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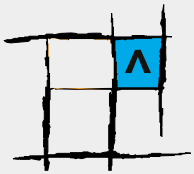

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Strategic Environmental Policies and Mergers

By

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Abstract

In the second half of the last century the attitude with respect to foreign investment has changed, and the role of this investment on development of Latin-American economies has become crucial. A fierce competition is taking place among these countries in a even more integrated region where environmental policies have become one of the suitable instruments to manage the perturbations on welfare caused by the change in foreign investment and specifically the perturbations caused by international mergers. According to this fact, we analyze environmental policies in the presence of mergers. Using a reciprocal dumping model with unemployment and foreign direct investment, we analyze the setting of pollution quota and pollution tax. Both policy instruments seem equivalent and depend on the marginal pollution disutility and the abatement pollution cost, the strictest and the weakest policy is used according to the magnitude of the two mentioned parameters. However, this equivalence is apparent as pollution tax is no continuous and the intuition behind is different in both cases. As a second result, we analyze the effect of a local merger on the welfare and the response of the government through these policy instruments. A merger in both cases will affect the welfare negatively and the response of the government is to compensate the monopolistic distortion strengthening the pollution policy. However it is possible if and only if the marginal pollution disutility is small.

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1 Introduction

Greenhouse effect, acid rain, desertification and change in the tempereature of the oceans are only a few adverse consequences derived from pollution. Hurricanes, twisters, gales and many more environment disturbances have cost the US government around 100 billon dolars in 1998 according to the Environment report 1999 of the US Congress. However, the socio-economic impact of these perturbances on developing countries is significately higher. In latin america economies the environmental perturbations affect the agriculture, fishing and all the economic activities subject to natural cicles. El nio effect increase the devastating effects of hurricanes in latin america and mainly in centroamerica. In a survey of the international Red Cross, the hurricane Mitch cost to the El Salvador half of their GDP by the destruction in infraestructure, agriculture and other economic activities.

This devastating effects of pollution in the world call for a coordinated effort made by the governments all over the world. An example os this attempt was the unsuccesful Rio Conference in Brazil 1992. The intensive use of natural resources and intensity production process is blamed to be the main cause of pollution. However, the governments are not willing to apply policies to reduce pollution because these policies increase the industrial costs and undermine the international competitiveness of domestic industries. In this sense, pollution control is a barrier to trade and, nowadays, it is extensively discussed in the free trade agreements.

Event though there is a vast literature on environment regulations, the existing literature has neglected the study of the effects of envirnomental regulations between developing economies.[1] The free trade agreement between Mexico and Costa Rica is an example where the trade of sugar is subject to pollution qouta reduction in both countries.

On the other hand, the international dimensions of competition policies are receiving growing attention by national governments and international organizations alike. National competition authorities are increasingly examining the conduct of foreign producers. The OECD and WTO are paying increasing attention to cross-border mergers (or international mergers) competition issues. This raises the question of how countries are affected by mergers and how they should respond to these.

mergers and competition policies have been discussed intermittently in the literature on international trade under imperfect competition. Some authors like Auquier

[1] An extensive survey is given by Cropper and Oates (1992).

and Caves (1979) point out that the optimal policy for a government is to encourage competition in the domestic market while allowing its firms to extract monopoly profits in foreign markets through an export cartel (or an export tax).

In developing economies mergers became more agresive. The lack of updated regulations and the need for foreign investment are the main reason for perturbances in welfare with this firm-strategy. The effect of merger in emerging economies welfare are far from a diagnostic. The unclear of the welfare effects of mergers in the banking system in Mexico or the agroindustries in centroamerica will depend on the institutional development and the government ability to use the available policy instruments in a trade framework.

In this paper we will analyse the effect of mergers on welfare of the domestic country in the presence of pollution policies and the response of the government who face a reduction in welfare. Nothing has been made before. We are interested in comparing the response using two different pollution restrictions: pollution quota and pollution tax. The analysis will be made in the presence of unemployment as Brander and Spencer (1987) and recripocal dumping framework as Brander and Krugman (1983).

The model is spelt out in detail in the following section. The analysis of merger and pollution quota is made in section 3. In section 4 we have merger and pollution tax, and finally in section 5 we conclude.

2 The Model

Assume that there are two countries, labelled A (domestic country) and B (foreign country), producing a homogeneous and tradeable commodity. We consider a partial equilibrium model of an oligopolistic industry in which there are exogenous number of n identical firms in A, and m identical firms in B. Each firm has a Cournot perception: it takes the output of other firms as given while maximising its profits.

The homogeneous output produced by firms located in A and B are X and Y respectively, where $X = X^A + X^B$ and $Y = Y^A + Y^B$ such that X^A is consumed in country A, and X^B is exported to country B. Similarly, Y^B is for local consumption in B and Y^A is exported to A.

The marginal costs of firms in A and B are K_X and K_Y, respectively. These costs are taken to be constant, and therefore equal to the average variable costs.[2] K_j

[2]Implicitly, there is a numeraire good in the background which is produced under competitive

$(j = X, Y)$ is defined as follows,

$$K_X = C_X + T_X, \tag{1}$$

and

$$K_Y = C_Y, \tag{2}$$

where C_j is the part of the unit cost that is determined by technological and factor market conditions, and is taken to be constant. Pollution arises only in country A during productin by n type firms.[3] As the production of X implies emission of pollution, T_X is the unit policy-induced cost of pollution abatement which will be spelt out later on. There is transport cost t incurred in exporting goods from one country to the other which is borne by the producers.

We have segmented markets with homogeneous goods, and the inverse demand functions are[4]

$$P_A = \mathcal{F}_A(D_A), \quad P_B = \mathcal{F}_B(D_B),$$

where

$$D_A = nX^A + mY^A, \tag{3}$$
$$D_B = nX^B + mY^B, \tag{4}$$

and P_i is the price in country i $(i = A, B)$, $\mathcal{F}_i^{'} < 0$ and $\mathcal{F}_i^{''} < 0$ for all D_i.

The profits of the firms located in A and B are given by

$$\Pi^A = (P_A - K_X)X^A + (P_B - K_X - t)X^B, \tag{5}$$
$$\Pi^B = (P_B - C_Y)Y^B + (P_A - C_Y - t)Y^A. \tag{6}$$

conditions. There is also just one factor of production in each country whose price is determined in the competitive sector.

[3]When we allow the foreign firms to pollute, our model suggests exactly the same result we got here. If both countries apply a simmilar pollution policy, they play a cournot strategic environmental policies which is consistent with result of this document. Therefore, for a more treatable analysis, we only consider when the domestic firms pollute. It is equivalent to say that country B does not induce any policy pollution cost.

[4]We assume that the utility functions, in each country, can be approximated by $U_A = u(X^A, Y^A) + \mathcal{M}_A$ and $U_B = u(X^B, Y^B) + \mathcal{M}_B$ where X and Y are the goods under consideration and $\mathcal{M}_A$ and $\mathcal{M}_B$ are the expenditure on the numeraire goods. The use of this approximation removes a number of theoretical difficulties, including income effects.

Each firm decides what proportion of the commodity it produces is for domestic consumption and how much for export. Under Cournot-Nash assumptions the first-order maximisation conditions are:[5]

$$X^A\mathcal{F}_A^{'} + \mathcal{F}_A = C_X + T_X, \tag{7}$$

$$X^B\mathcal{F}_B^{'} + \mathcal{F}_B = C_X + t + T_X, \tag{8}$$

$$Y^A\mathcal{F}_A^{'} + \mathcal{F}_A = C_Y + t, \tag{9}$$

$$Y^B\mathcal{F}_B^{'} + \mathcal{F}_B = C_Y. \tag{10}$$

Positive solutions to this system give the equilibria where two-way trade arises, provided the second order conditions are satisfied.[6]

On the other hand, the amounts of pollution generated (before any abatement) by each firm in the domestic country is θX, where θ is the constant amount of pollution per-unit of output produced.[7]

In order to keep the analysis at a tractable level, we shall henceforth assume linear and identical demand functions of the form

$$P_i = a - bD_i, \tag{11}$$

where the parameters a and b are positive.

We shall close the section by deriving the closed-form solutions of the variables discussed above, which are[8]

$$Y^A = \frac{(n+1)(a - C_Y - t) - n(a - C_X - T_X)}{b(m+n+1)}, \tag{12}$$

[5]They can be considered separately given the assumption of constant marginal costs.

[6]Second order conditions are

$$\Pi^A_{X^AX^A} = X^A\mathcal{F}_A^{''} + 2\mathcal{F}_A^{'} < 0, \quad \Pi^A_{X^BX^B} = X^B\mathcal{F}_A^{''} + 2\mathcal{F}_B^{'} < 0$$
$$\Pi^B_{Y^AY^A} = Y^A\mathcal{F}_A^{''} + 2\mathcal{F}_A^{'} < 0, \quad \Pi^B_{Y^BY^B} = Y^B\mathcal{F}_B^{''} + 2\mathcal{F}_B^{'} < 0$$

and

$$\Pi^A_{X^AX^A}\Pi^B_{Y^AY^A} - \Pi^A_{X^AY^A}\Pi^B_{Y^AX^A} > 0, \quad \Pi^A_{X^BX^B}\Pi^B_{Y^BY^B} - \Pi^A_{X^BY^B}\Pi^B_{Y^BX^B} > 0.$$

which in turn implies that reaction functions cross only once and they do so such that the equilibrium is stable (See Nikaido (1968, ch.7)). These conditions are also the Routh-Hurwitz conditions for stability.

[7]Implicitly, this unit pollution parameter is taken to be over and above the level which the World Health Organisation (WHO) considers to be harmless.

[8]It can be easily verified that, with linearity of demand, the second order conditions are always satisfied.

$$X^A = \frac{(m+1)(a-C_X-T_X)-m(a-C_Y-t)}{b(m+n+1)}, \tag{13}$$

$$X^B = \frac{(m+1)(a-C_X-t-T_X)-m(a-C_Y)}{b(m+n+1)}, \tag{14}$$

$$Y^B = \frac{(n+1)(a-C_Y)-n(a-C_X-t-T_X)}{b(m+n+1)}. \tag{15}$$

3 Optimal Quantity Restriction and Local Merger

Having set the basic framework, we shall now analyse the effect of local merger when a pollution quota policy is set optimally by the domestic country. It will be useful to review the welfare effect of horizontal mergers when the domestic country pursues an environmental regulation. Consider that the governments specifies the maximum allowance of pollution per unit of output. From (1) we define

$$T_X = \gamma(\theta - z_A), \tag{16}$$

where, z_A is the maximum quantity of pollution per unit of output produced the firms in country A are allowed to emit into the atmosphere.[9] We assume that the abatement technology is such that it costs each firm a constant amount γ to abate one unit of pollution. The parameter γ and θ together with the policy instrument used by the government will determine the policy induced part of the unit cost K_X's.

Following Salant et. al. (1983) and Dixit (1984), the domestic horizontal merger is modeled as an exogenous reduction in the number of domestic firms[10] We will analyse the effect of a change in the number of firms n on the welfare of the country A. Due to the symmetry of reciprocal dumping model, the analysis of country B with respect to m, in the case in which the government in B apply the same policy, is similar and therefore omitted.

We assume, as do Brander and Spencer (1987), that there is unemployment in the domestic country. In particular, the variable costs of the firms are bought in the host country, and are taken to be income of the nationals of that country.[11] The profits of the firm located in A do not remain in the host country as these firms are foreign

[9]Like in the case of θ, these instruments are taken to be over and above the level which the WHO considers to be harmless.

[10]Although the number of domestic firms will obviously take an integer value, it will be treated as a continuous variable.

[11]Implicitly, we assume that there is a competitive sector in the background. This sector uses labour and a specific factor (say land) under constant returns to scale. The imperfectly competitive sector uses labour and a constant returns to scale technology. The wage rate of labour (in terms

owned.[12] Therefore the welfare of the representative consumer in the host country, W_A, can be written as,

$$W_A = nC_X X + \mathcal{CS}_A - \psi Z_A, \tag{17}$$

where Z_A is the total amount of harmful pollution in country A defined as $Z_A = nz_A X$. ψ is the marginal disutility of pollution.[13] We assume, as do Lahiri and Ono (1998c) and Markusen, *et. al.* (1993, 1995), that the marginal disutility of pollution is constant.[14] $\mathcal{CS}_i$ is the consumer surplus and it is well known that

$$d\mathcal{CS}_A = bD_A dD_A. \tag{18}$$

This completes the model specification and we turn to its analysis. From the total differentiation of demands, reaction functions and welfare function (3), (4), (7)-(10) and (17) we get

$$\begin{aligned} dW_A = & \left[(nC_X - \psi n z_A)2\gamma(\frac{m+1}{\alpha b}) + \frac{n\gamma D_A}{\alpha} - nX\psi\right] dz_A \\ & + \left[(C_X - z_A\psi)\frac{(m+1)X}{\alpha} + D_A b\frac{X^A}{\alpha}\right] dn, \end{aligned} \tag{19}$$

where

$$\alpha = 1 + n + m.$$

In the case of pollution restrictions where n and C_X are constant, the effect on X will determine the direction of the effect on employment and pollution. An increase in z_A will reduce the cost of production for the firms in country A and give these firms a competitive edge over the firms in country B. There will be an increase in X and

of the numeraire competitive good) is exogenously given at a level higher than the market clearing one. With these assumptions, the total amount of labour used in the competitive sector and the rental rate of land would not depend on any of the policy parameters. Any policy induced change in employment in the non-competitive sector would be the total change in employment in the economy.

[12]This feature is very usual in many developing economies. The abscent of domestic investment in some industries come from different reasons such that the opening of markets to more efficient foreign competitors or simply the existence of large sunk cost. Many of the agroindustry in central america (see Tamara (2001)) or the car industry in Mexico are some examples.

[13]As we are considering a small economy, we ignore cross-border pollution. For an analysis of cross-border pollution see, for example, Copeland (1996).

[14]Other authors, like Asako (1979), consider that marginal disutility is an increasing function of output. However, we will see that this assumption will not change our results as the concavity condition of the welfare function holds.

consequently in employment and pollution. On the other hand, an increase in n will increase the number of firms polluting the local country and the income of employed factors despite the reduction in the output of the existing firms.

In the case of the consumer, an increase in pollution quota decreases marginal costs and therefore prices in both countries. On the other hand, an increase in the number of local firms will increase the total amount of the consumed good reducing its price.

For the welfare functions to be concave in z_A, from (19) we must have

$$\alpha b \frac{d^2 W_A}{dz_A^2} = n\gamma \left[n\gamma - 4\alpha(m+1)\psi \right] < 0,$$

Clearly the above conditions are satisfied if and only if

$$\psi > \frac{n}{4\alpha(m+1)}\gamma, .$$

We obtain the Nash optimal z_A from the coefficient of dz_A in (19) taking as given dn. We get

$$z_A^N = \frac{C_X}{\psi} + \frac{bD_A}{2\psi(m+1)} - \frac{\alpha b X}{2\gamma(m+1)}, \tag{20}$$

From (20), we can see that when γ is sufficiently smaller than ψ imposing pollution control has no costs but only benefits. Therefore the optimal policy is to impose the severest pollution restriction, i.e. $z_A^N = 0$. On the other hand, when γ is sufficiently larger than ψ the policy instrument may be positive.

Intuitively a high marginal cost of abatement means that pollution control has significant negative impact on production and price. A reduction in output reduces employment and an increase in price reduces consumers surplus. Therefore, when the marginal cost of abatement is sufficiently high, the government may be forced to allow positive amount of pollution. However, when the marginal cost for abating pollution is sufficiently small, the harmful effect of pollution outweighs the benefit obtained by the employment and consumer surplus. The government sets the severest pollution policy as it reduces the optimal output and consequently the pollution level.

Evaluating the optimal policy (20) in the coefficient of dn in (19), we have

$$\frac{dW_A}{dn} = \frac{bX^2\psi}{2\gamma} - \frac{bD_A}{2\alpha}(X^B - X^A) \tag{21}$$

together with the similarity of the demand functions it follows from (13) and (14) that $X^A > X^B$ and therefore (21) is positive.[15]

[15]One characteristic of the presente model is that each firm has smaller share of the foreign market than of its domestic market (see Brander (1981) p.7.).

Mergers in the local firms will reduce the welfare of the domestic country. A reduction in n will produce monopolistic distortions reducing the consumers surplus and employment in a greater proportion than the reduction in pollution. Formally we can say,

Proposition 1 *In a reciprocal dumping model of trade when government pursue a quota pollution restriction, mergers in local firms will reduce the welfare of the local country.*

Intuitively a reduction in the number of firms will produce monopolistic distortions such that the increases in the price will reduce the consumers surplus. On the other hand, a reduction in the number of firms will reduce employment since less firms hire less factors. These two effects dominates over the positive effect produced by a reduction in the amount of pollution produced by the domestic firms. The welfare of the domestic country will be reduced.[16]

Following the analysis made by Collie (1997), when a local merger reduces the local welfare, the governments try to correct this negative externality using the policy instruments. In this case, when the government pursues an optimal pollution policy, how should the local country respond to local merger?

In order to solve this question, we obtain the comparative static of a reduction in the number of local firms on the optimal pollution quota. Differentiating the optimal quota (20) with respect to n we get,

$$\frac{dz_A^N}{dn} = \frac{bX^A}{2\psi(m+1)\alpha}. \tag{22}$$

This expression is evidently positive and a local merger will produce a decrease in the optimal pollution quota. Formally we can say,

Proposition 2 *The optimal response of the domestic country to a local merger, is to decrease its pollution quota.*

Because a merger increase the monopolistic distrortions and consequently reduce the consumer surplus, the best response of the government is a reduction in pollution quota in order to open the market to foreign producers. Intuitively, a reduction in the pollution quota will increase the cost for local firms reducing their

[16]With full employment the last proposition holds as (21) does not change. The reduction in harmful pollution is smaller than the reduction in consumers surplus and the effect on local welfare will be negative.

production and their competitive advantage over the foreign firms. The increase in foreign production will increase consumer surplus. On the other hand, the increase in the cost of local firms will reduce harmful pollution and the overall effect is positive despite the reduction in employment.

4 Optimal Pollution Tax and Local Merger

Having analyzed the effect of a merger on local welfare in the presence of a pollution quota, we now turn to analyze the effect of a merger when the domestic government pursues an environmental pollution tax.[17] We shall henceforth concentrate on the case of uniform tax policy on pollution.

The Pollution tax has two associated costs to the n firms: (i) the tax paid, and (ii) the cost of pollution abatement. Denoting by q_A the post-abatement pollution level per unit of output (which is an endogenous variable chosen by the firms), the unit cost of the n firms is given by[18]

$$K_X = C_X + \gamma(\theta - q_A) + tq_A \tag{23}$$

where C_X is as before, $\gamma(\theta - q_A)$ is the unit abatement cost, and tq_A the unit tax paid.

In this case, the firms decides on q_A and X_A. The optimal behavior on pollution emission gives

$$q_A = \begin{cases} 0 & \text{if } t \geq \gamma \\ \theta & \text{if } t < \gamma \end{cases} \tag{24}$$

The n firms do not abate pollution at all when the tax rate is smaller than the private marginal cost of abatement. When the tax rate is larger than the marginal cost of abatement, the n firms emit only the harmless level of pollution.

Substituting (24) into (23) we get

$$K_X = \begin{cases} C_X + \gamma\theta & \text{if } t \geq \gamma \\ C_X + t\theta & \text{if } t < \gamma, \end{cases} \tag{25}$$

[17] It is to be noted that since there are two distortions in our model, viz., product-market imperfection and pollution externalities, the government should introduce two instruments -a Pigouvian tax on pollution and a Marshalian production subsidy- to achieve the first best. However, as Cropper and Oates (1992, p.864) note, 'environmental regulators are unlikely to have the authority (or inclination) to subside the outputs of monopolists.' Therefore, we consider an optimal second-best tax on pollution as in Barnett (1980) and Lee (1975).

[18] Again, it is just in our interest to analyse the effect of domestic mergers in the host country. So, the unit cost of the m firms is as before C_Y

and from (24) we obtain the total amount of pollution Q_A as

$$Q_A = \begin{cases} 0 & \text{if } t \geq \gamma \\ nX\theta_A & \text{if } t < \gamma, \end{cases} \tag{26}$$

From (26), when $t \geq \gamma$, the amount of pollution is zero, independent of the tax rate, t. When $t < \gamma$, all n firms pay the pollution tax as none of them abates any pollution.

The domestic country's welfare is given by

$$W_A = nC_X X + \mathcal{CS}_A - \psi Q_A + tq_A nX, \tag{27}$$

where the first, second and third term are the income of employed factors, consumers surplus and pollution disutility respectively as described before. The last term is namely the tax revenue. Total differentiation of (27) with respect to n and t, we get

$$\begin{aligned} dW_A = & \left[(\psi - t)(\frac{q_A^2 2n(m+1)}{b\alpha}) - \frac{nD_A q_A}{\alpha} + q_A nX - \frac{2n(m+1)q_A C_X}{b\alpha}\right] dt \\ & + \left[(C_X - q_A\psi + tq_A)\frac{(m+1)X}{\alpha} + D_A b\frac{X^A}{\alpha}\right] dn, \end{aligned} \tag{28}$$

where

$$\frac{dW_A}{dt}\mid_{t<\gamma} = (\psi - t)(\frac{\theta_A^2 2n(m+1)}{b\alpha}) - \frac{nD_A\theta_A}{\alpha} + \theta_A nX - \frac{2n(m+1)\theta_A C_X}{b\alpha}. \tag{29}$$

An increase in the pollution tax will increase the production cost of the firm in A and give these firms a competitive disadvantage with respect to those in country B. There is a reduction in the optimal output of the n firms which reduce the income of employed factors, consumers surplus and pollution disutility. On the other hand, an increase in n means an increase in the number of polluting firms, income of employed factors, consumers surplus and tax revenue. From (28) we have

$$t = \frac{bX\alpha}{2q_A(m+1)} - \frac{bD_A}{2q_A(m+1)} - \frac{C_X}{q_A} + \psi, \tag{30}$$

where

$$\frac{d^2W_A}{dt^2} = \frac{nq_A^2}{b\alpha^2}(1 - 4\alpha(m+1)) < 0. \tag{31}$$

The optimal tax is ambiguous and depends, among other parameters, on the marginal disutility for pollution, ψ. However, the welfare function is not necessarily continuous with respect to t and the possible discontinuity occurs when $t = \gamma$. From (29) we have

$$\begin{aligned} \frac{dW_A}{dt}\mid_{t\simeq\gamma} = & (\psi - \gamma)(\frac{\theta_A^2 2n(m+1)}{b\alpha}) - \frac{nD_A\theta_A}{\alpha} \\ & + \theta_A nX - \frac{2n(m+1)\theta_A C_X}{b\alpha}. \end{aligned} \tag{32}$$

There may exist a positive number ξ such that if $\psi - \gamma \geq \xi$, the optimal tax is set at any level higher than the unit abatement cost γ, reducing pollution emission to the harmless level. If $\psi - \gamma < \xi$, the optimal tax rate is strictly lower than γ, resulting in no abatement of pollution.

When ψ is sufficiently large, the beneficial effect of pollution control dominates all other effects, causing the tax rate to be set at such a level that eliminates any emission of pollution. This is similar to the case of pollution quota seen before. However, when ψ is relatively small, the optimal tax rate is set at a lower level and this level happens to be less than the marginal private cost of abatement, γ. The optimising firms therefore decide to pay the tax and do not bother with abating any pollution. This case is different than the quota case where the firms do not have the freedom to choose the level of abatement. Therefore, the tax and quota case are not necessarily equivalent in this case.

Evaluating the optimal policy (30) in the coefficient of dn in (28), we have

$$\frac{dW_A}{dn} = \frac{bX^2}{2\gamma} + \frac{bD_A}{2\alpha}(X^A - X^B) \tag{33}$$

from (13) and (14) it is clear that $X^A > X^B$ and therefore (33) is positive.

Mergers in the local firms will reduce the welfare of the domestic country. A reduction in n will produce monopolistic distortions reducing the consumers surplus, employment and tax revenue in a greater proportion than the reduction in pollution. Formally we can say,

Proposition 3 *In a reciprocal dumping model of trade when government pursue a pollution tax restriction, mergers in local firms will reduce the welfare of the local country.*

Intuitively, a reduction in the number of firms will produce monopolistic distortions through an increase in the price that will reduce consumers surplus. On the other hand, a reduction in the number of firms will reduce employment and tax revenue since less firms hire less factors and provide less income by taxing. These three effects dominates over the positive effect produced by a reduction in the amount of pollution in the domestic firms. Hence, the welfare of the domestic country will be reduced.

Again, to obtain the best response to this negative effect of mergers on domestic welfare, we should differentiate (30) with respect to n to obtain

$$\frac{dt}{dn} = -\frac{b(\alpha X + X^A)}{2q_A(m+1)\alpha} < 0. \tag{34}$$

This expression is evidently negative and a local merger will produce an increase in the optimal pollution tax. Formally we can say,

Proposition 4 *The optimal response of the domestic country to a local merger, is to increase its pollution tax.*

Intuitively, an increase in pollution tax will increase the tax revenue and the cost for local firms reducing their production and their competitive advantage over the foreign firms. The increase in foreign production will increase consumer surplus compensating the monopolistic distortions produced by the merger in local firms. On the other hand, the increase in the cost of local firms will reduce harmful pollution. Therefore the best response of the local government is to increase the pollution tax in order to increase the consumer surplus and tax revenue, and reduce pollution despite the reduction in employment.

It seems that the monopolistic distortions is the dominant effect of the merger on local welfare in both cases. When the domestic government pursues any of the two policy instruments the effect of a merger on local welfare and the response to this merger by the local government seems equivalent. The reduction in consumers surplus is the main origin of this negative effect and the main reason why the local government strengthen the pollution policy in both cases.

Although the effect of a merger on welfare and on policy response seem equivalent in both cases, it is true just in the case in which the marginal disutility is sufficiently small. When the marginal disutility is sufficiently large, the negative effect of a merger on local welfare would not be answered by the government. The intuition behind this phenomena is different in each case.

With a large ψ the harmless level of pollution is set in both cases. In the first case there is not pollution quota ($z_A = 0$) and the negative effect of a merger will be no responded by the government. The local government would like to increase the cost of the firm in order to give a comparative advantage to the foreign firms and reduce the price increasing the consumption despite the reduction in employment. However, with $z_A = 0$, the government has not instrument available to compensate the reduction in welfare produced by the merger.

In the case of a pollution tax, a large ψ implies a large impact of the pollution on the health of the people. The government has incentives to set a significantly big pollution tax increasing the cost of the local firms. In this sense, the firms have incentives to reduce pollution to the harmless level and no change in t will affect the cost of the firms.

5 Conclusion

In spite of the well known negative effect of pollution on the health of people, coordinate efforts made by governments all over the world have been rather limited. The pesimism and inflexibility expressed by all the members of the Rio Conference in Brazil is rooted in posible losses in consumption and production. Even coordinated actions against environmental degradation could be successful just under specific conditions.

We modelled, in a cournot oligopolistic setting of reciprocal dumping, the effect of mergers, in the presence of pollution restrictions, on welfare and the best response of the government when merger produce a negative externality. In the same context we analyse the effcicieny of two policy restrictions in this contex: pollution quota and pollution tax.

Considering the existence of unemployment, and in the presence of pollution quota, a local merger will reduce the local welfare. The monopolistic distortions and the reduction in employment are larger than the benefit in pollution reduction. To compensate this negative effect of merger on welfare the government in the local country reduce the pollution restriction reducing the competitive advantage of the local firms over the foreign firms. This effect will provide the market of cheaper productos. On the other hand, a local merger in the presence of pollution tax will reduce welfare as well. In this case, the government will increase pollution tax in order to expand the consumer surplus despite the increase in pollution.

Even when these two effects and the action taken by he government are simmilar in both instruments cases, it is just true with a small marginal disutility for pollution. When the marginal disutility is large, there is not response for the local government and the intuition behind each case is different.

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