules of origin of the upstream inputs have to be tightened to ensure the lower preferential access from other the FTA members. Hence, rules of origin should be the product-specific rules.

Recently the critics have worried that a spaghetti-bowl of overlapping FTAs might harm preferential trade by increasing transaction costs for manufacturers through complicated rules of origin. The spaghetti-bowl issue has been raised to discuss whether the preferential rules of origin should be harmonised. From my point of view, a variation across preferential rules of origin regimes is more preferable to harmonised rules of origin because the main purpose of rules of origin is to be a device to reach the country's objectives in establishing the FTA, which varies from agreement to agreement and from country to country. There is no golden rule for rules of origin.

To conclude, this thesis focuses on three interesting topics of international trade policy. These are (i) the reputation effect on quality upgrading (ii) misuse of antidumping measure and (iii) misunderstanding of rules of origin. It is found that a free market does not guarantee a desirable outcome for society nor individuals. Hence, to reach the objectives of a country, the government interference is needed. The government has to provide an optimal policy to induce individuals to behave optimally.

However, the government policies may not be effective as the government aims if they are not implemented at the right time and situation. For example, a policy of free entry will be appropriate to induce firms to export a high-quality product rather than a low-quality variant, if firms enter into mature markets. On the contrary, if this policy is used when firms enter into new

market, it cannot induce firms to upgrade the quality of their export product as the government intends. Similarly, The tight rules of origin do not guarantee an increasing in preferential trade flows and economic activities within the FTA region. If the government tightens up both final and intermediate goods rules of origin, preferential trade flows may fall rather than rise as expected. To promote preferential trade flows and economic activities within the FTA region, the government needs to negotiate for the tight final goods rules of origin and the loose intermediate goods rules of origin.

Frequently, the government faces a conflict between consumers and firms. For instance, consumers in the home country are likely to be harmed by collusion due to settling the private agreement in an antidumping case, while domestic firms can benefit from that. The government has to decide whether to allow domestic and foreign firms to settle the private agreement. Beside a conflict between consumers and firms, a conflict between the different groups of industries is always happened. For example, producers of final goods always require the loose final goods rules of origin due to a lower cost of complying with rules of origin, whereas producers of intermediate goods prefer the tight final goods rules of origin because of the more regional intermediate goods being required. The government has to choose to favour either a final goods industry or an intermediate goods industry. Hence, it is necessary for the government to set country's objectives clearly before making a policy.

A clear and correct understanding of issues is a key element of a policy

success. The government cannot develop a right policy and achieve its objectives, if it does not really understand the problems and situations. This thesis provides the theoretical studies and a policy discussion on (i) the reputation impacts on firms' quality choices, (ii) the effects of antidumping measures on collusion between domestic and foreign firms, and (iii) the impacts of rules of origin on firms' behaviour and preferential trade flows respectively. These will be a useful reference and guideline for policy makers, government officers, trade negotiators or even politicians when deal with the international trade policy related to these three issues.