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DOMESTIC INDUSTRIAL ENVIRONMENTAL COST AND STRATEGIC CHOICE IN DEVELOPING COUNTRIES

ABSTRACT

This paper examines competitive issues related to environmental policies like the European Union directives on Waste Electrical and Electronic Equipment and Restriction on Hazardous Substances implemented in 2006. In order to examine strategic environmental choice implications related to these directives, a vertical market model developed by Stephen F. Hamilton in analyzing competitive choice amongst domestic and foreign, downstream and upstream companies in the presence of environmental constraints was adopted. The main conclusion is that industrial and environmental policies in developing countries should be refocused so as to realize the integration of the environmental cost by internalizing the externalities.

Keywords: industrial chain, vertical contracts, industrial environmental trade policy, cost domestic, Pigouvian taxes

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INTRODUCTION

With the globalization and securitization of markets, the world's economy has accelerated its pace towards business development across countries and continents. The push to expand economic markets has encouraged aggressive exploration for new resources and the destruction of a great deal of the ecological environment. The developed countries have taken measures to restrict trade under the guise of protecting the environment. In pursuing these policies, some developed nations have restricted the competitive sale of standard, low cost products from developing countries in their markets aimed at protecting national industries and domestic goods. One such example, are two recent directives enacted and implemented by the European Union, through the European Parliament. The Waste Electrical and Electronic Equipment (WEEE) Directive, implemented on August 13, 2005, and the accompanying "Restriction on Hazardous Substances" (ROHS) enacted on July 1, 2006, seeks to impose regulations, costs and tax penalties on the manufacturing of electrical or electronic devices.* And also, the Energy Using Products (EUP) directive is about to be implemented. Developing countries with firms manufacturing products subject to environmental regulations face the question of what to do in addressing the costs of complying with directives while increasing markets for regulated goods. In the face of these odds, what should developing countries do to expand markets for their manufactured goods while limiting the impact environmental directives may have on their competitiveness? Against this background, this paper examines strategic issues related to environmental trade policy framework considering the developing nations by using the vertical model constructed by Stephen F. Hamilton to determine competitive policies.

LITERATURE REVIEW

Markusen (1985) was the first to propose the idea of the use of environmental policy as a trade strategy. Brander and Spencer (1985) utilized a control theory model within the context of the international market. Subsequent studies (Conrad 1993, Barrett 1994) provide support for the view that environmental trade policy can be detrimental to international competition but in different ways. In an international monopoly market, the best unilateral environmental trade policy appears to be an environmental tax that internalizes cost in the external domestic market. A more refined study (Kennedy 1994)

*Information on WEEE may be found at: http://ec.europa.eu/environment/waste/weee_index.htm.

extended the study of environmental trade policy to cross-border pollution. Nannerup (1998) examined asymmetric information differences between market participants impacted by environmental trade policy, while other researchers (Ulph 1996, Simpson and Bradford 1996, Carlsson 2000) looked at the marginal effect of investment, research and development in the area of environmental trade restrictions. During the period of these investigations, the European Union has sought to coordinate environmental and trade policies for firms operating in perfect and imperfect markets. In an effort to protect EU industries, environmental standards and policies were coordinated to strategically promote firms located in EU countries.[†] The European Union first established the uniform standards in its member countries, to eliminate any conflict between member countries over what was to be regulated.[‡] Building on experience with the regulation of chemical substances, the EU formulated rigorous standards for the regulation of machinery used in member countries. Consequently, once minimum standards were determined in these areas, the EU set about applying them to environmental policy. In this regard, the EU adopted flexible standards that emphasized differing requirements and standards for various countries. It has been argued that as a result of trade policies in the environmental services area, downriver exporters preferred to make a vertical linkage with the upriver suppliers (Bonanno and Vickers 1998). Within such a framework, governments may be better off seeking to balance pollution control measures with maintaining competitive advantages through the vertical integration of industries. Manufacturers can generate higher profits when government environmental regulation does not include significant charges to implement pollution abatement processes. The more restrictive a government's environmental regulation is, the more profits the pollution cleaning or abatement products manufacturers will have. In highlighting the advantages of developing industrial chains, it has been shown that when there is competition involving homogeneous products, downriver exporters tend to establish vertical relationships between upriver suppliers, in order to enhance their strategic position in the international markets (Hamilton and Stiegert 2000).

[†] For a discussion of the controversy over the use of environmental regulations as a means of restricting market competition, see: "Foreign Trade Standards Often Ignore Science, U.S. Group Says, May 6, 2003," at http://www.usembassy.it/file2003_05/alia/A3050605.htm

[‡] See: <http://www.zum.lt/Instit/en/1211.htm> as an example of how the process of standardization has developed in EU countries with respect to agricultural policy.

While these studies are helpful in understanding the new trend in environmental regulation, current research does not address the specific issues related to the European Union directives. Recent research (Hamilton and Stiegert 2000) challenged the existing paradigm related to environment trade policy result by taking a broader view of the vertical industrial structure that encompasses the input market. However, they do not directly (Hamilton and Stiegert 2000) address the issue of vertical market structure within the context of the present EU environmental trade policies. One contemporary concern not addressed in this earlier research is what happens when downriver (domestic or foreign distribution firms) and upriver (exporters or domestic companies) enterprises are unable to reach agreements on how to deal with the sharing of environmental costs and restrictions. The present paper develops an analysis based on the intergovernmental structure of competition, utilizing four different kinds of sub-gaming strategies between upriver (exporter or domestic firms) and downriver enterprises entering into a contract option arrangement. This paper will discuss those cases where upriver and downriver enterprises are likely to achieve agreements, so as to determine a balanced supply capacity for the downriver distributor while allowing for the downriver firm to separately set net income objectives. In addition, there is analysis of the meaning of non-competitive governmental environmental policy that is balanced with vertically structured industries which permits price and quantity competition. In concluding, the paper explores solutions to the environmental cost issue in relation to vertical market structure and the promotion of competition.

MODEL STRUCTURE

The model given here is an adaptation of the one provided in Hamilton and Requate (2004)[§] with attention to the issues of environmental directives such as WEEE and ROHS. Our model is used to examine the international environmental policy sub-game between export suppliers of goods (upstream firms) and domestic or foreign distributors (downstream enterprises) amongst various governments of the trading countries (developing versus developed nations).

[§] This particular model is an application of the formulation provided in S. F. Hamilton and T. Requate. 2004. Vertical structure and strategic environmental trade policy. *Journal of Environmental Economics and Management* 47 (2): 260-269.

The model makes use of the following initial assumptions: (1) a tradable commodity, (2) a decentralized vertical structure on the supply and demand of the markets, (3) free competition between market players that includes, companies, industries and government policy among trading countries. It is further assumed that governments have the authority to regulate upstream pollution and apply business taxes to companies, and that there is contracting between upriver and downriver business transactions that allows for an internal sub-game strategy. With respect to price and supply, this model establishes that in a competitive international market, the best non-cooperative environmental policy utilizes Pigouvian taxes.

Assumption 1

An industrial chain exists between upriver (export manufacturers of regulated goods) and downriver (domestic or foreign) enterprises, both at home and abroad, and there is a sub-game of international agreements which defines trading relationships between upriver and downriver firms.

Assumption 2

The trade commodities of both countries are widely dispersed in vertical markets. Between trading nations, production is organized between the upriver and the downriver enterprises which freely choose their business partners. The pollution that is generated by upriver (export companies) firms in the production of good x , is then incorporated by the downriver (domestic or foreign distributor) enterprises to create the final product y for sale in the international market. The downriver enterprise competitively determines price and quantity and engages in the differential production market that is comprised of domestic and overseas firms. The model utilizes the superscript d to denote a domestic enterprise and f to connote a foreign, overseas company.

The environmental policy game process may be defined as follows. The government of country i determines a trash draw-off tax rate t^i related to the production of the polluting input x . The downriver enterprises take part in an international monopolistically competitive market engaging in an economic sub-game of international agreements. The downriver enterprises can enter into contractual arrangements, and exchange rules on garbage imports with the upriver suppliers. The agreements which are negotiated by

downriver enterprises incorporate a wholesale price for garbage (pollutant) imports of ω^i and fixed transportation costs of f^i .

In the absence of an outside contractual agreement, the downriver enterprise in country i can purchase imports at a price of $\omega^i = \omega^i(t^i)$ within the domestic market, and pay a price for the garbage import (pollutant input) in country i based on the prevailing domestic environmental tax t^i according to the following formulation:

$$(1) \quad \omega^i(t^i) = \omega_0^i + t^i e^i$$

Where ω_0^i represents the base price of the trash import (polluting input), and e^i is an index coefficient based on the amount of pollution generated by imported goods from export country i (i.e. dissemination of pollution attributable to a country's exports in relation to total pollution). Within this cost allocation process of trading, it is supposed that environmental damage is confined to the downstream country, and that this country does not have the ability to interfere in the policy decisions of the export country (i.e. the export company and its government are autonomous with respect to production decisions about x). The domestic enterprise company faces an inverse demand function $P^d(Y)$ and the foreign firm confronts an inverse demand function $P^f(Y)$. The exportation quantity vector is defined to be: $Y = (y^d, y^f)$. $C^i(y^i, \omega^i(t^i))$ is the variable cost function for the downriver firm operating in country i dependent upon the quantity of goods sold y^i , and the price of the trash import $\omega^i(t^i)$. Using lower subscripts to denote differentiation, it is noted that cost with respect to quantity is positive, $C_y^i > 0$, marginal cost grows at an increasing rate $C_{yy}^i \geq 0$, cost will increase with the cost on the polluting input, $C_w^i > 0$, marginal increases in quantity and the cost of the polluting input will increase cost $C_{yw}^i > 0$, and production outputs y^d and y^f are substitutes for each other $P_{ij}^i > 0$.

The upriver enterprises and the downriver enterprises of country i and the downriver enterprises of country i and the downriver enterprises of country j (the downriver enterprises in country j of the downriver enterprises of country i) each constitute an industrial chain. The upriver enterprises and the downriver enterprises of country i may or may not be able to reach a contract solution. Similarly, the downriver enterprises of country i and the downriver enterprises of country j may or may not be able to achieve a contract solution.

Consequently, there are four different situations that may arise from negotiations involving upriver (export, manufacturer) and downriver (import, distribution) enterprises. This analysis incorporates the separate determination of the downriver firm's net income within country i , and the determination of balanced supply quantity that will maximize net income to that downriver company in country i . This feature extends the results found in literature (Hamilton and Requate 2004).

Proposition 1

Both the domestic upriver and downriver enterprises and the domestic upriver enterprises and the overseas downriver enterprises obtain a contract equilibrium condition. The equalizing solution is $(y_1^{d,c}, y_1^{f,c})$. The domestic downriver enterprises purchase the raw materials x at the price of ϖ^d from the upriver enterprises, which is used to completely manufacture the distributed product. The final product y would be sold to the domestic enterprises and the overseas downriver enterprises and ϖ^f is the price which the overseas downriver enterprise will purchase the raw materials from the upriver firm. The domestic downriver enterprise's profit R^d is:

$$(2) \quad R^d(y^d, Y, \varpi^d, F^d) = [P^d(Y)y^d - C^d(y^d, \varpi^d) - F^d] + [P^f(Y)y^f - C^f(y^f, \varpi^f) - F^f]$$

{Domestic Revenue over Cost}
{Foreign Revenue over Cost}

For the largest profit, the first condition for the domestic downriver enterprises is:

$$R_{y^d}^d = P_{y^d}^d(Y)y^d + P^d(Y) - C_{y^d}^d(y^d, \varpi^d) + P_{y^d}^f(Y)y^f = 0$$

The profit maximizing first condition for its overseas downriver firm is:

$$R_{y^f}^f = P^f(Y) + y^f P_{y^f}^f(Y) - C_{y^f}^f(y^f, \varpi^f) = 0$$

Equilibrium conditions for both the domestic and overseas downriver firms can be determined from solutions (y_1^d, y_1^f) . Such a solution will equate the marginal cost of acquiring and producing the goods to their marginal revenue with both the domestic and overseas downriver companies cooperating with each other.

Proposition 2

The domestic downriver firm has successfully negotiated an agreement with a domestic upriver enterprise, but not an overseas downriver firm. Under such circumstances, the equilibrium solution is $(y_2^{d,c}, 0)$. The production of domestic downriver firms can only be sold to domestic enterprises while R^d , the domestic downriver firm's profit is:

$$(3) \quad R^d(y^d, Y, \omega^d, F^d) = P^d(Y)y^d - C^d(y^d, \omega^d) - F^d$$

For the largest profit, the first condition for the domestic downriver enterprises is:

$$R_{y^d}^d = P_{y^d}^d(Y)y^d + P^d(Y) - C_{y^d}^d(y^d, \omega^d) = 0$$

The solution to $(y_2^{d,c}, 0)$ is then determined, and the equilibrium solution occurs when the domestic upriver and downriver firms cooperate with each other, but domestic downriver firms and foreign downriver firms do not cooperate.

Proposition 3

The domestic downriver enterprises have reached agreements with overseas downriver enterprises but failed to reach agreements with domestic upriver enterprises. The equilibrium solution is $(y_3^{d,c}, y_1^{f,c})$. The domestic downriver (producer) firm purchases the raw material x at a price ω^d in the spot market, and that raw material is used to manufacture a final product y . This final product y is then sold to domestic enterprise (distributor) companies or overseas downriver (import, distributor) firms. The domestic downriver enterprise's profit R^d is:

$$(4) \quad R^d(y^d, Y, \omega^d) = [P^d(Y)y^d - C^d(y^d, \omega^d)] + [P^f(Y)y^f - C^f(y^f, \omega^f) - F^f]$$

With the same first condition for the maximizing profit of the domestic downriver enterprises to the proposition 1, and the first condition of its overseas downriver enterprises for maximizing profit is no different from the condition of proposition 1.

The solution $(y_3^{d,c}, y_1^{f,c})$ may be determined. The solution is in equilibrium when the domestic and overseas downriver enterprises cooperate with each other, but the domestic downriver firm does not cooperate with the domestic upriver company.

Proposition 4

The domestic downriver enterprises fail to reach agreements with both the domestic upriver and overseas downriver companies, and that the equilibrium solution is $(y_4^{d,c}, 0)$. On the other hand, the domestic downriver enterprises purchase the raw materials x at the price of ω^d in the spot market, and this raw material is used to produce a final product y while the final product y would then be sold to the domestic distributor firm. Under this scenario, the domestic downriver enterprise's profit will be completely used to manufacture products. Consequently, the final product y would only be sold to the domestic firm generating a profit R^d of:

$$(5) \quad R^d(y^d, Y, \omega^d) = P^d(Y)y^d - C^d(y^d, \omega^d)$$

With the same condition as proposition 2, at this time, $Y = (y^d, 0)$ is same as in the equations (5) and (6) and $(y_4^{d,c}, 0)$ will be determined by solving equation (6). The solution is in equilibrium when the domestic downriver enterprises and domestic upriver enterprises do not cooperate with each other and as well as when the domestic downriver enterprises and overseas downriver enterprises do not cooperate with each other either.

QUANTITY COMPETITION ANALYSIS BASED ON VERTICAL CONTRACT

In order to obtain the input x with the garbage (pollutant) import, the contract that is negotiated by the downriver enterprise must offer the upriver producers a purchase price that generates some profit growth. Based on the profit function (Hamilton 2003), this analysis derives restraint conditions that provide for profit growth. The negotiated contract should assure that the upriver firm generates a profit, and that the solution offers the downriver firm the opportunity of generating a maximum profit. The objective function and constraint set is as follows:

$$(6) \quad \max_{\omega^d, F^d} \pi = P^d(Y^c)y^{d,c} - C^d(y^{d,c}, \omega^d) - F^d$$

$$(7) \quad \text{s.t. } F^d \geq (\omega^d - \omega^d(t^d))x^d + F^d \geq 0$$

If $x^d = x^d(y^{d,c})$, then $x_y^d > 0$ expresses the quantity of input x with the trash import included. If the overseas downriver enterprises elect to negotiate, the contract that produces the largest profit to them will depend on:

$$(\omega^d - \omega^d(t^d))x_y^d \frac{\partial y^{d,c}}{\partial \omega^d} + y^{d,c} P_f^d \frac{\partial y^{f,c}}{\partial \omega^d} - P_{y^d}^f(Y)y^f = 0$$

The first order conditions for determining the differential coefficient on pollution w^d , are:

$$(8) \quad \frac{\partial y^{f,c}}{\partial \omega^d} = \frac{-C_{y\omega}^d \pi_{fd}^f}{\Delta} > 0$$

$$(9) \quad \Delta = \pi_{dd}^d - \pi_{ff}^f - \pi_{df}^f \pi_{fd}^f.$$

Equations (8) and (9) ensure that the contracts of domestic downriver enterprises are independent of the foreign enterprises' choices.

Proposition 1

In the vertical contract, the downriver enterprise's price is lower than the control price of trash imports and lower than the total payments which may be offered to the upriver enterprises.

If the proposition is not true, then domestic downriver enterprises will face two situations:

(1) If $\omega^d = \omega^d(t^d)$, the first item of equation (7) then will be zero, and the second item negative, thus we can conclude that $\omega^d \neq \omega^d(t^d)$.

(2) If $\omega^d > \omega^d(t^d)$, then both of the items are negative, and from these part, we can deduce that $\omega^d < \omega^d(t^d)$.

According to the equation (6), $F^d > 0$, and also would be the same situation regarding the overseas enterprises.

Domestic downriver enterprises can promote the monopoly rent in international market through constituting a lower input price. On the surface, the total value of transport costs paid to the upper river enterprises happened to counterbalance the profit belonging to domestic enterprises due to the lower input prices. The lower input prices have changed a series of credit behaviors of domestic enterprises; this influences the competition among enterprises both domestic and abroad in the international market. The domestic downriver enterprises carry on the transaction by using the lower price with upstream enterprises to attain the compensational profit, which expands international output. During the environmental policy gestation period, both domestic and oversea governments undertake tax revenue policies to maximize net profit.

The profit of the downriver enterprises on contrast game in country i is

$$(10) \quad \tilde{\pi}^i(t^d, t^f) = \max_{y^i, \varpi^i, F^i} \pi^i(y^i, Y, \varpi^i, F^i)$$

Output of the domestic downriver enterprises is not only generated by country i but also country j . Thus, the environment destroyed in country i is decided by pollution due to products sold in i that come from companies in i and j . The objective function of domestic welfare adjustment is:

$$(11) \quad W^i(t^d, t^f) = \tilde{\pi}^i(t^d, t^f) + t^i e^i x^i - D^i(e^i x^i)$$

Proposition 2

If a vertical contract is used here, the best non-cooperation environmental policy is the Pigouvian taxes under the quantity competition given by

$$(12) \quad t^f = D_x^f$$

The choice of the best environmental policy is lower than the Pigouvian tax standard under quantity competition because the marginal expense may be internalized into the export firm's operations and become a kind of export subsidy. Under such circumstances, it is important for the export enterprise to obtain rent to overcome the additional marginal

expense. The best non-competitive policy in the model represents a compromise when the negotiating governments may have opposite motives. On one hand, the government wants to control pollution to protect its environment and on the other, the same government wants to provide competitive advantages for its domestic firms and industries. This situation cannot occur if industries are organized in such a way that vertical contracts exist. Current strategic trade research believes that the domestic policy-maker has the ability to obtain the international monopoly rent, but the enterprise is unable to obtain same in the competitive market. If there is a vertical market, the downriver enterprises may design a separate contract to propose an input price which can substitute the international rent, thus the exportation allowance of government is no longer necessary. A model on strategic environmental policy (Ulph 1996) which determines the conditions whereby policy makers can externalize the marginal costs of pollution has been developed over the years. Similarly, studies (Ulph 1996, Simpson and Bradford 1996) have also considered how policy makers might reduce the overall cost of pollution measures. Within the context of this type of modeling, the allocation of dollars for research and investment activities designed to mitigate pollution can not eliminate the constraints that may be created by strategic environmental trade policy because research and development investment introduce extra variable that may prevent the forming of personal or social alliances. However, in a vertical market it is not necessary to eliminate the function of the strategic environmental trade policy. The implied assumption in the model is that the vertical contracts are accepted when antitrust laws are popular. The vertical contracts will encourage bargaining between the upriver and downriver enterprises, making strategy rents which are relevant to import prices fully capitalized. If the vertical contract is not permitted, traditional impact of strategic environmental trade policy would be realized.

ANALYSIS OF COMPETITIVE PRICE BASED ON VERTICAL CONTRACT

When price competition is adopted by the downriver enterprises, $D^i(P^d, P^f)$ represents the demand function of company i in the international market while P^d and P^f respectively represent the set of prices by domestic and international enterprises. The assumption here is that products can be viewed as substitutes and that:

$$(13) \quad D_i^i < 0, \quad D_j^i > 0, \quad D_i^i D_j^j - D_j^i D_i^j \geq 0$$

$$(14) \quad \pi_{ii}^i < 0, \quad \pi_{ij}^i > 0, \quad \Omega > D_j^i \pi_{ji}^j$$

$$(15) \quad \Omega = \pi_{dd}^d \pi_{ff}^f - \pi_{df}^f \pi_{fd}^d.$$

Thus, equation (14) implies that the elasticity of demand increases in response to quantity competition, and that there will be a unique Nash Equilibrium price, assuring a profit maximum. If $D_j^i \pi_{ij}^j > D_j^i \pi_{ji}^j$, it can be satisfied when the price has more function to D^i and π_i^i than crossing price.

Proposition 1

The vertical contract equilibrium includes both the upriver price and total price of the inputs. On condition of price competition, there is an optimal contrast way (Bonanno and Vickers 1988). The purpose of trading between upper and down river enterprises is to get a total price including transportation price, which is a way to preventing higher garbage input. In contrast, country i will pay a higher purchase price and this can lead to an increase in the production cost in down river. These give competitor the idea that the input price will not be too high in the international market. Fixed payment can be an offset against the direct impact by the price increase. If we can pay the input at a price of $\omega^d > \omega^d(t^d)$, the domestic downriver enterprises will stimulate those of abroad, which will cope with this situation by promoting prices. The increase of the oversea enterprises product actually constitutes a positive effect on the profit of domestic enterprises. Since the aim of domestic enterprises is still equation (3), the contrast game profit is:

$$(16) \quad \tilde{\pi}^i(t^d, t^f) = \max_{P^i, \varpi^i, F^i} \pi^i(P^i, P, \varpi^i, F^i)$$

Proposition 2

If vertical contract is adopted, the optimal non-cooperative environmental policy is a Pigouvian tax.** The game analysis based on the vertical contract shows that the optimal tax rate is below the Pigouvian tax subsidy with quantity (or price) competition, which is in contrast to the conclusions drawn by the environmental trade policy under a traditional strategy. Vertical contracts may be available to some extent, but the deviation from Pigouvian taxes leads to suboptimal results. Except in the case of external pollution, the motive of national policy makers is very much connected to its transfer tax motivations. As the price input mechanism generated by vertical contract converges to a structure similar to the pollution tax, a government may not necessarily encourage upstream (producer) firms to export. As a result, under conditions of agreement between the upstream exporters and downriver providers, there is no cooperative environmental policymaking among governments.

If a government continues to exert international environmental policy directives in an effort to control industrial inputs, the result may be to encourage suboptimal vertical contracts. When the only available input involves garbage imports to produce an export good, environmental policy will allow the vertical contracting to incorporate an export subsidy and at the same time permit environmental laws to achieve Pigouvian taxes. In the end, it may be optimal for governments not to cooperate within such a framework.

IMPLICATIONS AND CONCLUSIONS

The Internalizing of Environmental Costs as a Policy Choice for Developing Countries

During the last decade, developing countries have faced significant charges and challenges in dealing with environmental pollution; for example, in 1995, the environmental cost of pollution in China was estimated to be 187.5 billion Yuan or about 3.2% of the country's gross domestic product (GDP). By the year 2000, this figure had grown to 700 billion Yuan or approximately 14% of GDP. In 2003, environmental costs in China reached an amount equivalent to 15% of GDP. The total cost related to control environmental pollution in China recently went up to 1.2 trillion Yuan. During the period 1996 to 2005,

** Under the circumstances of prevailing anti-trust law, the vertical contract is allowed, and the environmental policy basically has no strategic role. In the international monopoly market, the optimal environmental trade policy must be Pigouvian taxes whatever the price competition or the quantity competition.

environmental costs increased 12,500 hundred million Yuan. Among these costs, during the period of "the Ninth Five-Year Plan", the total amount that was used to control environmental pollution in China was more than 450 billion Yuan; for the period of "the 10th Five-Year Plan", the total amount that was used to control it was 110.66 billion Yuan (occupied 1.15% of GDP) in 2001, 136.34 billion Yuan (occupied 1.33% of GDP) in 2002, 162.73 billion (occupied 1.39% of GDP) in 2003, 190.86 billion Yuan (occupied 1.40% of GDP) in 2004, and soared up to 2000 billion Yuan for the first time, achieving about 8050 billion Yuan in 2005. During the period of "the 11th Five-Year Plan", the total amount of cost related to the control of environmental pollution continued to increase.

Conclusion 1

In order to protect the domestic environment and to avoid being accused of ecological dumping, a developing country should strive to realize the internalization of environmental costs. From an economic point of view, the developmental costs of reducing pollution, utilizing natural resources, and damage to the environment need to be properly reflected in the market price of the commodities and services. Failure to incorporate these costs into the pricing of goods for sale is likely to lead to significant environmental clean up costs for countries where pollution is occurring. However, trade itself doesn't cause or exacerbate environmental resources problems due to pollution, as long as the costs of the environmental resources are reflected in market prices. In many situations, taking into account the cost of the environmental resources could bring about great changes in the way goods are produced and consumed between trading countries. Under such market pricing, products causing ecological destruction and environmental pollution would be reduced as higher prices encouraged lower demand, and more ecologically sound products would enjoy higher demand due to a substitution effect. Therefore, countries would be able to ameliorate the negative consequences of the depletion of environmental resources, improve trade, strengthen international cooperation, participate in the setting up of world-wide environmental laws, product standards, and enhance the management of environmental resources if they all seek to improve and implement essential environmental and economic policies that result in the internalization of environmental costs within industries.

However, the principle of "letting who that produces pollution pay the expense" appears to be difficult to implement in practice. On one hand, it is hard to determine a

series of issues related to who is responsible for pollution, the relative share of the cost, and where to assign the benefit of payments. Alternatively, the imposition of environmental taxes and directives can harm consumer interests, especially if the producer monopolizes the market or if the product price elasticity is lower. In such instances, the environmental expenses can be shifted over onto the consumer. As an example, most nations have been reluctant to impose an effective energy policy since 1957. To some extent, the European Union's movement towards environmental policy directives appears to be a reaction to the worldwide neglect of environmental regulation for many decades.

Conclusion 2

There are two ways to realizing the internalization of environmental costs, one is the direct control method, the other is a market driven economic method. The direct control method involves setting quota restrictions. The economic market solution would utilize assigning environmental transfer fees to cover the cost of pollution (mainly dumping pollutants to collect fees), imposing an environment tax revenue system, incorporating a system of financial credits to stimulate anti-pollution activities, instituting a pollution power transaction system or deposit refund money system, use of voluntary agreements, and/or creating an environmental insurance system (similar to the US Superfund for Chemical Pollution), the goal of which is to make environmental costs internalized into industrial operations.† The special working group appointed by the EU Commission emphasized in a report issuing the environmental problems in 1992 (draft paper began in 1989) that either the economic or marketing procedure is to ensure that both the market and the environment can be considered. Take Germany for example, its taxes on poisonous gas has reduced its emission by 15%. Also, the Dutch has successful taxed the emission of lead, mercury, and tin, which too has reduced the emission almost by 90%. This paper suggests that the government should employ multiple economic adjustment methods that utilize “across-the-board internalization” of environmental costs, and gradually incorporates methods to stimulate import-export trading with the aim to overcoming “free-rider” behaviors in both domestic and foreign enterprises.

†† European Economic Community Committee appointed a special task force in 1989 to examine issues related the economic or market method for addressing environmental tax policy, and report back in 1992. Subsequently, Germany decided to levy taxes on firms discharging poisonous gas into the environment, with the result that over 3 years these gasses have been reduced 15% in their country. In Holland, there is a tax on firms that discharge lead, mercury or tin into the environment, which has led to a 90% reduction in these harmful agents within their country.

Conclusion 3

Essential countermeasures to treat trade and environmental problems in developing countries should embrace:

- Advancement in technology that brings into harmony environmental concerns and economic development.
- More enterprises should realize that it is significant for them to improve management and productivity. We are able to lower down the consumption of resources and the emission of the wastes, so as to reduce the cost and achieve a better dominant position in the market place just by making use of the advanced clean production technologies. Both economic and environmental efficiencies are realized. This has been proved by experiences of many companies.
- Improvement of industrial structure and product structure to address environmental concerns.
- China used to export raw materials and initial products mainly, now the situation has changed. From 1980 to 2005, the proportion of initial products for export has been reduced from 50.3% to 6.7%, while the industrial finished products has risen from 49.7% to 93.3%. China, however, has to strive on hard to further improve both industrial and product structure adjustment, cutting down the highly resource-consumption and pollution of industries. Meanwhile, tertiary industry should be encouraged, and products with high-tech, added value ought to be increased for export and competitiveness of the products in global market. In terms of the low per capita consumption of natural resources, better use of our abundant human resources to develop the heavily labor intensive industries, so as to protect the environment and fit in with the needs of the nation should be enhanced.
- To strengthen the environmental management of firms so as to assure compliance with the International Environmental Governance standard, ISO14000 with the proviso for clean production processes and environmental labeling.
- Clean production is an environmental strategy of the whole prevention mechanism as it affects procedure and the product itself; this will alleviate the impact and effect on people and the environment. The procedural requirements should ensure that clean production involves saving raw materials and power, avoidance of poisonous materials, improves quantity and quality of the waste and pollutant. To exert clean production, we may improve the management of the business, revise product design

and dispose of the waste properly.

- We should carry out international environment management standard, i.e. standard of ISO14000, which is aimed at guiding enterprises and social groups and other kinds of organizations to build and exert a unique standard of environmental management system while at same time striving to eliminate trade barriers and promotion of a harmonious trading environment.
- We should promote the environmental labeling regulation. Up till now, the EU, USA and Japan are on the process of exerting environmental labeling regulation. To grant a product an environmental label means that this kind of products has strength over other similar products on its environmental aspect, i.e., least adverse impact on environment. This also allows the customers to make choices considering environmental protection issues too. The experiences of the developed countries show that both the domestic and international markets are prone to these environmental protection products where enterprises granted can have better competitive ability and enhanced export volume. Because of differences of procedures and standards among countries, it is necessary to have a set of international indices and standards to prevent new forms of trade barriers that might result from diversity in environment.
- To promote environmental accounting and audit. Environmental accounting and audit has become an integral part of the management systems in company administration. Thus, if we promote this, we would be able to realize the internalization of the environment effectively and efficiently.

REFERENCES

- Barrett, S. 1994. Strategic environmental policy and international trade. *Journal of Public Economics* 54: 325-338.
- Bonanno, G. and J. Vickers. 1988. Vertical separation. *Journal of Industrial Economics* 36: 257-265.
- Brander, J. and B. Spencer. 1985. Export subsidies and international market share rivalry. *Journal of International Economics* 16: 227-242.
- Carlsson, F. 2000. Environmental taxation and strategic commitment in duopoly models. *Environmental and Resource Economics* 15: 243-256.
- Conrad, K. 1993. Taxes and subsidies for pollution-intensive industries as trade policy. *Journal of Environmental Economics and Management* 25: 121-135.

- Hamilton, S. and K. Stiegert. 2000. Vertical coordination, antitrust law, and international trade. *Journal of Law and Economics* 43: 143-156.
<http://www.zhb.gov.cn/eic/index.shtml>.
- Hamilton, S. and T. Requate. 2004. Vertical structure and strategic environmental trade policy. *Journal of Environmental Economics and Management* 47 (2): 260-269.
- Kennedy, P. W. 1994. Equilibrium pollution taxes in open economies with imperfect competition. *Journal of Environmental Economics and Management* 27: 49-63.
- Markusen, J. 1985. Multinational excursions. *Journal of International Economics* 19 (1-2): 192-194.
- Nannerup, N. 1998. Strategic environmental policy under incomplete information. *Environmental and Resource Economics* 11: 61-78.
- Simpson, R. and R. Bradford. 1996. Taxing variable cost: Environmental regulation as industrial policy. *Journal of Environmental Economics and Management* 30 (May): 282-300.
- Ulph, A. 1996. Environmental policy and international trade when governments and producers act strategically. *Journal of Environmental Economics and Management* 30 (3): 265-281.