

Bommer, Rolf; Schulze, Günther G.

**Working Paper**

## Economic integration and environmental policy: Does NAFTA increase pollution?

Diskussionsbeiträge - Serie II, No. 218

**Provided in Cooperation with:**

Department of Economics, University of Konstanz

*Suggested Citation:* Bommer, Rolf; Schulze, Günther G. (1994) : Economic integration and environmental policy: Does NAFTA increase pollution?, Diskussionsbeiträge - Serie II, No. 218, Universität Konstanz, Sonderforschungsbereich 178 - Internationalisierung der Wirtschaft, Konstanz

This Version is available at:

<https://hdl.handle.net/10419/101722>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

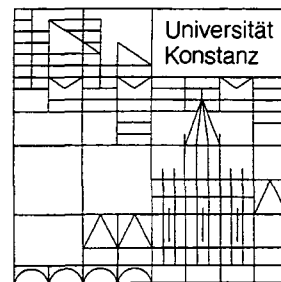
*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

**Sonderforschungsbereich 178  
„Internationalisierung der Wirtschaft“**

Diskussionsbeiträge



Juristische  
Fakultät

Fakultät für Wirtschafts-  
wissenschaften und Statistik

---

Rolf Bommer  
Günther G. Schulze

**Economic Integration and  
Environmental Policy:  
Does NAFTA Increase Pollution?**

532.746

---

Postfach 5560  
D-78434 Konstanz

Serie II — Nr. 218  
April 1994

27. APR. 1994 Weltwirtschaft  
Kiel

6) 112 (218) 21:

**Economic Integration and Environmental Policy:  
Does NAFTA Increase Pollution?**

**Rolf Bommer\***

**Günther G. Schulze\***

**W 113 (218)**



Serie II - Nr. 218

April 1994

\* *We are very much indebted to Karl-Josef Koch, Jürgen Meckl and Heinrich Ursprung for valuable comments and to Nicole Burkhardt for able research assistance. Financial support of the German Research Foundation is gratefully acknowledged. The usual disclaimer applies.*

## **Abstract**

Contrary to the wide-held perception that increased international competition will lead to the erosion of environmental standards we show that economic integration, such as NAFTA, may instead lead to tighter environmental control. In maximizing political support the administration will trade off some of the gains from trade liberalization accruing to both the export sector and labor for increasing support by the environmentalists and the losers of protection (i.e. the import sector). This is effected through tightened environmental control - NAFTA will result in higher environmental standards in the US.

## 1. Introduction

The North American Free Trade Agreement (NAFTA) is targeted at attaining welfare gains from trade through the elimination of trade barriers. However, the focus of the political debate has recently shifted to the environmental and social impacts of NAFTA. There is a growing concern that NAFTA will seriously harm the environment. Increased competition could lead to a harmonization of environmental standards at the lowest (Mexican) level. Moreover, the few economic studies on the environmental effects of NAFTA predict a slight improvement in the Mexican environment but a significant worsening in the US, mainly due to structural shifts (Grossman/Krueger 1993). Yet, these studies disregard the political process leading to environmental control by implicitly assuming a constant environmental policy. We explicitly incorporate the political determination of environmental policy and show that an endogenous policy reaction to trade liberalization such as NAFTA may substantially change the effects on the environment. Contrary to the wide-held perception that increased international competition will lead to the erosion of environmental standards we show that economic integration may instead lead to tighter environmental standards. NAFTA may not be as detrimental to the US environment as previous studies suggest.

Until now there is only scarce literature on trade liberalization and the environment.<sup>1</sup> Grossman/Krueger (1993) analyze the environmental effects of NAFTA and distinguish three mechanisms. First, trade liberalization may worsen the environment through increased economic activity. Increased income, on the other hand, will lead to a higher valuation of the environment, which may enhance environmental quality. Second, liberalization eases the transfer of new and often cleaner technology. Third, trade liberalization will shift production to sectors with comparative advantage. This will affect the environment because some sectors pollute more than others. For Mexico, Grossman and Krueger find that growth tends to reduce pollution. For the US, however, output and technological effects are negligible, given the size and technological standard of the US economy as compared to Mexico. Sectoral changes seem to be mainly at work, pointing to the US specializing in dirty production: NAFTA deteriorates the environment in the US.

This approach, like any other work on the environmental impact of NAFTA, is potentially flawed since it does not take the political process of regulation into account. This paper instead follows the political-economic approach to the environment, which

---

<sup>1</sup>For a survey see Dean (1992). Only few papers try to estimate the sectoral effects of liberalization in LDC's on the environment, like Markandya/Richardson (1990), Barrett (1991), and Anderson (1992).

explicitly models regulatory policy. Maximizing political support via redistributing income rather than correcting market failures and achieving overall efficiency are regarded as the predominant goals of self-interested politicians. This explains why environmental policy is so constantly suboptimal in efficiency terms.<sup>2</sup>

In the international context, the political-economic analysis of environmental policy has become prominent under the label of "ecoprotectionism" - environmental regulations may be used to illicitly protect domestic industries from foreign competition (Leidy/Hoekman, 1994; van Grasstek, 1992). This is especially important, since the use of most other protectionistic instruments is restricted by international agreements like GATT or subject to severe trade disputes.

Quite opposite from this, we inquire how the environment is affected by trade policy like the NAFTA agreement. Virtually no theoretical and empirical work has been done in this field. In a first attempt Ursprung (1992) shows how environmental policy is politically chosen in a small open economy. Rauscher (1991) undertakes a witty effort to analyze environmental policy impacts of capital market integration. However, he analyzes the choice of environmental policy by two countries from a benevolent dictator's perspective, maximizing national welfare. Like in all traditional approaches to economic policy, he neglects the political optimization process that leads to regulation. Since environmental control is the very outcome of an optimization process of self interested regulators (Stigler, 1971), we cannot assume this regulation will remain constant once important parameters to it (like profits and wages) are altered in the course of trade liberalization. It is this interdependence that lies at the core of our analysis.

The paper proceeds as follows. Section 2 presents evidence on the structural changes due to NAFTA and its ecological consequences. Section 3 introduces the model. First, it is shown how pollution affects the economy, then the optimal environmental standard is derived from the regulator's optimization process and, finally, we show how this optimal environmental control shifts in the course of trade liberalization. Concluding remarks are set out in section 4.

---

<sup>2</sup>Buchanan and Tullock (1975) find that quantitative restrictions to pollution are adopted instead of more efficient taxes, because the former create rents for the polluting producers. Downing (1981) examines the influence of pressure groups on the bureaucracy implementing pollution laws. Buchanan/Vanberg (1988) analyze voter influence on environmental policies in direct and representative democracies. Bartsch et al. (1993) explain the level of environmental policy with a lobbying contest between environmentalists and the industry. For a survey of this literature see Hahn (1990) and Weck-Hannemann (1994).

## 2. NAFTA, Sectoral Change and the Environment

We will examine sectoral effects of NAFTA in greater detail because they are crucial in determining the environmental impact of NAFTA. Trade liberalization creates winners and losers, depending on the structure of trade and removed protection. Some sectors will expand at the expense of others. This structural shift affects pollution, since sectors pollute to a different extent. In conventional analyses, three steps are taken in determining the environmental impact of the sectoral changes. First, numerical general equilibrium models are used to estimate sectoral changes. Second, pollution intensities are determined for the various sectors. Third, the environmental impact of the sectoral changes is calculated. This approach, however, assumes that the degree of environmental control remains unaffected by the trade liberalization. We will take these studies as starting point of our analysis and will show later that trade liberalization will alter the political process towards tighter environmental regulation rendering the existing predictions biased.

First we look at predicted structural shifts through the elimination of trade barriers. We focus on Mexican-US trade and on the highly protected sectors because these sectors are bound to react most drastically. US average tariff for Mexican goods amount to only 3,4%, but tariffs vary considerably between sectors (Weintraub, 1992a). Brown, Deardorff and Stern (1992, henceforth BDS)<sup>3</sup> analyze sectoral shifts in a computable general equilibrium model, assuming the complete elimination of tariffs between the US, Canada and Mexico, as well as a 25% reduction on import quota on agricultural products, food, textiles and apparel from Mexico<sup>4</sup>. They find that overall effects are not overly large, but sectoral shifts are sizeable: US exports are expected to increase for clothing (10%), footwear (11,2%), furniture (9,8%), rubber products (6,2%), chemicals (3,7%), iron and steel (6,5%), to list only some; US imports will increase in glass (57,6%), electrical machinery (10,0%), non-ferrous metals (5,3%) and furniture/fixtures (3,6%), among others.

---

<sup>3</sup>Various other studies estimate that the US sectors textiles, glass, furniture, electronic components, electric machinery and leather products may lose from the elimination of tariffs and non tariff barriers; see Weintraub (1992b) for an overview.

<sup>4</sup>In another scenario BDS assume an 10% increase in the capital stock of the Mexican economy. Although investment liberalization is a big issue in NAFTA, we confine ourselves to analyzing the effects of trade liberalization. Because the effects of investment liberalization are highly uncertain at the moment, we plan to analyze this issue in a future study.



Next, we will analyze whether the estimated structural shifts will lead to a deterioration in the environmental quality in the US.<sup>5</sup> This is the case if the estimated increase in US exports is relatively dirtier than the expected import changes.

Anderson (1993) provides evidence about the effects of trade liberalization on the environment in general. He finds that developing countries protect their import-competing and often dirty heavy industries, while discouraging their primary and labor intensive sectors. On the other hand, industrial countries often protect labor intensive sectors like textiles and agriculture. Trade liberalization will shift production to the sectors with competitive advantage: Poor countries probably get relief from environmental pressure by specializing in labor-intensive production. On the opposite, industrial countries may have to carry the burden of dirty industries. We apply this to the case of NAFTA and conclude that dirty production may shift to the US, increasing pollution there. Hettige et al. (1992) provide corroborating evidence. In a study on developing countries, they find by measuring sectoral toxic releases that open economies tend to have an industrial structure that is less polluting than the structure of closed economies. The opening up may therefore lead to a sectoral change in production from smokestack industries to cleaner ones. Again liberalizing trade in developing countries may shift dirty production to the countries of comparative advantage: the industrial countries.

Grossman and Krueger (1993) interpret the shift of utility output (including electricity) from Mexico to the US, as predicted by the BDS model, as an indication of a move of energy-intensive and therefore dirty production to the US.<sup>6</sup> In a second approach Grossman and Krueger combine estimated changes of output from the BDS model with toxic release data (again, assuming an elimination of tariffs and a 25% cut of non-tariff barriers). They find toxic release of Mexican industrial production to be reduced by 261 thousand pounds, whereas it increases considerably in the US (13,053 thousand pounds).

We analyze the relative environmental burden of US exports compared to US imports (see appendix). This is important for the political-economic analysis undertaken below. We use environmental control costs (ECC) as an indicator for industrial pollution levels and combine the two data sets.<sup>7</sup> The resulting ECC seem to be only somewhat higher for

---

<sup>5</sup>Other factors influencing environmental conditions, like growth effects of NAFTA, seem to be very small, looking at the size of the US economy compared to the Mexican economy. BDS find only an 0.1% increase in GDP for the US economy.

<sup>6</sup>Electricity production is a major part of the utility sector. Because disaggregated data are not available, Grossman and Krueger project the utility output change to the change of electricity production.

<sup>7</sup>The concept of ECC is one way to identify the dirtiness of industries. The underlying assumption is: the higher the cost of pollution abatement and control expenditures, the more dirty the industry. In the

exports than for imports, however the differences in ECC for the *changes* in US exports and imports due to NAFTA are significant. We obtain 0,49% ECC of output value for the expected increase in US exports compared to 0,44% for the expected import increase. With some necessary caution, resulting out of insufficient data material, we obtain again the result that the US specializes in the export of dirty products.

To sum up, there is considerable evidence that NAFTA will cause the dirty US export sector to grow at the expense of the cleaner import sector, and thereby deteriorate the environmental balance of the US.<sup>8</sup> This analysis, however, starts from the assumption that government regulation will stay the same. Since environmental policy is the result of a political optimization process of the regulating body trying to maximize political support, it is rather doubtful that the status quo regulation intensity remains the same once important parameters to the optimization process have been altered by trade liberalization. We will investigate this in the next section explicitly.

### 3. The Model

#### 3.1 Economic Sector

In this section we present a simple two-sector model which portrays how the use of environment affects the economy. It is based on the specific factors model as studied by Jones (1971) and is amended by environmental aspects. Consider two sectors, both of which are producing a tradable good with the help of labor, which is mobile between sectors, and sector-specific capital. These assumptions on factor mobility seem restrictive; however since political decisions are motivated by short-term considerations and installed capital can be reallocated between sectors only by very time-consuming investment-deinvestment processes, the assumption of sector specificity seems justified. On the other hand, workers are hired or made redundant much more easily as sectors expand or contract.<sup>9</sup> Production functions  $f^i(K^i, L^i)$ ,  $i = I, II$  are assumed to have the

---

two-digit SIC classification the percentage of ECC on output ranks between 0,16% for tobacco manufacturing and 1,21 % for primary metal products (Low, 1992). This concept has its shortcomings. It provides no data about the direct environmental impact of production, but only on the cost of cleaning up. Therefore we view our calculations only as preliminary results to be modified as soon as better data become available.

<sup>8</sup>One may surmise that a country with high environmental standards like the US specializes in clean production. However, empirical studies like Tobey (1990) find that environmental regulation has no significant impact on trade patterns. ECC are negligible compared to other factor costs like wages, which are decisive in determining the pattern of comparative advantage.

<sup>9</sup>If workers are imperfectly mobile between sectors they have a special interest in policies that foster the sector they are employed in; cf. Mussa (1982) for a static analysis of this phenomenon and Albert/Vosgerau (1989) for a dynamic formulation.

standard neo-classical properties and factor markets are assumed to be competitive so that factors are remunerated with their value marginal product. [ $L$  stands for labor,  $K$  for sector-specific capital, roman superscripts indicate the sectors.]

One sector may use the environment as an additional input to its production process; according to the considerations made in section 2 we assume it to be the export sector. We do not specify this use of the environment here; it can take a variety of forms such as the right to emit pollutants within specified limits in the production process, or other negative externalities like noise pollution, the use of natural resources (water, woods) for industrial purposes etc. All that matters is that this use can be restricted by environmental standards set by a regulating body, i.e. the government, and that it produces negative externalities. Hence the sectoral outputs are given by

$$x^I = g(E) f^I(K^I, L^I) \quad \text{and} \quad x^II = f^{II}(K^{II}, L^{II}), \quad (1)$$

where  $x$  denotes the output of the respective sectors and  $f_K, f_L > 0; f_{KK}, f_{LL} < 0$ . (Subscripts of functions refer to partial derivatives.) The use of the environment increases the individual firm's productivity, however at a diminishing rate. If the environment must not be exploited at all, the term  $g(E)$  vanishes: our set-up contains the standard specific factors model as a boundary case. Hence,  $g(E)$  has the following properties:  $g(0) = 1, g_E > 0, g_{EE} < 0$ .<sup>10</sup> The import-competing good serves as numeraire,  $p$  denotes the relative price of the export good. The maximization problem of the economy's production sector as a whole can now be formulated as follows:

$$\max_{L^I, L^{II}, E} \{ p x^I + x^{II}; x^I = g(E) f^I(K^I, L^I), x^{II} = f^{II}(K^{II}, L^{II}), E \leq \bar{E}, \bar{L} = L^I + L^{II} \} \quad (2)$$

$\bar{L}$  stands for the economy's total labor force,  $\bar{E}$  gives the maximum use of the environment per period of time. For now, we will regard it as exogenously set by the government; in the next section we will endogenize it as a result of a political optimization process. We model quantitative restrictions rather than taxes, because they are much more prevalent in real life for political-economic reasons (Buchanan/Tullock, 1975). The maximization yields the following standard relations:

$$p g(E) f_L^I = f_L^{II} = w \quad (3)$$

---

<sup>10</sup>We attribute the gain in productivity to both factors of production; the complaints of employers as well as of unions that too harsh environmental standards will jeopardize employment point in this direction. Our conclusion would yet continue to hold if environmental use would have only a capital augmenting impact: wage rates would rise along with the rental rates of the capital specific to sector  $I$  because labor has become relatively scarcer.

$$d L^I = -d L^II \quad (4)$$

$$E = \bar{E}, \quad (5)$$

where  $w$  denotes the wage rate, which is equalized across sectors as a consequence of labor mobility. Moreover it is seen that the industry will always utilize the environment to the maximum amount possible; therefore we drop the distinction between  $E$  and  $\bar{E}$  in the subsequent analysis. Capital owners of a specific sector are residual claimants to the output. Their remuneration ( $\Pi^I$ ) is given by

$$\Pi^I = p x^I - w L^I = p g(E) [f^I(L^I, K^I) - f_L^I(L^I, K^I) L^I] \quad (6)$$

$$\Pi^{II} = x^{II} - w L^{II} = f^{II}(L^{II}, K^{II}) - f_L^{II}(L^{II}, K^{II}) L^{II}. \quad (7)$$

In order to derive the regulator's optimal policy and changes thereof we first investigate how the economy reacts to an alteration, say an increase of the environmental use, i.e. reduced environmental standards. Production in the polluting sector becomes more rewarding and therefore labor will be attracted to this sector. Output and profits will increase whereas they will decline in the second sector. The reallocation of labor can be shown by totally differentiating (3) and solving it with respect to  $d L^I / d E$ :

$$\frac{d L^I}{d E} = - \frac{g_E p f_L^I}{p g(E) f_{LL}^I + f_{LL}^{II}} > 0. \quad (8)$$

The variation of profits through reduced environmental standards is given by equations (6) and (7), differentiated with respect to  $E$  and  $L$ :

$$\Pi_E^I = p \left[ g_E (f^I - f_L^I L^I) - g(E) L^I f_{LL}^I \frac{d L^I}{d E} \right] > 0 \quad (9)$$

$$\Pi_E^{II} = -L^{II} f_{LL}^{II} \frac{d L^{II}}{d E} = L^{II} f_{LL}^{II} \frac{d L^I}{d E} < 0. \quad (10)$$

The reduction in environmental standards leaves the capitalists of the export sector better off while the import sector's capital owners are on the losing end. Labor profits from pollution. From equation (3) it follows that

$$w_E = - f_{LL}^{II} \frac{d L^I}{d E} > 0. \quad (11)$$

Obviously, there are conflicting interests of the three producer groups with regard to the level of environmental use. Since pollution creates negative externalities, those affected by it will also oppose it - they might support the party with stronger emphasis on

environmental control or lobby for environment protection through environmentalist groups. Given the fact that the use of environment *is* regulated, the question arises: how are the opposing interests aggregated in the political process to determine the environmental standards that are finally adopted? This is what we will investigate in the next section.

### 3.2 A Simple Model of Environmental Regulation

As we have seen in the previous section, the regulation of the environmental use has three effects. First, it affects productivity (in the polluting sector) and hence the national product; second, it reallocates labor and redistributes income, and determines, third, the amount of negative externalities. These different effects cause the individuals to have different interests with respect to the tightness of environmental standards - according to their capital ownership, preference (for a clean environment), and the degree to which they are affected by pollution. The regulating body setting the environmental standards consists of politicians who seek to maximize political support via their environmental policy.<sup>11</sup> Following Stigler's (1971) and Peltzman's (1976) theory of regulation, we argue that the administration maximizes the following political support function:<sup>12</sup>

$$M = M(\Pi^I, \Pi^II, \tilde{w}, E), \quad (12)$$

which we assume to be twice continuously differentiable. The two industries will increase their support for the administration as their profits rise ( $M_{\Pi^I}, M_{\Pi^{II}} > 0$ ). The unions support the administration in order to maximize the workers' payroll in real terms (which is identical to the maximization of the real wage  $\tilde{w}$ , since labor remains internationally immobile under NAFTA):  $M_{\tilde{w}} > 0$ . Since prices are held fixed for the moment, the real wage rate  $\tilde{w}$  moves along with the nominal wage rate  $w$ , so that (11) applies. Lastly, the environmentalists trade their support against the improvement of the environment as such,  $M'_E < 0$ . (The prime is used to distinguish the partial derivative of  $M$  with respect to the support of the environmentalists from the derivative of the political support

---

<sup>11</sup> We do not go into institutional details here, but note instead that general principles of environmental regulation are typically laid down in federal laws (like the Clean Air Act) and are detailed and executed by the bureaucracy like the Environmental Protection Agency, which is headed by a person appointed by the President. It is thus clear that decision makers are not independent experts, but politicians or people dependent on politicians, who maximize political support.

<sup>12</sup> Further studies on political support motives are Hillman (1982) and Hillman/Moser (1993), among others.

function with respect to  $E$ , i.e.  $M_E$ , including all arguments.)<sup>13</sup> We assume diminishing marginal support or increasing marginal opposition, respectively. This parallels the second Gossen's law of the utility theory. Moreover, like Peltzman (1976) we assume that individuals are purely self-interested and not envious. Consequently, the political support function has the following additional properties:  $M_{\Pi^I \Pi^I}, M_{\Pi^U \Pi^U}, M_{\tilde{w}\tilde{w}}, M'_{EE} < 0$  and  $M_{ij}^{(0)} = 0, \forall i \neq j; (i, j = \Pi^I, \Pi^U, w, E)$ .

The support may take on various forms which may differ between the interest groups; industries may find campaign contributions most effective whereas environmentalists may recommend the general public to cast their vote in a specified way, etc. Our model is broad enough to encompass all these channels of exerting influence on a support-maximizing administration. The administration is maximizing its support by equating support for a reduction and for an increase of environmental use at the margin, i.e.

$$M_E = M_{\Pi^I} \Pi^I_E + M_{\Pi^U} \Pi^U_E + M_{\tilde{w}} \tilde{w}_E + M'_E = 0. \quad (13)$$

This political equilibrium is dependent on the overall economic conditions; once the constraints alter, the politically optimal regulation will do the same.<sup>14</sup> In the next section we will analyze this for the case of a trade liberalization, as the removal of trade barriers is at the core of the NAFTA agreement.

### 3.3 Environmental Regulation and Trade Liberalization

Trade liberalization will alter the relative price of the export good. The abolition of import barriers will make imports cheaper domestically. If the importing country is large this removal of trade impediments will also increase the world price for the respective imports and thus raise the export prices of the country's trading partner. At any rate the relative price of exports will increase.<sup>15</sup> This will make the export sector better off - again it attracts labor from the import sector, which will find its profits squeezed. These are standard results which we will report for completeness sake. Again the differentiation of equation (3) provides the reallocation of labor

<sup>13</sup> Instead of ascribing environmental concern only to a group of environmentalists we could also assume that the individual utility functions contain personal income and environmental quality:  $U = U(\Pi(E), E)$  or  $U = U(w(E), E)$ . This formulation yields the same results on the aggregate level (e.g. if aggregated through voting), provided we assume that the utility functions exhibit diminishing marginal utility and  $U_E(E = 0) > 0$ .

<sup>14</sup> Peltzman (1976, 225-229) has shown this for cost and demand shifts faced by a monopolist. Hillman (1982) has analyzed this for trade protection of declining industries facing exogenous price shifts.

<sup>15</sup> In a multi-commodity world this is only true "on average", but not for each single export and import commodity.

$$\frac{d L^I}{d p} = -\frac{g(E) f_L^I}{p g(E) f_{LL}^I + f_{LL}^II} > 0, \quad (14)$$

and the differentiation of (6) and (7) give us the variations of profits:

$$\Pi_p^I = g(E) (f^I - f_L^I L^I) - p g(E) f_{LL}^I \frac{d L^I}{d p} > 0 \quad (15)$$

$$\Pi_p^II = f_{LL}^II \frac{d L^I}{d p} < 0. \quad (16)$$

The wage rate rises in terms of the import good, but decreases in terms of the export good so that labor's position remains ambiguous. However, Ruffin/Jones (1977) have shown that protection presumably hurts labor and thus unions should favor trade liberalization.<sup>16</sup> The reason for this presumption is that the protected import good is in excess demand and that if the workers' consumption pattern is similar to the one of the economy as a whole the effect of dearer exportables will be more than offset by cheaper import goods. Thus, we will assume that  $\tilde{w}_p > 0$ .

Given the fact that trade liberalization is agreed upon<sup>17</sup> and that it has the demonstrated distributional consequences, we inquire how the regulation of the second policy variable, the environmental standards, will change. Note at the outset that trade liberalization has the same distributional impact as increased environmental use since the US export sector is the relative polluting one. The optimal environmental standards will shift according to equation (13), which is differentiated with respect to  $p$ .

$$\frac{d E}{d p} = -\frac{M_{E p}}{M_{E E}} \quad (17)$$

We look at  $M_{E p}$  first. Recall that we excluded envy.

$$\begin{aligned} M_{E p} = & \underbrace{M_{\Pi^I \Pi^I} \Pi_p^I \Pi_E^I}_{<0} + \underbrace{M_{\Pi^I \Pi^II}}_{>0} \underbrace{\Pi_{E p}^I}_{?} + \underbrace{M_{\Pi^II \Pi^II} \Pi_p^II \Pi_E^II}_{<0} \\ & + \underbrace{M_{\Pi^II \Pi^II}}_{>0} \underbrace{\Pi_{E p}^II}_{?} + \underbrace{M_{\tilde{w} \tilde{w}} \tilde{w}_p \tilde{w}_E}_{<0} + \underbrace{M_{\tilde{w}} \tilde{w}_{E p}}_{>0} + \underbrace{M'_{E p}}_{\leq 0} \end{aligned} \quad (18)$$

<sup>16</sup> This is of course not true for highly specialized labor, which we will regard as human capital specific to the respective sector. In that case unions representing these specific employees will side with the capitalists of their sector. See Magee (1980) for empirical evidence.

<sup>17</sup> We will not investigate the political reasons for the agreement on NAFTA as such rather take it as given. Moser (1990) provides a political-economic rationale for mutual trade liberalization.

We have signified the terms already calculated. Environmentalists are assumed to be interested exclusively in the quality of the environment ( $M'_{Ep} = 0$ ); if they anticipate a deterioration of the environmental quality following the specialization caused by a trade liberalization, they will oppose it, i.e.  $M'_{Ep} < 0$  (see section 2). The signs of the remaining terms in eqs. (18) and (19),  $(\Pi^i_{Ep}, \Pi^i_{EE}, \tilde{w}_{Ep}, \tilde{w}_{EE}, i = I, II)$ , are indeterminate without assumptions on the third derivatives of the production function with respect to labor. This is a problem constantly faced by economists analyzing optimal policy when factors are paid their marginal product.<sup>18</sup>

However it is reasonable to assume that  $\Pi_{EE}, \tilde{w}_{EE}$  are negative. For example, in determination of  $\Pi^I_{EE}$  two forces are at work. The increased use of the environment enhances productivity at a diminishing rate as  $g_{EE} < 0$ , thereby tending to make  $\Pi^I_{EE}$  negative. On the other hand, labor is attracted to the first sector which tends to increase profits as capital becomes scarcer. But as the environment is constantly deteriorating labor is likely to be dragged into the polluting sector at diminishing rates since it is becoming increasingly scarce in the second sector. This is because the sector-specific capital in the second sector remains constant and the production function exhibits positive, but diminishing marginal products. As the export sector in the US is sizeable the reallocation of labor will perceptibly dwindle as the environmental standards are being reduced. This will probably render the overall effect negative as the described first effect more than offsets the second. Since the increase in the relative price and in environmental use work in the same direction, they trigger a similar adjustment mechanism. But even if  $\Pi^I_{Ep}$  were positive (which we cannot exclude in a rigorous manner), it is highly unlikely that  $M_{Ep}$  will become positive: The increase of profits in the export sector would have to be so extraordinary that it would not only overcompensate the declining marginal political support from increased profits, but also more than offset the increasingly fierce opposition by the import sector and the environmentalists. As discussed earlier, the stake of the mobile factor ( $\tilde{w}_{Ep}$ ) will generally tend to be small. For these reasons we conclude that  $M_{Ep} < 0$ . In other words, the increase of political support due to a lowered environmental control diminishes if the price rises along with the environmental use. This is not surprising since both changes favor the same groups that are increasingly satisfied, displaying diminishing marginal gratitude in terms of political support, whereas the groups placed at a disadvantage will become increasingly worried.

---

<sup>18</sup> In principle there are two ways out: In a related context Hillman (1982, fn 14, 15) and Hillman/Moser (1993) simply assume analogous properties to hold. Rauscher (1991, eq. 16) sets the third derivatives equal to zero. Although this is not without justification, we have chosen not to follow this path but present the problem in the most general way and discuss which scenario will be most likely.



By the same token the second derivative of the political support function with respect to the environmental use, equation (19), will be negative. In fact this is the condition for the existence of the political equilibrium, i.e. an interior maximum of the political support function. We observe that the use of the environment *is* restricted in real life - this provides a second justification for (19) to be negative.

$$\begin{aligned}
 M_{EE} = & M_{\Pi' \Pi'} (\Pi'_E)^2 + M_{\Pi' \Pi''} \Pi'_{EE} + M_{\Pi'' \Pi''} (\Pi''_E)^2 \\
 & + M_{\Pi''} \Pi''_{EE} + M_{\tilde{w}\tilde{w}} \tilde{w}_E^2 + M_{\tilde{w}} \tilde{w}_{EE} + M'_{EE}
 \end{aligned}
 \tag{19}$$

Hence, we can conclude that equation (17) will have a negative sign.<sup>19</sup> The environmental standards will become more restrictive as a consequence of the removal of trade barriers. Trade liberalization benefits the exporting and polluting sector and labor and hurts the clean import sector. In order to re-establish a political support-maximizing equilibrium, the regulator will trade off some of this gain to the suffering second sector by tightening up the environmental control. This reduces the scope of income redistribution and the reallocation of labor, and additionally ensures the regulator increased political support by the environmentalists. It is the windfall gain for the exporting sector and labor from liberalization that makes the shift in environmental policy possible. At the same time it makes this shift necessary. In order to re-equate marginal political support, the regulator must partly reallocate additional gains originally accruing to a specific group to the other groups involved as the marginal political support is decreasing.

#### 4. Concluding Remarks

This paper suggests that the studies on the overall environmental impacts of NAFTA are seriously biased, overestimating the deterioration of the environment in the USA. The reason for this is that they fail to take into account the political process that determines the degree of environmental control. Although the indications are that the structural shift due to NAFTA will tend to increase the pollution in the US, it will not increase as much as predicted. The endogenous policy reaction may even reverse the impact of NAFTA on the environment. A political support-maximizing administration will trade off some of the gains from trade liberalization accruing to the export sector and to labor to the losers of removed protection, i.e. the owners of factors specific to the import sector. This is affected through a tightened environmental control, which will tend to place the export sector, which pollutes at a relatively higher level, and labor at a disadvantage and to foster the clean import sector. In doing so the administration will additionally increase its

---

<sup>19</sup>Note that respectively  $w_E$  and  $\tilde{w}_E$ , or  $w_{EE}$  and  $\tilde{w}_{EE}$  are identical up to a scaling factor.

political support from the environmentalists (or reduce their opposition to NAFTA). Indeed the agreement itself and its environmental side-agreement provide first indications that the administration is striving for increased environment protection: the administration has bound itself to spend 1 bn US \$ (Salinas-León 1993, 30) in the "border plan" and to set up an Environmental Protection Commission to coordinate technical assistance.

## References

- Albert, M./H.-J. Vosgerau (1990), Mobility, a Theoretical Analysis of the Key Factors of Structural Differences, in: Molle, W./ A. van Mourik (eds.), *Wage Differentials in the European Community: Convergence or Divergence?*, Avebury, Aldershot et al., 21-41.
- Anderson, K. (1993), *Economic Growth, Environmental Issues and Trade*, Discussion Paper No. 830, London, Centre for Economic Policy Research.
- Anderson, K. (1992), Effects on the Environment and Welfare of Liberalizing World Trade: The Cases of Coal and Food, in: Anderson, K./ R. Blackhurst (eds.), *The Greening of World Trade Issues*, New York, Harvester Wheatsheaf, 145-172.
- Barrett, S. (1991), Optimal Soil Conservation and the Reform of Agricultural Pricing Policies, *Journal of Development Economics*, 36, 167-187.
- Bartsch, E./M. Rauscher and I. Thomas (1993), Environmental Legislation and the Impact of Lobbying Activities, Working Paper 562, Kiel, Kiel Institute of World Economics.
- Brown, D./A. Deardorff and R. Stern (1992), A North American Free Trade Agreement: Analytical Issues and a Computational Assessment, *World Economy*, 15, 11-29.
- Buchanan, J./G. Tullock (1975), Polluters' Profits and Political Response: Direct Control versus Taxes, *American Economic Review*, 65, 139-47.
- Buchanan, J./V. Vanberg (1988), The Politization of Market Failure, *Public Choice*, 57, 101-13.
- Dean, J. (1992), Trade and Environment: A Survey of the Literature, in: Low, P. (ed.), *International Trade and the Environment*, World Bank Discussion paper Washington, D.C.
- Downing, P. (1981), A Political Economy Model of Implementing Pollution Laws, *Journal of Environmental Economics and Management*, 8, 255-71.
- Grossman, G./A. Krueger (1993), Environmental Impacts of a North American Free Trade Agreement, in: P. Garber (ed.) *The US-Mexico Free Trade Agreement*, Cambridge/MA, MIT Press.
- Hettige, H./R. Lucas and D. Wheeler (1992), The Toxic Intensity of Industrial Production: Global Patterns, Trends, and Trade Policy, *American Economic Review*, 82, Papers and Proceedings, 478-81.
- Hahn, R. (1990), The Political Economy of Environmental Regulation: Towards a Unifying Framework, *Public Choice*, 65, 21-47.
- Hillman, A. (1982), Declining Industries and Political-Support Protectionist Motives, *American Economic Review*, 72, 1180-7.
- Hillman, A./P. Moser (1993), Trade Liberalization as Politically Optimal Exchange of Market Access, Bar-Ilan University/Tel Aviv and St. Gallen University/ St. Gallen, mimeo.
- Jones, R. (1971), A Tree-Factor Model in Theory, Trade and History, in: J. Bhagwati et al. (eds.), *Trade, Balance of Payments and Growth*, Papers on International Economics in Honor of Charles Kindleberger, Amsterdam; North-Holland, 3-21.

- Leidy, M./ B. Hoekman (1994), 'Cleaning Up' While Cleaning Up: Pollution Abatement, Interest Groups and Contingent Trade Policies, *Public Choice*, **78**: 241-258.
- Low, P. (1992), Trade Measures and Environmental Quality: The Implications for Mexico's Exports, in: Low, P. (ed.), *International Trade and the Environment*, World Bank Discussion Paper, Washington, D.C., World Bank, 105-120.
- Markandya, A./R. Richardson (1990), The Debt Crisis, Structural Adjustment, and the Environment, London: London Environmental Economics Centre, mimeo.
- Merryfield, J. (1988), The Impact of Selected Abatement Strategies on Transnational Pollution, the Terms of Trade, and Factor Rewards: A General Equilibrium Approach, *Journal of Environmental Economics and Management*, **15**, 259-284.
- Magee, S. (1980), Three Simple Tests of the Stolper-Samuelson Theorem, in: Oppenheimer, P. (ed.), *Issues in International Economics*, Oriel, Stockfield, pp. 138-153.
- Moser, P. (1990); *The Political Economy of the GATT*, Grösch, Verlag Rüegger.
- Mussa, M. (1982), Imperfect Factor Mobility and the Distribution of Income, *Journal of International Economics*, **12**, 125-41.
- Peltzman, S. (1976), Toward a More General Theory of Regulation, *Journal of Law and Economics*, **19**, 211-40.
- Rauscher, M. (1991), National Environmental Policies and the Effects of Economic Integration, *European Journal of Political Economy*, **7**, 313-329.
- Richardson, M. (1993), Endogenous Protection and Trade Diversion, *Journal of International Economics*, **34**, 309-24.
- Ruffin, R. /R. Jones (1977), Protection and Real Wages: The Neoclassical Ambiguity, *Journal of Economic Theory*, **14**, 337-348.
- Salinas-León, R. (1993), Green Herrings, NAFTA and the Environment, *Regulation*, **16**, 29-34.
- Stigler, G. (1971), The Theory of Economic Regulation, *Bell Journal of Economics and Management Science*, **2**, 3-21.
- Tobey, J. (1990), The Effects of Domestic Environmental Policies on Patterns of World Trade: an Empirical Test, *Kyklos*, **43**, 191-209.
- Ursprung, H. (1992), The Political Economy of Environmental Decision Making. Working Paper Series II, No. 176, Department of Economics and Statistics, University of Konstanz.
- van Grasstek, C. (1992), The Political Economy of Trade and the Environment in the US, in: Low, P. (ed.), *International Trade and the Environment*, World Bank Discussion Paper, Washington, D. C., World Bank, 227-44.
- Weck-Hannemann, H. (1994), Die politische Ökonomie der Umweltpolitik, in: Bartel, R./ F. Hackl (eds.), *Einführung in die Umweltpolitik*, München, Vahlen, forthcoming.

Weintraub, S. (1992a), US-Mexico Free Trade: Implications for the United States, *Journal of Interamerican Studies and World Affairs*, 34, 29-52.

Weintraub, S. (1992b), Modelling the Industrial Effects of NAFTA, in: Lustig et al. (eds.), *North American Free Trade: Assessing the Impact*, Washington, D.C., Brookings Institution, 109-43.

## Appendix: Pollution Content of US Trade

SIC - Listing	US Export	Estimated	Increase	US Imports	Estimated
	World	US Exports	Exports	World	US Imports
	1000 \$	%	1000 \$	1000 \$	%
food, kindred products	18837,000	1,870	352,252	15210,000	1,710
textiles	2794,000	7,730	215,976	7294,000	0,230
apparel+related products	2349,000	10,010	235,135	22841,000	1,470
lumber+related products	6050,000	1,920	116,160	5848,000	0,860
furniture and fixtures	1011,000	9,800	99,078	5148,000	3,580
paper + allied products	8126,000	2,350	190,961	11880,000	0,090
printing + publishing	2598,000	1,700	44,166	1807,000	0,170
chemicals+allied products	35825,000	3,730	1336,272	20118,000	-0,480
petroleum and coal prod.	5019,000	-0,050	-2,509	11979,000	0,520
rubber+misc.plastics prod.	5010,000	6,150	308,115	9488,000	0,540
leather + leather products	1131,000	1,160	13,120	9837,000	1,930
stone + clay	1008,000	4,830	48,686	3926,000	0,730
glass	1129,000	-1,910	-21,564	1770,000	57,640
iron + steel	3644,000	6,490	236,496	11549,000	1,510
nonferrous metals	4775,000	-0,890	-42,498	11073,000	5,320
fabricated metal products	9117,000	6,020	548,843	11568,000	2,710
machinery, excl.electrical	55524,000	3,940	2187,646	54051,000	0,010
electric+electronic mach.	32718,000	1,840	602,011	55361,000	9,970
transportation equipment	56875,000	-0,180	-102,375	87972,000	2,130
misc.manufactured commod.	21880,000	4,050	886,140	35208,000	-0,760
Total	275420,000		7252,111	393928,000	
average ECC in % of Output	0,471		0,494	0,461	

<b>Appendix continued</b>						
SIC - Listing	Increase	ECC	ECC	ECC	ECC	ECC
	Exports	Abatement	in 1000 \$	in 1000 \$	in 1000 \$	in 1000 \$
	1000 \$	Cost in %	of Exports	of increase	of Imports	of increase
		of Output		US Exports		US Imports
food, kindred products	260,091	0,330	62,162	1,162	50,193	0,858
textiles	16,776	0,540	15,088	1,166	39,388	0,091
apparel+related products	335,763	0,540	12,685	1,270	123,341	1,813
lumber+related products	50,293	0,330	19,965	0,383	19,298	0,166
furniture and fixtures	184,298	0,300	3,033	0,297	15,444	0,553
paper + allied products	10,692	1,100	89,386	2,101	130,680	0,118
printing + publishing	3,072	0,140	3,637	0,062	2,530	0,004
chemicals+allied products	-96,566	1,180	422,735	15,768	237,392	-1,139
petroleum and coal prod.	62,291	1,530	76,791	-0,038	183,279	0,953
rubber+misc.plastics prod.	51,235	0,300	15,030	0,924	28,464	0,154
leather + leather products	189,854	0,240	2,714	0,031	23,609	0,456
stone + clay	28,660	0,700	7,056	0,341	27,482	0,201
glass	1020,228	0,700	7,903	-0,151	12,390	7,142
iron + steel	174,390	1,120	40,813	2,649	129,349	1,953
nonferrous metals	589,084	1,120	53,480	-0,476	124,018	6,598
fabricated metal products	313,493	0,480	43,762	2,634	55,526	1,505
machinery, excl.electrical	5,405	0,180	99,943	3,938	97,292	0,010
electric+electronic mach.	5519,492	0,350	114,513	2,107	193,763	19,318
transportation equipment	1873,804	0,280	159,250	-0,287	246,322	5,247
misc.manufactured commod.	-267,581	0,220	48,136	1,950	77,458	-0,589
						0,000
Total	10324,772	US industrial average 0,54	1298,081	35,832	1817,217	45,410
average ECC in % of Output	0,440					

ECC data are taken from Low (1992), estimated trade changes from Brown/Deardorff and Stern (1992) and US trade data from the Statistical Abstract of the US (1991) and the International Trade Statistics Yearbook (1991). To make data compatible we reclassify some sectors between SIC and SITC listings. For textiles and apparel we apply the ECC industrial average because sectoral data are not available.