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**R E S E A R C H P A P E R**

“Push” and “Pull” Impacts of NAFTA on  
Environmental Responsiveness and  
Performance in Mexican Industry

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One of the debates surrounding the implementation of the North American Free Trade Agreement (NAFTA) in January 1994 was the disparity in environmental standards between the U.S., Canada, and Mexico. The U.S. environmental community successfully pushed for NAFTA to include environmental side agreements designed to strengthen environmental regulation in Mexico. One goal of these side agreements was to improve environmental performance in Mexico through increased regulatory pressures on manufacturing firms operating in Mexico.

One would expect that increased regulatory pressures would “push” companies to improve industrial performance. However, we propose that NAFTA also impacts industrial environmental performance through increased trade opportunities. We expect that Mexican firms selling to U.S. and Canadian customers would manage environmental performance more aggressively than those firms only selling within Mexico, as the stronger environmental cultures of the U.S. and Canada create a “pull” effect on Mexican companies.

### **Key Results**

Using data from 221 Mexican manufacturing sites, we provide evidence that both the “push” effect of regulatory influence and the “pull” effect of market pressures were significantly associated with industrial environmental responsiveness, and that degree of environmental responsiveness is positively and significantly associated with environmental performance outcomes. Therefore, we conclude that NAFTA has exerted a positive influence on industrial environmental performance in Mexico.

Furthermore, we contribute evidence of the *relative* influence of regulatory and market pressure. In our sample, market forces were significantly more influential than regulatory influence, and led to a much stronger impact on environmental responsiveness. This finding contributes new evidence of the potential impact of trade agreements.

### **Introduction**

The North American Free Trade Agreement (NAFTA), implemented between the U.S., Canada, and Mexico effective January 1994, was a leading impetus for change in the world of Mexican business (Case 1999). The NAFTA agreement created the world’s largest free-trade area, and since its implementation trade between the U.S., Canada, and Mexico has increased substantially. Mexican imports to the U.S. and Canada almost tripled between 1993 and 1999, from \$44,658 million in 1993 to \$123,114 million in 1999 (ENEI, 2002). NAFTA also represented “the most environmentally-conscious trade pact” (Hufbauer *et al.* 2000, page 5) in the world. The NAFTA environmental framework, commonly referred to as the NAFTA side agreement, was created through NAFTA provisions and the North American Agreement on Environmental Cooperation (NAAEC). The intent of the NAFTA environmental framework was to harmonize health and safety regulations, environmental standards and enforcement of environmental laws between the U.S., Mexico and Canada. Prior to NAFTA, the environmental regulatory climates in the U.S. and Canada were strong compared to that of Mexico. Therefore, the greatest impact of these agreements on environmental management practices and performance would be exerted on Mexican companies.

By agreeing to NAFTA, the Mexican government caused Mexican firms to face additional pressures related to environmental management practices and performance. The purpose of this study is to analyze the NAFTA impact on Mexican environmental management

responsiveness and performance at the level of the manufacturing facility. Our conceptual model (Exhibit 1) proposes that the environmental provisions contained in the NAFTA and NAAEC exerted both a “push” pressure and a “pull” pressure on Mexican firms’ environmental responsiveness. The “push” pressure was exerted through NAFTA’s influence on Mexican environmental regulation. As a consequence of NAFTA participation, environmental management priorities were heightened in the Mexican government. New oversight agencies were created, new laws were passed, and enforcement procedures were strengthened. The “pull” pressure was exerted through NAFTA’s impact on Mexican exporting opportunities to the U.S. and Canadian markets. Customers in the U.S. and Canada, including both supply chain partners and final consumers, compelled Mexican manufacturers to satisfy their environmental management criteria, which were historically, legally, and culturally more demanding than Mexican criteria. We test the conceptual model using facility-reported measures of regulatory influence, exporting patterns, management practices, and environmental compliance (Exhibit 2).

Exhibit 1. Conceptual Model.

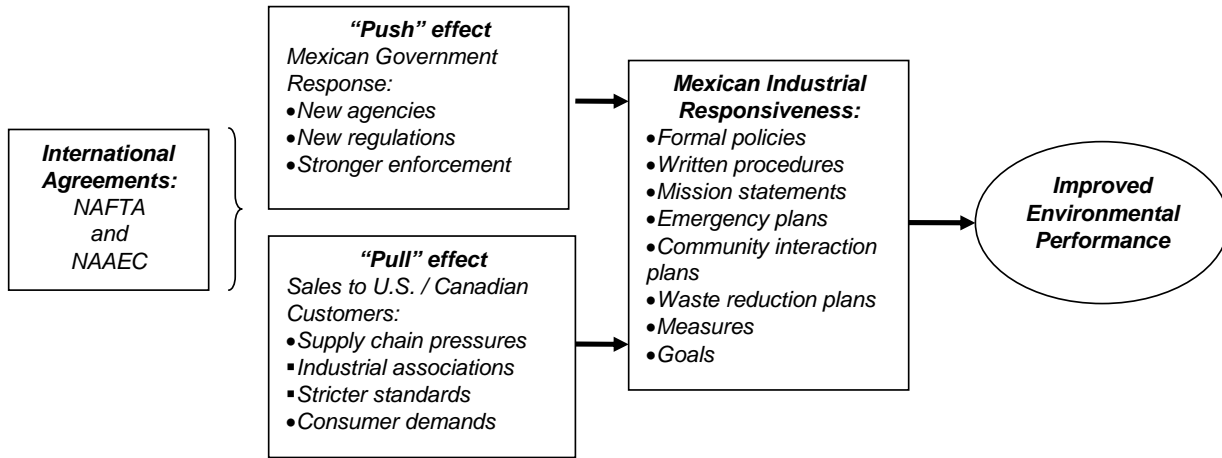
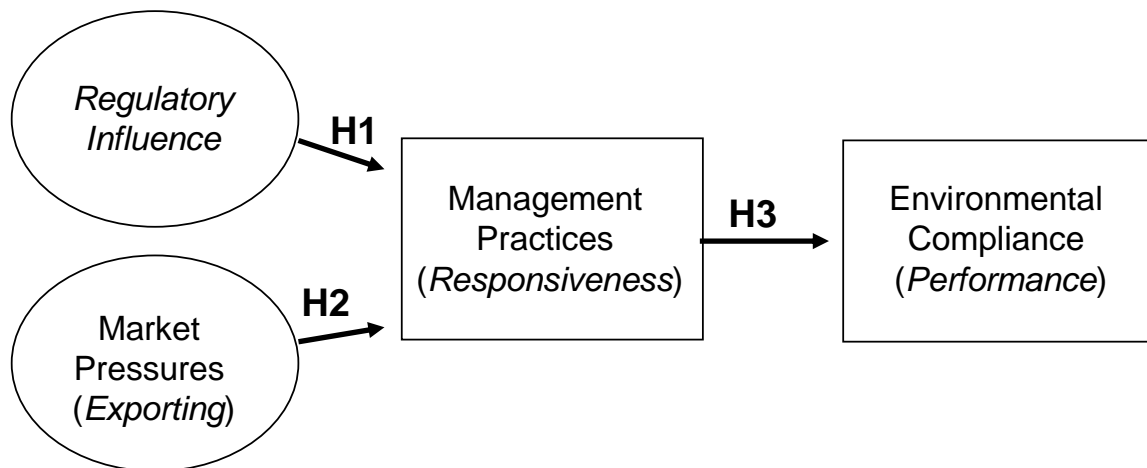


Exhibit 2. Empirical Model.



Our results demonstrate that both regulatory pressure and exporting to customers located in the U.S. and Canada positively impacted environmental management practices, which in turn positively impacted environmental performance. We therefore conceptually and empirically demonstrate a link between NAFTA and improved environmental performance in Mexican industry. We also empirically demonstrate that market pressures exerted more relative influence than regulatory pressures, and that market pressures resulted in a stronger environmental management responsiveness.

Although focused on changes in environmental management practices brought about by NAFTA, this study has implications for the management of environmental performance in economies across the globe. It contributes to the body of environmental management literature by demonstrating that *customer* pressure is a more effective impetus for managing industrial environmental performance, when those customers are located in countries with stronger environmental standards and cultures. This finding has potential policy-level implications for the evaluation of future trade agreements.

The remainder of the paper is organized as follows. In the next section we discuss relevant theory, briefly review previous research findings, and develop our hypotheses. The methods section describes the data and analytical methods. We then report the results and conclude with a discussion of those results.

### **Theoretical Development**

Contingency theory (Lawrence/Lorsch 1967) proposes that organizational performance results from the alignment of organizational dynamics with external pressures, which are perceived as potential opportunities or threats to the firm. Consistent with contingency theory, Aragon-Correa and Sharma (2003) argue that uncertainties in the general business environment increase the likelihood that firms will develop a proactive environmental strategy, which will be associated with competitive advantage. We describe below the changing business environment faced by Mexican industry as a result of NAFTA, and how Mexican firms reacted to the perceived opportunities/threats by changing their organizational dynamics leading to performance outcomes.

The resource-based view (RBV) of the firm (Barney 1986, 1991) focuses on how organizations develop unique capabilities that create competitive advantage. The RBV literature says that companies achieve strategic advantage through the development of resources that are value creating, rare, and difficult to imitate. A successful proactive environmental strategy is comprehensive and strategically complex, entailing the coordination of work across functional capabilities and is embedded in the culture of an organization (Buysse and Verbeke 2004). Environmental strategies impact the culture, the operational characteristics, and the longer term image and reputation of the organization, leading to capabilities that are not easily imitated by competitors.

In Nehrt's (1998) typology of environmental culture, the culture in Mexico prior to the mid-1990s could be best described as falling between no effective regulation to one containing some elements of command and control. Environmental protection standards were fragmented, government monitoring resources were low, and enforcement of the existing laws was inconsistent. The first Mexican environmental law was passed in 1971; however, enforcement

was limited and over the next two decades fewer than 2,000 inspection visits were made to Mexican companies (PROFEPA 2000).

In the early 1990s the Mexican government responded to increasing international and domestic pressures for stronger environmental oversight (Logsdon/Husted 2000, Rugman/Verbeke 1998a). Strong influence was exerted by the U.S. environmental community to demand that NAFTA represent a “green” U.S.-Canada-Mexico trade pact (Esty 1994). NAFTA and the NAAEC side agreement put intense pressure on the Mexican government to strengthen the implementation and enforcement of Mexican environmental regulations. Mexican regulatory changes included the creation of an environmental oversight agency in 1992, PROFEPA (Procuraduria Federal de Proteccion al Ambiente). In 1994, environmental oversight was elevated to a secretariat-level agency, SEMARNAP (Secretariat of Environment, Natural Resources, and Fisheries). These changes strengthened the coordination and control of Mexico’s environmental protection and regulation efforts. In contrast to the fewer than 2,000 regulatory inspections conducted between 1971 and 1992, between 1995 and 1998 PROFEPA performed 50,000 inspections (Hufbauer et al. 2000). In 1996, the Mexican legislature reformed the General Law of Ecological Equilibrium and Protection of the Environment, strengthening the control of hazardous wastes, increasing criminal penalties, and creating a public database of pollution and violations data (Logsdon/Husted 2000).

Selden and Song (1994) argue that changes in government regulation will lead to eventual improvements in environmental quality. At a macro level, Esty and Porter (2000) used a cross-section of data from 53 countries to demonstrate a positive association between a country’s environmental regulatory regime, environmental performance outcomes, and economic performance. At the firm level, Porter/van der Linde (1995) posit that increased environmental regulation creates pressures that motivate firms to change their behavior, thereby driving a proactive environmental response. The “Porter Hypothesis” is that environmental regulation signals firms about likely inefficiencies, raises the likelihood that environmental improvements and innovations will occur, and that the costs of these innovations will be offset by the competitive advantages that they create. The impact of regulatory pressures on a firm’s degree of environmental responsiveness has been widely discussed for firms in developed economies (Ramus/Steger 2000; Berry /Rondinelli 1998; Henriques/Sadorsky 1996; Hutchinson 1996).

Companies invest in “green” capabilities because environmental regulations are viewed as having a complementary impact on industrial performance, thereby creating a “win/win” outcome for the firm (Rugman/Verbeke 1998b). However, this “win/win” view is not universally held. Jenkins *et al.* (2002) describes two diametrically-opposed positions. *Optimists* are those who subscribe to the “win/win” view, pointing out that adhering to stricter controls benefits the firm through a reduction in costs associated with waste handling, cleanup, packaging choices, natural resource utilization, and potential fines, penalties and legal expenses. Companies may also generate revenues through the recycling of products and other resources, from the sale of “green” products, and may benefit from the reputational impacts of good environmental performance. *Pessimists*, or those that subscribe to a cost-based view, believe that regulation diverts internal resources from potentially higher-value projects. Companies are forced by regulation to spend management, physical, and financial resources on controlling environmental outcomes, instead of creating value and enhancing profitability through alternative initiatives.

Despite the on-going debate of the impact of environmental regulation on firm profitability, recent studies show that environmental regulation does impact environmental

management at the firm level. In a study of Canadian firms, Henriques and Sadorsky (1996) identified government regulation as the single most important source of pressure on environmental responsiveness at the firm level. Husted/Rodriguez (1998) report that stricter environmental laws had a strong impact on multinational firms' environmental investment decisions in a field study of 44 firms operating in Mexico. Buysse and Verbeke (2003) report that regulatory pressure is positively associated with firms pursuing a pollution prevention strategy in a sample of Belgian companies.

In this study of environmental responsiveness in Mexican industry, we hypothesize that manufacturing facilities experiencing stronger environmental regulatory pressures are likely to be more proactive toward managing environmental performance. Facilities facing stronger regulatory pressures will be more likely to have formal plans and procedures in place to manage environmental performance. They will be more likely to interact with community stakeholders that care about environmental performance. Implicit in this argument is that firms take actions and employ resources when the benefits of doing so outweigh the costs of the actions. Facilities that face strong regulatory pressures are more likely to self-regulate their own operations, because the costs of poor environmental performance include additional inspections, penalties, and even closure of plants if they do not comply with regulatory standards. Additionally, they may also benefit by reducing waste and other environmental costs in the organization.

We hypothesize that firms that perceive the strongest regulatory pressures will take more environmental management actions, while firms that perceive lesser degrees of pressure will take fewer actions.

Hypothesis 1. Degree of regulatory pressure will be positively associated with degree of environmental responsiveness in industrial facilities.

Freer trade stimulates prosperity, which creates the opportunity to devote additional resources to environmental protection (Esty 1994). Free trade also facilitates the transfer and adoption of innovation, knowledge, and best practices (Beghin/Potier 1997). Rugman *et al.* (1999) argue that although NAFTA has the potential to increase trade between Mexico and the U.S., the stricter environmental standards in the U.S. market create a "defense" mechanism to increasing Mexican imports, and that Mexican firms need to change their environmental management strategies in order to effectively compete. One strong impact of the NAFTA agreement has been increased trade between the three NAFTA countries, with Mexico experiencing the largest increase in trade. Between 1993 and 1999, Mexican imports to the U.S. and Canada almost tripled (ENEGI 2002).

The impact of increased trade between Mexico and the rest of North America on Mexican environmental performance has been debated. Some U.S. environmental groups have argued that increased trade would lead to industrial growth in Mexico, further taxing the Mexican environmental infrastructure; however, there is some evidence that as per capita income rises above a certain level, environmental performance improves (Grossman/Krueger 1992; Esty 1994 and 2001; Hufbauer *et al.* 2000). The "pollution haven" argument claims that countries with lower environmental standards will attract corporations that pollute more; however, this argument lacks theoretical (Esty 2001) or empirical (Antweiler *et al.* 2001; Dowell *et al.* 2000; Rugman/Verbeke 1998b) support. In a study of 89 multinational corporations operating in developing countries, Dowell *et al.* (2000) reported that two-thirds of the companies adhered to standards that were stricter than the local regulations. The "self regulation" theory suggests that

firms will self regulate their environmental management practices when non-governmental stakeholders exert pressures to do so (Christmann 2004). The likelihood of self regulation is especially strong in developing economies where regulatory pressures are relatively low.

Customers play a lead role in exerting pressure on suppliers for improved environmental performance (Walton/Handfield 1998). Rugman and Verbeke (1998b) link regulatory environment and customers by demonstrating that the relevant corporate environmental regulations are those of the country of the *foreign* customer, rather than those of the host country. Lundan (2004) further suggests that the role of consumers must be separately and explicitly considered, in addition to the role of regulation. In one of the few empirical studies focused on the influence of market pressures on environmental performance, Christmann and Taylor (2001) found that Chinese firms selling to customers from industrialized countries had better environmental performance and that exporting positively related to a firm's likelihood of adopting international environmental management standards.

NAFTA created enormous opportunities for Mexican firms to increase trade with U.S. and Canadian firms. Realizing these opportunities would depend upon the ability of the Mexican firms to meet the demands and expectations of the U.S. and Canadian customers. Because the U.S. and Canadian customers were located in jurisdictions with stronger environmental regimes (Esty/Porter 2000) and a stronger environmental culture (Nehrt 1998), we would expect that Mexican facilities that export to U.S. and Canadian customers to be more environmentally responsive than those facilities only selling their products within Mexico.

Hypothesis 2 – Facilities that export to U.S. and Canadian customers will be more responsive to managing environmental performance.

In the management control literature, planning forms part of the boundary system of the organization, establishes an *ex ante* form of control, and is a key mechanism used to convey strategic agendas and to influence the organization (Simons 1994; Langfield-Smith 1997). Shrivastava (1995) notes that theorists have paid little attention to how corporations can be reformed, redesigned, and restructured to achieve sustainability and improve environmental performance. This requires a focus on the organizational processes, systems, and coordinating mechanisms to implement and support the environmental strategy (Gabel/Sinclair-Desgagné 1998/1999; Cordano/Frieze 2000; Sharma/Vredenburg 1998; Christmann 2000). Developing a formal set of procedures and policies, or an environmental plan, increases self-regulation and is a fundamental part of implementing an effective environmental strategy (Berry/Rondinelli 2000; Henriques/Sadorsky 1996). Ramus and Steger (2000) found that having a published environmental plan tripled the probability of employees becoming more involved in corporate environmental strategy initiatives. Although there has been some debate about what kind of environmental plan is best, Steger (2000) found no significant performance effects from using a company-defined environmental plan versus using a certified planning process such as the International Standardization Organization's ISO 14001 or the European Union's Environmental Management and Auditing System. What makes a difference is that a company takes a systematic and comprehensive approach to environmental management. The elements that companies include in their environmental plans vary from perhaps only having a mission statement, to having plans and procedures identified to prevent or respond to specific environmental challenges, to incorporating measures and goals into the planning process. We would expect that firms that include more environmental planning elements into their



management practices would achieve better performance than firms that only, for example, included a mission statement.

Dasgupta, Hettige, and Wheeler (2000) previously reported that Mexican facilities with an environmental plan were more likely to be in compliance with Mexican environmental regulations<sup>i</sup>. Our analysis extends Dasgupta *et al.* by proposing a positive relationship between degree of planning and level of environmental performance achieved. That is, the best performing facilities will be the ones that have more comprehensive environmental management plans, and that the worst performing facilities do the poorest job in terms of planning.

Hypothesis 3 – Facilities with more comprehensive plans will achieve better environmental performance.

## **Methods**

### *Sample*

Data for this study comes from an extensive study into corporate environmental practices undertaken by World Bank researchers in conjunction with a number of Mexican government and academic partners. A team of World Bank researchers collaborated with the SEMARNAP and the Mexican Association of Industries to develop a detailed survey of Mexican manufacturing facilities environmental performance practices and outcomes. In 1995, a research team from the Monterrey Institute of Technology (Instituto Tecnológico y de Estudios Superiores de Monterrey - ITESM) visited 236 Mexican manufacturing facilities and conducted structured interviews in Spanish<sup>ii</sup> with management and operational personnel in each plant. The data collected included facility characteristics, sales and marketing information, organizational systems and structures, operational data, and environmental systems and outcome data. Confidentiality agreements between the research team and the plants participating in the study precluded the researchers from specifically identifying any of the plants or personnel interviewed.

The 236 facilities participating in the in-depth interviews were from four industry groups estimated to account for 75% to 95% of Mexico's total industrial pollution; they were located in Mexico's main industrial corridors. We eliminated the responses from 15 facilities with missing data, resulting in a sample of 221 facilities. The distribution of the sample by industry sector was as follows: food (27%), chemicals (26%), non-metallic minerals (21%), and metals (26%). Large facilities with over 250 employees accounted for 29% of the sample; small facilities with less than 100 employees accounted for 39% of the sample. All data collected was focused on the facility, or plant level. Data related to facility and overall firm profitability were not collected by the researchers.

## **Measures**

The variables used in our data analysis were generated directly from the survey and interview responses: Regulatory influence – Participants were asked how much influence required regulations have had on their environmental actions (none, little, some, definite, very definite). Exporting – Mexican sales only; exports to U.S. / Canada. Responsiveness – Based on the ISO 14001 international environmental certification standard, respondents were asked about the use of eight planning and procedural elements in their facilities. These included having a formal environmental management policy with written procedures, mission statement, plans and procedures for emergencies, community interaction plans, procedures beyond compliance,

measures and goals, and waste reduction plans. “Low” responders were those firms (33% of sample) employing 0 – 2 elements; “moderate” responders (35% of sample) employed 3 – 5 elements; “high” responders (32% of sample) employed 6 – 8 elements. Performance – Respondents characterized their plant’s environmental performance among one of five dimensions (reverse coded): 1) It’s rare that we comply with MX regulation; 2) We normally do not comply with MX regulations; 3) We normally comply with MX regulations; however, sometimes we miss in specific areas; 4) We consistently comply with MX environmental regulations; 5) We exceed the required regulations and have a world-class environmental program. Size was used as a control variable – Respondents were classified according to number of employees (small: < 100, medium: 100 – 250, large: > 250). Table 1 describes the data by industrial sector (Panel A) and reports the correlations between each of the variables (Panel B).

*Table 1. Descriptive Statistics.*

<b>Panel A: Descriptive Data by Industry Sector - Means and Standard Deviations</b>						
	Scale	All	Food	Chemical	Non-metallic Minerals	Metals
Number of respondents		221	60	57	47	57
Regulatory Influence	1 - 5 (none - high)	4.11 (1.33)	4.12 (1.38)	4.11 (1.36)	3.87 (1.24)	4.30 (1.34)
% exporting to the U.S. or Canada	0 - 100%	38%	25%	35%	53%	44%
Responsiveness	1 - 3 (low - high)	1.82 (0.82)	1.72 (0.76)	1.98 (0.83)	1.79 (0.81)	1.79 (0.88)
Performance	1 - 5 (poor - world class)	2.54 (0.88)	2.57 (0.91)	2.40 (0.94)	2.45 (0.77)	2.72 (0.84)
Size	1 - 3 (< 100 - > 250 empl.)	1.91 (0.82)	2.07 (0.80)	1.93 (0.80)	1.62 (0.80)	1.96 (0.84)

**Panel B: Correlation Matrix**

	Mean	1	2	3	4	5
1 Regulatory Influence	4.03					
2 Exporting	44%	0.05				
3 Responsiveness	1.82	0.26***	0.31***			
4 Performance	2.54	0.07	0.26***	0.47***		
5 Size	1.91	0.07	0.19**	0.34***	0.31***	
6 Sector	n/a	0.01	0.22**	0.01	0.07	-0.08

\*\* p < 0.01  
\*\*\* p < 0.001

**Preliminary analyses**

Prior to testing our hypotheses we took two additional steps to evaluate the data. Firm size has been reported as a moderating variable on environmental performance (Jenkins et al. 2002; Christmann 2000). The Kruskal-Wallis test, commonly used for nonparametric data,

indicated that the facilities in the non-metallic minerals industry group were significantly smaller than the other industry groups. We therefore included size as a control variable in our subsequent analyses.<sup>iii, iv</sup>

We also further evaluated the self-reported score of performance more closely. The on-site ITESM research team reported strong correlation between the self-report score of environmental performance and observed conditions at each firm (Dasgupta et al. 2000). To empirically confirm this, we triangulated the performance score with two additional pieces of reported data. The first was a listing of environmental actions undertaken by the facility, such as reducing or eliminating toxic materials, installing treatment equipment, waste reduction or recycling actions, and process changes. The second was a report of environmental outcomes, defined as more efficient use of energy, materials, or water, and economic improvements due to pollution prevention. We would expect to find a positive association between performance actions and our performance variable, as companies that take specific actions to impact performance would be likely to perform better overall. We also would expect to find a positive association between operational environmental outcomes and overall facility performance. We found a strong and significant association both between environmental actions and performance ( $\chi^2 = 14.46$ ,  $p < .0001$ ) and between environmental outcomes and performance ( $\chi^2 = 31.44$ ,  $p < .0001$ ), providing additional confidence in the facility-reported measure of performance.

### Model

To test our hypotheses, we employed a technique described in Agresti (1990) to extend loglinear logit modeling to account for ordinality of the predictors. Agresti (1990) states that the scores should reflect the insights about the way in which the classification was constructed and used. The questionnaires used in the study were designed such that the levels of the response are equi-spaced in intent. The row and column order scores are assigned as  $u_1 \leq u_2 \leq \dots \leq u_I$  and  $v_1 \leq v_2 \leq \dots \leq v_J$  respectively and are intended to assign a relative and meaningful numerical ordering to the nominal classification scheme. The commonly employed model in this case is further described in Nelder and Wedderburn (1972) as a Generalized Linear Model with a log-link function and assumed Poisson distributed counts. We begin with a row-by-column contingency table and assumed Poisson distributed counts in the cells.

The *size-controlled* model is:

$$\log m_{ijk} = \mu + \alpha_i + \tau_j + \delta_k + \beta u_i v_j + \alpha \delta_{ik} + \tau \delta_{jk}$$

where:  $m_{ijk}$  count associated with the  $ijk^{th}$  cell for  $i^{th}$  row,  $j^{th}$  column and  $k^{th}$  size

and:  $i = 1, \dots, I$ ,  $j = 1, \dots, J$  and  $k = 1, \dots, K$ .

$u_i$   $i^{th}$  fixed column order score

$v_j$   $j^{th}$  fixed row order score

$\mu$  overall mean

$\alpha_i$   $i^{th}$  row effect

$\tau_j$   $j^{th}$  column effect

$\delta_k$	$k^{th}$ size effect
$\beta$	association
$\alpha\delta_{ik}$	$i^{th}$ row by $k^{th}$ size interaction
$\tau\delta_{jk}$	$j^{th}$ column by $k^{th}$ size interaction

We evaluated the outcome of each hypothesis test using the beta term, which describes a measure of linear-by-linear association between the predictors of interest. All parameters in the model were estimated using a ridge-stabilizing Newton-Raphson, an iterative algorithm that maximizes the log-likelihood function with respect to the model. We further verified the validity of each model by examining the standardized Pearson residuals and plots of observed versus fitted responses; no deviations were found.

### *Post-hoc Analysis*

Our hypotheses H1 and H2 individually tested the influence of regulatory influence and market influence on environmental responsiveness. However, we are left with the unanswered question of whether government regulation or customer pressure has a stronger impact on the environmental responsiveness of the firm.<sup>v</sup> That is, which mechanism is more influential – the marketplace, or regulations and the threat of government oversight? We used ordinary least squares regression analysis to provide insights into the relative relationship of these “push” and “pull” forces. First, we recoded *exporting* as a dummy variable, with Mexican sales only as 0 and exports to U.S. and Canada as 1. By using this dummy variable, we can interpret the associated beta term as the relative amount of impact that exporting to U.S. and Canadian customers has on responsiveness. Our model therefore was constructed with *responsiveness* as the dependent variable, and *regulatory influence* and *exporting-dummy* as the independent variables.

### **Results**

The purpose of this study was to conceptually and empirically link NAFTA to manufacturing facility practices in Mexican industry that would impact environmental performance. The NAFTA agreements exerted both a “push” and a “pull” pressure on Mexican firms – “pushing” regulation onto firms which causes them to respond through managerial actions, and “pulling” their responsiveness through the desire to sell to trading partners who demand better environmental performance. As a consequence of firms’ responsiveness to environmental management concerns, environmental performance at the firm level would be improved.

Empirical support was found for each of our three hypotheses (Table 2). Our first hypothesis, that facilities reporting stronger regulatory pressure would be more responsive toward managing environmental performance, was strongly supported by the data ( $\chi^2 = 12.78$ , p-value = 0.0004). The data also strongly supported our second hypothesis that facilities exporting to the U.S. and Canada would be more responsive to environmental management issues ( $\chi^2 = 8.03$ , p-value = 0.0046). Our hypothesis that the degree of environmental responsiveness would be positively associated with the degree of environmental performance was again very strongly supported by the data ( $\chi^2 = 32.40$ , p-value = 0.0001).

*Table 2. Results of Hypotheses Tests.*

Hypothesis	$\chi^2$	p-value
H1 "Push" effect: Regulatory Influence → Responsiveness	12.78	0.0004
H2 "Pull" effect: Exporting to U.S./CN → Responsiveness	8.03	0.0046
H3 Responsiveness → Environmental Performance	32.40	0.0001

The post hoc regression results (Table 3) show us that the regression model was significant, with an F-value of 14.72. Furthermore, both regulatory influence and exporting were significant variables in the model. An interpretation of the beta coefficients tells us that regulatory influence impacted the responsiveness of exporting firms by 0.098 and that market influence impacted responsiveness by 0.427 (each on a 1 – 3 scale). Furthermore, the market variable is more highly significant than the regulatory influence variable ( $t = 3.833$  versus  $t = 2.495$ ). These results demonstrate that the “pull” influence of the U.S. and Canadian marketplace was significantly stronger and impacted industrial planning more than the “push” pressure created by regulatory influences.

*Table 3. Post-hoc Ordinary Least Squares Regression Results.*

Dependent Variable: Responsiveness (n = 221)					
Variable Name	Predicted Sign	Coefficient	Standard Error	t-statistic	p-value (two-tailed)
Intercept		0.715	0.207	3.449	0.001
Regulatory Influence	+	0.098	0.039	2.495	0.013
Exporting	+	0.427	0.111	3.833	0.000
Size		0.262	0.068	3.850	0.000
<b>ANOVA:</b>					
F-statistic		14.72			
Significance (F)		0.000			
R <sup>2</sup>		19.5%			
Adjusted R <sup>2</sup>		18.2%			

## **Discussion**

The implementation of NAFTA spurred the Mexican government to strengthen environmental regulation through creating stronger oversight agencies, by implementing more regulations, and by more consistently enforcing environmental regulations. A stronger regulatory

environment puts pressure on or *pushes* companies to conform with the laws, or face the risks of penalties, fines, and potentially closure of the firm. Firms in Mexico facing regulatory pressure would therefore be expected to minimize the risks associated with non-compliance by taking specific managerial actions. Our results confirm that regulation exerts a *push* effect on companies to implement management practices to respond to regulatory demands.

These findings are consistent with Henriques and Sadorsky (1996); however, our findings extend Henriques and Sadorsky in two key areas. First, we analyze firm data from a developing economy with a less mature system of environmental enforcement. Our results show that regulation still positively and strongly impacts responsiveness in a country without a strong history or culture of environmental enforcement. Second, Henriques and Sadorsky reported that companies reporting regulatory pressure are more likely to have an environmental management plan. We extend this finding by reporting that the *degree* of regulatory pressure is significantly associated with *degree* of management planning or responsiveness - firms that feel greater regulatory pressure are more likely to develop a *more comprehensive* set of plans.

This finding is particularly important in the context of our third hypothesis, which demonstrates that firms with more comprehensive plans also achieve better environmental performance outcomes. Our analysis extends Dasgupta *et al.* (2000) who reported a positive relationship between planning and whether or not firms complied with environmental regulations. Instead of measuring compliance as a dichotomous “yes/no” variable, we look at degree of compliance over a continuous 5-point scale. This result gives insights to managers about how to impact environmental performance. Managers wanting to improve environmental performance should evaluate the breadth of their environmental management practices, as the more effective facilities were those with more comprehensive plans.

By creating additional exporting opportunities, NAFTA also created a “pull” effect on Mexican businesses to be more environmentally responsive. Mexican firms wanting to sell to customers in the U.S. and Canada, countries that have stronger environmental cultures, would need to be more sensitive to the demands of these customers. The demands of the U.S. and Canadian customers would compel, or *pull* the Mexican firms to improve environmental performance. As confirmed by testing our primary model, facilities exporting to the U.S. and Canada implemented more environmental management actions than those selling only within Mexico.

One of the key contributions we make in this study is through evaluating the *relative* influence of regulatory and market pressures. Although both are significant in determining degree of responsiveness, the regression results demonstrate that the market influence had a bigger impact on managerial action taking. Companies that exported to the U.S. and Canada had stronger environmental plans than did companies that only sold within the Mexican market. We present data in Table 4 to provide further insights into the differences between respondents that only sold within Mexico and those that exported to the U.S. and Canada. Using t-tests of between-group differences we demonstrate more specifically the differences between exporters and non-exporters. Exporters to U.S. and Canadian customers were significantly more responsive to environmental issues than were non-exporters, and employed an average of 4.26 (out of 8) planning elements while non-exporters used an average of 2.55 elements.

*Table 4. Comparison of non-exporting and exporting facilities.*

Variable	Scale	Sales Patterns	
		Mexico only	Exports to U.S. / Canada
Regulatory Influence	1 - 5 (none - high)	3.92	4.06 *
Responsiveness	1 - 3 (low - high)	1.56	2.07***
Planning elements (#)	0 - 8 elements	2.55	4.26***
Performance	1 - 5 (poorest - world class)	2.24	2.72***
Size	1 - 3 (< 100 empl. - > 250 empl.)	1.75	2.06**

\*  $p < 0.05$

\*\*  $p < 0.01$

\*\*\*  $p < 0.001$

The data indicates that exporting firms perform better than non-exporting firms. The presence of customers in the supply chain with stronger environmental performance expectations creates an incentive for Mexican firms to take environmental actions. Non-exporting firms do not have the same degree of market pressure, and are on average smaller than the exporting firms. They may thus have less incentive to implement an environmental management strategy, and potentially fewer resources to do so. Therefore, the potential impact that a new trade agreement may have on environmental management practices will depend, in part, on the ratio of firms exporting or selling to multi-national enterprises to purely domestic firms.<sup>vi</sup> The ability of the trade agreement to transform industrial practices, however, would be increased by the degree that the new trade agreement opens the exporting market to new entrants.

It is also likely that the actual “pull” effect of the U.S. and Canadian customer is understated, because it is reasonable to assume that many of the respondents sell to U.S. and Canadian customers located in Mexico. These customers, especially those who are processing goods for later sale in the U.S. and Canadian markets, would also be exerting pressure on their supply chain partners to meet stricter environmental performance criteria. We were unable to perform this test as the data did not identify the nationalities of the customers, but only the market in which the sales were made. To more fully evaluate the impact of the “pull” effect, we recommend that future research compare firm performance between firms selling locally only, firms selling locally but to multi-national enterprises, and firms exporting.

NAFTA was instrumental in changing the Mexican regulatory climate surrounding environmental performance. Our data verifies that regulatory pressure drives industrial-level decision making related to implementing an environmental management strategy. The world has entered an era of globalization where nations are increasingly seeking economic and trade pacts with other nations. Since the NAFTA agreement, we have seen a number of major trade agreements and mutual recognition pacts implemented, with perhaps the most notable example being the European Union. The expectation is that these pacts lead to greater commonality among laws, standards, and regulations, all of which will have an impact on firm-level decision making. Strengthened regulations will push firms to take actions to conform to the new regulatory environment.

Our data also demonstrates that Mexican manufacturing facilities that export goods to the U.S. and Canada, countries with much stronger histories and cultures of environmental protection, implement stronger environmental management practices than do facilities that only sell within Mexico. Given that economic and trade pacts are designed to facilitate trade between nations, an equally important impact on environmental performance will be the "pull" factor exerted by the increase in trade that results from these trade pacts. Companies wanting to sell to customers in countries with stronger environmental cultures will need to be more responsive to the demands of their customers. We already see strong examples of this in the supply chain for the automotive industry, where Ford and General Motors require their supply chain partners to achieve ISO 14001 certification. Intel also requires its global suppliers to meet Intel's environmental performance requirements. Supply chain pressures are key drivers in management decision making, and are playing an important role in promoting improved environmental performance. Therefore, as the practice of global sourcing is increased partly as a consequence of trade pacts between nations, industrial environmental performance can be expected to improve in those companies that are selling to customers located in countries with stronger environmental cultures. Trade agreements exert pressure on organizations through regulatory changes, but also through pressures exerted by customers that have expectations and requirements of their trading partners.

Our study demonstrates that NAFTA has had a positive impact on Mexican environmental performance at the manufacturing level through instigating the Mexican government to strengthen the Mexican environmental regulatory climate and by opening up the U.S. and Canadian markets to Mexican producers. However, although the results of our study indicate that industrial environmental performance improved in Mexico correspondent with the NAFTA agreement, the evidence shows that average environmental performance remained rather weak. As shown by the mean value of 2.54 in Table 1, average performance falls between "we normally do not comply with Mexican regulations" and "we normally comply, but sometimes miss in specific areas." Because the plants in this study were starting off from a relatively low base of performance compared to what we would expect in a developed country with stronger environmental regulations, it can be argued that credible regulation would have a more noticeable effect on firms in a formerly poorly-regulated country, such as Mexico. Also, although changes brought about due to NAFTA have helped to improve industrial environmental performance in Mexico, one cannot conclude that NAFTA has mitigated all environmental performance problems found in Mexican industry.

Our data is focused on Mexican industrial practices related to regulatory pressures and trading patterns; however, this study has implications for industrial environmental management practices and for trade policy on a global basis. By demonstrating that environmental management practices are sensitive to both regulatory pressures and to customer pressures when those customers are based in countries with stronger environmental cultures, it provides insights into how environmental management practices and outcomes across the globe may be impacted through increased trade.



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## **ENDNOTES**

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<sup>i</sup> We use a subset of data collected and previously analyzed by Dasgupta, *et al.* (2000). Dasgupta *et al.* examined the relationship between various internal and external factors and whether or not a facility was in regulatory compliance.

<sup>ii</sup> The complete survey instrument and data is available at [http://www.worldbank.org/nipr/work\\_paper/1877](http://www.worldbank.org/nipr/work_paper/1877). An English translation is available from the authors.

<sup>iii</sup> We also tested each of our hypotheses with and without industry sector as a control variable. The results were essentially the same; we therefore only report the results of the size-controlled model.

<sup>iv</sup> Including profitability of the parent firm was debated. However, empirical evidence is mixed as to whether profitability enables better environmental performance or if better environmental performance enables profitability (Jenkins, *et al.* 2002; Margolis/Walsh 2001). Furthermore, data for this study was collected at the plant level only, and no parent companies were identified.

<sup>v</sup> We appreciate the recommendations of the reviewer for this analysis.

<sup>vi</sup> We thank one of the reviewers for this insight.