Community Pressure and the Relocation of Toxic Facilities

Xiao Wang, University of Illinois at Urbana Champaign, xwang208@illinois.edu
George Deltas, University of Illinois at Urbana Champaign, deltas@illinois.edu
Madhu Khanna, University of Illinois at Urbana Champaign, khanna1@illinois.edu
Xiang Bi, University of Florida, xiangbi@ufl.edu

Selected Paper prepared for presentation at the 2017 Agricultural & Applied Economics Association Annual Meeting, Chicago, Illinois, July 30-August 1

Community Pressure and the Relocation of Toxic Facilities

Xiao Wang, George Deltas, Madhu Khanna, Xiang Bi

May 11, 2017

Abstract

In mid-1989, the first report from the Toxic Releases Inventory (TRI) program, one of the most prominent environmental right-to-know programs in the US, was released to the public and generated community pressure on the facilities that emit toxic chemicals to their neighborhoods. This paper examines how community pressure characterized by the community demographics affects the tendency of local toxic facilities to relocate. Our results show that a 1% increase in the population density and the share high-educated residents in the community will raise the probability of toxic facilities to relocate by 0.1% and 2.3% respectively. However, we find little evidence on a heterogeneous relocation tendency of the light and heavy polluters. These results suggest that the public pressure initialed by the TRI program does motivate toxic facilities to leave communities with a relatively high demand for environmental goods, but the pressure may not effectively target towards the heavy polluters.

JEL Code: R3, Q53, D63

Key Words: Relocation, Toxic Release Inventory, Environmental Justice

1 Introduction

Public information disclosure has been widely used as an environmental regulation instrument to engage the public in providing incentives for firms to self-regulate their environmental performance. The Toxic Release Inventory (TRI) program is a key example of such an approach. It mandates manufacturing facilities emitting regulated toxic chemicals over a threshold to report their level of emissions annually to the US Environmental Protection Agency (EPA), which will then publicly disclose this information through an annual TRI report. Since the first public release, the TRI information has effectively garnered media coverage and the attention of communities and investors (Hamilton, 1995a; Mastromonaco, 2015). This public concern on toxic releases then made the polluters start to suffer increasing scrutiny and community pressure. Researchers show that the TRI information has stimulated community activists to participate in negotiations with local polluting facilities on pollution reduction and compensation (MacLean and Orum, 1992), and this has generated negative effects on stock market returns of large polluters (Khanna, Quimio, and Bojilova, 1998).

The TRI was first released in June 1989 but garnered credibility and attention mainly from 1990 onwards (Hamilton, 2005). It made communities aware for the first time about the location and emissions of toxic facilities in their region. A growing body of literature has examined the impact of community characteristics on the location choice of toxic facilities that are entering a market (e.g. De Silva, Hubbard, and Schiller (2016)). However, few research has examined the relocation responses of existing facilities. This is probably because the relocation decisions need to face extra pre-relocation costs, which makes the case less likely to happen and harder to observe (Jeppesen and Folmer, 2001). However, relocation is much more interesting than the entering of new facilities to many researchers because existing facilities who want to move treat location decision more seriously than many new facilities. Lots of entrepreneurs do not consider location much than the finance and other factors (Pellenbarg, 2005). This makes it a less ideal objects of research about the influence of location characteristics on the location choice of facilities.

In this study, we seek to examine the incentives created by the public disclosure of environmental information for the facilities to relocate across communities. We mainly investigate the impact of community characteristics on the likelihood of a TRI-reporting facility moving from its initial location. Then as a complement, we compare the destinations of the relocated facilities to their origins and explore the after-moving behavior of the facilities. We undertake this analysis using panel data of 20,325 facilities reporting to the TRI during 1990 to 2011. The data include detailed information about the location of each facility and the demographics of their corresponding census-tracts.

We proxy the public pressure asserted by communities using five community characteristics: the population density, per capita income, education level, voter turnout, and the racial composition. In examining the impact of community pressure, we control for other factors that could also influence the relocation decision of facilities, namely local regulatory pressure, as proxied by the status of a county in being in "attainment" with the National Ambient Air Quality Standard. Additionally, we control for facility characteristics that could influence the extent of scrutiny that facilities may face from the public and the facilities' costs of moving. We proxy for these factors by the scale of the toxic emissions from each facility and by its size (number of employees). We also include year, industry and location fixed effects to control for unobserved factors correlated with the relocation decisions in some specifications.

Early research examining the association between the location of toxic facilities and the community characteristics suffers from the reverse causality problem that arises from households' voting with their feet for environmental quality. That is, with the exit and entry of toxic facilities, households can migrate as a response to the change of local environmental quality and thus alter the community demographics. This could make it difficult to identify whether community characteristics affect facilities' location or vice-versa. To overcome this identification problem, we use the 1990 demographics to explain the re-location of facilities afterwards. Since the public had little information about toxic emissions prior to 1990, community characteristics before 1990 could not have been affected by the emission of local facilities, given the invisible and odorless nature of most toxic pollutants.

We undertake the analysis using several different but complementary approaches. We first estimate the effects of the community demographics in 1990 on the relocation of local toxic facilities over the following ten or twenty years. Next, we include time-varying information about relocation decisions and perform a panel regression that estimates the long-term effects of the demographics in 1990 on the probability of facilities' relocating in each specific year after 1990. The first regression describes the prevalence of the relocation of facilities after communities learned about their exposure to toxic pollutants, while the second estimates the annual probability of a toxic facility's relocation considering the impact of time-varying factors. In both analyses, we include the annual emission level of facilities and its interaction with the demographic characteristics, thereby examining the different impacts of the demographic factors on the relocation of heavy and light polluters. We also compare the destination choices and the origins of the relocated facilities to further check the role of community pressure on the relocation decisions.

The main results show that a 1% increase in the population density of a census tract in 1990 increased the probability of a toxic facility in that census tract to relocate in some subsequent year by 0.1% on average, and a 1% increase in the share of residents with a bachelor degree or higher increased the probability of relocation by 2.3% on average. However, little evidence is found that the level of emissions and its interaction with those demographic factors have significant impacts on the relocation except that the facilities with zero or no reported emission are more likely to move. These results indicate that community pressure did have a statistically significant effect on the facilities' relocation decisions but the effect was not targeted effectively towards large polluters. We also find that the relocated facilities tended to move into sparsely populated, poor, and less educated communities.

These findings suggest that toxic facilities do use relocation to reduce the community pressure around them. More interestingly, facing the same community characteristics, heavy and light polluters have a similar tendency to relocate. This could be because the relocation costs are higher for larger emitters and exceed the costs from the community pressure. However, it may also be that the intensity of community pressure is not based on the facilities' level of emissions reported to TRI but only on whether they are listed in the TRI as an emitter. Our findings show that the potential for relocation and the absence of the effective targeting of public pressure may undermine the effectiveness of public disclosure programs; instead of inducing pollution intensive firms to reduce emissions, they may simply lead to reshuffling of emissions across space.

2 Literature Review

2.1 Impacts of Community Demographics on Toxic Facilities

Many studies have found evidence that the TRI program increased the communications between toxic facilities and their local communities. Hamilton (2005) surveys the current literature and lists two ways that communities usually use to claim their rights for a toxic-free environment. One way is the direct negotiation, which is usually carried out by residents living nearby the toxic facilities. Researchers have found that local community groups used court suits and labor unions to require the facilities to be "good neighbors" (MacLean and Orum, 1992). For example in Northfield, Minnesota, the release of the TRI data promoted the community activists to join the negotiation of the local workers union with the Sheldahl Incorporated plant, resulting in the company's promise to reduce its use and emissions of methylene chloride (Hamilton, 2005). The other way is the collective action. In the non-Coasean world, the process of direct negotiations can be hard to manage when the number of victims is large (Baumol and Oates, 1988), and in those scenarios, local communities need to use the political process such as lobbying local governments to voice their demands. MacLean (1996) pointed out that the TRI information can be a powerful political force.

He gave an example from the Ohio Environmental Council which took advantage of TRI information in the mayor election of Cincinnati to deal with the complains from citizens on the toxic polluters.

The community pressure from the TRI information disclosure can also make the investors generate negative expectation on the profit of the polluting facilities. Particularly, heavy polluters are expected have to face expenditures on pollution reduction, liability for court suits, and compensation to local communities. Their expectations have been found to be reflected on the stock price of the TRI facilities and thereby generate potential financial losses on the polluters (Konar and Cohen, 1997). Khanna, Quimio, and Bojilova (1998) further found that the negative impacts on the stock market returns of large polluters have led the facilities to subsequently reduce their toxic emission. This financial influence can strengthen the impact of the community pressure on toxic facilities.

Motivated by the negative impact of community pressure on toxic facilities, several studies have examined the strategic locating behavior of the facilities. In these studies, researchers usually proxy the community pressure by specific community characteristics referring to the literature about people's value on environmental amenities (e.g. Hausman (1993), Roe et al. (2001), S. E. Sexton and A. L. Sexton (2014)). Overall, the literature suggests that rich and high-educated people have a higher willingness to pay for environmental amenities; so do the communities with high population density because they have more victims. Some research on environmental injustice also tests the impact the racial composition, which is also believed to be used by facilities to judge the compensation demand of communities (e.g. Brown (1995)). However, the current literature has not generated consistent conclusions on the effect of race. Hamilton (1995b) further adds the voter turnout as an additional proxy, arguing that communities with a higher propensity of having collective actions are more likely to voice their rights.

Having these demographic factors as proxies, Hamilton (1995b) uses the 1987 TSDR[1]

[1]TSDR is the National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities.

survey data on toxic facilities to empirically examine the influence of community pressure on the facilities' capacity expansion plan, which is a subset of the location choice decision. The plans are prospective and thus are unlikely to affect the demographics of the facilities' neighborhoods at the survey time. The estimating results show that facilities in sparsely populated, low-educated, and low-voter-turnout communities are more likely to have a capacity expansion plan. However, it also shows that rich communities are correlated with more capacity expansion plans while the racial composition has no significant impacts.

Arora and Cason (1999) improve the research of Hamilton (1995b) by using the TRI data which reflect the real behavior of toxic facilities. Using the zip-code level data and a probit model, they analyze the relationship between community demographics in 1990 and whether the community had toxic facilities in 1990 or 1993. Their results show a significant effect of the racial composition but no effect of voter turnout after controlling for the income, education, and population. However, as the authors point out, there is no causal inference from this regression due to the potential reverse causality problem, which may arise from the influence of the location of facilities on the migration of local residents.

Wolverton (2009) overcomes the reverse causality problem through using the community demographics data of the first year when a toxic facility opened in the community to explain the location of facilities. Given that communities are hard to respond to the arrivals of facilities instantly, the demographics of communities are not contaminated by the facility's arriving. Using the TRI data of Texas from 1987 to 1993, this analysis finds negative effects of income on the location of facilities but no significant effects of racial composition or population. Moreover, they surprisingly found that communities with a high rate of educated people or voter turnout are more likely to attract facilities. Their explanation points out that the education level may also contain the information on local labor quality and the voter turnout may contain information on the communities' demand of more jobs. Later, De Silva, Hubbard, and Schiller (2016) follow Wolverton (2009)'s identification strategy while updating the TRI data to the period of 1999 to 2006 and changing the sets of covariates.

Their results, however, show a significant effect of the racial composition although also controlling for income, education, and population.

Wolverton (2009) and De Silva, Hubbard, and Schiller (2016) also emphasize the importance of controlling for critical economic factors which can be correlated with the local demographics and also the location choice of facilities in the regression. Particularly, the former analysis controls for the transportation cost, labor cost, and the general state of local economy using the distance to railroads, county-average wage rate, and the unemployment rate, respectively. The later analysis adds the number of facilities in a community[2] in the estimation to further control for the industrial agglomeration effect. In particular, De Silva, Hubbard, and Schiller (2016) notice that clean facilities in the local industrial cluster contribute insignificantly to the agglomeration effect on a toxic facility, but other toxic facilities contribute significantly.

2.2 Relocation Behavior of Facilities

Early studies on the relocation of facilities focus much on the influence of local economic and geographic factors. Moses (1958) is one of the pioneers that theoretically explain the relocation of industrial activities by modeling the trade-off of facilities between cheaper inputs and the transportation costs across locations. Nakosteen and Zimmer (1987) embody this spirit and form their model to generate testable hypotheses on the determinants and consequences of the relocation of facilities. They find that the growth of state economy and industry is correlated with a facility's propensity to relocate. Krugman (1997) documents more comprehensively the critical factors that affect the relocation of facilities, including the local labor cost, market size, transportation costs, and natural environments. Duranton and Puga (2004) additionally address the effect of the agglomeration economy on the optimal location choice of facilities. These studies support the work of Wolverton (2009) on controlling the economic factors in the analysis on the location choice of facilities, especially those

[2] In both Wolverton (2009) and De Silva, Hubbard, and Schiller (2016), the community is defined as a census tract.

correlated with the local demographic factors.

In the modern research on this topic, researchers start to treat facilities as agents with limited information and rationality. They integrate this assumption to the analytical framework by including the facilities' internal characteristics in the models. These characteristics can determine the relocation behavior of facilities through affecting the relocation transaction costs of the facilities. For example, a large facility may spend much for the relocation-related activities such as replacing fixed assets, re-employing workers, and collecting information about the destinations for relocating. These costs may cancel out the benefits of relocation for these facilities and thus make them inert to move. Van Dijk and Pellenbarg (2000) and Brouwer, Mariotti, and Ommeren (2004) use survey data on facilities' willingness to relocate and their internal characteristics to analyze the determinants of the relocation. Using an ordered logit regression, they find that the size, growth rate, industry sector, market size (e.g. serving local market or export/import to interaction market), and the type of organization (e.g. subsidiary to another corporate) of facilities are factors that significantly affect the probability of facilities to relocate.

3 Conceptual Framework of Facilities' Relocation

We follow Nakosteen and Zimmer (1987) to explain the relocation decisions of toxic facilities using a profit maximization framework. Denote facilities as $i, i = 1, 2, ..., I$. For any facility i, the goal for the entrepreneurs is to maximize the profit π_i, which is a simple function of $p_i * q_i$. p_i denotes the market price of products and input factors of facility i, and q_i denotes the quantities. Specifically, we assume that no facility has a large market power to influence the local price and thus have strategic actions. p and q are determined by the characteristics of the facility i and its local market l. Denote the observed characteristics of facility i in location l as X_{il}, the observed characteristics of location l as Z_l, and the unobserved factors as e_{il}. Then we could write π_i as a function $f(X_{il}, Z_l, e_{il})$.

Facility i can relocate from location l_0 to l_1 and alter Z_l to change its profit level. Given the shift of Z_l, the facility may also alter the level of X_{il}, such as the toxic emission level, to reoptimize its profit. Suppose the relocation cost is $C_{il_0l_1}$. Facility i will then relocate from l_0 when $\pi_{il_0}(X_{il_0}, Z_{l_0}, e_{il_0}) + C_{il_0l_1}$ is smaller than the $\pi_{il_1}(X_{il_1}, Z_{l_1}, e_{il_1})$ for the best available alternative l_1.

Theoretically, it would be ideal to comprehensively analyze the joint decision of a facility on whether to leave l_0, the destination choice of l_1, and the optimal after-moving X_{il} in one model. However, the empirical work has compuational problems in the identification process. Specifically, modeling the destination choice requires us to identify the choice set of the alternative locations for each facility. Many empirical studies at the small regional level can use the whole set of zipcodes, census tracts, or counties in the region as the choice set (e.g. De Silva, Hubbard, and Schiller (2016)). However, our study uses the TRI facilities across the US, and the number of jurisdictions is tremendously large at the national level. Although econometricians have developed models to deal with the large choice set problem, integrating it with the relocation decision and the after-moving behavior will make the model be too complicated to generate empirically testable hypothesis.

Therefore, in this research, we mainly focuses on modeling the decision of toxic facilities on whether to leave their current location. The leaving can be motivated by the facility's desire to expand capacity, shifts in the demand or labor market, or other profit related concerns that can overcome the inertia of staying in the current place (Van Dijk and Pellenbarg, 2000). We assume that given certain alternative locations, facility i judges the relocation decision mainly based on the determinants of the profit in its current location l_0 and the estimated cost of relocating. Conditional on the relocation decision, the facility then enter a transition state where they decide their after-moving behavior and select the optimal alternative location from suitable sites that are available(List, McHone, and Millimet, 2003). We touch the analysis on the destination choice and the after-moving behavior in the end through a comparison between the before- and after-relocation scenarios of the facilities using summary statistics.

4 Empirical Model

4.1 The Prevalence of Relocation: A Cross-sectional Regression

We start analyzing the relocation behavior of toxic facilities in the TRI program from looking at the beginning of the story in 1990. The TRI was first released in 1989 but garnered credibility and attention mainly from 1990 onwards (Hamilton, 2005). Prior to the TRI, there was no such information source for the public to know about toxic facilities and many of their invisible and odorless emissions (Bui and Mayer, 2003; US EPA, 2016). These facts indicate that toxic facilities were less likely to consider the community pressure on toxic pollutants and then intentionally choose their location prior to 1990. This exogeneity provides us a good condition for identifying the effect of community pressure in 1990 on the relocation decision of facilities after that.

We take advantage of the geographic variations of the community characteristics in 1990 and do a cross-sectional regression to explain the probability of toxic facilities in each community to relocate within the subsequent T years after 1990. The regression is performed using a logit model at the facility level. The equation can be written as

$$logit(Move_{ilcsk}) = \alpha + \beta Comm_{lcs} + \gamma_1 X_{ilcsk} + \gamma_2 Z_{lcsk} + \lambda_s + \lambda_k + \epsilon_{ilcsk} \tag{1}$$

where i denotes facilities; k denotes industries; l, c, and s denote census tracts, counties, and states, respectively. $Move_{ilcsk}$ is a binary indicator of whether facility i relocated from its original census tract l_{1990} within T years after 1990. $Comm_{lcs}$ denotes the key explanatory variables including the characteristics of the census tract where facility i located in 1990. They are used to measure the community pressure suffered by the facility. X_{ilcsk} is the facility characteristics that we controlled in the regression. It includes the size, which is used to measure the relocating cost of the facility, and the scale of toxic pollution of facility i, which is used to measure the extent of scrutiny that the facility may face from the public. Z_{lcsk} is the location characteristics controlling for the local regulatory pressure and the socio-economic conditions of the local market. They can influence the relocation decision through determining the profit π_{il_0} of the facility. λ_s and λ_k denote the state and industry fixed effects. ϵ_{ilcsk} denotes the facility-specific unobserved factors.

We choose census tract as the geographic unit to identify relocation because of the consideration on the scale of impact of toxic pollutants on the neighborhoods. Currie et al. (2015) find that the emission of eight common toxic chemicals affects the air quality[3] of neighborhoods only at a localized scale, which can be within a 1-mile-radius. In our available data, census tract is the smallest unit of measurement of most community characteristics[4] and thereby is properest to use to catch the geographic scale of residents affected by the toxic pollutants and generating pressure. This measurement cannot explain the relocation of facilities within the community, so we only focus on the relocation across census tracts. A census tract is usually much larger than a 1-mile-radius circle, and the characteristics outside the circle may add noise to the estimation. However, we expect the noise to be small if considering the media's effect, which may initiate a wider source of pressure from residents living outside of the circle.

Following the literature, we employ five community characteristics as proxies for the community pressure($Comm_{lcs}$) on toxic facilities. They are the population density, per capita income, education level, racial composition, and the voter turnout. Specifically, the education level is measured by the share of residents who have a bachelor degree or higher, and the racial composition is measured by the share of white residents. Our data on the first

[3]We only talk about the air quality here because of two reasons. First, according to the TRI data, air emission is the major part($> 50\%$) of total emission of more than 70% toxic facilities in the US. Second, air emission is all on-site, which means it is unable to be transported into places far from the neighborhood around the toxic facility. This makes the community pressure be more targeted to the facility nearby.

[4]We obtain the data from the US Census, which is the most widely used data source for the statistics of community demographics. We can only obtain the data on per capita income, the most widely used proxy for community pressure, from at most the census tract level.

four characteristics can reach to the census tract level, but the data on the voter turnout can only be obtained at the county level. This coarseness can cause the voter turnout, as well as some other covariates measured at the county level, to lose their power to explain the relocation within counties. To generate a reasonable estimation on their effects, we also examine the case where relocation is identified only as moves across county borders. However in these regressions, we still use the census-tract demographics to explain the cross-county moves, assuming that the pressure on the facilities still mainly come from the residents living nearby. We only want to increase the explanation power of the county-level characteristics in the regression.

For the two facility characteristics in X_{ilcsk}, we use the the number of employees to measure the size of a facility and use the total amount of toxic releases to measure the scale of pollution from the facility. Particularly, we use linear splines to allow the emission levels of facilities to enter the model in a flexible form. To test whether the pressure of a community is higher on heavy polluters, we also interact the toxic emission terms with the community characteristics in the regression. Finally, we add a binary indicator for the emission of zero to deal with the left-censoring problem initiated from the data-generating process of TRI. The TRI program only requires toxic facilities to report their amount of emission when its level is greater than the reporting threshold; therefore, many facilities have missing values in their emission level in some years.

We proxy for the local regulatory pressure using the Clean Air Act (CAA) attainment status and the number of toxic facilities in each community. The Clean Air Act requires the EPA to assign a status annually to each county in being in "attainment" or "non-attainment" according to the National Ambient Air Quality Standard. If a county is in "non-attainment", facilities that emit regulated pollutants in that county will receive a more stringent regulation. The regulation generates high abatement costs to the facilities and thus can stimulate them to relocate[5]. The attainment status is measured at the county

[5]If a county is in non-attainment, the EPA will require polluting facilities in the county to implement emission reduction technologies. These techs could be very costly (Greenstone, List, and Syverson, 2012).

level. To further control for a finer local regulatory pressure, we include the number of toxic facilities in each census tract as another covariate. The clustering of toxic facilities can attract the attention of regulators and thus increase the expected environmental regulatory cost of each facility in the cluster (Gray and Shadbegian, 2007). Meanwhile, the number of toxic facilities could generate an agglomeration effect initiated from the industrial cluster which shares similar production factors. This may result in an expected benefits to the facility. As a result, we can not theoretically predict the sign of the total effect of the number of toxic facilities on the relocation of the facilities.

For the economic factors, we control for the local labor cost and the market size using the industry-specific average wage rate and the employment level of the county as proxies. Other unobserved economic, regulatory, and geographic characteristics are captured by the state and industry fixed effects. The state fixed effects could particularly cover the unobserved state-level tax policies, environmental regulations, transportation networks, and other local amenities that have been shown in the literature as determinants of the relocation decisions of facilities. The industry fixed effects can control for the unobserved industry-specific moving trends of facilities (e.g. the sunbelt moving of corporations from the northeast to the west and south). It is worth noticing that we cannot use county fixed effects to consider the time-invariant county-level unobserved factors, which will be ideal if being controlled. This is because many counties that have toxic facilities do not have any facilities relocated during the 20 years; therefore, adding county dummies will restrict these facilities out of the sample in a non-random process.

4.2 Relocation by Year: A Panel Regression

The cross-sectional regression analyzes the prevalence of the relocation of toxic facilities within a long period after the TRI information disclosure. However, policy makers may be

The assignment of the status is also determined by the number of victims in the community and thereby may be correlated with the local demographics. Again, we emphasize the air pollutant regulation because the emissions of about 70% toxic facilities are mainly air emissions. Of the total air toxic emissions, about 71% are under the CAA regulation.

more interested in the propensity of a toxic facility is to move in some year. In this section, we take the time variations of the relocation into account and perform a panel regression. This regression estimates the probability of a facility to relocate in each specific year after 1990.

We still use the logit model built at the facility level to do the regression. The equation can be written as

$$logit(Move_{ilcskt}) = \alpha + \beta Comm_{lcs1990} + \gamma_1 X_{ilcskt-1} + \gamma_2 Z_{lcskt-1} + \lambda_s + \lambda_k + \lambda_t + \epsilon_{ilcskt} \quad (2)$$

where t denotes the year; i,l,c,s,k still denote the facility, census tract, county, state, and industry, respectively. Comparing to Equation 1, the dependent variable $Move_{ilcskt}$ in this model is changed into a binary indicator of whether a toxic facility relocated in year t with t = 1991, 1992,..., 2010[6]. The key explanatory variable $Comm_{lcs1990}$ contains the same set of community characteristics and is still evaluated at the 1990's level. The covariates in X_{ilcskt} and Z_{lcskt} are also the same as those used in the cross-sectional regression, but now with panel data, we can further control for the time variations of these factors to catch their short-term effects on the relocation of facilities. To avoid the reverse causality problem arising from adding the time variations, we use a 1-year lag on X_{ilcskt} and Z_{lcskt} in case some of the covariates respond to the relocation of facilities quickly. λ_s and λ_k denote the state and industry fixed effects, and we add the λ_t - the year fixed effects - into the regression to control for the unobserved events in each specific year.

We use the 1990 level $Comm_{lcs}$ mainly concerning the reverse causality problem. The main data source of the five community characteristics is the US Census, which is carried out decennially and has extremely limited time variations from 1991 to 2010. Using the

[6]The panel data we used in this regression contain the whole time-series of the facilities in the sampling period, including the records of the relocated facilities after their moving. In the panel regression, we do not include these after-moving records because relocation may affect the facility characteristics after relocating, which generates the endogeneity problem. This model explains the moving behavior of facilities using the information before their movings, and thus it works similarly to a survival model. We did not choose the survival model such as Weibull or Cox because of the lack of information on the start year of the facilities, which is a critical parameter in the survival model.

interpolation method may cause bias in the estimation because in each decade, the change in the demographics can be endogenous to the migration of toxic facilities within the decade (Banzhaf and Walsh, 2008). Therefore, we follow the same strategy as in the cross-sectional regression and use the 1990 level demographics to explain the relocation of facilities in each subsequent years. Identification of the effect of the 1990 demographics on the relocation many years later can be hard because of the large temporal gap. However, as the demographics are highly stationary from 1990 to 2011[7], the cross-sectional variations in 1990 can capture a large part of the variations in 2010, we thereby can still technically identify their effects.

A key advantage of the panel regression comparing to the cross-sectional version is the controlling for the short-term effects of the observed and unobserved factors. These effects can be substantially correlated with the relocation when they are extensive and strong. Take the 2008 financial crisis as an example. The employment level in the US plummeted by about 6% in 2008 and 2009 comparing to 2007[8]; meanwhile, as shown in Figure 1, the relocating rate of toxic facilities increased sharply in 2009 and 2010. This correspondence expresses the importance to control for the short-term impacts of the covariates as well as the year fixed effects.

Before turning into the results, we want to elaborate the potential limitations associated with the identification approach and discuss our trade-offs to deal with it. The first issue is about the assumption on the small market power of the toxic facilities. We find that some counties have only a few facilities which are likely to influence the local demographic and economic characteristics substantially. To reduce the bias from the impact of one specific facility on the whole market, we restrict the sample to the facilities located in counties with more than ten toxic facilities. Meanwhile, adjacent facilities might influence each other through the local market, and their relocation behavior could be correlated, which violates the i.i.d. assumption. We cluster the standard errors at the census tract level to allow for

[7]We did a test on the three variables of their stability by regressing each variable on its 10-year lags. In the results, coefficients of the lags are close to 1: population density has 1.03, per capica income and non-white rate both have 1.01, and share of high education has 0.79, which support the stability.

[8]Refer to the figures from the Bureau of Labor Statistics. http://www.bls.gov/web/empsit/cps_charts.pdf.

the spillovers among adjacent facilities. In the panel regression, this clustering additionally allows for the correlations among the same facility's behavior across years.

The other issue is about the omitted variable bias. First, some facility characteristics may be correlated with the local demographics while also influencing the relocation decision. Brouwer, Mariotti, and Ommeren (2004) and Knoben and Oerlemans (2008) find that a facility's size, growth rate, age, ownership of the current building, the previous relocation history, size of owned market (e.g. local or do import/export business to global markets) and the type of organization (e.g. status of subsidiary to another business) have significant effects on the facility's relocation behavior. The size and growth rate are highly correlated and we have already controlled for the size in the regression. An export- or import-oriented facility tends to locate in areas with specific geographic characteristics, which usually also have particular demographic characteristics (e.g. coastal areas). We consider the import or export orientation of facilities in a robustness check and find consistent results. For the other factors such as the relocation history, we need to assume they are not correlated with local demographics. Second, some unobserved and time-variant location factors may affect both the community demographics in 1990 and the relocation of facilities after 1990 even after controlling of the state fixed effect. One of the key concerned factors is the local tax rate. We use the data from the Census of Government to analyze the local corporate tax rate at the county level and find that it is stable across years. Therefore, the temporal variations is less likely to be a source of serious biases. However, the cross-sectional variations within a state may still matter. We refer to the literature and find that many empirical studies on the relocation of facilities fail to find an effect of the local tax rate on the relocation of facilities (Nakosteen and Zimmer, 1987; Guimarães, Rolfe, and Woodward, 1998; Hu et al., 2008). Based on these results, we believe that this omitted variable only has limited potential to cause a serious bias on the estimations.

5 Data

We use the Toxic Release Inventory(TRI) data from 1990 to 2011 from the EPA to identify toxic facilities. The TRI program covers facilities that 1) have more than 10 employees, 2) are under specific SIC codes, which include utilities, all manufacturing, hazardous waste and other main pollution-contributing industries, and 3) manufacture, process or use any TRI-listed chemicals in quantities above the threshold levels[9]. Once covered by the TRI program, facilities are mandated to submit information about their annual toxic emissions of each chemical regulated by the TRI to the EPA (SARA1986). The TRI program started in 1987, but the first public disclosure of the 1987 data was in June 1989. Since then, the EPA publishes the TRI data collected in the previous year together with an analysis report every year in July. In our analysis, we focus on the reaction of facilities to the community pressure in 1990. Given that the households only know the TRI data of 1990 in year 1991, we only explain the relocation of facilities from 1991 onwards in this analysis.

Our data on the relocation of toxic facilities come from the National Establishment Time-Series database(NETS). The NETS data provide information about the geographic coordinates and the characteristics of facilities in each year from 1990 to 2011. We combine the NETS data with the TRI data through matching the address, 8-digit SIC code, and the name of facilities with the assists from the NETS data provider[10]. This process matches 79.1% records in the TRI data. We did a two-sample t-test on the level of toxic emissions of

[9] The thresholds are different across chemicals and depend on the way that a facility handles the chemical. Generally, the threshold is 25,000 lbs a year for manufacturing a chemical or 10,000 lbs for the usage of a chemical. It is also worth noticing that reporting threshold is on the amount of chemicals that facilities handled not actually emitted. Even if a facility recycled all the toxic wastes and have zero emission, they still need to report if their handling amount is over the threshold. Details can be found in https://www.epa.gov/toxics-release-inventory-tri-program/basics-tri-reporting.

[10] The NETS data provider first treats a facility that has the same street-level address and can be uniquely identified by the address in both NETS and TRI as the same facility. If the street address cannot uniquely identify a facility in either dataset, it then turns to the address + 8-digit SIC code to do the matching and identification. If still fails, it then turns to address + SIC + name of facility, so on and so forth. We complement this matching by changing the street address, which is hard to code for the matching, to the 4-digit, 3-digit, and 2-digit geographic coordination. The three levels of geographic coordination could identify the 11m-radius, 110m-radius, and 1.1km-radius circle on the map. Our approach managed to match additional TRI records to the NETS data after using the matching results from the NETS data provider.

the matched and unmatched records. The results show that the unmatched records have a significantly higher level of total and onsite toxic emissions but a lower level of offsite toxic emissions on average than the matched records. This means, comparing to the full set of TRI records, the facilities in our sample are cleaner but have more releases transferring to offsite places on average. This information needs to be remembered when doing inference from the testing results on this sample.

The NETS data identify relocation of a facility through comparing the facility's address in one year with its address in the next year. If there is a difference, the current year will be assigned as the time of the relocation. With the address data from 1990 to 2011, we identify relocation from 1990 to 2010.

The NETS data is converted from the Dunn and Bradstreet data archives, which is widely used in the studies on the location of facilities (e.g. Nakosteen and Zimmer (1987); Neumark, Zhang, and Wall (2007); Holladay (2015)). Neumark, Zhang, and Wall (2007) check the data quality of NETS on the relocation of facilities using a media search. They find that the NETS reflects about three-quarters of the cross-city relocation that can be searched in the media, thereby offers a good record for the real relocating behavior of facilities. They also show that the NETS data on the employment of facilities have a comparable quality to the Current Population Survey (CPS) from the US Census Bureau.

We obtain data on the population density, per capita income, education level, and the racial composition of each census tract in the US from the 1990 Census from the US Census Bureau. The voter turnout data come from the Dave Leip's Atlas of the US presidential elections from 1988 to 2012. For the covariates, we obtain the data on the industry-specific wage rate and the employment level of each county from the Quarterly Census of Employment and Wages from the Bureau of Labor Statistics. The data on the Clean Air Act (CAA) attainment status of counties come from the EPA Greenbook.

6 Results

6.1 Summary of the Sample

Our final sample of this analysis contains 20,325 toxic facilities, including 3,606 facilities that have relocated across census tracts during 1991 to 2010 and 16,719 facilities not relocated[11], i.e. a rate of relocation of 17.7%. In the 3,606 relocated facilities, 1,667 have relocated across counties. The locations of these toxic facilities cover 10,002 census tracts which belong to 499 counties.

Table 1 presents the summary statistics of the the facility characteristics, the 1990 demographics, and other socio-economic characteristics of the census tracts/counties that have facilities located in. We did the calculation for the non-relocated and relocated facilities separately and then use a two-sample t-test to show the difference in the mean between the two groups. We can first see that the census tracts with a high level of population density, per capita income, and education rate are more likely to have a relocated facility. However, there is no statistically significant difference in the voter turnout. The share of white residents is significantly lower in the census tracts with moved facilities, but the significance disappear for the case of the cross-county moves. This result reflects the noise in the racial composition variable apart from the information on the community pressure. In terms of the other factors, we can see that the relocated facilities also have a smaller number of employees and less amount of toxic emission although the difference in the emission level is not quite significant. Meanwhile, relocated facilities are located in counties with a high wage rate, a high employment level and a high propensity of being non-attainment.

[11] We only use the facilities born before 1990 in the sample since we are interested in the effect of the community pressure motivated from the TRI program. For facilities born after 1990, they may initially choose to locate in poor and less educated communities because of the impact of TRI program. Their initial location choice could influence the relocation decision through affecting the the profit π_{il_0}. To avoid encountering this source of bias, we do not include facilities born after 1990 in the analysis.

6.2 Results of the Cross-sectional and the Panel Regressions

Table 2 presents the results from the cross-sectional logit regression in the cases of $T = 10$ and $T = 20$. Column (1) and (4) show the results from a specification without including the facility characteristics. Column (2) and (5), (3) and (6) correspond to the specifications including the number of employees and the scale of toxic emissions, respectively. The control variables and the fixed effects are noted in detail in the bottom half of the table.

The results suggest that a high population density and education level of a census tract significantly motivate a toxic facility in the census tract to relocate within 10 or 20 years. Conditional on these two factors, the income, share of whites, and the voter turnout do not show statistically significant effect. From the estimated coefficients in Column (6), we calculate the marginal effects of the population density and the education level at the mean value of the covariates. The results show that a 1% increase in the population density and the share of high-educated residents of a census tract in 1990 will increase the probability of a toxic facility in the census tract to relocate within 20 years by 2.6% and 40.4%. The estimates indicate that strong community pressure can push local toxic facilities to relocate, and the educated communities tend to present a stronger influence.

Column (2) and (5) demonstrate that the number of employees has a negative effect on the relocation of facilities, which is consistent with the research from Van Dijk and Pellenbarg (2000) and Brouwer, Mariotti, and Ommeren (2004) who note that small-sized facilities have fewer transaction costs of relocating. Column (3) and (6) further show that this result is robust after we add the level of emissions in the regression. Using the coefficient in Column (6) and the mean value of the covariates, we calculate the marginal effect of the number of employees and find that a 1% increase in the employee number in 1990 will reduce the probability of a facility's relocating by 2.7%.

In contrast with the number of employees, we can see from Column (3) and (6) that most linear spline terms of the emission levels do not have a significant effect on the relocation, indicating that facilities with a small and a large amount of toxic releases do not have a different tendency to relocate. Nevertheless, the zero-emission indicator has a strong and statistically significant effect, showing a higher relocating propensity of facilities that do not report or report zero toxic releases to the TRI.

We investigate the zero-reported polluters to explain the positive coefficient of the zero-emission indicator. First, we see that the zero emitter are smaller in size than the positive emitters on average, although some of them are still large. By interacting the number of employees with the zero-emission indicator, we find that the total effect of the zero-emission indicator decreases rapidly as the number of employees grows. A t-test results also show that when the facility's size is over 1,200 employees, there is no significant difference in the rate of relocation between the zero emitters and the positive emitters. The above results imply that the facilities with a high propensity to move are both small in size and light in polluting. Their mobility may come from the low relocating cost and small burden of cleaning the old sites before relocating (Levinson, 1996).

In terms of the covariates, we can see a significant positive effect of the county-average employment level and a negative effect of the number of facilities in the census tract. This indicates that toxic facilities are more likely to leave from economic centers, but the agglomeration benefit from local industrial clusters may deter the move. The county-average wage rate has a positive effect in most cases, which means a high labor cost can be a push factor on relocation, but this effect is not statistically significant. It is more concerned that the proxy for the local regulatory pressure, the county attainment status, also only shows an insignificant effect. We presume that this insignificance may come from the weak power of the county-level factors on explaining the relocation within counties. Therefore, we divide the relocated facilities into those moved across counties and those moved within a county and repeat the regression for the two cases separately. Table 3 presents the results from these regressions. Column (1) to (4) show the regression results from the specifications using cross-county moves, and Column (5) to (8) correspond to the specifications using within-county moves. Specifically, in the first case, the facilities that relocated within counties are treated the same as the facilities not moved, and in the second case, we do not include the facilities that moved across counties while also remove the covariates evaluated at the county level from the regression.

From Table 3, we can see that the results on the demographic and facility characteristics in both cases are consistent with the results in Table 2 in terms of the significance level and the signs of most coefficients. However, Column (1) to (4) show a noticeable increase in the significance level of the county attainment status. This result corresponds to our expectation that toxic facilities are more likely to leave communities with stringent environmental regulations. Nevertheless, the number of facilities in the local census tract starts to lose its significant effect on the cross-county relocation, and its magnitude decreases. It indicates that the agglomeration benefit is less likely to retain the facilities that are not only constrained by the local community pressure but also on a broader scale regulatory pressure. Column (1) to (4) also show a notable change in the sign of the voter turnout, which switches from positive to negative, although the effect is not statistically significant. This result does not accord with our hypothesis on the community pressure from the collective actions. However, Wolverton (2009) notice that the statistic of voter turnout also contains other information on the community's collective actions such as their demand for more jobs. Therefore, it is not surprisingly to find that communities with a higher voter turnout retain the toxic facilities.

Table 4 presents the results from the panel regression. We show the functional specifications in the same order as in Table 2 and Table 3. The results are consistent with the ones from the cross-sectional regression. In Column (1) and (2), the population density and the education level of a census tract in 1990 still have a significantly positive effect. From the estimated coefficients in Column (2), we calculate the marginal effects of the population density and the education level at the mean value of the covariates. The results suggest that a 1% increase in the population density and in the share of high-educated residents of a census tract in 1990 will increase the probability of a toxic facility in that census tract to relocate in year t (t = 1991, 1992,...,2010) by 0.1% and 2.3% on average, respectively. The income level, share of white residents, and the voter turnout still have no significant effect. Column (3) to (6) correspond to the panel version of the regressions results show in Table 3. Again, we see a negative effect of the voter turnout when focusing on cross-county moves. In terms of the facility characteristics, we can find that the number of employees has a significant and negative effect on the relocation probability, the zero-emission indicator has a positive effect, while the linear splines of positive emission levels have no significant effect. For the covariates, the county average wage rate starts to show some significance in its effect. The significance may come from adding the time variations of the covariates in the regression, which reflects the importance of controlling for the short-term effects of the economic factors.

6.3 Heterogeneity of the Heavy and Light Polluters

Table 5 and Table 6 present the regression results of the specifications including the interaction terms of the toxic emission levels with the demographic factors. The interactions include the linear splines and also the zero-emission indicator. We make the interaction for one demographic factor at a time. In the table, we only show the cases where the interactions use the demographic factors that have a significant effect in the previous regressions.

Table 5 shows that most of the interaction terms do not have a statistically significant effect on the relocation of facilities within 10 or 20 years, which implies that the community pressure is likely to be homogeneous on the light and heavy polluters. The only term that has a significant effect is the interaction between the population density and the spline including the heaviest emitters. In Column (5), we can see that this term has a positive effect on the relocation probability in 20 years, which indicates that the community pressure may have higher effect on pushing out the heaviest toxic polluters in the long-term. In Column (9) and (11), we can also see a positive effect of the interaction between emission and population density but only with a relatively low significance level.

Table 6 presents consistent results with Table 5, showing an insignificant effect of most interaction terms. However, two interaction terms related to the high education level are significant. The first term is the interaction between the high-education rate with the spline including the heaviest emitters in Column (4). We can see that his term has a positive effect on the probability of relocating across counties in a specific year t. It indicates that the community pressure may also push harder on the heaviest toxic polluters to relocate in the short-term. The second term is the interaction between the education level and the zero-emission indicator in Column (6). We can see the term having a negative effect on the relocation, which means that the community pressure is less likely to affect the within-county relocation of facilities with no reported toxic emission.

7 The Behavior of Toxic Facilities after Moving

As a complement to the relocation story, we also investigate the destination choice and the after-moving behavior of the relocated facilities. Many empirical studies analyze the location choice of toxic facilities using the discrete choice model which predicts the location of facilities with the attributes of each alternative location using a random utility framework. This model requires researchers to identify a finite choice set of locations for each facility. In the existing studies, researchers mostly focus on the locations of toxic facilities at the small regional level such as in one specific state (e.g. Wolverton (2009)). Therefore, they can use the whole set of zipcodes, census tracts, or counties in the region as the choice set (e.g. De Silva, Hubbard, and Schiller (2016)). Nevertheless, our study uses the TRI facilities across the US. The number of counties is tremendously large at the national level, and thus it is hard to carry out a discrete choice analysis even only on the cross-county moves. As a substitute for a regression analysis, we turn to use summary statistics to analyze the destination choice of facilities. Specifically, we did a comparison between the origins and the destinations of each relocated facility in terms of the location characteristics related to the community and regulatory pressure. We expect that the relocated facilities are leaving from communities with high pressure and are moving into communities with relatively low pressure.

Table 7a presents the results from the comparison. We calculate the difference between the origins and destinations in population density, income level, education level, and the voter turnout. To see whether the emission level of facilities affects their destination choice, we show the statistics separately for the positive emitters and the extremely heavy emitters. From the results, we can see that the facilities are relocating into less populated, poorer, and less environmentally regulated communities. The education level is not significantly different between the destinations and the origins in terms of the whole set of moved facilities. However, this gap becomes significant for the movers with a positive emission level after moving and is further extended when we look at the facilities emitting extremely heavily after relocating. The same pattern of the widening gap appears in the income level, attainment status, and in some specifications of the population density. These results imply that facilities that are expected to emit more pollutants are more likely to move into communities with less pressure on their polluting behavior.

We then consider the information contained in the other determinants of the relocation behavior and use the regression results in the previous tables to examine the destination choice of facilities. Specifically, we take advantage of the estimated coefficients from the panel regression, i.e. numbers in Column (2), (4), (6) of Table 4, and calculated the scores(Xb) with respect to the demographic and regulatory characteristics of the origins and destinations. The score is a weighted summation of the values of these location characteristics. It can help us to comprehensively identify the relative attractiveness of the original and destined communities to the toxic facilities.

Table 7b shows the results. Column (3) to (7) shows the scores calculated with the three demographic factors that show a significant difference in the comparison shown in Table 7a. We can see that the score of the origins are significantly higher than the destinations in all specifications, which means the facilities tend to have a higher relocation propensity when facing the characteristics of the origins rather than those of the destinations. The gap of the scores between the two communities expands with an increase in the emission level of the facilities after moving.

The result in Table 7 indicate that when the facilities decided to relocate, they tend to choose their destination communities jointly with their after-moving behavior such as polluting. Motivated by this finding, we examined the facility characteristics before and after the relocation. We still do the comparison using the summary statistics. The characteristics in the comparison are the size, emission level, and the emission density measured by the toxic releases per employee of facilities. Again, we calculate the difference of each characteristic in the origins and the destinations, and then we do a t-test to see whether the difference is significantly away from zero. Our sample contains many facilities that do not report to TRI before moving[12], therefore, we do the summary for the non-reporters and reporters separately to see whether the growth of the reported and non-reported emitters before moving are different after their relocation.

Table 8 presents the results of the summary. Column (1) to (3) present the calculation of the difference in the levels of the facility characteristics, and Column (4) to (6) correspond to the cases with the log of the characteristics. The difference of each facility characteristics X is calculated as the mean value of X in the years after moving minus the mean value of X within 3 years before moving. i.e. $\Delta X = Mean(X)_{t>T} - Mean(X)_{T-3\leq t\leq T}$. To clarify the effect of relocation on the changes of the facility characteristics, we also use the records of the non-moved facilities and carry out a placebo test on the changes before and after a randomly assigned fake move.

We can see from the results that facilities generally increase their size and emission levels after moving, but their emission density do not increases significantly. This growth mainly

[12] Our sample includes all the facilities that report at least once during 1990 to 2011. Some facilities include in the sample only start to report to TRI after moving. However, we cannot know whether these facilities do not use any toxic chemicals or have a emission level under the reporting threshold before moving. Therefore, it is not reasonable to assume that these facilities do not care about the community pressure around them and thus exclude them from the analysis.

comes from the facilities that did not report to TRI before moving. The facilities that report to TRI before moving actually tend to reduce their size and emission levels after moving, but their emission density also do not change much.

Comparing the above results with the results from the placebo test, we can see a significant difference in the magnitude of the ΔX of the non-reporters, which means the growth of these small polluters are not only because of the natural increase in scale over time but also the change of the surroundings because of relocating. These results imply that although these facilities do not directly report to TRI, they may also consider the constraints of the community pressure on their development in the future and thereby decide to relocate. The relocation in return helps on their growth. It is also worth noticing that Column (6) show a clear lower log emission density of the non-reporter in the real case than the that in the placebo test, which implies that the growth of these polluters may not be absolutely a bad trade-off for the local economy.

However, the ΔXs of the reporters in the placebo test are not quite different from the ΔXs in the real case, which means the relocation does not seem to affect the growth of the large polluters significantly. Combining with the results in Table 7, we can see that the reporting facilities are using relocation to reduce the community and regulatory pressure around them but may not because of the constrain of the pressure on their growth.

8 Conclusion

The TRI program, as one of the largest environmental right-to-know programs in the US, has been widely proved to effectively reduce emissions from toxic facilities after its implementation. However, because the TRI uses the non-uniformly distributed community pressure to regulate toxic facilities, it may leave chances for the facilities to relocate from communities with high pressure to the ones with low pressure to reduce their abatement costs. The relocation of toxic facilities could not only weaken the effect of the TRI on lowering the scale of toxic emission at the national level, but also hurt the interests of communities with less bargaining power in environmental issues.

In this paper, we examine the potential influence of the community pressure on the relocation of toxic facilities after the disclosure of TRI information in mid-1989. We measure the community pressure by the demographic characteristics of communities and find that facilities in densely populated and high-educated communities are more likely to relocate. Meanwhile, these facilities also tend to move into less populated, poor, and low-educated communities. These results imply that toxic facilities are indeed seeking for places with less community pressure on pollution. The findings remind the policy makers to consider the potential problem of environmental injustice brought by the relocation of facilities.

More importantly, we reveal some clues indicating that the relocated facilities increased their emission level in the new communities comparing to facilities that stayed. This tells the policy makers that when evaluating the TRI program, they should consider the potential negative effect of the relocation on reducing the toxic emission of facilities. However, to gain a clearer understanding of whether the relocation really undermines the effect of the TRI program, we need a more accurate comparison between the emission of the relocated facilities in their new communities and the counter-factual where the facilities did not move. This problem requires future work.

We also find in the analysis that heavy and light toxic emitters suffer from similar community pressure on their relocation decisions. These results concur with the study by Mastromonaco (2015) that finds most TRI facilities which influence the local housing price have low or even no TRI-reported emissions. One possibility to explain this phenomenon is that the relocation costs are higher for large emitters even after controlling for employment, perhaps because these emitters are more capital intensive, and the increased community pressure on these emitters is balanced by their high relocating costs. Alternatively, it may be that the community pressure on the facilities is not based on their level of emissions reported to TRI but simply on whether they are listed on the TRI. If this is true, then after the relocation, the pressure on the facilities in their new communities may not adjust with a growing emission of the facilities. Such a pattern might further reduce the effectiveness of the TRI. In the future, it is worthwhile to re-investigate the mechanism of the TRI program on reducing the emission of facilities.

Table 1: Summary Statistics

	Cross-census-tract Moves			Cross-county Moves		
Variable	Non-move records[1]	Move records	Diff. in means	Non-move records[2]	Move records	Diff. in means
	(1)	(2)	(3)	(4)	(5)	(6)
Census Tract Level Demographics						
Population Density in 1990 in log	2380.43	3604.60	-1224.17***	2439.14	3533.35	-0.438***
	(3577.13)	(4876.60)		(3638.25)	(5145.77)	
Per capita Income in 1990 (thousand $)[3]	12.40	13.86	-1.46***	12.44	14.46	-2.02***
	(7.11)	(8.84)		(7.19)	(9.05)	
Bachelor Degree of Higher % in 1990	0.10	0.13	-0.033***	0.10	0.14	-0.039***
	(0.08)	(0.10)		(0.08)	(0.11)	
Share of White Residents in 1990	0.80	0.78	0.02***	0.80	0.79	0.01
	(0.25)	(0.25)		(0.25)	(0.25)	
County Characteristics						
Voter turnout in 1990	0.63	0.63	0.00	0.63	0.64	-0.01
	(0.09)	(0.09)		(0.09)	(0.09)	
Industry-specific Wage Rate[4]	1040.33	1088.16	-47.83***	1041.21	1104.20	-62.99***
	(366.54)	(369.63)		(365.10)	(379.78)	
Employment Level (thousand people)[5]	53.32	69.97	-16.58***	54.45	67.67	-13.22***
	(86.40)	(97.01)		(87.37)	(94.56)	
Attainment Status (1 = Non-attainment)[6]	0.57	0.69	-0.12***	0.58	0.72	-0.14***
	(0.50)	(0.46)		(0.50)	(0.47)	
Facility Characteristics						
Number of Employees	222.55	162.39	60.16***	220.89	136.07	84.82***
	(605.59)	(505.09)		(607.57)	(325.81)	
Total Toxic Emission (thousand pounds)	58.20	17.60	40.60*	56.97	9.21	47.77
	(1249.15)	(185.45)		(1228.56)	(149.81)	
Number of Facilities	16,719	3606		18,658	1667	

[1] We generate statistics of the non-relocated facilities using the observations across all their living years during the sampling period. For the relocated facilities, we only use the observations in the year before their relocation, which are the most reliable description on the scenario of the facilities before relocating. There are 3,606 facilities relocated across census tracts during 1991 to 2010(i.e. 17.7% relocation rate), 1,667 out of 3,606 facilities relocated across counties(i.e. 8.2% relocation rate), and 16,719 facilities stayed in their original census tracts.
[2] This group includes the records of facilities that moved across census tracts but within counties.
[3] The income level is in the 2012-adjusted dollars.
[4] This is the county average weekly wage rate and is industry-specific, which means for each facility, this number is the average wage rate of the industry that the facility belongs to. It is also in the 2012-adjusted dollars.
[5] This is the total number of employed people in the county.
[6] This is the status of a county of being attainment(IA) or non-attainment(NA) according to the National Ambient Air Quality Standard.

Table 2: Cross-sectional Regressions

	Moved in 10 years			Moved in 20 years		
	(1)	(2)	(3)	(4)	(5)	(6)
Proxies for the Communities Pressure						
Population Density in 1990 in log	0.23502***	0.22702***	0.25410***	0.18999***	0.18370***	0.20318***
	(0.02695)	(0.02741)	(0.02819)	(0.02072)	(0.02088)	(0.02134)
Per capita Income in 1990 (thousand $)	0.00540	0.00549	0.00544	0.00231	0.00244	0.00241
	(0.00342)	(0.00348)	(0.00350)	(0.00301)	(0.00304)	(0.00306)
Bachelor Degree of Higher % in 1990	3.09021***	3.04987***	2.90132***	3.18888***	3.17807***	3.06014***
	(0.32330)	(0.32448)	(0.32709)	(0.27863)	(0.28066)	(0.28226)
Share of white resident in 1990	-0.11602	-0.10262	-0.14085	-0.12013	-0.10754	-0.14101
	(0.12372)	(0.12635)	(0.12777)	(0.10237)	(0.10380)	(0.10453)
County avg. Voter turnout in 1990	0.67339	0.47349	0.42133	0.60489	0.44369	0.41898
	(0.54067)	(0.55233)	(0.55870)	(0.43355)	(0.44017)	(0.44548)
Facility Demographics						
Number of Employees in log in 1990		-0.33302***	-0.27063***		-0.26008***	-0.20329***
		(0.02045)	(0.02062)		(0.01674)	(0.01713)
Zero-Emis. Indicator (1 = YES)			1.27323***			0.92155***
			(0.11392)			(0.08448)
Toxic Emission Level between min to knot 1			0.13688*			0.07734
			(0.07177)			(0.05448)
Toxic Emission Level between knot 1 to knot 2			0.00064			-0.00902
			(0.01528)			(0.01215)
Toxic Emission Level between knot 2 to knot 3			0.00389			0.00537**
			(0.00340)			(0.00268)
Toxic Emission Level between knot 3 to knot 4			-0.00077			-0.00202
			(0.00197)			(0.00158)
Toxic Emission Level between knot 4 to max			-0.00002			-0.00002
			(0.00003)			(0.00002)
Covariates						
Industry-specific Wage Rate in log in 1990	-0.08972	0.11665	0.15753	-0.01804	0.15553	0.19292
	(0.13984)	(0.14404)	(0.14496)	(0.11613)	(0.11890)	(0.11950)
Employment Level in log in 1990	0.10396***	0.09766***	0.07457**	0.10088***	0.09471***	0.07705***
	(0.03101)	(0.03172)	(0.03214)	(0.02527)	(0.02572)	(0.02596)
CAA Attainment Status in 1990 (1 = Non-attainment)	0.19022*	0.14478	0.11882	0.15553**	0.11972	0.09680
	(0.09747)	(0.09863)	(0.09944)	(0.07776)	(0.07826)	(0.07883)
Number of Toxic Facilities in the census tract in 1990	-0.02598**	-0.02638***	-0.02295**	-0.01246*	-0.01296*	-0.01063
	(0.01026)	(0.01016)	(0.01005)	(0.00740)	(0.00744)	(0.00733)
Constant	-2.40854**	-2.03425*	-3.12373***	0.98815	1.26129	0.49805
	(1.06409)	(1.07730)	(1.10407)	(1.29548)	(1.31014)	(1.32348)
Observations	17839	17839	17839	17839	17839	17839
Industry FE	YES	YES	YES	YES	YES	YES
State FE	YES	YES	YES	YES	YES	YES

[1] In the sample, 2,382 facilities relocated across census tracts within 10 years after 1990. There are 1,224 facilities relocated in more than 10 years after 1990, and they are treated as non-relocated facilities in the regression using $Move10$.
[2] All the explanatory variables in this regression are evaluated at the 1990's level.
[3] The 4 knots of the toxic emission level are at the 65 percentile (2.6), 75 percentile (14.01), 90 percentile (69.7), and 95 percentile (175) of the emission.
[4] The number of observations does not equal to the total number of facilities(i.e. N = 20,325) in the sample because of the missing values in some of the covariates in the regressions. For the regressions with census tract demographics, 379 facilities that relocated within the 20-year window have missing values in some of the covariates, and 2,107 non-relocated facilities have missing values. After eliminating these facilities, the sample has a relocation rate of 18.1%.

Table 3: Cross-sectional Regression: cross-county vs. within-county moves

	Moved across counties				**Moved within county**			
	Moved in 10 years		Moved in 20 years		Moved in 10 years		Moved in 20 years	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proxies for the Communities Pressure								
Population Density in 1990 in log	0.09273***	0.10236***	0.06291**	0.07108***	0.33296***	0.34815***	0.29208***	0.30280***
	(0.03580)	(0.03731)	(0.02599)	(0.02659)	(0.03322)	(0.03414)	(0.02838)	(0.02905)
Per capita Income in 1990 (thousand $)	0.00070	0.00012	-0.00079	-0.00108	0.00814*	0.00864*	0.00488	0.00553
	(0.00468)	(0.00460)	(0.00393)	(0.00388)	(0.00441)	(0.00453)	(0.00402)	(0.00409)
Bachelor Degree of Higher % in 1990	3.85636***	3.57453***	3.29900***	3.09184***	2.49382***	2.46905***	2.85920***	2.85895***
	(0.44156)	(0.43951)	(0.36067)	(0.35787)	(0.42209)	(0.42582)	(0.36214)	(0.36695)
Share of white resident in 1990	-0.19033	-0.21648	-0.12285	-0.13758	-0.10957	-0.12780	-0.17589	-0.19221
	(0.17981)	(0.18370)	(0.14030)	(0.14141)	(0.15587)	(0.15916)	(0.13210)	(0.13433)
County avg. Voter turnout in 1990	-0.01063	-0.33597	-0.07333	-0.26025				
	(0.78326)	(0.79257)	(0.59827)	(0.60150)				
Facility Characteristics								
Number of Employees in log in 1990		-0.30331***		-0.18779***		-0.23385***		-0.19770***
		(0.03003)		(0.02353)		(0.02723)		(0.02317)
Zero-Emis. Indicator (1 = YES)		1.51086***		0.93365***		1.07421***		0.84474***
		(0.19342)		(0.12273)		(0.14400)		(0.11189)
Toxic Emission Level between knot 0 to knot 1		0.24548**		0.11514		0.06662		0.04952
		(0.11654)		(0.07818)		(0.09328)		(0.07279)
Toxic Emission Level between knot 1 to knot 2		-0.00206		-0.01300		0.00717		-0.00127
		(0.02361)		(0.01724)		(0.02022)		(0.01619)
Toxic Emission Level between knot 2 to knot 3		0.00213		0.00539		0.00443		0.00527
		(0.00539)		(0.00381)		(0.00427)		(0.00342)
Toxic Emission Level between knot 3 to knot 4		-0.00029		-0.00382		0.00019		-0.00103
		(0.00431)		(0.00247)		(0.00232)		(0.00192)
Toxic Emission Level between knot 4 to knot 5		-0.00382		-0.00015		-0.00001		-0.00001
		(0.00253)		(0.00019)		(0.00001)		(0.00001)
Covariates								
Industry-specific Wage Rate in log in 1990	-0.11688	0.15194	-0.02762	0.16959				
	(0.20239)	(0.20585)	(0.16015)	(0.16254)				
Employment Level in log in 1990	0.15942***	0.13185***	0.09860***	0.07549**				
	(0.04572)	(0.04696)	(0.03389)	(0.03443)				
CAA Attainment Status in 1990 (1 = Non-attainment)	0.70941***	0.63509***	0.58808***	0.53301***				
	(0.16046)	(0.16140)	(0.11515)	(0.11525)				
Number of Toxic Facilities in the census tract in 1990[2]	-0.01216	-0.00801	-0.00046	0.00170	-0.02489*	-0.02374*	-0.01082	-0.01060
	(0.01181)	(0.01148)	(0.00871)	(0.00863)	(0.01356)	(0.01332)	(0.00929)	(0.00914)
Constant	-3.95994***	-4.89736***	-2.57579**	-3.19197***	-1.78818***	-1.55915**	1.19604	1.60391
	(1.52008)	(1.53347)	(1.15972)	(1.17103)	(0.64162)	(0.75409)	(1.08394)	(1.15329)
Observations	17839	17839	17839	17839	16179	16179	16179	16179
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
State FE	YES	YES	YES	YES	YES	YES	YES	YES

[1] We use census-tract-level clustering for the regressions using census tract demographics and use county-level clustering at the regressions using county demographics to consider the intra-group correlations.
[2] This variable measures the number of toxic facilities in the census tract of facility i in the regressions with census-tract demographics.

Table 4: Panel Regression

	All		Moved across counties		Moved within counties	
	Moved in year t		Moved in year t		Moved in year t	
	(1)	(2)	(3)	(4)	(5)	(6)
Proxies for Community Pressure						
Population Density in log in 1990	0.20852***	0.20046***	0.10487***	0.09247***	0.31839***	0.30872***
	(0.01990)	(0.01983)	(0.02725)	(0.02700)	(0.02787)	(0.02792)
Per capita Income in 1990(thousand $)	0.00156	0.00126	-0.00057	-0.00102	0.00378	0.00366
	(0.00265)	(0.00263)	(0.00379)	(0.00368)	(0.00354)	(0.00356)
Bachelor Degree of Higher % in 1990	2.91168***	2.64064***	3.45260***	3.12056***	2.76542***	2.63573***
	(0.24044)	(0.23941)	(0.34151)	(0.33658)	(0.32668)	(0.32834)
Share of White Residents in 1990	-0.08888	-0.09202	-0.10353	-0.09129	-0.15685	-0.16673
	(0.09434)	(0.09480)	(0.13794)	(0.13811)	(0.12590)	(0.12663)
County avg. Voter turnout in 1990	0.46325	0.38208	-0.38289	-0.46710		
	(0.39096)	(0.38916)	(0.57595)	(0.56559)		
Facility Characteristics						
Number of Employees in log		-0.20495***		-0.27067***		-0.16317***
		(0.01493)		(0.02290)		(0.02078)
Zero-Emis. Indicator (1 = YES)		1.09606***		1.17159***		1.04986***
		(0.08380)		(0.12333)		(0.11722)
Toxic Emission Level between min to knot 1		-0.01543		-0.05628		0.01675
		(0.05930)		(0.08839)		(0.08051)
Toxic Emission Level between knot 1 to knot 2		0.01472		0.02098		0.01370
		(0.01402)		(0.02174)		(0.01863)
Toxic Emission Level between knot 2 to knot 3		0.00324		0.00097		0.00283
		(0.00333)		(0.00546)		(0.00432)
Toxic Emission Level between knot 3 to knot 4		-0.00089		-0.00267		0.00042
		(0.00206)		(0.00361)		(0.00258)
Toxic Emission Level between knot 4 to max		-0.00001		-0.00000		-0.00002
		(0.00002)		(0.00003)		(0.00002)
Covariates						
Industry-specific Wage Rate in log	0.02395	0.19996**	0.05984	0.27745**		
	(0.08937)	(0.08839)	(0.12983)	(0.12792)		
Employment Level in log	0.11415***	0.08852***	0.14846***	0.11750***		
	(0.02330)	(0.02345)	(0.03386)	(0.03410)		
CAA Attainment Status (1 = Non-attainment)	0.06264	0.02345	0.26675***	0.22132***		
	(0.05868)	(0.05874)	(0.08276)	(0.08272)		
Number of Toxic Facilities in the census tract	-0.01921***	-0.01742***	-0.01011	-0.00876	-0.01911**	-0.01920**
	(0.00596)	(0.00587)	(0.00768)	(0.00762)	(0.00798)	(0.00789)
Constant	-5.68110***	-5.98525***	-6.64633***	-6.93317***	-4.40596***	-4.02404***
	(0.68957)	(0.69415)	(0.97427)	(0.97162)	(0.41101)	(0.43630)
Observations	270226	270226	270226[3]	270226	255638	255638
Industry FE	YES	YES	YES	YES	YES	YES
State FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

[1] Due to the threshold of the TRI reporting, we do not observe the emission of the toxic facilities in their non-reporting years. Meanwhile, some facilities have no toxic emission but still report to TRI because of handling a large amount of toxic chemicals. These facilities report zero emission to TRI. We identify these facilities using the "zero-Emis. Indicator" to identify these extremely light emitters. The identifier equals to 1 the facility did not report or report 0 to TRI in year t.

[2] The 4 knots of the toxic emission level follow the same pattern as the one used in the cross-sectional regressions.

[3] This number is larger than the case of cross-county moves because we lose fewer observations due to the missing values in the county-level factors.

Table 5: Cross-sectional Regression with Interaction Terms

	All				Moved across counties				Moved within county			
	Moved within 10 years		Moved within 20 years		Moved within 10 years		Moved within 20 years		Moved within 10 years		Moved within 20 years	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Proxies for the Communities Pressure[1]												
Population Density in 1990 in log	0.19615**	0.25443***	0.20359***	0.20325***	0.07062	0.10179***	0.12833	0.07018***	0.27508**	0.34831***	0.27380***	0.30324***
	(0.08794)	(0.02827)	(0.06080)	(0.02139)	(0.13704)	(0.03733)	(0.09049)	(0.02661)	(0.11699)	(0.03421)	(0.08379)	(0.02910)
Per capita Income in 1990 (thousand $)	0.00539	0.00527	0.00239	0.00231	0.00016	-0.00008	-0.00106	-0.00117	0.00874*	0.00840*	0.00561	0.00547
	(0.00350)	(0.00354)	(0.00306)	(0.00309)	(0.00460)	(0.00466)	(0.00388)	(0.00389)	(0.00451)	(0.00456)	(0.00409)	(0.00411)
Bachelor Degree of Higher % in 1990	2.91400***	3.46650***	3.06962***	3.06407***	3.57417***	4.99133***	3.09089***	2.68874**	2.49165***	2.68337*	2.87816***	3.25373***
	(0.32839)	(1.07023)	(0.28275)	(0.84917)	(0.44025)	(1.74695)	(0.35819)	(1.17953)	(0.42690)	(1.41424)	(0.36752)	(1.13593)
Share of white resident in 1990	-0.14461	-0.13036	-0.14526	-0.13286	-0.21225	-0.20406	-0.13716	-0.12778	-0.12811	-0.11759	-0.19616	-0.18543
	(0.12808)	(0.12740)	(0.10473)	(0.10424)	(0.18375)	(0.18336)	(0.14151)	(0.14149)	(0.15924)	(0.15897)	(0.13461)	(0.13418)
County avg. Voter turnout in 1990	0.40462	0.40517	0.40730	0.40157	-0.34055	-0.35844	-0.25067	-0.27087				
	(0.56131)	(0.55896)	(0.44746)	(0.44592)	(0.79397)	(0.79348)	(0.60188)	(0.60286)				
Facility Characteristics												
Number of Employees in log in 1990	-0.27190***	-0.26950***	-0.20416***	-0.20185***	-0.30386***	-0.30118***	-0.18759***	-0.18496***	-0.23575***	-0.23327***	-0.19951***	-0.19769***
	(0.02066)	(0.02065)	(0.01715)	(0.01719)	(0.03004)	(0.03006)	(0.02352)	(0.02354)	(0.02731)	(0.02719)	(0.02319)	(0.02318)
Zero-Emis. Indicator (1 = YES)	0.67586	1.29349***	0.73656	0.86185***	0.98959	1.66614***	1.17181	0.82092***	0.52612	1.04773***	0.53706	0.84504***
	(0.69647)	(0.17956)	(0.48730)	(0.13281)	(1.08663)	(0.32772)	(0.71956)	(0.19810)	(0.92624)	(0.22169)	(0.67911)	(0.17540)
Toxic Emission Level between min to knot 1	0.06656	0.28811**	0.26864	0.15078*	0.51050	0.39627**	0.54659	0.09458	-0.42008	0.22912	-0.07059	0.19616*
	(0.45971)	(0.11323)	(0.32086)	(0.08748)	(0.73969)	(0.19772)	(0.47145)	(0.13053)	(0.56704)	(0.14286)	(0.44944)	(0.11519)
Toxic Emission Level between knot 1 to knot 2	0.07687	-0.01286	0.01801	-0.01184	-0.03440	0.01663	-0.01944	0.00592	0.18698	-0.03063	0.07811	-0.02433
	(0.10011)	(0.02404)	(0.07217)	(0.01958)	(0.15781)	(0.03837)	(0.10413)	(0.02820)	(0.12571)	(0.03169)	(0.09943)	(0.02604)
Toxic Emission Level between knot 2 to knot 3	-0.01519	-0.00045	0.00054	0.00264	0.00471	-0.00699	0.00063	0.00469	-0.03063	0.00646	0.00235	0.00255
	(0.01934)	(0.00553)	(0.01538)	(0.00438)	(0.02722)	(0.00878)	(0.01873)	(0.00610)	(0.02636)	(0.00690)	(0.02266)	(0.00552)
Toxic Emission Level between knot 3 to knot 4	-0.01133	0.00086	-0.01169	-0.00114	0.01690	0.00204	0.00117	-0.00259	-0.02050	0.00057	-0.02506**	0.00005
	(0.01455)	(0.00296)	(0.01079)	(0.00251)	(0.01868)	(0.00641)	(0.01441)	(0.00361)	(0.01428)	(0.00346)	(0.01206)	(0.00307)
Toxic Emission Level between knot 4 to max	-0.00171	0.00001	-0.00096	-0.00002	-0.02491***	-0.00279	-0.00011	-0.00025	-0.00106*	0.00000	-0.00117*	-0.00001
	(0.00186)	(0.00005)	(0.00061)	(0.00005)	(0.00929)	(0.00454)	(0.00071)	(0.00030)	(0.00055)	(0.00003)	(0.00068)	(0.00003)
Interactions	Pop. Density	Edu.	Pop. Density	Edu.	Pop. Density	Edu.	Pop. Density	Edu.	Pop. Density	Edu.	Pop. Density	Edu.
Zero-Emis. Indicator (1 = YES)	0.07816	-0.19963	0.02525	0.46315	0.06890	-1.11843	-0.03047	0.83843	0.07088	0.17008	0.04051	-0.04065
	(0.08955)	(1.07883)	(0.06326)	(0.85643)	(0.14023)	(1.74363)	(0.09314)	(1.18920)	(0.11915)	(1.43450)	(0.08744)	(1.14868)
Toxic Emission Level between min to knot 1	0.00922	-1.29425*	-0.02511	-0.64087	-0.03519	-1.11533	-0.05721	0.15482	0.06292	-1.53938	0.01578	-1.34574
	(0.05883)	(0.75844)	(0.04177)	(0.60008)	(0.09595)	(1.17810)	(0.06179)	(0.80604)	(0.07206)	(1.05048)	(0.05772)	(0.83929)
Toxic Emission Level between knot 1 to knot 2	-0.01015	0.12879	-0.00371	0.03453	0.00429	-0.14339	0.00076	-0.14454	-0.02348	0.35973	-0.01050	0.22279
	(0.01296)	(0.16553)	(0.00946)	(0.13283)	(0.02088)	(0.24635)	(0.01382)	(0.17639)	(0.01602)	(0.22838)	(0.01283)	(0.18432)
Toxic Emission Level between knot 2 to knot 3	0.00252	0.03423	0.00063	0.02145	-0.00041	0.06994	0.00064	0.00297	0.00462	-0.01912	0.00038	0.02173
	(0.00257)	(0.03465)	(0.00207)	(0.02903)	(0.00370)	(0.05188)	(0.00253)	(0.03928)	(0.00344)	(0.04572)	(0.00302)	(0.03751)
Toxic Emission Level between knot 3 to knot 4	0.00137	-0.01458	0.00128	-0.00887	-0.00227	-0.01845	-0.00071	-0.01466	0.00262	-0.00473	0.00313*	-0.00965
	(0.00189)	(0.02140)	(0.00145)	(0.01860)	(0.00253)	(0.04184)	(0.00203)	(0.02531)	(0.00184)	(0.02649)	(0.00160)	(0.02325)
Toxic Emission Level between knot 4 to max	0.00023	-0.00045	0.00014	-0.00001	0.00266***	-0.01286	-0.00001	0.00098	0.00015*	-0.00016	0.00017*	0.00005
	(0.00023)	(0.00082)	(0.00009)	(0.00054)	(0.00092)	(0.04394)	(0.00011)	(0.00201)	(0.00008)	(0.00054)	(0.00009)	(0.00049)
Covariates												
Industry-specific Wage Rate in log in 1990	0.15827	0.15298	0.19199	0.19037	0.14353	0.14896	0.16149	0.16774				
	(0.14522)	(0.14514)	(0.11966)	(0.11977)	(0.20469)	(0.20619)	(0.16236)	(0.16294)				
Employment Level in log in 1990	0.07521**	0.07608**	0.07804***	0.07837***	0.13132***	0.13437***	0.07673**	0.07779**				
	(0.03230)	(0.03214)	(0.02606)	(0.02596)	(0.04667)	(0.04694)	(0.03439)	(0.03444)				
CAA Attainment Status in 1990 (1 = Non-attainment)	0.11993	0.11760	0.09884	0.09533	0.63908***	0.63518***	0.53455***	0.53089***				
	(0.09934)	(0.09938)	(0.07885)	(0.07885)	(0.16149)	(0.16147)	(0.11530)	(0.11545)				
Number of Toxic Facilities in the census tract in 1990	-0.02323**	-0.02273**	-0.01093	-0.01049	-0.00777	-0.00806	0.00161	0.00164	-0.02345*	-0.02338*	-0.01053	-0.01035
	(0.01005)	(0.01007)	(0.00733)	(0.00734)	(0.01140)	(0.01148)	(0.00859)	(0.00863)	(0.01331)	(0.01333)	(0.00914)	(0.00914)
Constant	-2.66947**	-3.19669***	0.50695	0.48265	-4.56678**	-5.12287***	-3.57325***	-3.17107***	-1.01043	-1.62236**	1.83725	1.53052
	(1.28087)	(1.11039)	(1.37991)	(1.32673)	(1.84652)	(1.55007)	(1.32930)	(1.18537)	(1.16991)	(0.77238)	(1.28057)	(1.15968)
Observations	17839	17839	17839	17839	17839	17839	17839	17839	16179	16179	16179	16179
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
State FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

[1] The demographics characteristics - population density, income, education level, and the racial composition are evaluated at the census-tract level.

Table 6: Panel Regression with Interaction Terms

	All		Moved across counties		Moved within county	
	Moved in year t		Moved in year t		Moved in year t	
	(1)	(2)	(3)	(4)	(5)	(6)
Proxies for Community Pressure[1]						
Population Density in log in 1990	0.20094***	0.20040***	0.11399***	0.09220***	0.28784***	0.30900***
	(0.02043)	(0.01983)	(0.02826)	(0.02700)	(0.02833)	(0.02793)
Per capita Income in 1990(thousand $)	0.00127	0.00121	-0.00094	-0.00116	0.00374	0.00363
	(0.00263)	(0.00263)	(0.00369)	(0.00368)	(0.00355)	(0.00355)
Bachelor Degree of Higher % in 1990	2.64326***	2.65472***	3.11642***	3.32252***	2.63995***	2.50399***
	(0.23973)	(0.25056)	(0.33660)	(0.35296)	(0.32910)	(0.35189)
Share of White Residents in 1990	-0.09212	-0.09115	-0.08691	-0.08276	-0.16266	-0.16729
	(0.09476)	(0.09471)	(0.13825)	(0.13816)	(0.12665)	(0.12644)
County avg. Voter turnout in 1990	0.38171	0.38062	-0.43724	-0.45674		
	(0.38961)	(0.38906)	(0.56473)	(0.56618)		
Facility Characteristics						
Number of Employees	-0.20492***	-0.20476***	-0.26983***	-0.26990***	-0.16372***	-0.16319***
	(0.01492)	(0.01493)	(0.02289)	(0.02288)	(0.02076)	(0.02080)
Zero-Emission Indicator (1 = YES)	0.91222*	1.20301***	1.39080*	0.91030***	0.84315	1.39523***
	(0.48078)	(0.13674)	(0.72339)	(0.20307)	(0.69930)	(0.19112)
Toxic Emission Level between min to knot 1	-0.36714	0.09459	0.44603	-0.08285	-0.95753*	0.18275
	(0.37406)	(0.09397)	(0.52567)	(0.14440)	(0.51036)	(0.12454)
Toxic Emission Level between knot 1 to knot 2	0.14996	0.00046	0.02296	0.01698	0.27104*	0.00149
	(0.09721)	(0.02184)	(0.12418)	(0.03604)	(0.14239)	(0.02724)
Toxic Emission Level between knot 2 to knot 3	-0.01063	0.00150	0.02037	-0.00033	-0.03615	0.00403
	(0.01760)	(0.00513)	(0.02100)	(0.00857)	(0.02619)	(0.00648)
Toxic Emission Level between knot 3 to knot 4	-0.01128	0.00084	-0.01585	-0.00007	-0.00410	0.00175
	(0.01376)	(0.00311)	(0.01870)	(0.00510)	(0.01944)	(0.00397)
Toxic Emission Level between knot 4 to max	-0.00025	-0.00008	-0.00012	-0.00075**	-0.00039	-0.00002
	(0.00041)	(0.00009)	(0.00042)	(0.00032)	(0.00063)	(0.00005)
Interaction Terms	Pop. Density	Edu.	Pop. Density	Edu.	Pop. Density	Edu.
Zero-Emission Indicator (1 = YES)	0.02454	-0.85984	-0.02963	2.12854	0.02686	-2.70896**
	(0.06309)	(0.85831)	(0.09579)	(1.39601)	(0.09120)	(0.82401)
Toxic Emission Level between min to knot 1	0.04665	-0.92095	-0.06849	0.21220	0.12613*	-1.31998
	(0.04830)	(0.62851)	(0.07053)	(1.00799)	(0.06446)	(0.18484)
Toxic Emission Level between knot 1 to knot 2	-0.01804	0.12343	-0.00030	0.04048	-0.03336*	0.10092
	(0.01269)	(0.14874)	(0.01692)	(0.25549)	(0.01813)	(0.04327)
Toxic Emission Level between knot 2 to knot 3	0.00184	0.01449	-0.00289	0.00788	0.00512	-0.00935
	(0.00239)	(0.03327)	(0.00309)	(0.06261)	(0.00342)	(0.18484)
Toxic Emission Level between knot 3 to knot 4	0.00148	-0.01532	0.00188	-0.01812	0.00071	-0.01594
	(0.00186)	(0.02247)	(0.00281)	(0.03795)	(0.00251)	(0.03155)
Toxic Emission Level between knot 4 to max	0.00003	0.00047	0.00002	0.00456**	0.00005	0.00001
	(0.00005)	(0.00058)	(0.00005)	(0.00196)	(0.00008)	(0.00057)
Covariates						
Industry-specific Wage Rate in log	0.20341**	0.20060**	0.27138**	0.27832**		
	(0.08844)	(0.08841)	(0.12774)	(0.12796)		
Employment Level in log	0.08821***	0.08845***	0.11859***	0.11852***		
	(0.02352)	(0.02345)	(0.03410)	(0.03415)		
CAA Attainment Status (1 = Non-attainment)	0.02245	0.02210	0.22237***	0.22203***		
	(0.05874)	(0.05871)	(0.08273)	(0.08280)		
Number of Toxic Facilities in the census tract	-0.01769***	-0.01768***	-0.00844	-0.00870	-0.01904**	-0.01926**
	(0.00588)	(0.00588)	(0.00760)	(0.00762)	(0.00788)	(0.00790)
Constant	-5.81950***	-6.09911***	-7.28965***	-6.72506***	-3.68855***	-4.36909***
	(0.82975)	(0.69843)	(1.18563)	(0.97903)	(0.78922)	(0.46341)
Observations	270226	270226	270226	270226	255638	255638
Industry FE	YES	YES	YES	YES	YES	YES
State FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

[1] The demographics characteristics - population density, income, eduation level, and the racial composition are evaluated at the census-tract level.

Table 7: The Comparison between the Relocating Origins and Destinations

(a) Summary Statistics of the Difference

All[1]	N	(1) Δ Pop. Density	(2) Δ Income	(3) Δ Edu.	(4) Δ Voter turnout	(5) ΔAttn. Status
All	3,606	1658.5***	0.82***	0.00	-0.001	0.07***
		(85.59)	(0.19)	(0.00)	(0.001)	(0.01)
Emission >0 lbs[2]	925	1661.8***	2.31***	0.03***	0.001	0.11**
		(136.93)	(0.37)	(0.00)	(0.002)	(0.01)
Emission >12,000 lbs[3]	375	1564.15***	3.29***	0.04***	0.003	0.13***
		(195.12)	(0.591)	(0.01)	(0.003)	(0.02)
Moved across counties	N	Δ Pop. Density	Δ Income	Δ Edu.	Δ Voter turnout	ΔAttn. Status
All	1,667	1850.5***	1.14***	0.00	-0.005*	0.14***
		(135.33)	(0.31)	(0.00)	(0.002)	(0.01)
Emission >0 lbs	384	1918.6***	4.57***	0.05***	0.000	0.26**
		(180.37)	(0.65)	(0.01)	(0.005)	(0.03)
Emission >12,000 lbs	158	1541.50***	5.68***	0.08***	0.007	0.27***
		(246.19)	(1.08)	(0.01)	(0.007)	(0.04)
Moved within the county	N	Δ Pop. Density	Δ Income	Δ Edu.	Δ Voter turnout	ΔAttn. Status
All	1,939	1494.23***	0.54**	0.00	-	-
		(108.60)	(0.25)	(0.00)	-	-
Emission >0 lbs	541	1479.88***	0.70	0.02***	-	-
		(195.70)	(0.42)	(0.01)	-	-
Emission >12,000 lbs	217	1580.72***	1.55**	0.02**	-	-
		(286.34)	(0.63)	(0.01)	-	-

[1] This table shows the statistics of the difference between the relocating origins and the destinations in terms of each proxy for the community or regulatory pressure on toxic facilities. We use only the relocation records calculate the statistics. First, we subtracted the value of a characteristic in the origin's census tract by the value of the characteristic in the destination's census tract for each relocation record. Then, we calculated the mean of these differences and do a t-test to see whether the mean difference is significantly different from 0.

[2] This criterion separates the facilities that emit toxic pollutants right after relocating and the facilities that do not.

[3] 12,000 lbs is at the 90 percentile of the toxic emission level of facilities in the first year after moving. This criterion separates the facilities that emit an extremely large amount of pollutants right after relocating and the facilities that do not.

(b) Scores of the Covariates

All[1]		X_1[2]				X_2			
	N	Origin	Destination	Diff.	P-value[3]	Origin	Destination	Diff.	P-value
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All	3,606	1.849	1.684	0.165	0.00	1.865	1.698	0.167	0.00
		(0.007)	(0.007)			(0.007)	(0.007)		
Emission >0 lbs	925	1.868	1.568	0.300	0.00	1.883	1.581	0.302	0.00
		(0.014)	(0.014)			(0.013)	(0.014)		
Emission >12,000 lbs	375	1.862	1.517	0.345	0.00	1.876	1.529	0.347	0.00
		(0.021)	(0.021)			(0.022)	(0.022)		
Moved across counties		X_1				X_2			
	N	Origin	Destination	Diff.	P-value	Origin	Destination	Diff.	P-value
All	1,667	1.086	1.002	0.084	0.00	1.120	1.030	0.090	0.00
		(0.009)	(0.009)			(0.009)	(0.010)		
Emission >0 lbs	384	1.145	0.871	0.274	0.00	1.180	0.898	0.282	0.00
		(0.021)	(0.015)			(0.021)	(0.015)		
Emission >12,000 lbs	158	1.231	0.877	0.354	0.00	1.247	0.888	0.359	0.00
		(0.036)	(0.025)			(0.036)	(0.025)		
Moved within county		X_1				X_2			
	N	Origin	Destination	Diff.	P-value	Origin	Destination	Diff.	P-value
All	1,939	2.755	2.523	0.232	0.00	-	-	-	-
		(0.011)	(0.013)			-	-	-	-
Emission >0 lbs	541	2.752	2.405	0.347	0.00	-	-	-	-
		(0.020)	(0.025)			-	-	-	-
Emission >12,000 lbs	217	2.692	2.298	0.394	0.00	-	-	-	-
		(0.032)	(0.040)			-	-	-	-

[1] This table shows the calculating results of **Xb** with respect to different factors in **X**. **X** is a set of explanatory variables. **b** is the vector of the estimated coefficients shown in Table 4 in Column(3) and Column(6).

[2] X_1 includes the covariates related to the community pressure. They are the population density, per capita income, and the share of people with a bachelor degree or higher in the census tract. X_2 has the three covariates in X_1 and adds the CAA attainment status, which is a proxy for the regulatory pressure.

[3] This p-value comes from the two-sample t-test on the scores of the origins and the destinations.

Table 8: Summary of the Changes of Facility Characteristics after Relocating

All moves		(1)	(2)	(3)	(4)	(5)	(6)
	N	ΔEmp. Num.[1]	ΔEmission [2]	ΔEmis. per Emp.	Δlog(Emp.Num.)[3]	Δlog(Emission)	Δlog(Emis. per Emp.)
All	3,606	15.71**	32.43*	2.23	0.26***	-0.13***	-0.39***
		(6.22)	(17.31)	(1.40)	(0.02)	(0.03)	(0.03)
No report before moving	1,673	57.20***	84.63**	5.03*	0.63***	0.21***	-0.41***
		(8.63)[4]	(37.06)	(3.00)	(0.03)	(0.04)	(0.05)
Reported before moving	1,933	-20.19**	-12.76***	-0.20	-0.07***	-0.43***	-0.36***
		(8.79)	(3.53)	(0.15)	(0.02)	(0.04)	(0.05)
Cross-county Moves							
	N	ΔEmp. Num.	ΔEmission	ΔEmis. per Emp.	Δlog(Emp.Num.)	Δlog(Emission)	Δlog(Emis. per Emp.)
All	1,667	33.26***	56.51*	4.51	0.32***	0.03	-0.30***
		(8.98)	(33.56)	(2.99)	(0.03)	(0.05)	(0.05)
No report before moving	802	75.59***	129.33*	9.50	0.77***	0.39***	-0.37***
		(16.09)	(69.33)	(6.21)	(0.05)	(0.07)	(0.08)
Reported before moving	865	-5.98	-11.01*	-0.10	-0.09***	-0.31	-0.22***
		(8.56)	(6.56)	(0.10)	(0.03)	(0.07)	(0.07)
Within county Moves							
	N	ΔEmp. Num.	ΔEmission	ΔEmis. per Emp.	Δlog(Emp.Num.)	Δlog(Emission)	Δlog(Emis. per Emp.)
All	1,939	0.63	11.72	0.26	0.20***	-0.26***	-0.46***
		(8.69)	(14.29)	(0.34)	(0.02)	(0.04)	(0.05)
No report before moving	871	40.27***	43.47	0.93	0.50***	0.05	-0.45***
		(7.43)	(31.50)	(0.69)	(0.03)	(0.06)	(0.07)
Reported before moving	1,068	-31.70**	-14.17***	-0.28	-0.05*	-0.52***	-0.48***
		(14.31)	(3.56)	(0.26)	(0.03)	(0.04)	(0.06)
Placebo Test on Non-movers[5]							
	N	ΔEmp. Num.	ΔEmission	ΔEmis. per Emp.	Δlog(Emp.Num.)	Δlog(Emission)	Δlog(Emis. per Emp.)
All	13,268	-17.18***	-14.02**	-0.29	-0.05***	-0.40***	-0.35***
		(2.04)	(6.54)	(0.19)	(0.01)	(0.02)	(0.02)
No report before moving	2,574	-7.14	34.96*	0.29***	0.06***	-0.12***	-0.17***
		(4.66)	(18.42)	(0.07)	(0.01)	(0.03)	(0.03)
Reported before moving	10,694	-19.59***	-25.81***	-0.43*	-0.08***	-0.48***	-0.40***
		(2.28)	(6.80)	(0.23)	(0.01)	(0.02)	(0.02)

1 This table summarizes the change of size and emission levels of relocated facilities after moving, comparing to what they were before moving. $\Delta X = Mean(X)_{t>T} - Mean(X)_{T-3\leq t\leq T}$, where t denotes for year, and T is the relocating year. ΔX is the difference between the mean value of X in the years after moving and mean value of X in 3 years before moving. Specifically, if the facility moved in year 1991 to 1993, the mean is calculated using the data of year 1990 to the move year only.

2 We treat the censored emission levels as 0.5 thousand lbs, which is the highest threshold of censoring, in the calculation of ΔX. An alternative is to substitute the censored emission by 0. We use this strategy to recalculate ΔX and do the two sample t-test. The results are very similar to the ones shown in column (1) to (3) of the table.

3 This is the change of a factor X in log. We use the log form in order to deal with the extreme values found in the data of employee number and emission levels because they may have severe influence on the mean.

4 Standard errors in parenthesis.

5 In the placebo test, we randomly assign a fake moving year on the each non-moved facility and then calculate the difference of the factors before and after the fake move. When assigning the years, we randomly pick a number between 1991 to 2010 for each facility as the moving year. However, some facilities closed before 2010, and if they are assigned a number larger than their closing year, then they are not included in the placebo test. Therefore, the number of facilities in the placebo test is smaller than the number of non-moved facilities in the sample, and the facilities closed early are less likely to be included in the placebo test. We use this method because the relocated facilities seldom closed before 2010 and thus is not suitable to be compared with the non-movers closed early.

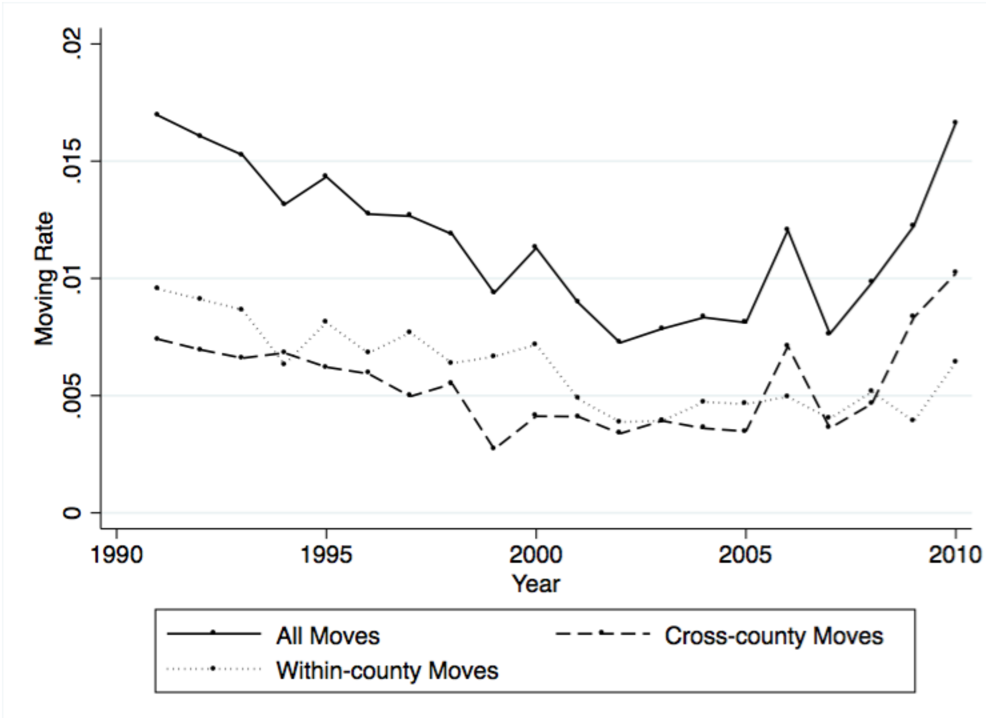

Figure 1: The Relocation Rate of Toxic Facilities from 1991 to 2010

References

Arora, Seema and Timothy N Cason (1999). "Do Community Characteristics Influence Environmental Outcomes? Evidence from the Toxics Release Inventory". In: *Source: Southern Economic Journal* 65(4), pp. 691–716.

Banzhaf, H.Spencer and Randall Walsh (2008). "Do People Vote with Their Feet? An Empirical Test of Tiebout". In: *American Economic Review* 98(3), pp. 843–863.

Baumol, William J. and Wallace E. Oates (1988). *The Theory of Environmental Policy.* second. Cambridge University Press.

Brouwer, Aleid E., Iliaria Mariotti, and Jos N. van Ommeren (2004). "The firm relocation decision: An empirical investigation". In: *Annals of Regional Science* 38(2), pp. 335–347.

Brown, P (1995). *Race, class, and environmental health: a review and systematization of the literature.*

Bui, Linda T M and Christopher J Mayer (2003). "Regulation and Capitalization of Environmental Amenities: Evidence from the Toxic Release Inventory in Massachusetts". In: *The Review of Economics and Statistics* 85(3), pp. 693–708.

Currie, Janet et al. (2015). "Environmental Health Risks and Housing Values : Evidence from 1600 Toxic Plant Openings and Closings". In: *American Economic Review* 105(2), pp. 678–709.

De Silva, Dakshina G, Timothy P Hubbard, and Anita R Schiller (2016). "Entry and Exit Patterns of "Toxic" Firms". In: *American Journal of Agricultural Economics* 98(3), pp. 881–909.

Duranton, Gilles and Diego Puga (2004). *Chapter 48 Micro-foundations of urban agglomeration economies.* Vol. 4. 04. Elsevier Inc., pp. 2063–2117.

Gray, Wayne B. and Ronald J. Shadbegian (2007). "The environmental performance of polluting plants: A spatial analysis". In: *Journal of Regional Science* 47(1), pp. 63–84.

Greenstone, Michael, John A List, and Chad Syverson (2012). "The Effects of Environmental Regulation on the Competitiveness of US Manufacturing". In: *NBER Working paper 18932*.

Guimarães, Paulo, Robert J. Rolfe, and Douglas P. Woodward (1998). "Regional Incentives and Industrial Location in Puerto Rico". In: *International Regional and Science Review* 21(2), pp. 119–138.

Hamilton, James T (1995a). "Pollution as News: Media and Stock Market Reactions to the Toxics Release Inventory Data". In: *Journal of Environmental Economics and Management* 28, pp. 98–113.

Hamilton, James T (1995b). "Testing for Environmental Racism: Prejudice , Profits , Political Power?" In: *Journal of Policy Analysis and Management* 14(1), pp. 107–132.

Hamilton, James T (2005). *Regulation through Revelation: the origin, politics, and impacts of the Toxics Release Inventory Program*. Cambridge University Press.

Hausman, Jerry A (1993). *Contingent valuation: A critical assessment*. Emerald Group Publishing Limited.

Holladay, J. Scott (2015). "Exporters and the Environment". In: *Canadian Journal of Economics (forthcoming)*.

Hu, Wuyang et al. (2008). "Understanding Firms' Relocation and Expansion Decisions Using Self-Reported Factor Importance Rating." In: *Review of Regional Studies* 38(1), pp. 67–88.

Jeppesen, Tim and Henk Folmer (2001). "The confusing relationship between environmental policy and location behaviour of firms : A methodological review of selected case studies". In: *The Annals of Regional Science* 35(4), pp. 523–546.

Khanna, Madhu, Wilma Rose H. Quimio, and Dora Bojilova (1998). "Toxics Release Information: A Policy Tool for Environmental Protection". In: *Journal of Environmental Economics and Management* 36(3), pp. 243–266.

Knoben, J. and L. a. G. Oerlemans (2008). "Ties that Spatially Bind? A Relational Account of the Causes of Spatial Firm Mobility". In: *Regional Studies* 42(3), pp. 385–400.

Konar, Shameek and Ma Cohen (1997). "Information as regulation: the effect of community right to know laws on toxic emissions". In: *Journal of Environmental Economics and Management* 32, pp. 109–124.

Krugman, Paul (1997). *Development , Geography , and Economic Theory.* The MIT Press.

Levinson, Arik (1996). "Environmental regulations and manufacturers' location choices: Evidence from the Census of Manufactures". In: *Journal of Public Economics* 62, pp. 5–29.

List, John A, W W McHone, and D L Millimet (2003). "Effects of air quality regulation on the destination choice of relocating plants". In: *Oxford Economic Papers-New Series* 55(4), pp. 657–678.

MacLean, Alair (1996). "The Right Stuff: Information in the Public Interest". In: *New Solutions: A Journal of Environmental and Occupational Health Policy* 6(3), pp. 48–58.

MacLean, Alair and Paul Orum (1992). *Progress report: Community right-to-know.* Tech. rep.

Mastromonaco, Ralph (2015). "Do environmental right-to-know laws affect markets? Capitalization of information in the toxic release inventory". In: *Journal of Environmental Economics and Management* 71, pp. 54–70.

Moses, Leon N. (1958). "Location and the theory of production". In: *The Quarterly Journal of Economics* 72(2), pp. 259–272.

Nakosteen, R. A. and M. A. Zimmer (1987). "Determinants of Regional Migration by Manufacturing Firms". In: *Economic Inquiry* 25(2), pp. 351–362.

Neumark, David, Junfu Zhang, and Brandon Wall (2007). "Employment Dynamics and Business Relocation: New Evidence from the National Establishment Time Series". In: *Research in Labor Economics* 26(November), pp. 39–83.

Pellenbarg, Piet H. (2005). "Firm migration in the Netherlands". In: *45th Congress of the European Regional Science Association*.

Roe, B et al. (2001). "US consumers' willingness to pay for green electricity". In: *Energy Policy* 29, pp. 917–925.

Sexton, Steven E. and Alison L. Sexton (2014). "Conspicuous conservation: The Prius halo and willingness to pay for environmental bona fides". In: *Journal of Environmental Economics and Management* 67(3), pp. 303–317.

US EPA (2016). *2014 TRI National Analysis*. Tech. rep. January.

Van Dijk, Jouke and Piet H. Pellenbarg (2000). "Firm relocation decisions in The Netherlands: An ordered logit approach". In: *Papers in Regional Science* 79(2), pp. 191–219.

Wolverton, Ann (2009). "Effects of Socio-economic and Input-Related Factors on Polluting Plants' Location Decisions". In: *B.E. Journal of Economic Analysis and Policy: Advances in Economic Analysis and Policy* 9(1).