The Global Diffusion of Environmental Clubs: How Pressure from Importing Countries Supports The Chemical Industry's Responsible Care® Program*

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Abstract. Environmental clubs have proliferated across sectors and issue areas. We examine the diffusion of the chemical industry's Responsible Care® (RC) program. Much of the work on the diffusion of clubs has focused on the demand side: why firms join these clubs despite the costs of doing so. There is some work focusing on the supply side: why actors establish or create a new club. However, there is virtually no work examining why national-level industry associations decide to subscribe to an existing global environmental club in order to make it available to their members.

Industry organizations in 17 lower and middle-income countries have joined RC, comprising 25 percent of RC members. We ask, in the context of developing countries, what motivates national associations to join RC? Drawing on an original dataset of RC global diffusion in 195 countries (1985–2017), we estimate a Cox proportional hazards model of the risk of joining RC. We find that RC adoption is more likely when a country exports chemicals to other countries that have joined RC (the California effect) and is unaffected by the total volume of its chemical trade. Thus, while exposure to global markets per se may not influence RC adoption, incentives change considerably when countries' key importers signal their support for these environmental practices. This is because importing firms often realize that because they have joined Responsible Care, NGOs and stakeholders expect them to demand that their overseas suppliers adopt the same sort of environmental policies and work place safety practices. In addition, peer pressure and learning matter: RC adoption is more likely when countries in close physical vicinity (e.g., within 500 miles) have joined the club. Finally, domestic factors play a role as well: both the level of democracy and the size of the economy encourage national associations to join RC.

Keywords: Voluntary environmental programs, trade, Responsible Care, voluntary regulation, California Effect

Introduction

Environmental clubs (also known as voluntary environmental programs) are important instruments of environmental policy (Khanna and Damon, 1999; Maxwell, Lyon, and Hackett, 2000; Prakash and Potoski, 2006; DeLeon and Rivera, 2007; Morgenstern and Pizer, 2007). As tools of industry self-regulation, they are sponsored by industry associations, nonprofits, and international organizations such as the United Nations and the International Organization for Standardization. Interestingly, even governments with the authority to enact mandatory regulations also sponsor voluntary clubs. The US Environmental Protection Agency has been at the forefront of establishing such clubs starting in the 1990s (Coglianese and Nash, 2001; Fiorino, 2006).

Firms are often viewed as opposing regulations. Why would profit seeking firms want to self-regulate, and moreover voluntarily? The popularity of environmental clubs thus poses interesting theoretical questions. It speaks to the broader issue of the motivations for actors to incur private costs (via joining voluntary clubs) and to contribute to the production of public goods such as environmental protection. After all, the rationale for mandatory regulations lies precisely in such free riding concerns (Hardin, 1968; Olson, 1965).

Environmental clubs outline the business and social rationale for voluntary environmental protection by profit seeking firms. Their institutional design address two issues: rewards for incurring the cost of environmental protection and assurances that firms voluntarily incurring such costs will receive excludable benefits which free riders will not be able to capture.

As a reward of club participation, stakeholders can bestow tangible and non-tangible reputational benefits on firms (Prakash and Potoski, 2006).[1] Stakeholders motivated to reward corporate good behavior are willing to do so because they view club membership as a signal about unobserved virtuous corporate conduct (Spence, 1973). Moreover, this branding signal allows stakeholders to differentiate club members from non-members; hence, they can target their rewards (or punishments) exclusively on club members (or non-members and potential free riders). These rewards can take many forms: larger market share, higher stock prices, due diligence defenses in law suits, regulatory relief, and better relationships with the local community.

Environmental clubs have been embraced by several industry associations as tools of industry self-regulation (Rees, 1997; Gupta and Lad, 1983; King and Lenox, 2000) and

1 There are various perspective on voluntary regulations. These include legal (Teubner, 1983), sociological (Rees, 1997), and moral perspectives (Baron, 2010).

therefore as vehicles to project the industry's reputation for responsible environmental practices. Viewed this way, industry level clubs are a collective effort to secure the social and regulatory license to operate for the industry (Clarkson, 1998; Gunningham, Kagan, and Thornton, 2003). This sort of collective reputational insurance is particularly important in the context of industrial accidents; a mishap for one firm creates negative reputational spillovers across the industry (Prakash and Potoski, 2006; Barnett and King, 2008). Thus, via industry-level clubs, the industry association can build collective goodwill for environmental stewardship and secure some sort of reputational insurance for its members.

RC is perhaps the first environmental club sponsored by an industry association. The Chemical Industry Association of Canada launched Responsible Care® in 1985 (Hoffman, 1997; Prakash, 2000). Soon after, in 1988, the American Chemistry Council (previously known as the Chemical Manufacturers Association) also adopted RC. RC has individual companies as well as national associations as members. The associations are responsible for the exact implementation of Responsible Care among their members, and national associations' RC programs differ in terms of development and emphasis (International Council of Chemical Associations, 2015). Over the last three decades, the RC club has spread to chemical associations in 67 countries.[2] This is a unique case of industry self-regulation via the same institutional vehicle (the RC club) across a large number of states.[3]

RC aims to promote responsible, safe and transparent environmental practices. Accordingly, members of RC commit to a set of guiding principles emphasizing responsible conduct in the areas of environment, health, safety, and security through product and process design, communication of risks to stakeholders, cooperation with governments to improve regulation, and education and research on the effects of products and processes.[4] RC also requires monitoring and reporting of environmental, health, safety, and security performance. In most countries, members are required to publicly

2 Officially there are 62 national associations in 67 countries that are members of the ICCA Responsible Care Leadership Group.The Arabian Gulf countries Saudi Arabia, Kuwait, United Arab Emirates, Qatar, Oman and Bahrain are combined in one chemical association. See canadianchemistry.ca/responsible-care/about-responsible-care.

3 Conzelmann (2012) documents how various national chemical associations differed in their preferences for the universal template for RC. He suggests that these differences, in part, reflect their domestic level preferences for different types of regulatory practices.

4 responsiblecare.americanchemistry.com/ResponsibleCare/Responsible-Care-Program-Elements/Guiding-Principles

report their environmental, energy, safety, and accountability metrics, which include their release of hazardous air pollutants, net water consumption, greenhouse gas emissions, number of safety incidents, and community outreach activities.[5]

While the voluntary club literature tends to focus on why firms join a given environmental club (Delmas and Montiel, 2008), we explore why industry associations adopt an industry-level environmental club in the first place. Our empirical approach is unique because we focus on a single industry only, the chemical industry, and on its flagship club, Responsible Care®. With this approach, we control for industry-level and program-level heterogeneity.

In particular, we are most interested in exploring the role of international trade in motivating industry associations to establish RC in their country. In doing so, we engage with an important policy debate on whether international trade hurts or promotes environmental regulations. Some claim that international trade abets regulatory races to the bottom (Charnovitz, 1993). In this view, countries exposed to global markets have incentives to deregulate in order to attract and retain firms, even polluting ones (Jaffe, Peterson, Portney, and Stavins, 1995). The logic is that regulations impose costs and make firms uncompetitive in global markets. In this scenario, it is inconceivable that industry associations will establish voluntary self-regulatory programs that impose additional regulatory costs on their members. Rather, one would expect that these associations will lobby for less regulation and oppose any attempt to promulgate new regulations, mandatory or voluntary.

Other scholars offer a more positive assessment of the effect of international trade on environmental regulation. They suggest that exposure to global markets incentivizes firms to innovate and therefore pollute less; the argument being that pollution is a waste of resources and therefore costly for firms (Porter and van der Linde, 1995). Some view the effect of trade on regulation working in a different way. Vogel (1995) argued that the effect of trade on domestic regulatory systems depends not on how much a country trades, but with whom it trades. In terms of mechanism, he suggests that trade is a vehicle to diffuse environmental practices from importing to exporting countries: the higher the salience of a given importing market for an exporter, the more likely importers will be willing to adopt environmental practices supported in the importing market (Prakash and Potoski, 2007). If importing countries enjoy substantial leverage to influence the regulatory standards in the exporting countries, they can help both raise or lower these standards. Thus, the direction of regulatory races depends on the

5 responsiblecare.americanchemistry.com/Performance-Management

regulatory preferences of the importing country in relation to that of the exporting country.

We are particularly interested in examining the California Effect argument in the context of RC diffusion in developing countries. As the current spat between the US Environmental Protection Agency and California over auto emission standards highlights, California can influence the emission standards car makers adopt because it accounts for about every eighth car sold in America. Automakers cannot afford to ignore the California market, but they also would prefer to follow to avoid the expense of producing cars with different emission standards. Therefore, they choose to adopt California's emission standards for all cars, although they are more stringent than those set by the federal government.

The key lesson is that market power provides buyers (California) the necessary leverage over suppliers (auto firms). And with this leverage, buyers are in a position to influence the policies and practices of their suppliers. Of course, buyers themselves are often responding to pressure from environmental organizations and other stakeholder groups to demonstrate environmental stewardship in their firms and in their global supply chains. Thus, membership in Responsible Care can become a signal for importing firms to assure their stakeholders that their overseas suppliers are functioning in an environmentally responsible way. If the California Effect argument holds, then a developing country industry association is more likely to establish RC if its member firms export to countries that already have established RC. If importing countries' firms have joined RC – which is likely because many chemical industry associations mandate that their members join it – then these firms probably come under pressure from local groups to transmit RC to their suppliers. After all, this is also a requirement of RC's Stewardship code. Thus, exporting firms are probably getting a nudge from their importing markets to establish RC (Prakash and Potoski, 2007). Because industry associations seek to safeguard the economic and political interests of their members, they are likely to establish RC in their country in response to such pressures from the overseas market.

To explore the role of California Effect in the global diffusion of RC, we have assembled an original dataset of 195 countries for the time period 1985–2017. We find that exports to RC members are the strongest single driver of the diffusion of RC. By exporting more to RC members, the likelihood of joining RC increases by 566 percent.

This finding holds even when we control for RC adoption in neighboring countries. Moreover, it also holds when we control for a range of domestic factors that might motivate industry associations to establish RC. Arguably, given the modest level of eco-

nomic development, developing countries often lack a strong domestic constituency to demand responsible corporate behavior. This sort of lack of demand is probably accentuated in situations when the country is undemocratic. However, our results hold even when we control for levels of economic growth and democracy.

Trade, The Environment, and Industry Self-Regulation

In 1984, Union Carbide's fertilizer plant in Bhopal, India, leaked 40 tons of highly toxic methyl isocyanate gas, causing the immediate death of at least 3,800 people (Broughton, 2005). This was perhaps the worst industrial accident in human history and sent shockwaves around the world, in particular among communities that lived in the vicinity of chemical plants. In response to the Bhopal disaster, the US Congress enacted the Emergency Planning and Community Right to Know Act that compelled facilities to share information about industrial hazards with local communities. Further, Section 313 of this Act created the Toxics Release Inventory (TRI) system which required facilities above a certain size to report their annual release of specified toxic chemicals (Hamilton, 1995; Hoang, McGuire, and Prakash, 2018). The Bhopal disaster also led to massive litigation and an arrest warrant for Union Carbide's President Warren Anderson. Most critically, it raised questions about the ability of chemical industry to function safely.

The chemical industry established RC in the aftermath of Bhopal. It was their effort to collectively demonstrate their commitment to safe industrial practices and environmental protection. In doing so, the industry sought to win back some level of social and political legitimacy, and possibly even preempt future regulation.

As the chemical industry has globalized in the last three decades, it has sought to diffuse RC across the world from the initial sites in Canada and the United States. The reasons for expanding RC across the world are the same as when RC was created: an industrial accident in one facility creates collective reputational damage for all in the industry. There are several examples. The 1979 Three Mile Island disaster brought an end to the building of new nuclear power stations in the United States. The Fukushima disaster has posed serious problems for the nuclear industry in many European countries, including Germany, which has decided to completely switch away from nuclear power (Jahn and Korolczuk, 2012).

The reason for this collective penalty is that in some cases, all firms in a given industry share a common reputation. This means that if a firm is worried about its reputation for industrial safety, it will need to exercise some control over the industrial practices of

other firms in the industry. This means that industry associations will seek to promote self-regulatory programs that improve industrial practices and therefore the collective image of the sector. Of course, there is concern about free riding: some firms might want to partake of the benefit of an industry level club without joining it. Anticipating this problem, chemical industry associations in many countries strongly encourage, sometimes even mandate, that all their members join RC.

The RC club provides a collective insurance policy to all members of the chemical industry. But not all chemical industries face the same sort of domestic pressure to demonstrate superior environmental and health and safety practices. Many countries face serious problems of governance failure where the government is not able to enforce even existing laws. Their legal systems are weak, and citizens use judicial strategies to compel firms to provide a safe environment for local communities and to share information about potential industrial hazards.

Why then would industry associations seek to establish RC in their territories when they face little risk of governmental intervention or regulation in their operations? Further, as time passes, and the image of Bhopal fades, demands for regulating chemical industry fall out of media headlines. Why, then, would industry associations seek to establish RC in their countries?

This is where the international economic context becomes important. Arguably, those countries whose chemical industries have high levels of exposure to global markets are most likely to embrace such collective reputation management clubs. After all, a single industrial accident in just one firm might taint all firms in that country, drawing retribution from global markets. The reality is that in global markets, buyers and sellers are separated by spatial, linguistic, and sociocultural barriers. Sometimes buyers infer sellers' environmental practices from the overall reputation of the country in which the sellers are located (Hudson and Jones, 2003). As Van Ham (2001: 3) notes: "Image and reputation have become essential parts of a state's strategic capital. Like branded products, branded states depend on trust and customer satisfaction." Thus national-level industry associations recognize that there are country reputation effects that international buyers pay attention to. An industrial accident in one firm can damage business prospects for all chemical firms located in that country. This is why they are interested in establishing RC in their territories: so that local firms will have the opportunity to join it and in doing so, support the collective efforts of reputation management. Based on this argument, the greater the level of exposure of a particular industry to global markets, the stronger the incentives for the national industry association to establish RC.

Another school of thought, pioneered by David Vogel (1995), suggests that the uptake of specific regulatory standards (industry clubs such as RC that incorporate higher standards) depends not only on the level of exposure to global markets but whether overseas customers are demanding evidence of specific types of standards or industrial practices. He termed this as the "California Effect": California, by virtue of being the largest car market in the US was able to encourage automobile companies to adopt its superior emission standards across all US states. This is because automakers interested in selling in California had economic incentives to tap into economies of scale by offering the same superior product across all US markets. Viewed this way, the national association of a given country will have greater incentives to establish RC if the overseas markets to which its firms export have adopted RC. The reason is that when overseas customers have adopted RC, they understand the meaning of its brand signal. Thus, from an exporter's perspective, joining RC becomes a worthwhile cost because its RC membership signal will be understood and even appreciated by their overseas customers. Thus, RC membership has a compelling economic rationale. Moreover, given that RC's Stewardship Code encourages RC firms to diffuse RC throughout their supply chains, overseas customers probably also exert some sort of pressure to their overseas suppliers to join RC.

Alongside the export effect and the California Effect, RC adoption might be facilitated by some sort of neighborhood effect. Scholars note that geography plays an important role in the diffusion of norms and practices (Kopstein and Reilly, 2000). For example, information about best industrial practices probably flows more easily between neighboring countries, or between countries in close physical proximity. Similarly, this information might flow more easily between countries that share a common language (and therefore have access to the same trade journals) or even share a common religion. The key insight is that every actor is situated in a variety of "neighborhoods," and this actor could potentially learn of new norms and practices by observing its neighbors. These neighbors might also indirectly impose some sort of a peer pressure on the country to adopt superior industrial practices (Simmons and Elkins, 2004; DiMaggio and Powell, 1983).

While so far we have emphasized the role of international factors, we suggest that domestic factors can play an important role in RC adoption as well. A strong NGO presence could encourage RC adoption: NGO campaigns may put pressure on national chemical associations to establish RC and demonstrate superior environmental practices. Governments concerned about the environment may direct associations to join RC or motivate them to join RC to pre-empt government regulation. Democratic

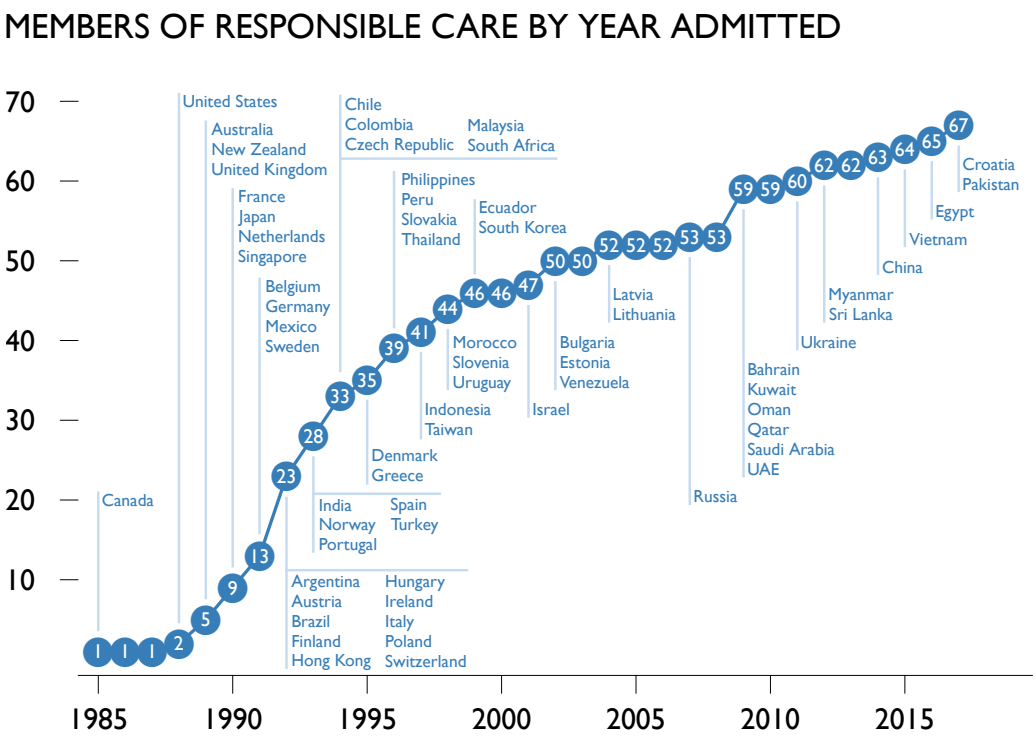

Figure 1. *The expansion of Responsible Care over time.*

countries could allow the voices of NGOs and citizens to be heard about environmental protection as well as industrial hazards; indeed, democracy is often a prerequisite for NGOs to feel politically free to name and shame sectors and companies. People with a higher standard of living likely can better afford to be concerned with the chemical sector's conduct. Thus, industry associations in more democratic and richer countries might have greater incentives to establish RC. Further, multinational corporations are often heavily scrutinized and concerned with their reputation. They may be driving the adoption of RC in their host countries. Finally, countries with larger economies might be more amenable to such industry self-regulation simply because their industries have more resources to invest in collective reputational measures.

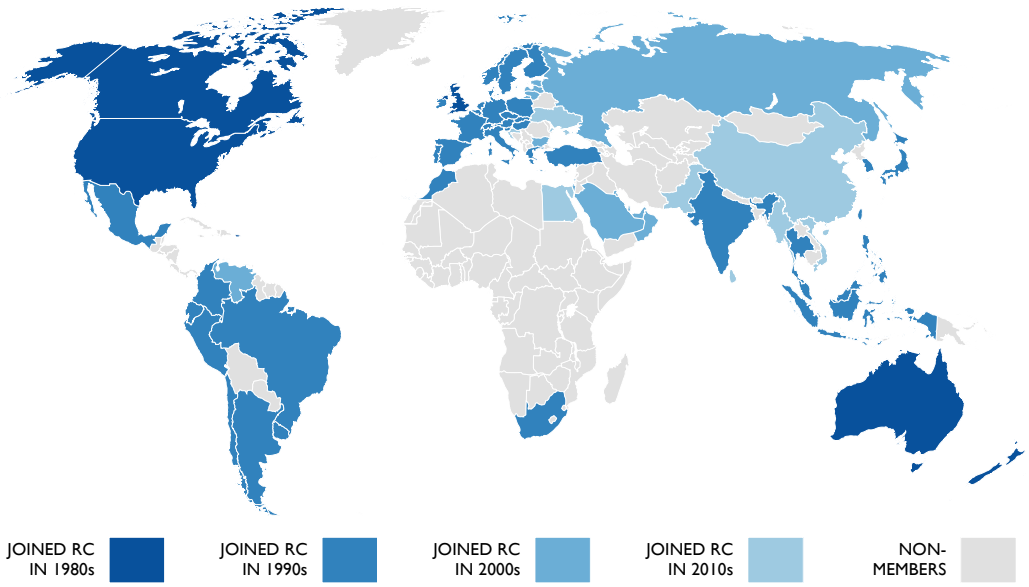

Figure 2. *The expansion of Responsible Care over space.*

Data and Methods

Responsible Care is a voluntary code of conduct developed, monitored, and enforced by the American Chemical Council (ACC) with the aim of establishing industry-wide environmental, health, safety and security standards through self-regulation. To this end, RC tracks and publicly reports performance data of RC member firms and employs third-party audits to verify performance on health, safety and security indicators. Many of RC's policies demand that members go "beyond compliance;" that is, RC's standards are often more stringent than extant laws.

As of November 2018, 67 national industry organizations and 102 partner companies are members of Responsible Care®. The established national industry associations form the Responsible Care Leadership Group (RCLG), which seeks to broaden support for the RC charter by expanding membership of national chemical associations and companies (International Council of Chemical Associations, 2015). At the country level, RC membership has indeed grown over time, with particularly rapid expansion in the 1990s, followed by steady increases in subsequent years (Figure 1). From its founding in Canada, RC spread first to other English-speaking industrial countries, then to a mixture of industrialized and developing nations, especially in Europe

and Latin America, but more recently in Asia and Africa (Figure 2). While a majority of RC members are advanced industrialized countries, a growing number of developing nations have joined, including Poland (1992); India and Turkey (1993); Colombia (1994); the Philippines, Peru, and Thailand (1996); Indonesia (1997); Morocco (1998); Ecuador (1999); Bulgaria (2002); Ukraine (2011); Myanmar and Sri Lanka (2012); Vietnam (2015); Egypt (2016); and Pakistan (2017).[6]

We seek to understand the potential drivers of the spread of RC membership across countries from its founding to the present day. To this end, we estimate an event history model of RC membership on a near-census of countries. Starting in 1985, we observe each country *i* until that country joins Responsible Care, or until 2017, whichever is later. That is, once a country joins RC, it leaves the risk set, whereas countries that have not yet joined RC as of 2017 are treated as right-censored. We then model the probability h of joining RC – the *hazard* – as a function of time t using a Cox proportional hazards model (Cox, 1972; Box-Steffensmeier and Jones, 2004). This semiparametric model allows for a flexible, data-driven baseline hazard rate, in turn subject to proportional shifts as a result of covariates.

In our case, the Cox proportional hazards model can be written as

$$h_i(t) = h_0(t) \exp(x_{i,t-1}\beta + \mathbf{z}_{i,t1}\gamma), \tag{1}$$

where $h_i(t)$ is the hazard function for country i and $h_0(t)$ is the baseline hazard function. Our covariate of interest, $x_{i,t-1}$, measures the percentage of country i's chemical exports which were sent to countries which were members of RC. This is thus a measure of the extent to which Responsible Care induces non-members who trade with it to join RC: the so-called "California Effect." We also control for a vector of time-varying covariates $\mathbf{z}_{it}$ to mitigate the possibility of confounding the California Effect with other factors that may influence a country's decision to join RC.[7] In either case, covariates proportionally shift the baseline hazard to create each country's specific hazard function. In particular, exponentiated coefficients (or hazard ratios) show how

6 We define "developing countries" as those included in contemporary classifications of lower and lower middle income countries by the World Bank.

7 We accommodate time-varying covariates within the Cox proportional hazards framework using the counting-process formulation of Anderson and Gill (1982).

many times more likely a country is to join RC, relative to the baseline hazard, given a one-unit increase in the relevant covariate.[8]

In the next section of the paper, we consider a baseline model of RC membership that controls for covariates that might influence a country's decision to join RC. We collected covariate data on all 195 independent and internationally recognized countries that existed in 2017. We then excluded six countries – Bahrain, Oman, United Arab Emirates, Saudi Arabia, Kuwait and Qatar – which joined RC as a single entity (the "Arabian Gulf"). This joint decision violates the assumption that each unit in the Cox model is at risk independently from the other units, conditional on covariates.[9] However, as we show below, our results are unchanged when these countries are included. After excluding countries with missing data and the six members of the Arabian Gulf, there are 146 countries are in our baseline model.

Several of our covariates are computed from annual dyadic trade in chemical products, which we draw from World Bank's World Integrated Trade Solutions (WITS) database for every country in our study.[10] We use these data to compute the *Percent of chemical exports sent to current RC members*, which represents the California effect. We rely on the same underlying trade data to measure the *Percent of chemical exports sent to current OECD states*, which controls for the general influence of rich, highly-regulated countries on trade partners, as well as each country's *Chemical exports as a percent of world chemical exports*, which captures the extent to which a given country is a major exporter of chemicals in a given year. In alternative specifications, we also consider the *Percent of chemical exports sent to the US or current EU member states* as a robustness check.

We also control for possibility of spatial diffusion of RC membership using a series of neighborhood variables computed for each country and year using the minimum physical distances between countries provided by Weidmann and Gleditsch (2010). We find the best fit using *Percent of countries within 500 miles belonging to RC*, we also test for *Percent of countries within 2000 miles belonging to RC* and the *Percent of contiguous countries belonging to RC*. In an alternative specification, we consider the possibility of diffusion

8 In all models, we cluster standard errors by country to account for the dependence of observations within a country.

9 A simple control for these countries would not be adequate to address this problem, which suggests a distinct data-generating process for these states.

10 Specifically, we measure trade in chemicals using United Nations Comtrade import data under SITC 1 chapter 5, containing all chemical products, as reported by WITS. In general, we infer each country's chemical exports to the other countries in the world by looking at the sources of each country's chemical *imports*, which are usually more reliably reported than export data

across linguistic neighborhoods by controlling for the *Percent of current RC members who share a country's primary language*, using data from Greenhill (2015).

The presence of local environmental NGOs might incentivize the chemical industry to join RC. More NGO presence means more pressure on firms to be environmentally responsible and more scrutiny of firms' operations by external actors. This means management will take environmental issues more seriously, both for proactive and reactive reasons. Proactively, firms want to make sure that environmental management systems are in place so that environmental accidents do not take place due to human error, oversight, or neglect. RC is a way for firms to commit to establish such systems and honor their environmental commitments. Reactively, when accidents do happen, RC membership allows firms to claim due diligence if NGOs accuse them of negligence. Accordingly, we control for the *Count of environmental NGOs present* in each country using the most recently available data from 2018 from the International Union for Conservation of Nature (IUCN).

In a similar way, ratification of environmental treaties may either proxy governments' concern for the environment or indicate the pressure to protect the environment placed on that government by international institutions; either force could lead to domestic pressure on the chemical sector to join RC (Cao and Prakash, 2012; Neumayer, 2002; Ehrlich, 2009). On the other hand, if treaty obligations comprise a substitute for RC membership, we may see the opposite effect. We allow for either possibility by controlling for each country's ratification of environmental treaties over time, using data from Ronald B. Mitchell's International Environmental Agreements Database (Mitchell, 2018). For each country-year, we compute the number of multilateral environmental treaties initiated after 1979 which the country has ratified; we then standardize these counts across all countries for each year to construct an *Environmental treaty ratification score*.[11]

Another control variable seeks to adjust for possibility that countries with extensive operations by multinational chemical corporations may face greater pressure to join Responsible Care® to cope with the heightened scrutiny MNCs often attract. More-

11 Using only treaties initiated in 1980 or later avoids inflating the treaty counts for countries that have been in existence for longer periods, especially those that only became independent in the postwar era. Standardizing treaty counts by year avoid importing a time trend into our measure of treaty ratification; while environmental treaties have certainly grow in number over time, a heavily trended measure might be more easily confounded with other trends. Neither choice makes a difference to our results: using simple counts of treaties or using all multilateral treaties in the IEA database yields substantively similar results.

over, multinationals operating in a country may lobby the national chemical association to subscribe to RC to compel their smaller competitors to live up to RC requirements (Vogel, 1995). Ideally, we would directly control for MNC presence, but we lack adequate measures. As an alternative, we control for total inward foreign direct investment stocks as a percentage of GDP using data from UNCTAD.

Other controls include the size of the economy as a whole, measured using *GDP* in constant 2010 US dollars, and the level of economic development, measured using *GDP per capita* in constant 2010 US dollars. Both are taken from the World Bank World Development Indicators, and both enter the model in logs to allow for diminishing returns to scale in the effects of size and development on encouraging countries to join RC. We also control for the degree of democracy in each country, measured using the Polity IV 0–20 point scale; more democratic countries may face greater pressure to protect the environment (Yasmeen, Li, Hafeez, and Ahmad, 2018). Finally, we consider the possibility that the thirty countries in our dataset which became independent after 1985 may have taken advantage of their latecomer status to join a well-developed Responsible Care program at an "earlier" relative date. Accordingly, we include a covariate adjusting for *Countries formed after RC was founded*.

Results

Table 1 shows the raw results of our preferred model, but interpreting these results requires a bit of arithmetic. The Cox regression coefficients have been exponentiated to form hazard ratios, so that values greater than one indicate *increases* in the hazard rate (and hence greater risk of RC membership), while values less than one show reductions in the hazard rate (less risk). While interpretation of hazard ratios is simple for binary covariates, our key covariates are continuous, so the hazard ratio associated with an increase in a covariate from a to b is $\exp(\hat{\beta})^{b-a}$ rather than just $\exp(\hat{\beta})$. To present our findings more intuitively, we show in Figure 3 how a similarly large change in each covariate influences the risk of joining RC. Specifically, we compute the change in the risk of joining RC given an increase in each variable from its 25th percentile to its 75th percentile (all else equal), as recommended by Harrell (2015).[12] Figure 3 sorts these effects from the largest to smallest in absolute size.

Shown at the top of Figure 3 is our most important finding: sending more chemical exports to RC members significantly increases the likelihood of joining RC by a factor

12 See Table 2 in the Appendix for the interquartile range of each covariate.

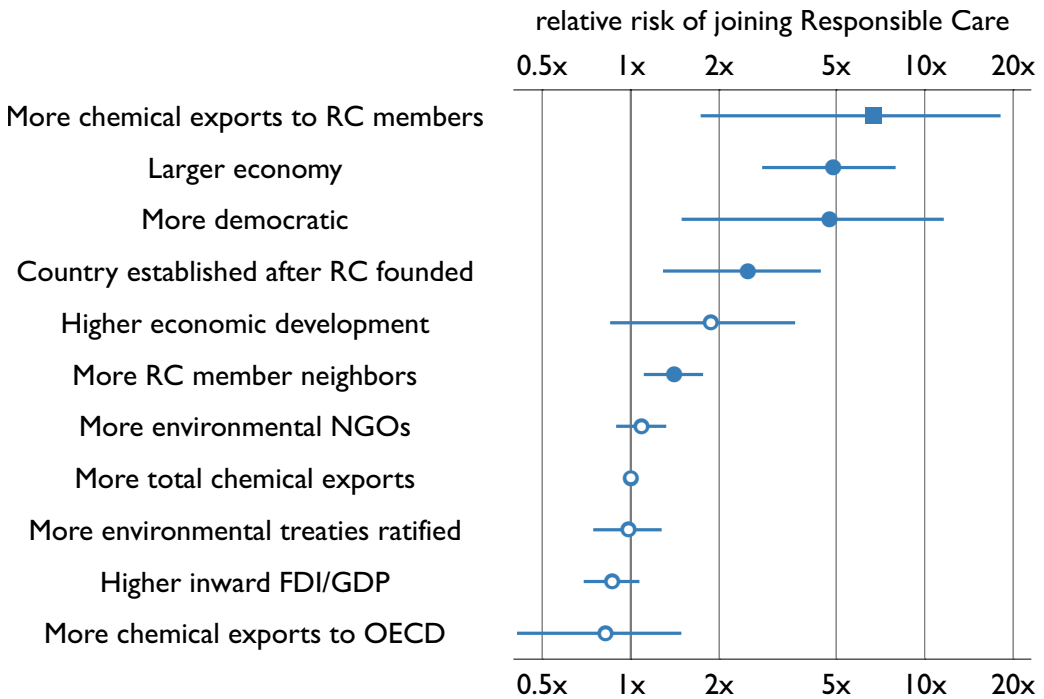

Figure 3. *Drivers of membership in Responsible Care.* Each entry shows the estimated relative risk of joining of Responsible Care given a change in one covariate in the baseline model of RC membership, while holding all other covariates constant. In general, the plot shows the increased risk of membership given an increase in the covariate from its 25th percentile to its 75th percentile. (The only exception is "country established after RC founded", which is shifted from 0 to 1.) Each circle or square represents the estimated relative risk for the variable listed to the left and is filled in when the effect is significant at the 0.05 level. Horizontal lines show 95% confidence intervals.

Table 1. Cox model of the risk of joining Responsible Care, 1985–2017.

Covariate	hazard rate	95% CI lower	95% CI upper
Percent of chemical exports sent to current RC members$_{t-1}$	1.027	1.009	1.045
Percent of chemical exports sent to current OECD states$_{t-1}$	0.995	0.984	1.007
Chemical exports as a percent of world chemical exports$_{t-1}$	1.036	0.934	1.149
Percent of countries within 500 mi belonging to RC$_{t-1}$	1.015	1.005	1.025
Country formed after RC was founded	2.389	1.306	4.372
Environmental treaty ratification score$_{t-1}$	0.971	0.720	1.310
Count of environmental NGOs present	1.017	0.980	1.055
Stock of inward FDI/GDP$_{t-1}$	0.995	0.988	1.002
Polity-2 democracy score$_{t-1}$	1.126	1.035	1.226
log GDP per capita$_{t-1}$	1.350	0.923	1.975
log GDP$_{t-1}$	2.013	1.599	2.534
Total countries at risk		149	
Total country-years at risk		3140	
Total events		57	
AIC		359.907	
Concordance index (Harrell's *c*)		0.928	

Covariates with both 95% confidence limits above 1.0 significantly increase the probability of joining Responsible Care. Standard errors used to compute confidence intervals are clustered by country. The concordance index shows the proportion of all pairs of countries for which the model correctly predicts which country will join RC first. Schoenfeld residuals show no evidence of violation of proportionality for any covariate. The Efron method is used to resolve ties.

of 6.66 (95% CI: 1.74 to 17.8), for a 566% percent increase in risk. This strongly suggests the Responsible Care® program has created a California Effect whereby RC membership at the export destination increases the risk of RC membership in the exporting country. One possible concern is that RC members tend to be rich, highly regulated economies, so this covariate may be picking up a more generalized pressure from these kinds of trading partners, rather than something specific to the RC program. It is therefore noteworthy that the effect of exports to RC members holds even controlling for the percentage of chemical exports a country sends to current OECD members, which itself has no effect on the tendency to join RC. Taken together, these results suggest trade can provide incentives to countries to increase voluntary regulation as a signal to international buyers or in order to live up to requirements of export destinations.

We found four other significant drivers of RC membership, including both domestic and international factors:

First, all else equal, larger economies are 4.89 times more likely to join RC (95% CI: 2.84 to 7.88), for a 389% increase in risk. It is worth noting this effect holds constant the size of the domestic chemical industry in terms of total exports, which itself has no effect on the risk of joining RC, suggesting it is not the volume of trade, but the destination of exports driving the spread of this voluntary institution.

Second, more democratic countries are 4.76 times more likely to join RC (95% CI: 1.51 to 11.48), for a 376% increase in risk.

Third, countries that became independent after 1985 are 2.50 times more likely to join RC in any given year (95% CI: 1.31 to 4.37), suggesting latecomers are likely to "catch-up" in joining RC.

Finally, having more neighbors that are RC members increases a country's risk of joining RC by 1.41 times (95% CI: 1.12 to 1.74).[13] This may be due to the spread of norms through neighbors' interaction and socialization, or because the similar environment faced by neighbors leads to isomorphic pressures (DiMaggio and Powell, 1983).[14]

As noted, total chemical exports and chemical exports to OECD countries had no effect on RC membership, all else equal. We found also no effect of ENGOs, environmental treaties, or FDI on the tendency of countries to join RC. For the environmental NGOs this may be due to measurement error. The environmental NGOs are time invariant, measuring the number of NGO members to IUCN in 2018. The lack of effect of multilateral environmental treaties is more puzzling, though can potentially also be due to measurement error: this measure is agnostic to the particular content and importance of the treaties. Finally, economic development may have a mild positive effect, but is far from statistically significant ($p = 0.12$).

Robustness Checks

In this section, we consider four alternative models to confirm the robustness of our main finding that higher levels of exports to RC members makes countries more likely to join RC themselves. We show how little this result varies across models in Figure 4.

First, we consider a simple bivariate Cox model with exports to current RC members as the only covariate. The purpose of this model is to suggest our results are not an

13 These findings reflect a "neighborhood" consisting countries within 500 miles at their closest point. The spatial neighborhood effect is smaller when using a 2000 mile range and insignificant when only contiguous neighbors are considered.

14 This may also be explained by the influence of the European Chemical Industry Council (CEFIC) in which European chemical associations are organized.

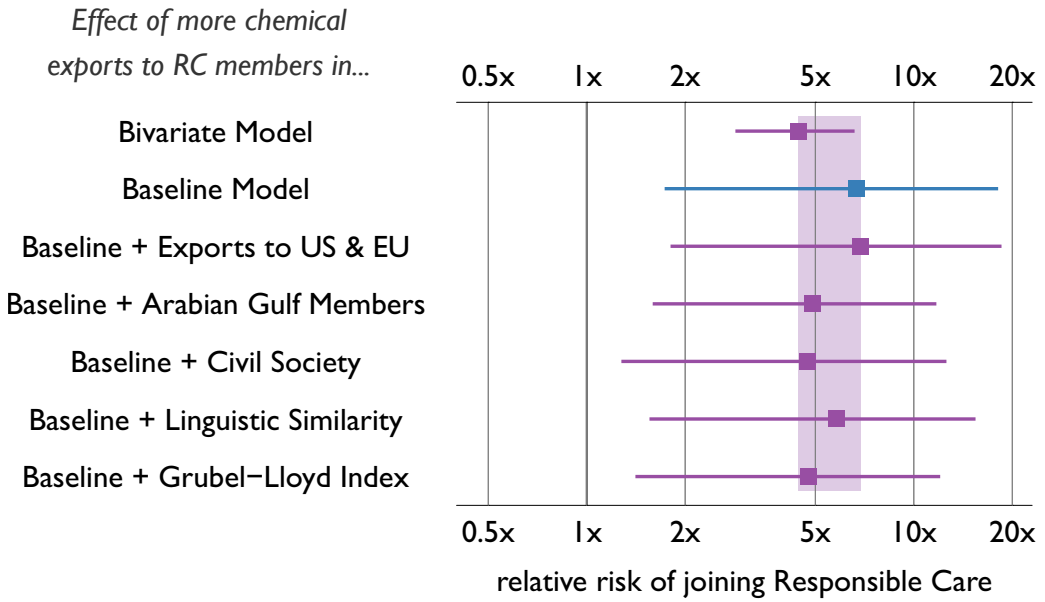

Figure 4. *Robustness of the Responsible Care program's California Effect.* Each entry in this "ropeladder plot" (Adolph, 2013) shows the estimated relative risk of joining of Responsible Care when a country's exports to RC members increases from the 25th percentile to the 75th percentile (all else equal) under different model specifications. The blue square indicates the point estimate of this effect under the baseline model from Figure 3 and the purple circles indicate alternative estimates of the California Effect under alternative models. Each circle or square is filled in when the effect is significant at the 0.05 level. Horizontal lines show 95% confidence intervals. The shaded purple box show the range of point estimates across all robustness checks.

artifact of the specific set or number of controls we included in the baseline model. In this bivariate model, we find a substantively similar but more precise California Effect: more chemical exports to RC members raises the risk of RC membership by 4.09 times (95% CI: 2.73 to 5.91).

For the remainder of our robustness checks, we return to the full set of covariates contained in our baseline model and make specific additions or substitutions. For example, if we replace the control for chemical exports to OECD countries with a control for chemical exports to the United States and EU, we find no change whatsoever in the effect of exports to RC members, suggesting the California Effect we identify is not sensitive to our definition of "rich, heavily regulated countries." Likewise, our results do not materially change if we include in the model the six Arabian Gulf countries

we excluded in the baseline model on the grounds of their choice to join RC being correlated.

Our next robustness check addresses the limitations of our measure of environmental NGO activity, which captures the number of environmental NGOs currently present in each country. In the absence of a time-varying measure of environmental NGO presence, we turn to broader measures of domestic civil society activity, on the assumption that environmental NGOs are often an important part of broader domestic civil society organization (Anheier and Themudo, 2002). We therefore add to the model the *Core civil society index* of the Varieties of Democracy project, a time-varying measure of government repression and control over entry and exit of civil society organizations and popular participation in civil society. While countries with a stronger civil society are 2.02 time more likely to join RC, the result is smaller than that associated with traditional measures of democracy, and not statistically significant (95% CI: 0.83 to 4.15). Our estimate of the effect of the RC California effect remains unchanged.[15]

Our penultimate robustness check considers the possibility that neighborhood influences on RC membership may be not spatial but cultural in nature. Thus we add to the baseline model a measure of the percentage of current RC member states that share with a given country the same primary language (or, where legally established, any official languages). We do, indeed, find a modest positive effect of linguistic similarity on the risk of joining RC: countries that share a language with more current members are 1.42 times more likely to join (95% CI: 1.17 to 1.71). However, controlling for the linguistic neighborhood does not alter the main result regarding the effect of exporting to RC members.

Finally, we address a challenge, known as Galton's problem, that confronts all studies of cross-national diffusion: it is possible we have mistaken one of a variety of other causes, including independent, convergent development across national chemical industries, for a process of imitation and influence. While we can never fully eliminate the possibility of confounding, we are concerned about a particular alternative explanation. It may be the case that countries with similar chemical industries may have similar tendencies to trade with either developed countries (in general) or RC members (in particular), and that these similar industrial structures may also encourage countries

15 In this robustness check, we exclude the Polity score measure of democracy, as it is highly correlated with the Varieties of Democracy Core civil society index, and we lack sufficient data to parse the difference between these two measures in a single model. However, even if we include both measures as controls, our results for the RC California effect remain the same.

to adopt RC around the same time. While Galton's problem can never be completely resolved in observational research (Shalizi and Thomas, 2011), there are two reasons to view diffusion as the more likely explanation in this case. First, the lack of a relationship between trade with the OECD and RC membership casts doubt on industrial structure as a confounder: if domestic chemical industry structure were truly the cause of RC membership, we would expect countries with similar trade exposure to developed countries to have similar tendencies to join RC. Second, as an additional check, we added a control for the degree of intra-industry trade in chemicals, which should also proxy similarities in chemical industries across countries. Specifically, we use the Grubel-Lloyd index (Grubel and Lloyd, 1971), which rates the degree of intra-industry trade from 0, indicating a country is solely a chemical importer or exporter, to 1, indicating an even mix of import and export in chemicals.[16] An increase from the 25th to the 75th percentile of intra-industry trade in chemicals renders countries 54% more likely to join RC, although the effect is not statistically significant (95% CI: 0.90 to 2.45). Yet as Figure 4 shows, with this new control the California effect of trade with other RC members remains significant and substantively similar to the baseline model, suggesting again that diffusion, rather than similar industrial development, most likely lies behind our findings.

Conclusion

The 1984 Bhopal disaster was a wakeup call for the chemical industry. It drove home the point that industrial accidents in one firm affect all firms in the industry. Given the collective nature of the reputation problem, a collective response was required. This is why the chemical industry launched the industry level RC club.

Much of the literature on voluntary clubs focus on why firms join these clubs. This paper explored the diffusion of a private institutional framework itself. Namely, why do national industry associations adopt RC and thereby become part of the institution itself? We focused in particular on the role of international trade in explaining RC membership, thereby engaging in an important policy debate: whether international trade hurts or promotes environmental regulation. On the one hand, some expect that international trade leads to races to the bottom, as low levels of regulation would attract firms to a country (Charnovitz, 1993). On the other hand, some argue that trade

16 For country i and year t, the Grubel-Lloyd index of intra-industry trade is $1 - (\text{Exports}_{it} - \text{Imports}_{it})/(\text{Exports}_{it} + \text{Imports}_{it})$, where Exports_{it} indicates country i's total exports in the chemical sector, while Imports_{it} indicates total chemical imports to country i.

can promote the diffusion of environmental regulation: through the requirements of export markets, sending countries will increase their standards (Vogel, 1995).

In our research, we find strong evidence for this last argument. We find that the more countries trade with RC members, the higher the likelihood that the national industry associations in those countries join RC. This provides evidence for the "California Effect," namely that standards are spread via the export destination. Of course, national associations in importing countries themselves are probably responding to NGO and stakeholder pressure to demonstrate environmental stewardship in their global supply chains. And when national associations have themselves joined Responsible Care, NGOs expect that they will require similar standards from their overseas suppliers. Thus, membership in Responsible Care becomes a key element of the diffusion dynamics. This is why we didn't find evidence for the "volume of trade" argument. The value of a country's chemical exports had no influence on the "risk" of joining RC.

Another driver for RC membership, though its effect is smaller, is the share of countries in a country's vicinity that are members of RC. This suggests that membership of nearby countries facilitates the uptake of RC. In terms of domestic drivers, larger economies and more democratic countries are particularly likely to adopt RC. Multilateral environmental treaty ratification, the number of environmental NGOs, the size of FDI, exports to the OECD or higher level of economic development were not significant drivers of RC uptake among national chemical industry associations.

Although our article focuses on the role of trade in the decision of national chemical associations associations to join RC, there are surely other factors we have overlooked due to limited data availability. Because of a lack of consistent longitudinal data, we are unable to assess the role that internal politics, firm concentration, or other chemical industry or association characteristics play in associations' decisions to join RC. In particular, we cannot address the possibility that large firms may have greater influence on national associations, or that differences across firms within an association may influence the politics of deciding to join RC.[17] We encourage further data collection and research to address these limitations and to take associations' internal dynamics into account.

At a time of emerging opposition to international trade, our paper offers a word of caution. While trade has several negative consequences, in some situations it can serve as a vehicle for the diffusion of positive norms and practices, even ones that are

17 Heterogeneous firm preferences and behavior within an industry have been noted in other policy areas, such as climate change (Jones and Levy, 2007; Fisher, Leifeld, and Iwaki, 2013).

embodied in voluntary clubs. The crucial issue is that buyers must demand that sellers demonstrate good behavior. Thus, our paper suggests that instead of blaming or praising trade, we need to encourage buyers to exercise their power as customers and demand better practices and superior standards from their sellers.

Appendix

Table 2. Descriptive statistics of covariates for all country-years at risk.

			percentiles		
Covariate	**Mean**	**SD**	**25th**	**50th**	**75th**
Percent of chemical exports sent to current RC members	45.49	34.63	10.79	45.48	77.78
Percent of chemical exports sent to current OECD states	40.24	31.49	10.90	35.77	65.40
Chemical exports as a percent of world chemical exports	0.21	1.08	0.00	0.01	0.05
Percent of countries within 500 mi belonging to RC	14.30	22.36	0.00	0.00	20.00
Country formed after RC was founded	0.13	0.33	0.00	0.00	0.00
Environmental treaty ratification score	-0.12	0.82	-0.63	-0.31	0.21
Count of environmental NGOs present	5.09	7.12	1.00	3.00	6.00
Inward FDI stocks as a percent of GDP	32.64	80.69	6.01	15.11	34.13
Polity-2 democracy score	11.89	6.41	6.00	14.00	18.00
GDP per capita (in constant $k)	4.76	10.27	0.67	1.63	4.37
GDP (in constant $b)	108.16	498.68	4.72	12.98	43.77

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