Essays on Environmental and Labor Economics

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Essays in Environmental and Labor Economics

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Abstract

This dissertation is the collection of three papers on environmental and labor economics. The First chapter is on environmental economics. The main objective of this chapter is to explore the effect of local community pressure on the corporate environmental management effort expended by factories regulated under the Clean Water Act. Many factors influence corporate environmental management, which I interpret to include the full spectrum of pollution control techniques from reactive end-of-pipe treatment techniques to proactive pollution prevention protocols. The analysis of this chapter empirically exploits to two survey-based measures of local community pressure. One captures the perceived need to respond to local concerns over the natural environment. The other measure captures the economic importance of the polluting facility in the local community. These two measures capture countervailing forces. While the first reflects greater local environmental pressure, the second reflects less local environmental pressure. Our results reveal that local community pressure positively influences corporate environmental management in general; however, in certain cases, the two local dimensions reveal distinctions between a community's desire for environmental protection and economic activity.

The second chapter is also on environmental economics, which serves as an extension to the first chapter. Here, I explore the effect of spatially defined local community characteristics on the wastewater management environmental choice by constricting rings of community characteristics within 1,5,10 and 15 miles of the regulated facility location. The study includes not only economic characteristics of the community, but also socioeconomic, demographic and political community characteristic that serve as proxies of local community pressure. In addition, to empirically answer the question whether local communities promote water pollution control, this study assesses whether the communities are environmentally discriminated against on

demographic characteristics or social instability. Results reveal wealthier communities appear to induce facilities to increase their environmental efforts and improve wastewater management practices but this effort fades as the distance to the facility grows.

The third chapter of this dissertation studies the effect of terrorist attacks on the labor market to provide empirical evidence on the economic consequences of terrorism on the labor supply. It Is a co-authoring work with William Duncan. We develop a set of hypotheses from classical labor economic theory around the consumer maximization problem and propose a threshold for endangerment costs that, when reached, causes individuals to choose not working and less consumption, rather than work and face the danger of terrorism and violence. As such, I hypothesize that increased endangerment costs lead to fewer people working, less hours worked per week, lower wages, and less job permanence. The importance of this kind of research cannot be understated, as the mechanisms through which terrorism impacts a society are still not clearly understood. Many studies of terrorism focus on more advanced countries (Eckstein and Tsiddon 2004). But in Iraq, one of the major economic consequences of the conflict and subsequent terrorist activity has been the shocks to the labor supply. In addition, understanding the impact of terrorist attacks on labor supply of countries under severe pressure from terrorism may provide future motivation for research into refugee crises and labor policies of destination countries.

The main contribution of this chapter to the ongoing literature is study the effect of terrorism in Iraq on the labor supply, using several measures of the labor force: employment status, wages, hours worked per week and job permanence. Moreover, I generate a geospatial variable to incorporate potential spillover effects of terrorism. To do this, we use a nationwide household socio-economic survey conducted in 2007 by the Iraqi Organization for Statistics and Information Technology (COSIT), Kurdistan Regional Statistics Office (KRSO) and the World Bank. This data

was only recently released, and thus is largely unexplored. I generate two different data sets (panel and cross-sectional) based on both the Arabic and English version of the household socio-economic survey. To the best of my knowledge, this might be the first study that empirically explores the economic consequences of terrorism on the labor market within a country that faced sequential terrorist attacks such as Iraq. Briefly, the preliminary results show strong evidence in favor of each hypothesis.

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1 Effects of Local Community Pressure on Corporate Environmental Management

1.1. Introduction

Since the establishment of the Environmental Protection Agency (EPA) in 1970, environmental regulation in the United States has made major strides to control pollution. A primary example is the enactment of the Clean Water Act of 1972, which aims to regulate every pollutant or contaminant discharged from a point source of pollution into U.S. waters by requiring permits with discharge limits. These limits are only effective if regulated point sources, namely, industrial and municipal facilities, adhere to these limits. To ensure this adherence, regulatory agencies conduct inspections and take enforcement actions. The literature is rife with empirical analyses that examine the efficacy of such regulatory pressure across a wide range of environmental media and economic sectors (e.g., Gray and Deily, 1996; Laplante and Rilstone, 1996; Helland, 1998a; Helland, 1998b; Earnhart, 2004a; Earnhart, 2004b). As important, much scholarship explores the role of non-regulatory pressure, such as local community pressure, for prompting efforts to reduce pollution. Similarly, policymakers share a deep interest in this non-regulatory pressure. For example, the EPA promotes the use of other levers for inducing regulated polluters to constrain their emissions and discharges through better environmental management. In particular, the recent EPA Next Generation Compliance initiative, initiated under the Obama administration, is promoting roles for non-regulatory actors. As one prominent actor, the initiative is empowering local communities to pressure regulated facilities to constrain their pollution.

Under the new presidential administration of Donald Trump, federal environmental policy is shifting toward environmental de-regulation. Some of these de-regulatory efforts relate to the Clean Water Act. Namely, the Trump administration wishes to scale back the scope of the Clean

Water Rule, also known as Waters of the United States.[1] As part of this policy shift, traditional environmental regulatory pressure, exerted through inspections and enforcement, is expected to decline. When environmental regulatory pressure is weaker, if not absent, the importance of other channels to induce corporate environmental management, such as local community pressure, is greater. In essence, the decrease in regulatory pressure crowds-in local community pressure. Thus, local community pressure may play a bigger role under the Trump administration.

Several previous studies explore the role of local community pressure on environmental management choices using either direct or indirect measures of local community pressure. Some studies craft direct measures of local community pressure from responses to surveys of regulated facilities (Henriques and Sadorsky, 1996; Blackman and Bannister, 1998; Dasgupta et al., 2000; Da Motta, 2006). Other studies use community characteristics, e.g., per capita income, to serve as proxies of local community pressure (Becker, 2003; Earnhart, 2004b; Mexwell, 2000; Pargal and Wheeler, 1996; Pargal et al., 1997; Wolverton, 2009).

This study contributes to the scholarly literature and the policy discussion on the role of non-regulatory actors. Our study contributes to the literature in two ways. First, it theoretically explores the impact of local community pressure on corporate environmental management while acknowledging the possibility that local pressure may crowd out pro-social intrinsic motivations on the part of facilities' management personnel. Thus, the overall effect on corporate environmental management effort is ambiguous. Second, our study distinguishes between a local community's concern over the natural environment and its concern for economic activity.

[1] The Clean Water Rule is an environmental regulation that gives the federal government authority to limit pollution in major bodies of water, rivers, streams, and wetlands. It was issued under the Clean Water Act. This rule is designed to expand the federal government's authority to regulate pollution in smaller streams and rivers that flow into larger bodies of water.

I explore the effect of local community pressure on the corporate environmental management effort expended by chemical manufacturing facilities regulated under the Clean Water Act. Similar to several previous studies, we use a survey to generate self-reported, subjective measures of local community pressure. One survey question asks facility managers to assess their facilities' need to respond to the local communities' environmental concerns. A separate question asks facility managers to depict their facilities' economic importance for the local community. Our analysis explores the effects of these two local community factors on several important dimensions of corporate environmental management: environmental labor (quantity of environmental engineers), environmental capital (wastewater treatment technologies), and environmental protocols (self-audits). Our results reveal that local community pressure positively influences corporate environmental management in general; however, in certain cases, the two local dimensions reveal distinctions between a community's desire for environmental protection and economic activity.

The rest of the paper proceeds as follows. Section 2 reviews the relevant literature. Section 3 constructs a theoretical framework, which generates testable hypotheses. Section 4 describes the econometric framework. Section 5 discusses the data and provides summary statistics. Section 6 details the econometric analysis and reports the empirical results, while interpreting them as a means for testing theoretically derived hypotheses. Section 7 concludes and assesses briefly future research.

1.2. Literature Review

Much empirical analysis explores the effect of local community pressure on corporate environmental management or environmental performance. Within this literature, we distinguish between (1) studies that explore the role of local community pressure using survey-based measures, which reflect a type of direct measure, and (2) studies that explore the role of local community pressure using local community characteristics as proxies, which represent indirect measures. These proxies are appropriate under the assumption that local community pressure is correlated with the key community characteristics. For example, wealthier communities engage in more efforts to pressure locally regulated sources to reduce their pollution as a means of improving local environmental quality because environmental quality is a normal good (Earnhart, 2004b).

1.2.1. Direct Measures of Local Community Pressure

Some studies analyze the effect of local community pressure using direct measures derived from survey data. Henriques and Sadorsky (1996) use a survey to collect data on Canada's 750 largest firms to assess why firms formulate official plans for handling environmental issues. To measure local community pressure, Canadian firms were asked to rate the importance of public pressure on their company from a scale of 1 to 7. The study provides evidence that local community pressure positively influences a firm's decision to formulate an environmental plan.

To identify the principal determinants of a firm's decision to adopt a clean technology, Blackman and Bannister (1998) survey owners or managers of 95 traditional brick companies in Juarez, Mexico. The study uses a dichotomous variable indicating whether a firm has membership in an Institutional Revolutionary Party (PRI) local organization. Results reveal that local community pressure promotes the adoption of a clean technology.

Dasgupta et al. (2000) explores the effect of self-reported local community pressure on the environmental performance of polluters using World Bank survey data on Mexican manufacturers operating in four sectors: food, chemicals, nonmetallic minerals, and metals. The survey gathers detailed data on regulatory compliance, formal regulation, and local community pressure, as measured by responses to key survey questions. Empirical results show that local community does not significantly affect the environmental performance of the studied facilities.

Gangadharan (2006) uses the same World Bank survey data to study the influence of local community pressure on the probability of a firm complying with environmental regulations. Empirical results indicate that local community pressure substantially influences the likelihood of a firm's over-compliance; however, the magnitude of its impact is not large.

Da Motta (2006) utilizes a survey of large Brazilian plants from 1997 to analyze the facilities' environmental performance. The analysis includes several variables that reflect local community pressure. The study concludes that local community pressure and NGO pressure are the two main factors explaining corporate environmental performance.

1.2.2. Indirect Measures of Local Community Pressure

Other studies explore the effect of local community pressure on corporate environmental management or performance using demographic or socioeconomic characteristics of the local community, which serve as proxies or indirect measures of local community pressure.

One of the most common economic characteristics used to measure local community pressure is income. Some analyses use median household income (Arora and Cason, 1999; Brooks and Sethi, 1997; Hamilton, 1993). Other studies use per capita income (Becker, 2003; Earnhart, 2004b; Maxwell et al., 2000; Pargal and Wheeler, 1996; Pargal et al., 1997; Wolverton, 2009). Most of these studies conclude that greater pressure as proxied by higher community income leads to better environmental performance from facilities located in the community.

Few empirical studies analyze the effect of *age* (Arora and Cason, 1999; Pargal et al., 1997; Pargal and Wheeler, 1996). These results reveal no significant effect.

Several empirical analyses assess the effect of local community population. Some of these studies use total population to capture this effect (Arora and Cason, 1999; Wolverton, 2009). Other studies use population density (Becker, 2003; Brooks and Sethi, 1997; Dasgupta, 2002; Earnhart, 2004b; Hamilton, 1993; Maxwell et al., 2000; Pargal et al., 1997; Pargal and Wheeler, 1996). One study measures only a community's sensitive population, which is the percent of population under five years or over 64 years of age (Becker, 2003). Arora and Cason (1999) find that total population influences corporate environmental performance in only a sub-sample of their study. Similarly, Wolverton (2009) reveals a positive effect only in certain econometric specifications. Pargal et al. (1997), Becker (2003), and Earnhart (2004b) demonstrate positive effects of population destiny on corporate environmental performance. In contrast, Pargal and Wheeler (1996) reveal a negative effect of population density on corporate environmental performance. Brooks and Sethi (1997) find that greater population density leads to more toxic releases in a given local community.

Some empirical studies use community educational attainment as proxy for a community's intellectual sophistication generally or environmental sophistication specifically (e.g., Pargal and Wheeler, 1996). One study uses the percentage of adults with four or more years of college to capture educational attainment (Hamilton, 1993). Similarly, some studies use the percentage of people aged 25 years or more with at least a bachelor's degree (Brooks and Sethi, 1997; Arora and Cason, 1999; Maxwell et al., 2000; Becker, 2003). Other studies use the high school graduation rate or percentage of local residents with at least a high school diploma (Earnhart , 2004b; Wolverton, 2009). Pargal and Wheeler, 1996 finds that communities with high level of education gives high weight to water pollution. Brooks and Sethi (1997) demonstrate that educational attainment is significantly and negatively related to exposure to air pollution. Similarly, Arora and Cason (1999) find that people aged 25 years or more with at least a bachelor's degree are significantly and negatively affect the toxics release inventory in most of the U.S. regions. In contrast, Becker (2003) shows that educational attainment have statistically zero effects on air pollution abatement (APA) expenditure by U.S manufacturing plants.

Several empirical studies explore the effect of local unemployment on corporate environmental management or performance (Pargal and Wheeler 1996; Pargal et al., 1997; Becker, 2003; Earnhart, 2004b; Arora and Cason, 1999). Becker (2003) finds that the unemployment rate has zero statistical effects on the APA operating cost per dollar of output. Earnhart (2004b) shows that the unemployment rate negatively affects corporate environmental performance.

Other studies analyze the percentage of workers employed in manufacturing sectors as means for evaluating workers' trade-offs between employment and the natural environment (Brooks and Sethi, 1997; Wolverton, 2009; Arora and Cason, 1999). Brooks and Sethi (1997) find that the proportion of workers in manufacturing positively affects the toxic pollutants released in a given local community. Similarly, Wolverton (2009) shows that the proportion of workers in manufacturing positively affects the siting of a polluting facility in a given community.

To capture a community's propensity to engage in political or collective action, some empirical studies examine the effect of voter turnout in presidential elections (Hamilton, 1993; Arora and Cason, 1999; Becker 2003; Wolverton, 2009; Brooks and Sethi, 1997; Earnhart, 2004b). Hamilton (1993) finds that, as a community's voter turnout grows, a polluting firm is less likely to expand into the particular community. Similarly, Brooks and Sethi (1997) reveal that voter turnout negatively affects the amount of toxic releases in a given community. In contrast, Becker (2003) shows that voter turnout negatively affects pollution abatement operating cost per dollar of output. Earnhart (2004b) finds no significant impact of voter turnout on corporate environmental performance.[2]

Our study contributes to this literature in two ways. First, it theoretically explores the impact of local community pressure on corporate environmental management while

[2] Our study also contributes to a robust literature exploring the effects of various factors on corporate environmental management (e.g., Earnhart and Leonard, 2013).

acknowledging the possibility that local pressure may crowd out pro-social intrinsic motivations on the part of facilities' management personnel. Second, our study empirically distinguishes between a local community's concern over the natural environment and its desire for economic activity using direct measures of these two dimensions.

1.3. Regulatory Context

1.3.1. National Pollutant Discharge Elimination System

This study examines environmental management offered by polluting facilities regulated under the U.S. Clean Water Act. One of the Act's main purposes is to protect water quality by controlling wastewater discharges from point sources. To this end, the EPA created the National Pollutant Discharge Elimination System (NPDES) to control these point source discharges. The system's main form of control is the issuance of facility-specific permits, which identify the pollutant-specific discharge limits imposed on regulated facilities. Permits are issued and re-issued generally on a 5-year cycle by the EPA or authorized state agencies. (As noted below, state agencies can obtain the authority to share in the implementation of the NPDES system, including the authority to issue permits, conduct inspections, and take enforcement actions.)

When establishing discharge limits within individual facilities' permits, the issuing agency considers the relevant Effluent Limitation Guideline standard, which is designed to require a minimum level of wastewater treatment for a given industry, and the state water quality-based standard, which is designed to ensure that the water body receiving the discharges meets state-based ambient surface water quality standards. After a candidate discharge limit is determined under each standard, the more stringent limit is written into the permit. Each permitted discharge limit represents a performance-based standard under which compliance is based solely on the regulated facility's discharges. Thus, a facility may use any available abatement method to comply with its permitted limits. A myriad of abatement methods is available to facilities: end-of-pipe treatment equipment (i.e., physical capital), deployment of labor, and other methods (e.g., self-audits).[3]

In the NPDES system, permitted facilities are required to monitor and self-report their discharges on a regular basis. Thus, inspections are not needed to assess compliance with imposed discharge limits. Moreover, since permitted limits constrain discharges over an entire month (or longer), individual inspections are not able to assess compliance with discharge limits.

To ensure compliance with issued permits, the EPA and authorized state agencies periodically inspect facilities and take enforcement actions as needed. Inspections represent the backbone of environmental agencies' efforts to monitor compliance and collect evidence for enforcement (Wasserman, 1984); inspections also maintain a regulatory presence (EPA, 1990). Agencies use a mixture of informal enforcement actions (e.g., warning letters) and formal enforcement actions, which include penalties (i.e., fines).

Both the EPA and nearly all state agencies possess the authority to issue permits, inspect NPDES facilities, and take enforcement actions against non-compliant facilities. For state agencies, this authority is called "primacy". To obtain approval for NPDES primacy, a state agency must demonstrate the regulatory capacity to administer the NPDES program. In particular, state agencies must possess an arsenal of monitoring and enforcement tools similar to the EPA in order to obtain primacy (Earnhart and Glicksman, 2011).[4] While the EPA retains authority to monitor and impose sanctions on regulated facilities in all states, regardless of primacy, authorized state

[3] The deployment of labor enhances the effectiveness of all types of equipment and other abatement methods. Wastewater engineers monitor, maintain, and operate treatment equipment; implement self-auditing protocols, administer internal monitoring systems, and undertake other environmental management practices.

[4] For our sample and sample period, only four state agencies lacked NPDES primacy: Alaska, Massachusetts, Maine, and Texas.

regulatory agencies are primarily responsible for monitoring and enforcement. For regulated facilities operating in states without NPDES primacy, EPA regional offices are fully responsible for monitoring and enforcement. For regulated facilities operating in states with primacy, EPA regional offices generally conduct inspections and take enforcement actions when state agencies fail to intervene or when federal pressure may be needed for inducing compliance, e.g., repeat offenders, recalcitrant facilities (Earnhart, 2004a).

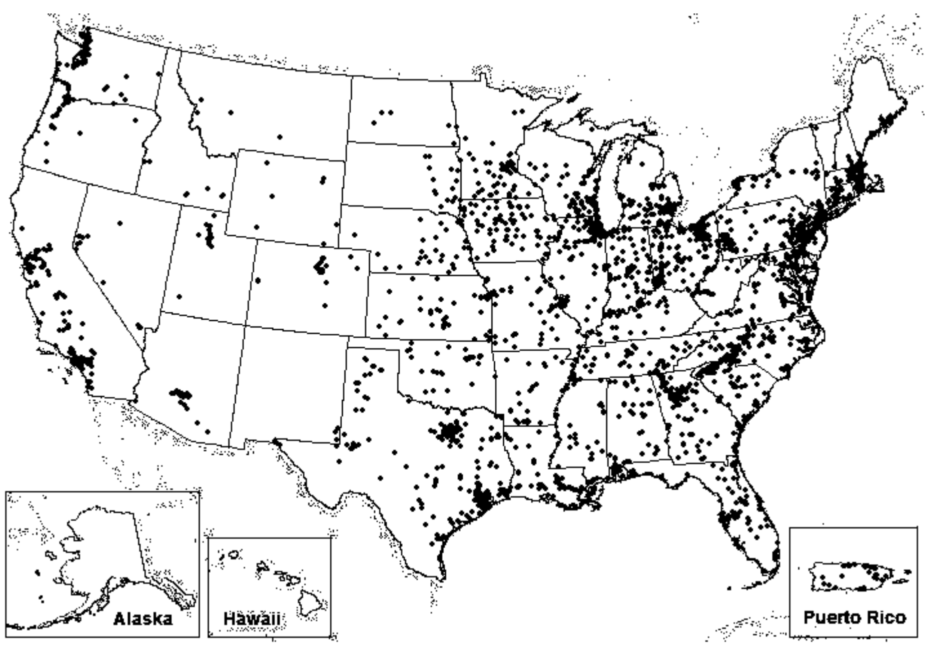
Clearly regulatory agencies play a critical role in prompting regulated facilities to engage in environmental management in order to control their wastewater discharges. However, additional agents exert pressure on regulated facilities, such as stockholders, insurance providers, and labor unions. This study focuses on the pressure exerted by local communities.

1.3.2. Chemical Manufacturing Sector

The Clean Water Act principally constrains wastewater discharges from point sources, which divide into two categories: municipal sources (i.e., municipal wastewater treatment facilities) and industrial sources. This study focuses on a single sector within the category of industrial sources: chemical manufacturing facilities. Figure 1 maps all regulated chemical manufacturing facilities operating in the United States. Our study's focus on a single sector is consistent with other empirical studies of industrial pollution (e.g., Laplante and Rilstone, 1996; Barla, 2007; Earnhart, 2009; Earnhart and Harrington, 2014).

The chemical manufacturing sector proves an excellent choice for analyzing the effects of government interventions on environmental labor. First, the EPA has shown a strong interest in this sector as evidenced by its study, jointly authored with the Chemical Manufacturing Association (CMA), on the root causes of non-compliance in this sector (EPA, 1999) and its own study on the compliance history for chemical manufacturers (EPA, 1997). Consistent with this interest, two sub-sectors in the industry, industrial organics and chemical preparations, were regarded by the EPA as priority sectors during a portion of the study period. Further, the CMA (now known as the American Chemistry Council [ACC]) has demonstrated a strong interest in promoting pollution reduction and prevention with its Responsible Care initiative. The chemical manufacturing sector also generates a large amount of wastewater; as evidence, data on wastewater discharged in 2008 that are disaggregated by 4-digit Standard Industrial Classification (SIC) code reveal that four of the 10 most polluting sub-sectors operate in the chemical manufacturing sector (EPA, 2011). Finally, facilities in this sector devote substantial labor to environmental management. The average facility in our sample has a ratio of environmental employment to total employment of 0.046. Chemical manufacturing facilities also allocate many resources into environmental capital equipment and conduct several self-audits; see Earnhart and Leonard (2013) for details.

Figure 1.1
Map of Chemical Manufacturing Facilities Operating in the United States



Source: U.S. EPA.

1.4. Conceptual Framework

This section sketches a conceptual framework from which we derive testable hypotheses. An individual firm regulated under the Clean Water Act faces local community pressure to engage in environmental management in order to improve the local environment.[5] In each period, the firm’s manager chooses the firm's level of environmental management, as measured by the amount of environmental labor (e.g., engineers)[6], the amount of environmental capital (i.e., installation of wastewater treatment equipment), and the extent of environmental protocols (e.g., self-audits). The firm generates gross profits, incurs environmental management costs (e.g., salaries of environmental engineers), and faces costs imposed by external regulatory and non-regulatory actors stemming from poor corporate environmental management. For example, the firm faces penalties imposed by the regulatory agency for failing to comply with environmental protection laws. The firm’s net profits equal gross profits less the sum of environmental management costs and external environmental costs.

As the focus of our study, the firm’s local community “penalizes” the firm by increasing its production costs and/or decreasing its revenues. Since local workers do not wish to work for a firm that is harangued by local citizens, the firm faces higher labor costs when the firm engages in weaker environmental management. Since customers do not wish to buy a product from a firm that is criticized by local citizens, the firm faces lower revenues when the firm exerts weaker environmental effort.

Within this context, the net profit-maximizing firm chooses the environmental management level that minimizes all environmentally related costs. To achieve this minimum, the firm balances

[5] The theoretical analysis assumes that each firm owns a single facility, so no difference exists between the firm and facility.
[6] Compatible with the literature (Raff and Earnhart, (2018)).

its marginal environmental management costs, representing the marginal abatement costs, against its marginal external environmental costs. Alternatively, we can view the reduction of external environmental costs as the benefits of environmental management. In this case, the net profit-maximizing firm seeks to equate the marginal costs and benefits of environmental management. As local community pressure rises, the marginal benefits of environmental management grow. Thus, in response to greater local pressure, the firm chooses a higher level of environmental management. We label this connection as the "benefit effect".

However, external pressure may generate a countervailing force. An influential body of literature explores how pro-social motivations influence regulated behavior. This literature demonstrates that monetary incentives or disincentives stemming from regulatory pressure may "crowd out" intrinsic motivations to behave pro-socially, such as protecting the environment (Fehr and Falk, 2002; Frey and Jegen, 2001; Brekke et al., 2003; Bowles and Polinia-Reyes, 2012). This literature also reveals that these monetary incentives or disincentives may "crowd out" reputational motivations (Benabou and Tirole, 2006). In both cases, the "crowding out" effect undermines the effectiveness of greater regulatory pressure. Similarly, increased local community pressures may crowd out pro-social motivations. Under certain conditions, the crowding out effect may even dominate so that greater local community pressure leads to counter-productive results (e.g., Benabou and Tirole, 2006).

Considering all of the forces identified above, we derive a pair of competing hypotheses:

Hypothesis H1: If greater local community pressure fails to crowd out pro-social motivations or this crowding out effect is sufficiently small, then local community pressure positively affects the level of corporate environmental management (Hypothesis H1a). If the crowding out effect is sufficiently large so that the *crowding out effect dominates the benefit effect, then local community pressure negatively affects the level of corporate environmental management (Hypothesis H1b).*

Our empirical analysis tests this pair of hypotheses.

1.5. Econometric Framework

1.5.1. Dependent Variables and Primary Regressors

In each year t, facility i chooses its level of environmental management, denoted as Y_{it}, which represents the amounts of labor, capital, or protocol devoted to environmental management:

(1) Environmental employees as a ratio of overall employees at a given facility;

(2) Environmental capital to treat biological oxygen demand or total suspended solids;

(3) Annual count of self-audits.

Thus, our econometric analysis explores three types of dependent variables. It estimates the relationship between each of the four identified dependent variables and a set of primary regressors and control factors, as described below.

The two primary regressors represent direct measures of local community pressure draw from a survey, as described in Section 5. One measure reflects a facility's subjective assessment of the facility's need to respond to local community concerns about the natural environment. The other measure reflects the facility's self-reported assessment of its contribution to the local economy in terms of jobs, taxes, etc. As the facility's economic impact grows, we expect a local community to reduce its pressure for better environmental management, fearing that the facility may shift part of its production to other sites or leave town altogether. Thus, economic impact is negatively correlated with local community pressure.

1.5.2. Control Factors

The econometric analysis controls for variation in other explanatory variables. To control for facility characteristics, the analysis includes the following factors. First, industrial sub-sector indicators control for variation in facilities' abilities to control their operations based on the type of product being manufactured. The analysis includes two sub-sectoral indicators: organic chemical indicator and inorganic chemical indicator, with "other chemicals" as the omitted category.

Second, environmental management, especially the number of environmental employees, may depend on the size of the regulated facility. The analysis measures facility size using two proxies: the number of facility employees and the NPDES facility classification. For the latter, the analysis includes a "major facility" indicator, with "minor facility" as the omitted category.

Third, the analysis controls for facility age. As a facility ages, the facility may need to expend greater effort to generate the same level of environmental performance, e.g., compliance with environmental protection laws.

To control for the pressure exerted by regulatory agencies, the econometric analysis includes factors measuring the government interventions undertaken by state agencies and EPA regional offices. Our analysis considers different types and categories of government interventions. It considers two types of inspections: federal and state. Similarly, our analysis considers two forms of enforcement: informal actions and formal actions. As important, our econometric analysis considers two categories of government interventions: (1) government interventions against one's own facility, and (2) government interventions against all other facilities that are similar to one's own. These two categories influence how each facility forms expectations about enforcement before the facility selects its level of environmental management. Our econometric analysis assumes that each facility bases its expectations of future enforcement on the experiences of other similar facilities along with its own recent experiences (Shimshack and Ward, 2005; Earnhart, 2004a,b,c; Earnhart, 2009). General deterrence reflects the *ex ante* general "threat" of future punishment based on the recent experiences of other facilities with regulatory interventions (Sah, 1991; Cohen, 2000; Thornton et al., 2005; Shimshack and Ward, 2005; Shimshack and Ward, 2008, Gray and Shadbegian, 2007). Specific deterrence adjusts this general threat based on the specific enforcement experiences of particular facilities in the recent past (Cohen, 2000; Earnhart and Friesen, 2013).

Our econometric analysis includes both general and specific deterrence measures as control factors. Consider first inspections. For specific deterrence, our analysis generates two measures to capture the number of federal inspections and state inspections conducted in the 24 months preceding the current year at the individual facility. For general deterrence, our analysis generates two measures to capture the number of federal inspections and state inspections conducted in the 12 months preceding the current year at other facilities of similar size (based on the distinction between major and minor facilities) operating in the same EPA region, in the case of federal inspections, and in the same state, in the case of state inspections. For comparability across space and over time, we divide these regional or state-specific counts by the number of other similarly sized facilities operating in the same EPA region or state (Earnhart and Leonard, 2013). Since a facility needs time to learn about and respond to inspections conducted at other regulated facilities, we lag these general deterrence measures by one year. (For example, the state inspection-related general deterrence measure for a *major* facility operating in 2001 captures inspections conducted by the state agency at other *major* facilities operating in the same state during the year of 1999.)

Similarly, specific and general deterrence measures capture informal and formal enforcement actions.

Finally, the analysis controls for variation in regulatory pressure not already reflected in the government intervention measures by including EPA regional indicators and year-specific indicators.

The next section describes the data used to estimate the functional relationship between each dependent variable reflecting the extent of environmental management effort and the explanatory variables identified above.

1.6. Data

1.6.1. Sources

Our empirical analysis exploits information gathered from two different data sources.

First, our study exploits data collected using an original survey of regulated facilities operating in the chemical manufacturing industry; see Earnhart and Glicksman (2011) for details. The survey consists of a number of confidential questions that gather data on environmental management practices undertaken by individual facilities. In particular, the survey gathers data on the amount of labor devoted to environmental management, measured in person-months. The specific survey question inquires "how many person-months of time did your facility allocate to help ensure that the facility met environmental regulations"; thus, this survey question secures data on personnel dedicated to environmental management. The survey contains data on environmental labor for the years 1999, 2000, and 2001.[7]

[7] For this survey, we asked facilities to provide data on employment for each calendar year separately. Facilities were able to draw upon employment records when answering our survey questions on employment. As part of our implementation of the survey, we encouraged facilities to gather these records prior to the phone conversation when we recorded responses. Moreover, we facilitated this gathering of records by sending copies of the survey questions before the phone conversation.

Two separate survey questions gather data on environmental capital. One question inquires whether or not the facility operates capital equipment to treat biological oxygen demand. A similar question inquires whether the facility operates capital equipment to treat total suspended solids. These survey questions gather information about current operations. Guided by the insight of wastewater engineers, we assume these data reflect conditions for the 12 months preceding a facility's completion of our survey. (This assumption is only meaningful for constructing the specific and general deterrence measures of government interventions.)

One more survey question asks facilities to register the number of self-audits conducted annually over the period 1999 to 2001.[8]

Collectively, we possess panel data for environmental employment and self-audits and cross-sectional data for environmental capital.

The survey also offers self-reported measures of local community pressure. One measure captures local environmental concerns using this specific survey question: "Which of the following best describes the attitude that managers of your facility have towards the facility's need to respond to local community concerns about the environment?". Survey respondents chose from five categories: "little concern about the need to respond ", "some concern", "quite a bit of concern", and "a great deal of concern". We create an indicator that captures the two higher categories ("quite bit of concern" and "great deal of concern"), with the two lower categories ("little of" and "some") as the omitted category.

The other measure of local community pressure captures the facility's economic impact on the surrounding community. The specific survey question follows: "In your view, to what degree does

[8] The survey asked facilities to provide data on self-audits for each calendar year separately. Facilities were able to draw upon records when answering our survey questions on audits. As part of our implementation of the survey, we encouraged facilities to gather these records prior to the phone conversation when we recorded responses. Moreover, we facilitated this gathering of records by sending copies of the survey questions before the phone conversation.

your facility contribute to the local economy, relative to other local businesses, in terms of jobs, taxes, and the like?" Survey respondents chose from four categories: "very little", "small amount", "significant amount", and "great deal". We create an indicator that captures the two higher categories ("significant" and "great"), with the two lower categories ("small" and "very little") as the omitted category.

In addition to data on our dependent variables and primary regressors, the survey gathers information on facility characteristics (e.g., facility age) and characteristics of the firms owning the facilities (e.g., ownership structure).

To implement the survey, Earnhart and Glicksman (2011) and collaborators identified the proper population based on a full extract drawn from the EPA Permit Compliance System (PCS) database, which records information on facilities permitted within the NPDES system, as of September 2001; this extract included 2,596 chemical facilities. To remain in the survey population, facilities needed to meet the following criteria: (1) possessed an NPDES permit, (2) faced restrictions on their wastewater discharges, (3) discharged regulated pollutants into surface water bodies, and (4) were operating as of 2002. Application of these criteria identified 1,003 facilities to contact. Of those facilities contacted between April of 2002 and March of 2003, 268 facilities completed the survey, implying a 27 % response rate. This rate is comparable to previous large-scale surveys of industrial sectors (e.g., Arimura et al., 2008) and lies above the average response rate of 21 % as identified by a review of 183 published studies based on business surveys (Paxson, 1992).

Given the survey's non-response rate of 73 %, the potential for sample selection bias is a valid concern. We assess this concern in two ways. First, we compare the original sample of 1,003 potentially eligible facilities to the 268 facilities that completed the survey. Based on this comparison, we find no systematic state or regional bias in survey participation. As examples, only the Midwest region is slightly over-represented in the response group and only the Northeast region is slightly under-represented. However, these differences are small. Moreover, across most of the states, the difference between representation in the original sample and representation in the response group averages less than 2 %. In contrast, our assessment reveals some difference in the participation of major facilities versus minor facilities. In the original sample, 69 % of facilities are minor facilities and 31 % are major facilities. In the group of survey respondents, major facilities are slightly over-represented at 39 %, a statistically significant difference.

As a stronger assessment, we test for sample selection bias by assessing whether any relevant factors appear to affect a facility's decision to complete our survey once it is contacted. We use a probit model to estimate the relationship between the binary decision to complete or not complete our survey and a set of relevant factors, including major versus minor status, recent experience with inspections and enforcement actions, and EPA region. The probit estimation results (available upon request) reveal bias in a single dimension: major facilities were more likely to respond to the survey than were minor facilities. Given this difference, we would need to interpret cautiously the coefficient on the major facility indicator in our regression results.[9]

For these reasons, our study does not correct for any potential sample selection bias. This lack of correction is consistent with recent published studies of environmental management practices (e.g., Anton et al., 2004; Arimura et al., 2008).

[9] We acknowledge that major facilities may respond to local community pressure differently than minor facilities. We would be able to capture these differences by interacting the major indicator with the local community pressure measures. In this case, our selection bias would contaminate the interaction terms, prompting us to interpret these interactions cautiously as well. However, we do not include these interactions. Thus, the selection bias does not disrupt any additional interpretation.

To complement these survey data, our study also collected data from the EPA PCS database on each facility's location, NPDES major or minor classification, and four-digit standard industrial classification (SIC) code. The PCS database also provides data on inspections conducted by federal and state regulators. The PCS database and the EPA Docket database provide data on federal enforcement actions.

1.6.2. Statistical Summary

Table 1.1 provides summary statistics for the dependent variables, primary regressors, and control factors. As shown in Table 1.1, the ratio of environmental employees to overall employees is about 0.05. Of the sampled facilities, roughly 58 % operate capital equipment to treat BOD and

Table 1.1
Descriptive Statistics

Variable	N	Mean	Standard Deviation
Dependent Variables			
Ratio of Environmental Employees to Overall Employees	746	74.73	178.93
Capital Treatment Cap :			
Use of Biochemical Oxygen Demand treatment (BOD)	254	0.582	0.494
Use of Total Suspended Solids Treatment TSS	252	0.690	0.463
Self-audit	705	5.947	12.764
Primary Regressors			
Environmental concerns of the local community	765	0.874	0.331
The Economic Impact of the facility	777	0.710	0.453
Control Factors			
EPA region	804	4.641	1.821
Year	804	2000	0.817
Facility age	780	42.188	24.530
Number of facility employees	781	259.926	480.9
Organic facility	804	0.435	0.496
Inorganic facility	804	0.309	0.462
Major facility	804	0.384	0.486

69 % operate capital equipment to treat TSS. The average facility conducts six self-audits annually. While this average may seem high, it reflects a skewed distribution since 15 % of the sampled

facilities do not conduct a self-audit in a given calendar year. Of the sampled facilities, 87 % felt a higher need to respond to local environmental concerns and 71 % generated a higher impact on the local economy.

1.7. Econometric Analysis

1.7.1. Estimation Techniques

For our analysis, we adopt different estimation techniques to address the variety of data. First, to accommodate and exploit the panel data, the empirical analysis employs standard panel data estimation techniques using the following equation:

$$Y_{it} = \alpha + \beta_i X_{it} + \eta F_{it} + \delta G_{it} + \theta L_i + \mu D_t + \varepsilon_{it} \quad \ldots (1)$$

where: α is the intercept term, β_i are the slope coefficients, X_{it} the set of primary regressors, F_{it} facility characteristics controls, G_{it} government interventions controls, L_i regional indicators, D_t year indictors and ε_{it} is an error term.

For the cross-sectional data, the analysis employs the following equation

$$Y_i = \alpha + \beta_i X_i + \eta F_i + \delta G_i + \theta L_i + \varepsilon_i \quad \ldots (2)$$

Where: α is the intercept term, β_i are the slope coefficients, X_{it} the set of primary regressors, F_i facility characteristics controls, G_i government interventions controls, L_i regional indicators, and ε_{it} is an error term.

The measures of local community pressure do not vary over time. For this reason, the panel data analysis focuses on pooled OLS, which generates at least consistent estimates for time-invariant factors, and random effects estimation, which is consistent under certain conditions.

The environmental employment measure captures a continuous dependent variable so standard estimators are sufficient. However, the environmental capital measures are binary dependent variables spanned by a cross-sectional data, reflecting the presence of absence of any treatment equipment for a particular pollutant: BOD or TSS. Following the literature, we implement both a linear probability model and a Probit estimator to explore these binary outcomes. The environmental self-audit dependent variable reflects count data. We implement a negative binomial model to estimate this count measure.

To assess the robustness of our results, the empirical analysis uses four different regressor sets (i.e., models), which vary based on the inclusion of control factors. The first regressor set is the parsimonious model (Model 1), which excludes all control factors. The second set adds year and regional indicators (Model 2). The third set adds facility characteristics (Model 3). The full set includes all the control factors (Model 4). The next sub-section primarily uses the full model estimates to interpret the empirical results. The econometric analysis clusters standard errors at the facility level when analyzing the panel data.

1.7.2. Empirical Results

1.7.2.1. Ratio of Environmental Employees to Overall Facility Employees

Table 1.2 displays the results from the pooled OLS regression and random effects estimation of the ratio of environmental employees to overall facility employees. Regardless of the estimator, the results indicate that both local community factors significantly affect the environmental employee ratio. If a facility feels a stronger need to respond to local environmental concerns, the facility employs a greater proportion of environmental employees. If a facility's economic impact increases, then the facility reduces its proportion of environmental employees. These results reveal that both local community factors appear to push local community pressure in the same direction.

Collectively, these results support Hypothesis H1a. As local community pressure rises, facilities increase their environmental management efforts by hiring more environmental employees (as a proportion of overall employees).

Table 1.2.1
Pooled OLS esiomation of Dierct Local Ccommunity Pressure on the Facility 's Ratio of Enviermental Employees to Overall Employees

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	0.0526*** (0.000)	0.0488*** (0.000)	0.0524*** (0.000)	0.0539*** (0.000)
The Economic impact of the facility	-0.0507*** (0.002)	-0.0390*** (0.002)	-0.0417*** (0.003)	-0.0417*** (0.003)
Controal Factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	705	705	690	689
R-squared	0.037	0.147	0.174	0.198

-Robust p-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 1.2.2
Random Effects Esiomation of Direct Local Ccommunity Pressure on the Facility 's Ratio of Enviermental Employees to Overall Employees

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	0.0503*** (0.007)	0.0466** (0.013)	0.0507*** (0.008)	0.0506*** (0.009)
The Economic impact of the facility	-0.0495* (0.064)	-0.0381* (0.065)	-0.0399* (0.090)	-0.0401* (0.091)
Controal Factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	705	705	690	689

-Robust p-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

1.7.2.2. Presence of Environmental Capital

Using the cross-sectional data, we estimate a facility's choice to install environmental capital, namely, equipment designed to treat one of two wastewater pollutants: Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS). Table 1.3.2 displays the results for BOD treatment capital. Tables 1.3.1 and 1.3.2 display the linear probability model and Probit estimates, respectively. Table1.4.1 displays the results for TSS treatment capital. Tables 4.a and 4.b display the linear probability model and Probit estimates, respectively.

We first interpret the BOD capital-related results shown in Table 1.3.1 If a facility feels a greater need to respond to local environmental concerns, the facility is more likely to install BOD treatment capital. However, this positive effect is statistically significant only in the Models 1 and 2 estimates. Once we control for facility characteristics, the effect becomes insignificant. Thus, our conclusion is not robust across the regressor sets. These results only weakly support Hypothesis H1a.

Table 1.3.1
Liner Probablity Esiomation of Dierct Local Community Pressure on the Facility Use of Biochemical Oxygen Demand treatment (BOD)

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	0.136 (0.143)	0.114 (0.234)	0.0728 (0.439)	0.0757 (0.431)
The Economic impact of the facility	0.160** (0.025)	0.138* (0.067)	0.0578 (0.455)	0.0585 (0.456)
Contral Factors				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	248	248	238	238
R-squared	0.036	0.156	0.251	0.252

Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

In addition, if a facility has a larger impact on a local community’s economy, the facility is more likely to install BOD treatment capital. As with local environmental concerns, this positive effect is statistically significant only in the Models 1 and 2 estimates. Once we control for facility characteristics, the effect becomes insignificant. Thus, our conclusion is not robust to the choice of regressor set. In contrast to local environmental concerns, these results weakly support Hypothesis H1b.

Table 1.3.2
Probit Estimation of Dierct Local Ccommunity Pressure on the Facility Use of Biochemical Oxygen Demand Treatment (BOD)

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	0.355 (0.144)	0.325 (0.204)	0.219 (0.422)	0.261 (0.342)
The Economic impact of the facility	0.411** (0.024)	0.391* (0.053)	0.173 (0.436)	0.126 (0.589)
Contral Factors				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	248	248	238	238
R-squared	0.036	0.156	0.251	0.252

- Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Thus, results for the two local community dimensions (weakly) support competing hypotheses. Greater local community pressure driven by environmental concerns does not appear to crowd out pro-social motivations (or at least not sufficiently so), while greater local community pressure stemming from a weaker concern about a facility's economic impact appears to crowd out pro-social motivations. This pair of conclusions is theoretically possible. Nevertheless, future research – both theoretical and empirical -- should explore this combination of effects more closely, as Section 8 discusses further.

Next, we interpret the TSS capital-related results shown in Table 1.4.2 If a facility feels a greater need to respond to local environmental concerns, the facility is less likely to install TSS treatment capital. However, this negative effect is statistically significant only in the Models 3 and

4 estimates. We must control for facility characteristics in order to generate a significant effect. Thus, our conclusion is not robust across the regressor sets. Still, these results moderately support Hypothesis H1b since the effect proves significant when using the larger regressor sets.

Table1.4.1
Liner Probablity Estimation of Direct Local Community Pressure on the Facility Use of Total Suspended Solids Treatment (TSS)

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	-0.0534 (0.523)	-0.0731 (0.405)	-0.124 (0.142)	-0.148 (0.100)
The Economic impact of the facility	0.122* (0.074)	0.119* (0.100)	0.0597 (0.428)	0.0576 (0.449)
Contral Factors				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	246	246	236	236
R-squared	0.014	0.063	0.151	0.194

Robust P-value in parentheses: *** p<0.01, ** p<0.05, *p<0.1

In addition, if a facility more greatly impacts a local community's economy, the facility is more likely to install BOD treatment capital. This positive effect is statistically significant only in the Models 1 and 2 estimates. Once we control for facility characteristics, the effect becomes insignificant. Thus, our conclusion is not robust to the choice of regressor set. Similar to local environmental concerns, these results (at least weakly) support Hypothesis H1b.Thus, results for the two local community dimensions support the same hypothesis (Hypothesis H1b). Regardless of the local community dimension, greater local community pressure crowds out pro-social motivations. Overall, our estimates for environmental capital mostly support Hypothesis H1b; the effect of local environmental concerns on BOD treatment capital represents the exception.

Table 1.4.2
Probit Estimation of Direct Local Community Pressure on the Facility Use of Total Suspended Solids Treatment (TSS)

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	-0.167 (0.507)	-0.224 (0.392)	-0.401 (0.139)	-0.444 (0.127)
The Economic impact of the facility	0.344* (0.063)	0.346* (0.076)	0.182 (0.390)	0.119 (0.588)
Contral Factors				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	248	248	236	230

- Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

1.7.2.3. Annual Count of Environmental Self-Audits

Using the panel data, we estimate a facility's choice over the frequency of self-audits as measured by the annual count of audits. Table 4 displays the random effects negative binomial estimates[10]. As shown in Table 4, if a facility feels a greater need to respond to local environmental concerns, the facility conducts fewer self-audits. However, this effect is only statistically significant in the Models 1 and 2 estimates. Thus, once we control for facility characteristics, the effect becomes insignificant. Thus, our conclusion is not robust to the choice of regressor set. These results provide only weak evidence to support Hypothesis H1b.

In addition, the effect of a facility's economic impact is positive. If a facility more greatly impacts a local community's economy, the facility conducts more self-audits. This positive effect is statistically significant regardless of the regressor set. Thus, our conclusion is robust to the

[10] We test whether the negative binomial estimator dominates the Poisson estimator, which is another standard count data estimator, by assessing over-dispersion; the likelihood ratio test statistic rejects the null hypothesis of no over-dispersion (p=0.00). We also test whether a zero-inflated model is warranted; the Vuong test statistic fails to reject the null hypothesis of a non-excessive count of zeros (p=0.00).

choice of control factors. These results strongly support Hypothesis H1b. Overall, both local community dimensions demonstrate that greater local community pressure crowds out pro-social motivations so much that this effect dominates.

Table 1.5.1
Results of Random Effects Negative Binomial of Direct Local Community Pressure on the Facility's Number of Self-Audit

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	-0.578** (0.045)	-0.550* (0.067)	-0.443 (0.141)	-0.517 (0.101)
The Economic impact of the facility	0.505** (0.019)	0.467** (0.030)	0.443* (0.056)	0.481** (0.041)
Contral Factors				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	686	686	649	648

- Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Overall, our results for three types of environmental management – labor, capital, and protocols – support different competing hypotheses. Our environmental labor results support Hypothesis H1a, our environmental capital results support both Hypotheses H1a and H1b but mostly Hypothesis H1b, and our environmental (audit) protocol results support Hypothesis H1b. These results collectively reveal that the crowding out effect stemming from local community pressure influences different types of environmental management differently.

To interpret these differences, recall that pro-social motivations include both intrinsic and reputational motivations. While intrinsic motivation relies on internal introspection, reputational motivation relies on visibility. Clearly environmental management types differ in their visibility. We conjecture that environmental capital is more visible than environmental labor. If true, the crowding out of reputational motivation should play a greater role for environmental capital. Our results are consistent with this distinction.

Table 1.5.2
Results of Random Effects Incident Rate Ratio of Direct Local Community Pressure on the Facility's Number of Self-Audit

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	0.561** (0.045)	0.577* (0.067)	0.642 (0.141)	0.596 (0.101)
The Economic impact of the facility	1.657** (0.019)	1.596** (0.030)	1.558* (0.056)	1.618** (0.041)
Contral Factors				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	686	686	649	648

- Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

1.7.2.4. Marginal Effects of Local Community Factors

Our primary results assess the signs and statistical significance of our coefficient estimates. In order to assess the economic importance of our estimated effects, we calculate marginal effects for both primary regressors and all five dependent variables. Consider first environmental labor. The pooled OLS and random effects coefficient estimates reflect marginal effects. As shown in Table 2, if a facility feels a greater need to respond to local environmental concerns, the facility increases the ratio of environmental to overall employees by 0.047 to 0.051, depending on the model and estimator. If a facility more greatly impacts a local economy, then the facility reduces this ratio by 0.038 to 0.050. Relative to a sample mean of 0.049, these impacts seem quite important.

Consider next the marginal effects on environmental capital. The linear probability model coefficient estimates reflect marginal effects. See Tables 1.6.1 and 1.6.2. The Probit coefficients reflect the marginal effect only on the index function. To evaluate the marginal effect on the probability of adoption, we must condition on particular values of the regressors. As one common practice, for each primary regressor, we calculate the marginal effect based on each observation's values for the other regressors and then calculate the average of these observation-specific marginal effects, i.e., average marginal effect. Tables 3.c and 4.c. display these average marginal effects for BOD capital and TSS capital, respectively.

For BOD treatment capital, the linear probability model coefficients reveal that, if a facility feels a greater need to respond to local environmental concerns, the likelihood of adoption rises by 0.136 % to 0.0757 %, depending on the model. If a facility more greatly impacts a local economy, the likelihood of adoption rises by 0.058 % to 0.160%. The Probit-based marginal effects are similar. If a facility feels a greater need to respond to local environmental concerns, the likelihood of adoption rises by 0.079 % to 0.138 %, depending on the model. If a facility more greatly impacts a local economy, the likelihood of adoption rises by 0.054 % to 0.160 %. Relative to a sample mean of 58 %, these impacts seem important.

Table 1.6.1
Average marginal estimation of Direct Local Community Pressure on the existence of Biochemical Oxygen Demand treatment (BOD)

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	0.138	0.115	0.069	0.0792
The Economic impact of the facility	0.160	0.139	0.054	0.0380

Marginal effects for TSS treatment capital reveal similarly important impacts. Based on the linear probability model coefficients, if a facility feels a greater need to respond to local environmental concerns, the likelihood of adoption decreases by 0.148 % to 0.0534 %, depending on the model. If a facility more greatly impacts a local economy, the likelihood of adoption rises by 0.057 % to 0.122%. Similarly, the Probit-based marginal effects reveal that, if a facility feels a greater need to respond to local environmental concerns, the likelihood of adoption decreases by 0.121 % to 0.558 %. If a facility more greatly impacts a local economy, the likelihood of adoption rises by 0.035 % to 0.123 %. Again, relative to a sample mean of 69 %, these impacts seem important.

Table 1.6.2
Average marginal estimation of Direct Local Community Pressure on Facility Use of Total Suspended Solids Treatment (TSS)

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	-0.558	-0.711	-0.114	-0.121
The Economic impact of the facility	0.123	0.119	0.057	0.035

Lastly, we assess the marginal effects of local community factors on the annual count of environmental self-audits. For this assessment, we calculate incident rate ratios based on the underlying coefficient estimate.[11] These ratios reflect the impact of a one-unit change in each of the primary regressors on the count of audits. A ratio of one implies no impact. A ratio below one implies a negative impact, while a ratio above one implies a positive impact.

Table 1.6.3 displays the incidence rate ratios. If a facility feels a greater need to respond to local environmental concerns, the facility reduces its frequency of self-audits by 44 % to 36 %, depending on the model. If a facility more greatly impacts a local economy, the facility increases its audit frequency by 56 % to 66 %. Clearly, these impacts are economically important.

[11] Each negative binomial coefficient reflects the difference between the log of expected counts. Let X capture the regressor, β the regression coefficient, and μ the expected count. Identify two specific values of X that reflect a one-unit difference in X: X_0 and X_0+1. Given this notation, the difference between the log of expected counts is written as follows: $\beta = \log(\mu[X_0+1]) - \log(\mu[X_0])$. The difference between two logs is equal to the log of their quotient. Therefore, each parameter estimate reflects the log of the ratio of expected counts. An incidence rate ratio exploits this equivalence.

Table 1.6.3
Results of Random Effects Incident Rate Ratio of Direct Local Community Pressure on the Facility's Number of Self-Audit

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Environmental concerns of the local community	0.561** (0.045)	0.577* (0.067)	0.642 (0.141)	0.596 (0.101)
The Economic impact of the facility	1.657** (0.019)	1.596** (0.030)	1.558* (0.056)	1.618** (0.041)
Contral Factors				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	686	686	649	648

- Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0

1.8. Conclusions

This study explores the effects of local community pressure on corporate environmental management as reflected in regulated facilities' employment of environmental labor, installation of environmental capital (i.e., wastewater treatment equipment), and use of environmental protocols (i.e., frequency of self-audits). Local community pressure stems from two local dimensions: local environmental concerns in general and the local economic impact of an individual facility. Our theoretical analysis generates two competing hypotheses, which differ based on the importance of any pro-social motivations possibly held by facility management personnel and the extent to which local community pressure crowds out these motivations. Our empirical analysis tests these hypotheses by examining the environmental management effort expended by chemical manufacturing facilities regulated under the Clean Water Act between the years 1999 to 2001.

In general, the empirical results suggest that local community pressure greatly affect corporate environmental management. However, our results for three types of environmental management – labor, capital, and protocols – support different competing hypotheses. Our environmental labor results support Hypothesis H1a, revealing no meaningful role for the crowding out of pro-social motivations. Our environmental capital results support both Hypotheses H1a and H1b but mostly Hypothesis H1b, the latter revealing a sufficiently strong crowding out effect. And our environmental (audit) protocol results support Hypothesis H1b, again demonstrating a substantial crowding out effect. These results collectively reveal that the crowding out effect stemming from local community pressure influences different types of environmental management differently.

Our analysis provides some evidence on some effectiveness of local community pressure as a tool for inducing better corporate environmental management. However, our analysis mostly offers evidence of counter-productive local community pressure. Regardless, we contribute to both the scholarly literature and policy debate. This said, we acknowledge the limitations of our research. Our study examines only one sector's environmental management efforts to control pollution disposed into one medium (water) over a three-year period (1999-2001). And we examine only one form of non-regulatory external pressure: local community pressure. We encourage future research to broaden the scope of this empirical analysis by exploring additional sectors, additional media (e.g., air), and additional external actors (e.g., stockholders).

2 The Effect of Spatially Defined Local Community Characteristics on Corporate Environmental Management

2.1.Introduction

A substantial literature examines the ways community characteristics affect local environmental outcomes. Several studies have shown the importance of various economic and political factors in explaining the level of toxic releases or local ambient pollution (e.g., Kriesel et al. 1996; Arora and Cason 1999). Explanatory variables common to many of these studies include household incomes, house values, population density, educational attainment, poverty rate, racial composition, voting behavior, and other measures of local demographics, economic conditions, and political opposition. In this paper, we examine whether local factors impose more environmental pressures on the industrial facilities regulated under the Clean Water and increase the level of water pollution abatement.

The principle motivation here is to provide additional evidence on which community characteristics impact local environmental outcomes. This paper's chief innovation in the realm of literature on water pollution, is that it is the first to examine the effects of spatially defined local community characteristics on the corporate environmental management. To deliver this contribution, firstly, we examine the effects of nonspatial local community characteristics within 1,5,10 and 15-mile radii of the regulated facility location. Secondly, we construct rings of those economic, demographic, and socioeconomic local community characteristics within the distance gap between 1-5-mile radii, 5-10-mile radii and 10-15-mile radii.

In principle, the effects studies based on the spatially defined local community characteristics should yield the same expected effects as studies based on non-spatial local community characteristics since they are all obviously interrelated. However, given potentially serious concerns with the spatial measurement of some of these environmental outcomes, the examination of several different ones is certainly a worthwhile endeavor.

Controlling for facility characteristics and various forms of environmental regulation, the preliminary results of non- spatial community characteristics indicate certain community characteristics (e.g. per household income) found to have additional effects on the corporate environmental choice of environmental labor and capital. However, the preliminary results of the spatially defined local community characteristics are not in favor of this hypotheses.

The rest of the paper proceeds as follows. Section 2 reviews the relevant literature. Section 3 constructs a theoretical framework, which generates testable hypotheses. Section 4 describes the econometric framework. Section 5 discusses the data and provides summary statistics. Section 6 details the econometric analysis and reports the empirical results, while interpreting them as a means for testing theoretically derived hypotheses. Section 7 concludes and assesses briefly future research.

2.2. Literature Review

In Chapter one we explore most of the literature that explore the effect of local community pressure, here we will have relisted some of these literatures focusing on the literature that analyses explore the effect of local community pressure on corporate environmental management or performance using local community demographic or socioeconomic characteristics, which serve as proxies or indirect measures of local community pressure. The set of local community characteristics that we focus on here is the one adopted by this analysis which include demographic (e.g. median age, black share of the community) economics (e.g. median household income and housing status) and socioeconomic characteristics (e.g. poverty and educational attainment)

Few empirical studies analyze the effect of the demographic characteristics of the local community such as the community average or median age and the community minority proportion (Arora and Cason, 1999; Pargal et al., 1997; Pargal and Wheeler, 1996). Most of these results reveal no significant effect.

The most common economic characteristics used in the literature to measure local community pressure is the community median household income (Arora and Cason, 1999; Brooks and Sethi, 1997; Hamilton, 1993). Most of these studies conclude that greater pressure as captured by higher community income leads to better environmental performance from facilities located in the community.

Several empirical studies use socioeconomic community such as the community educational attainment as proxy for a community's intellectual sophistication generally or environmental sophistication specifically (e.g., Pargal and Wheeler, 1996). One study uses the percentage of adults with four or more years of college (Hamilton, 1993). Other studies use the percentage of people aged 25 years or more with at least a bachelor's degree (Brooks and Sethi, 1997; Arora and Cason, 1999; Maxwell et al., 2000; Becker, 2003). Additionally, some studies use the high school graduation rate or percentage of local residents with at least a high school diploma (Earnhart , 2004b; Wolverton, 2009). Pargal and Wheeler, 1996 finds that communities with high level of education gives high weight to water pollution. Brooks and Sethi (1997) demonstrate that educational attainment is significantly and negatively related to exposure to air pollution. Moreover, Arora and Cason (1999) find that people aged 25 years or more with at least a bachelor's degree are significantly and negatively affect the toxics release inventory in most of the U.S. regions. In contrast, Becker (2003) shows that educational attainment has statistically zero effects on air pollution abatement (APA) expenditure by U.S manufacturing plants.

Our study contributes to this ongoing literature by defining the local community characteristics spatially. Our analysis uses data gathered on 1- mile, 5-miles, 10-miles and 15 miles radii to construct a ring of the distance within those different mile radii.

2.3. Conceptual Framework

Similar to chapter one, this section sketches a conceptual framework from which we derive testable hypotheses. An individual firm regulated under the Clean Water Act engage in environmental management in order to improve the local environment pressured by certain local community characteristics that spatially defined. These community characteristics are proxies for the local community pressures. In each period, the firm’s manager chooses the firm's level of environmental management, as measured by the amount & quality of environmental labor, the presence of environmental capital and the quality of environmental capital. The firm generates gross profits, incurs environmental management costs (e.g., upgrading treatment cost), and faces costs imposed by external regulatory and non-regulatory actors stemming from poor corporate environmental management. For example, the firm faces penalties imposed by the regulatory agency for failing to comply with environmental protection laws. The firm’s net profits equal gross profits less the sum of environmental management costs and external environmental costs.

Following the above, the analysis hypothesis that the closer the local individual to the facility location, the higher their impacts on the facility environmental effort. That is local community pressure should fall away as distance grows. For example, the homeowners within 1- mile radius of the facility location in particular may demand greater pollution abatement efforts from their nearby facility compares to the homeowners within 5-miles or 10 mil radii. Similarly, the homeowners within the ring between the 1- 5 miles radii has more vested interest in pollution abatement efforts from their nearby facility than the homeowners with the ring between the 5- 10 miles radii. following that the analysis consider the following hypothesis

$$H_1: Community\ pressure\ decressing\ in\ distance\ from\ the\ facility$$

That is:

$$\beta_{i1} > \beta_{i5} > \beta_{i10} > \beta_{i15}$$

While H_1 is the main testing hypothesis, the analysis also considers testing the relation between each local community demographic, economics and socioeconomics characteristics and the environmental management choice, the list of these hypotheses are summarized below:

Local Community Characteristics	***H1***	***H0***
Median age	$\beta > 0$	$\beta \leq 0$
Black share of population	$\beta < 0$	$\beta \geq 0$
Per household income (calendar year=1999, current $)	$\beta > 0$	$\beta \leq 0$
Share of population aged 25 or over with bachelor's degree or higher	$\beta > 0$	$\beta \leq 0$
Share of population living in same house as 1995	$\beta > 0$	$\beta \leq 0$
Male share of populations aged 18 or over	$\beta > 0$	$\beta \leq 0$
Owner-occupied share of housing	$\beta > 0$	$\beta \geq 0$
Share of population under poverty line	$\beta < 0$	$\beta \leq 0$

Where: β is the estimated coefficient

2.4. Econometric Framework[12]

2.4.1. Dependent Variables

In each year t, facility i chooses its level of environmental management, denoted as Y_{it}, which represents the amounts of labor, capital, or protocol devoted to environmental management:

3. Environmental employees as a ratio of overall employees at a given facility;
4. Extent of wastewater treatment upgrade;
5. Extent of environmental training offered.

Thus, our econometric analysis explores three types of dependent variables. It estimates the relationship between each of the three identified dependent variables and a set of primary regressors and control factors, as described below.

2.4.2. Explanatory variables

The set of primary regressors represent indirect measures of local community pressure represented by economics, demographic, and socioeconomics local community characteristics. We draw upon the previous literature for local characteristics that may influence outcomes of interests mentioned above as well as contribute through the spatial constriction of these variable as primary regressors to present accurate idea regard the individuals that immediately affected by the facility environmental behavior what extend the local community pressure may affects the environmental management.

2.4.2.1. Non-Spatial Community Characteristics

The local community characteristics implied in this analysis can be broadly—and somewhat arbitrarily—classified as belonging to one of three groups: (1) Economics local community characteristics which include per household income, which we transform to the log

[12] The set of control factors are the same set used for the analysis of chapter 1

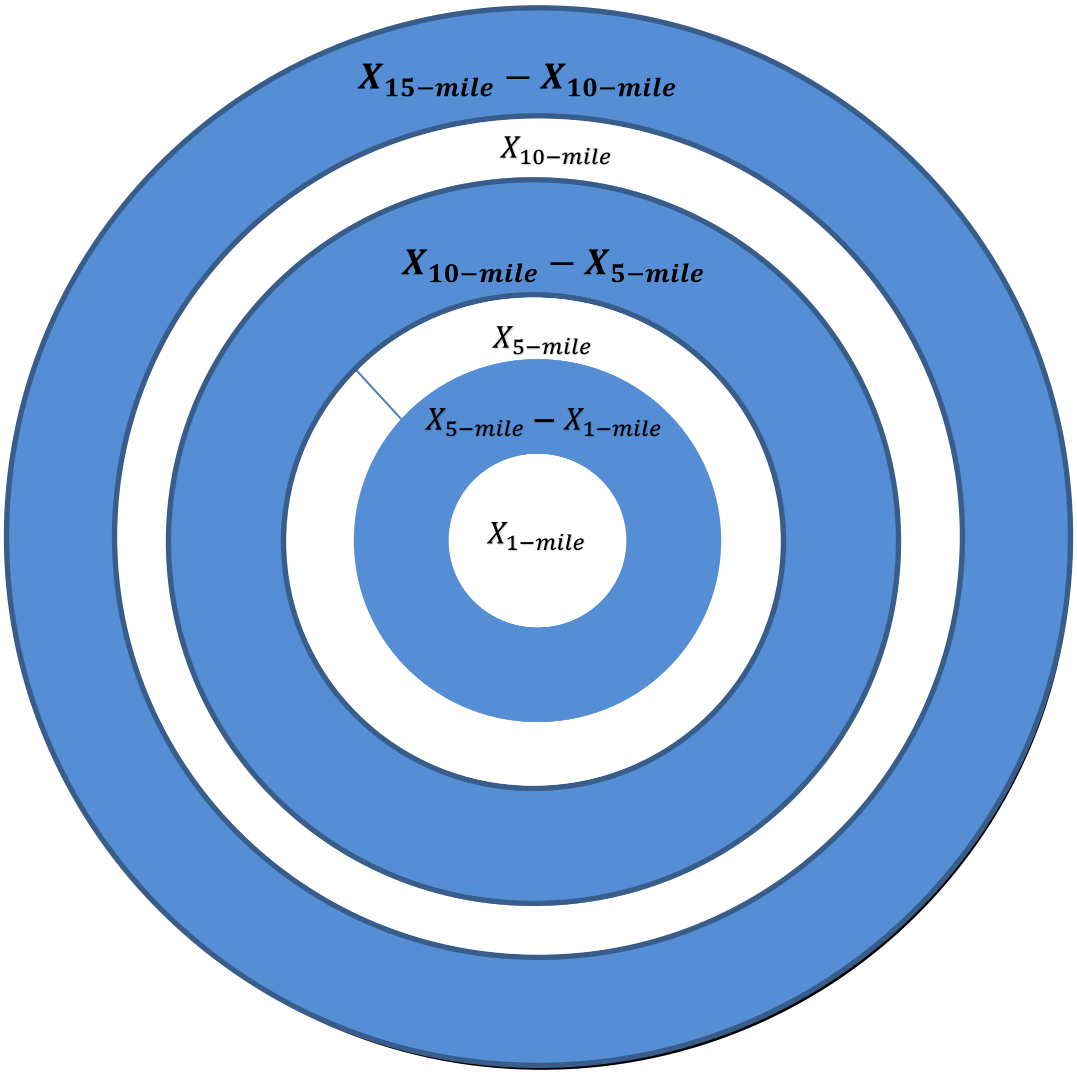
form as it skews toward the tail, and state of the housing market. The income is a common measure for local community pressure in the literature, as the demand for environmental quality, like that for any other good, may simply derive from income and preferences. If environmental protection is a normal good, wealthier communities might be expected to press for stricter requirements on their polluting plants. In addition, we assess economics characteristics that capture state of the housing market (e.g. share of population living at the same house as 1995 and the owner-occupied share of housing) as the higher the owner-occupied share of housing in the local community may promote more stable community that advocate for the environment which drive the facility managers to consider more environmental friendly operating decisions. Similarly, litigation may result in compensation for reduced property values. (2) Demographic local community characteristics (e.g. Black share of the local community population) which we use to explore the apparent correlation between minority populations and local pollution levels and the siting of polluting facilities. This might be expected to reflect that subgroups of the population are "environmentally discriminated" to the point that they may not impose stricter requirements on their polluting facility. (3) Socioeconomics local community characteristics including median age, education attainment of the local community captured by the share of population aged 25 or over with bachelor's degree or higher, gender measure and the share of poor population. Local communities with high rates of poverty and/or low levels of educational attainment may result in lower damages being awarded in the event of injuries and/or deaths from accidental exposure to pollution. This also may reflect on the notion of environmental injustice.

2.**4.2.2. Spatially Defined Local Community Characteristics**

All the community characteristics mentioned in section 4.2.a are gathered within one- mile radius of each respective polluting facility in order to present accurate idea regard the individuals that immediately affected by the facility environmental behavior. Nevertheless, this radius is extended up to maximum fifteen-mile radius to test whether the regression result holds or not. Furthermore, we spatially define the local community characteristics by construct rings of these characteristics of represents the distance between the four different mile radii as represented by figure 2.1.

Figure 2.1

The Construction of Spatial Local Community Characteristics



As figure 2.1 shows the rings take a donut shape where the hole of the donut represents the local community characteristics within 1- mile radius of the polluted facility. The first ring represents the distance between the 5-mile radius and 1- mile radius. Here, the spatial local community characteristics, which are the second set of regressors for this analysis, are calculated by taking the difference of each characteristics within the different mile radii. For instance, X_{5-1} is the local community characteristics within the distance between the 5-mile radius and 1- mile radius is calculated following

$$\boldsymbol{X_{5-1} = X_{within\ 5\ mile\ raduis} - X_{within\ 1\ mile\ raduis}}$$

2.5. Data

2.5.1. Sources

Our study exploits data on our dependent variables using our study exploits data collected using an original survey of regulated facilities operating in the chemical manufacturing industry; see Earnhart and Glicksman (2011) for details. The survey consists of a number of confidential questions that gather data on environmental management practices undertaken by individual facilities.

The primary regressors data collected using United States Census Bureau. As we use the 2002 economic census data to construct the economics, demographic, and socioeconomics community measures at a county level. These measures are sorted into one, five, ten, and fifteen – mile radius increments of the facility location.

To complement the above data, our study also collected data from the EPA PCS database on each facility's location, NPDES major or minor classification, and four-digit standard industrial classification (SIC) code. The PCS database also provides data on inspections conducted by federal and state regulators. The PCS database and the EPA Docket database provide data on federal enforcement actions.

The data in use constructed into multiple surveys including a cross-sectional survey (snapshot) made up to 12 months preceding survey completion, a survey spanning the results of three-year window made up to 36 months preceding survey completion, and finally a panel data survey for the period (1999-2001) clearly made in years prior to survey completion (i.e., 2002,2003).

2.5.2. Statistical Summary

Table 2.1 provides summary statistics for the dependent variables, primary regressors, and control factors. As shown in Table 1, the ratio of environmental employees to overall employees is about 0.05. Of the sampled facilities, roughly 61 % operate wastewater treatment upgrading, and 93% offer environmental training. While this average may seem high, it reflects a skewed distribution since 7 % of the sampled facilities do not offer environmental training in a given calendar year. The average median age of the local community the 1- mile radius is 36 years while it shrinks down to -0.14 when we spatially defined the median age within the 1-5-mile radii. Of the sampled of local community within 1- mile radius, 17% of the population is black compare to -0.05% within the rings of the distance between the 1-5-mile radii. The average per household income for the household within the 1-mile radius is $ 47.85 compared to $1.42 for the household within the 1-5-mile ring. 15 % of the population of the local community within the 1- mile are over 25 years old with bachelor’s degree or higher compare to 0.26% of the population within the 1-5-mile ring. The share of population living at the same house is 60% within the 1- mile compare to -0.15% within the ring of 1-5 mile. The local community within the 1-mile is 64% owner occupied compare to -0.15% within the 1-5-mile ring.

Table 2.1
Descriptive Statistics

Variable	N	Mean	Std. Dev.
Dependent Variable			
Ratio of Environmental Employees to Overall Employees	746	0.490	0.131
Wastwater tretment upgrade – any kind (vs . none)	256	0.613	0.487
Extent of environmental trining (vs. none)	265	0.932	0.252
Local Community Characteristics within 1-Mile Radius (*)			
Median age	795	36.01	4.414
Black share of population	795	0.174	0.236
Log of Per household income	795	-3.82	0.285
Share of population aged 25 or over with bachelor's degree or higher	795	0.149	0.086
Share of population living in same house as 1995	795	0.593	0.086
Male share of populations aged 18 or over	795	0.480	0.029
Owner-occupied share of housing	795	0.643	0.143
Share of population under poverty line	795	0.149	0.094
Spatially Defined Local Community Characteristics within the Ring between 1- Mile& 5- Mile radii			
Median age	795	-0.147	3.248
Black share of population	795	0.014	0.130
Log of Per household income	477	-1.267	1.354
Share of population aged 25 or over with bachelor's degree or higher	795	0.026	0.060
Share of population living in same house as 1995	795	-0.015	0.061
Male share of populations aged 18 or over	795	-0.003	0.261
Owner-occupied share of housing	795	-0.015	0.107
Share of population under poverty line	795	-0.005	0.060

Although the male percentage of the local community within the 1- mile is 48%, the male percentage drop to -0.03% within the 1-5 ring. Finally, the poor share of the local community within the 1- mile radius is 15%, while it is only appears to be -0.05% within the 1-5 mile radii ring.

2.6. Econometric Analysis

This section describes our econometric analysis.

2.6.1. Estimation Techniques

For our analysis, we adopt different estimation techniques to address the variety of data. First, to accommodate and exploit the panel data, the empirical analysis employs standard panel data estimation techniques. The measures of local community pressure do not vary over time. For this reason, the panel data analysis focuses on pooled OLS, which generates at least consistent estimates for time-invariant factors, and random effects estimation, which is consistent under certain conditions.

The environmental employment measure captures a continuous dependent variable so standard estimators are sufficient. However, the environmental capital measures and extent of environmental training offered are binary dependent variables, reflecting the presence or absence of upgrading the treatment for a particular pollutant or the whether the pollutant facility offer environmental training or not. Following the literature, we implement both a linear probability model and a Probit estimator to explore these binary outcomes.

Also, we explore the effects of local community presser using both spatially and none-spatial defined local community characteristics of local within the different mile radii of the pollutant facility location.

To assess the robustness of our results, the empirical analysis uses four different regressor sets (i.e., models), which vary based on the inclusion of control factors. The first regressor set is the parsimonious model (Model 1), which excludes all control factors. The second set adds year and regional indicators (Model 2). The third set adds facility characteristics (Model 3). The full set includes all the control factors (Model 4). The next sub-section primarily uses the full model estimates to interpret the empirical results. The econometric analysis clusters standard errors at the facility level when analyzing the panel data.

2.6.2. Empirical Results

This sub-section interprets the results for the primary regressors. Appendix B interprets the results for the control factors.

2.6.2.1. Results Using Non-Spatial Local Community Characteristics

2.6.2.1. a. Ratio of Environmental Employees to Overall Facility Employees

Table 2.2 displays the results from the pooled OLS regression and random effects estimation of the ratio of environmental employees to overall facility employees with the different miles. Here we focus on the significant results.

The pooled OLS estimators within the 1-mile radius for the black share of the community, the education attainment measure and the gender measure indicate a positive and significate effects on the ratio of environmental employees. Both, the education attainment measure and the gender measure results hold the same using the random effects estimator.[13]

The results of the RE estimator for the education attainments hold the same within the 5, 10 and 15 mil radii and it the only variable that indicates positive statically significant results. Collectively these results support the hypothesis highest levels of educational attainment may result in increasing the number of environmental employees hired by the facility. The result listed in appendix A.

2.6.2. 1. b. Presence of Environmental Capital

Using the cross-sectional data, we estimate a facility's choice to upgrade the wastewater treatment. The results shown in Table 2.3 for linear probability estimators and table 4 for the Probit estimator. Both estimators generate the same results which indicates a significant statistical correlation between only the education attainments and upgrade the wastewater treatment, however, these results are skeptical as its inconsistent within the different mile radius. For that future

[13] The Durbin–Wu–Hausman test indicates the inconsistency of the OLS estimator, so our preferred specification would be the RE estimator.

investigations for these results need to be done. The 5 Mile radius and above results listed in Appendix B.

Table 2.2.1

Pooled OLS Estimation of Local Community Characteristics within 1- Mile Radius on the Ratio of facility environmental employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.000960	-0.000304	-0.000534	-0.000607
	(0.469)	(0.818)	(0.681)	(0.647)
Black share of population	0.0446**	0.0625***	0.0592***	0.0661***
	(0.045)	(0.009)	(0.010)	(0.005)
Log of Per household income (calendar year=1999, current $)	0.0759	0.0498	0.0378	0.0546
	(0.118)	(0.200)	(0.310)	(0.175)
Share of population aged 25 or over with bachelor's degree or higher	0.496***	0.370***	0.392***	0.437***
	(0.005)	(0.005)	(0.003)	(0.001)
Share of population living in same house as 1995	-0.125	-0.0299	-0.00635	-0.00626
	(0.223)	(0.708)	(0.936)	(0.938)
Male share of populations aged 18 or over	0.615***	0.550***	0.567***	0.598***
	(0.002)	(0.004)	(0.002)	(0.001)
Owner-occupied share of housing	0.0208	-0.0245	-0.0681	-0.0609
	(0.712)	(0.578)	(0.146)	(0.215)
Share of population under poverty line	-0.188**	-0.177**	-0.179**	-0.191**
	(0.013)	(0.018)	(0.018)	(0.023)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	724	724	709	709
R-squared	0.084	0.172	0.203	0.230

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 2.2.2
Random Effects Estimation of Local Community Characteristics within 1- Mile Radius on the Ratio of facility environmental employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.000976	-0.000348	-0.000561	-0.000465
	(0.691)	(0.890)	(0.824)	(0.854)
Black share of population	0.0357	0.0553	0.0533	0.0551
	(0.518)	(0.336)	(0.354)	(0.337)
Per household income (calendar year=1999, current $)	0.0701	0.0406	0.0285	0.0300
	(0.288)	(0.583)	(0.701)	(0.686)
Share of population aged 25 or over with bachelor's degree or higher	0.483***	0.352**	0.371**	0.388**
	(0.002)	(0.039)	(0.031)	(0.024)
Share of population living in same house as 1995	-0.108	-0.0211	0.000294	-0.0130
	(0.406)	(0.884)	(0.998)	(0.928)
Male share of populations aged 18 or over	0.607*	0.544*	0.556*	0.565*
	(0.056)	(0.088)	(0.082)	(0.077)
Owner-occupied share of housing	0.0124	-0.0271	-0.0651	-0.0531
	(0.896)	(0.806)	(0.566)	(0.641)
Share of population under poverty line	-0.172	-0.147	-0.153	-0.139
	(0.396)	(0.475)	(0.461)	(0.505)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	724	724	709	709

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 2.3.1
Linear Probability Estimation of Local Community Characteristics within 1- Mile Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.00370	0.000744	0.00300	0.000856
	(0.691)	(0.940)	(0.767)	(0.932)
Black share of population	0.123	0.0468	0.0856	0.0202
	(0.542)	(0.829)	(0.700)	(0.927)
Log of Per household income (calendar year=1999, current $)	-0.190	-0.243	-0.214	-0.299
	(0.477)	(0.417)	(0.480)	(0.336)
Share of population aged 25 or over with bachelor’s degree or higher	-0.636	-0.792	-0.857	-1.165
	(0.298)	(0.255)	(0.224)	(0.112)
Share of population living in same house as 1995	0.0817	0.220	0.198	0.170
	(0.866)	(0.688)	(0.715)	(0.760)
Male share of populations aged 18 or over	-1.182	-1.297	-1.311	-1.466
	(0.314)	(0.284)	(0.274)	(0.227)
Owner-occupied share of housing	0.331	0.186	0.230	0.0578
	(0.377)	(0.670)	(0.619)	(0.903)
Share of population under poverty line	0.763	0.596	0.536	0.427
	(0.305)	(0.453)	(0.500)	(0.599)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	253	253	244	244
R-squared	0.033	0.055	0.070	0.119

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

2.6.2. 1. c. Extent of Environmental Training

Using the cross-sectional data, we estimate a facility’s choice to offer an environmental training. The results shown in Table 2.4 for linear probability estimators and the Probit estimator.

The results of Linear probability and Probit estimators indicates a positive significant correlation between the per household income and the choice to effort environmental training,

Table 2.3.2
Probit Estimation of Local Community Characteristics within 1- Mile Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.00978	0.00114	0.00702	0.000703
	(0.690)	(0.965)	(0.789)	(0.979)
Black share of population	0.356	0.134	0.238	0.0580
	(0.528)	(0.821)	(0.694)	(0.925)
Log of Per household income (calendar year=1999, current $)	-0.517	-0.729	-0.710	-0.728
	(0.459)	(0.369)	(0.383)	(0.395)
Share of population aged 25 or over with bachelor's degree or higher	-1.643	-2.154	-2.462	-2.905
	(0.304)	(0.239)	(0.183)	(0.134)
Share of population living in same house as 1995	0.257	0.736	0.693	0.409
	(0.841)	(0.615)	(0.635)	(0.785)
Male share of populations aged 18 or over	-3.203	-3.658	-3.893	-4.543
	(0.313)	(0.267)	(0.239)	(0.170)
Owner-occupied share of housing	0.900	0.460	0.545	0.315
	(0.349)	(0.686)	(0.647)	(0.799)
Share of population under poverty line	2.172	1.805	1.769	1.440
	(0.286)	(0.399)	(0.410)	(0.509)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	253	253	244	244

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

these results are weakly significant within the first mile radius, but the significant level keep increasing when we test the result within the different mile radii. More interestingly, both estimations results indicate a negative significant correlation between the share of poor population and the choice to effort environmental training. The significant of this result does not hold within the 15-mile radius. Appendix C display those results.

These results support the hypothesis that the wealthier the community the more environmental training the facility would offer for its employees.

On contrast to our hypothesis, estimators for the owner occupancy share of the local community with the 1 mile indicates a negative significant correlation regardless the estimation type, however the significance of these results disappear as soon as we consider the owner

Table 2.4.1

Linear Probability Estimation of Local Community Characteristics within 1- Mile Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00320	-0.00323	-0.00222	-0.00231
	(0.359)	(0.368)	(0.547)	(0.552)
Black share of population	0.0982	0.0346	0.0548	0.0528
	(0.309)	(0.727)	(0.591)	(0.627)
Log of Per household income (calendar year=1999, current $)	0.212	0.253*	0.266*	0.253*
	(0.106)	(0.068)	(0.058)	(0.065)
Share of population aged 25 or over with bachelor’s degree or higher	-0.462	-0.261	-0.282	-0.256
	(0.143)	(0.467)	(0.430)	(0.494)
Share of population living in same house as 1995	0.0189	0.258	0.289	0.298
	(0.943)	(0.424)	(0.370)	(0.370)
Male share of populations aged 18 or over	-0.223	-0.543	-0.467	-0.426
	(0.546)	(0.216)	(0.366)	(0.421)
Owner-occupied share of housing	-0.416**	-0.604**	-0.739***	-0.739**
	(0.042)	(0.022)	(0.007)	(0.010)
Share of population under poverty line	-1.177***	-1.360***	-1.549***	-1.513***
	(0.005)	(0.003)	(0.001)	(0.001)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	262	262	251	251
R-squared	0.096	0.137	0.183	0.189

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 2.4.2
Probit Estimation of Local Community Characteristics within 1- Mile Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.0242	-0.0263	-0.0195	-0.0240
	(0.475)	(0.484)	(0.631)	(0.561)
Black share of population	0.834	0.237	0.468	0.430
	(0.388)	(0.785)	(0.591)	(0.622)
Log of Per household income (calendar year=1999, current $)	0.884	1.286	1.616	1.570
	(0.348)	(0.230)	(0.170)	(0.234)
Share of population aged 25 or over with bachelor's degree or higher	-2.726	-1.043	-0.686	-0.538
	(0.238)	(0.711)	(0.814)	(0.864)
Share of population living in same house as 1995	0.392	1.967	1.976	2.338
	(0.853)	(0.389)	(0.353)	(0.275)
Male share of populations aged 18 or over	-2.318	-5.595	-3.628	-3.984
	(0.548)	(0.146)	(0.434)	(0.359)
Owner-occupied share of housing	-3.750*	-5.371**	-6.693**	-7.084***
	(0.069)	(0.033)	(0.012)	(0.009)
Share of population under poverty line	-7.862***	-9.545***	-12.03***	-12.31***
	(0.005)	(0.001)	(0.000)	(0.000)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	262	262	251	251

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

occupancy rate within the 5 or 10-mile radius. Also, the median age indicates a negative correlation when we consider the median age of the local community within the 5- mile radius. The results listed in appendix C.

Some of the results of this section clearly indicates the effects of the local community characteristics on the corporate environmental choice. Specifically, the economics characteristics measured by per household income and the education attainments.

2.6.2.2. Results using Spatially Defined Local Community Characteristics

2.6.2.2. a. Ratio of Environmental Employees to Overall Facility Employees

Using the spatially defined local community characteristics we estimate a pooled OLS and RE estimation to capture the effects of these characteristics on the facility choice of environmental labor. Table2.5 display the results of OLS estimator and the RE estimator results.

The Durbin–Wu–Hausman test indicates the inconsistency of the OLS estimator, so our preferred specification

would be the RE estimator. When we test the effect of the community characteristics in each ring separately. The RE estimators indicated statistically zero correlation between the spatially defined community characteristics and the choice of environmental labor. However, based on the collinearity test between these characteristics result, we estimate both pooled OLS and RE estimators treating these characteristics as one set of regressors. Table 2.5.2 displays the RE estimation results for this specification correlation. There are indicators of a correlation between the economics characteristics (e.g. per household income, the state of the housing market), socioeconomics characteristics (e.g. median age, education attainment, gender and poverty) and the facility choice of environmental labor. However, some of these results are inconsistent across the different rings. For example, the per capita income, indicates a positive correlation within the

Table 2.5.1
Pooled OLS estimation of Local Community Characteristics within the distance between 1-Mile radius and 5- Mile Radius on the Ratio of facility environmental employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.000976	-0.000348	-0.000561	-0.000465
	(0.691)	(0.890)	(0.824)	(0.854)
Black share of population	0.0357	0.0553	0.0533	0.0551
	(0.518)	(0.336)	(0.354)	(0.337)
Per household income (calendar year=1999, current $)	0.0701	0.0406	0.0285	0.0300
	(0.288)	(0.583)	(0.701)	(0.686)
Share of population aged 25 or over with bachelor's degree or higher	0.483***	0.352**	0.371**	0.388**
	(0.002)	(0.039)	(0.031)	(0.024)
Share of population living in same house as 1995	-0.108	-0.0211	0.000294	-0.0130
	(0.406)	(0.884)	(0.998)	(0.928)
Male share of populations aged 18 or over	0.607*	0.544*	0.556*	0.565*
	(0.056)	(0.088)	(0.082)	(0.077)
Owner-occupied share of housing	0.0124	-0.0271	-0.0651	-0.0531
	(0.896)	(0.806)	(0.566)	(0.641)
Share of population under poverty line	-0.172	-0.147	-0.153	-0.139
	(0.396)	(0.475)	(0.461)	(0.505)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	439	439	427	427
R-squared	0.015	0.152	0.210	0.250

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 2.5.2
Random Effects Estimation of Local Community Characteristics within the distance between 1-Mile radius and 5- Mile Radius on the Ratio of facility environmental employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00167	-0.00340	-0.00330	-0.00316
	(0.553)	(0.241)	(0.255)	(0.276)
Black share of population	-0.0581	-0.0663	-0.0628	-0.0661
	(0.455)	(0.386)	(0.415)	(0.391)
Log Per household income (calendar year=1999, current $)	-0.000710	-0.00306	-0.00434	-0.00431
	(0.924)	(0.701)	(0.588)	(0.591)
Share of population aged 25 or over with bachelor's degree or higher	-0.0357	-0.227	-0.205	-0.196
	(0.853)	(0.263)	(0.311)	(0.333)
Share of population living in same house as 1995	0.132	0.00401	-0.000737	0.0161
	(0.485)	(0.984)	(0.997)	(0.935)
Male share of populations aged 18 or over	-0.292	-0.302	-0.421	-0.406
	(0.414)	(0.391)	(0.229)	(0.246)
Owner-occupied share of housing	-0.0144	-0.102	-0.100	-0.0964
	(0.912)	(0.459)	(0.476)	(0.492)
Share of population under poverty line	0.169	0.0509	0.0684	0.0720
	(0.418)	(0.806)	(0.740)	(0.727)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	439	439	427	427

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

ring between the 1- 5-mile radius using only parsimonious model, however, these results turn to negative regardless the estimator when we consider the local community characteristics with the 5- 10 miles. Then again, regardless the estimator when we consider the local community characteristics with the 10- 15 miles, the results indicate a positive correlation. Appendix A display these results.

2.**6.2. 2. b. Presence of Environmental Capital**

Table 2.6.1 displays the results of linear probability estimation of spatially defined local community characteristics effects on the facility choices of upgrading wastewater treatment or not. The result does not indicate any statistical correlation between the spatially defined local community characteristics and the facility choice of treatment upgrading. The same conclusion holds for the results of the Probit estimator. Table 2.6.2 shows the results of the Probit estimations.

2.6.2. 1. c. Extent of Environmental Training

Table 2.7.1 displays the results of linear probability estimation of the effects of the spatially defined local community characteristics on the facility choices of offering environmental training or not. The result does not indicate any statistical correlation between the spatially defined local community characteristics and the facility choice of treatment upgrading. Nevertheless, the probit estimation indicates a positive correlation between the owner occupancy rate in the local communities with the 10- 15-mile radii ring only.

2.7. Conclusions

This study explores the effects of local community characteristics on corporate environmental management as reflected in regulated facilities' employment of environmental labor, installation of environmental capital (i.e., upgrade of wastewater treatment), and extent of environmental training. We represent sets of local community characteristics include economics, demographic and socioeconomics characteristics of the local community. In addition, we explore a spatially defined local community characteristics that constructed as rings around the pollutant facility within 1-15 miles radii.

Table 2.6.1
Linear Probability Estimation of Local Community Characteristics within the distance between 1- Mile Radius and 5 Miles Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0188*	0.0172	0.0185	0.0173
	(0.095)	(0.168)	(0.133)	(0.180)
Black share of population	-0.0418	-0.0686	-0.153	-0.209
	(0.909)	(0.854)	(0.688)	(0.593)
Log of Per household income (calendar year=1999, current $)	0.0329	0.0328	0.0466	0.0390
	(0.263)	(0.392)	(0.241)	(0.390)
Share of population aged 25 or over with bachelor's degree or higher	-1.166	-1.317	-1.412	-1.478
	(0.219)	(0.212)	(0.163)	(0.170)
Share of population living in same house as 1995	-1.748**	-1.507	-1.585	-1.491
	(0.048)	(0.134)	(0.118)	(0.150)
Male share of populations aged 18 or over	-0.181	-0.307	0.231	-0.341
	(0.899)	(0.835)	(0.874)	(0.823)
Owner-occupied share of housing	-0.780	-0.608	-0.558	-0.429
	(0.187)	(0.390)	(0.435)	(0.567)
Share of population under poverty line	-1.081	-0.863	-0.884	-0.381
	(0.258)	(0.406)	(0.389)	(0.703)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	154	154	148	148
R-squared	0.095	0.123	0.151	0.218

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 2.6.2
Probit Estimation of Local Community Characteristics within the distance between 1- Mile Radius and 5 Miles Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0564	0.0506	0.0545	0.0501
	(0.119)	(0.179)	(0.147)	(0.191)
Black share of population	-0.123	-0.218	-0.473	-0.760
	(0.905)	(0.832)	(0.655)	(0.504)
Log of Per household income (calendar year=1999, current $)	0.0976	0.0949	0.130	0.108
	(0.299)	(0.390)	(0.255)	(0.405)
Share of population aged 25 or over with bachelor's degree or higher	-3.429	-4.022	-4.320	-5.325*
	(0.195)	(0.166)	(0.127)	(0.085)
Share of population living in same house as 1995	-5.085*	-4.614	-4.795*	-4.687
	(0.054)	(0.108)	(0.095)	(0.121)
Male share of populations aged 18 or over	-0.211	-0.643	0.851	-1.912
	(0.963)	(0.894)	(0.861)	(0.712)
Owner-occupied share of housing	-2.184	-1.671	-1.575	-1.564
	(0.200)	(0.378)	(0.413)	(0.451)
Share of population under poverty line	-3.298	-2.712	-2.735	-0.975
	(0.218)	(0.330)	(0.321)	(0.739)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	154	153	147	144

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 2.7.1
Linear Probability Estimation of Local Community Characteristics within the distance between 1-Mile radius and 5- Mile Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.00200	0.000716	-0.00113	-0.00304
	(0.557)	(0.864)	(0.807)	(0.575)
Black share of population	0.000892	0.0307	0.0469	0.0427
	(0.994)	(0.836)	(0.771)	(0.817)
Log of Per household income (calendar year=1999, current $)	0.0116	0.0144	0.0165	0.0187
	(0.309)	(0.264)	(0.239)	(0.245)
Share of population aged 25 or over with bachelor’s degree or higher	0.0398	0.0463	0.0892	0.0913
	(0.938)	(0.938)	(0.880)	(0.883)
Share of population living in same house as 1995	0.184	0.0935	0.0313	0.104
	(0.493)	(0.780)	(0.929)	(0.805)
Male share of populations aged 18 or over	0.000654	0.0864	0.314	0.113
	(0.998)	(0.778)	(0.398)	(0.765)
Owner-occupied share of housing	0.269	0.342	0.469	0.391
	(0.216)	(0.208)	(0.118)	(0.211)
Share of population under poverty line	0.0531	0.0232	0.0923	0.0734
	(0.895)	(0.963)	(0.857)	(0.899)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations				
R-squared				

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 2.7.2
Probit Estimation of Local Community Characteristics within the distance between 1- Mile Radius and 5 Miles Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0170	-0.00659	-0.0913	-0.0596
	(0.690)	(0.913)	(0.265)	(0.460)
Black share of population	0.0485	-1.186	-1.332	-0.928
	(0.968)	(0.489)	(0.504)	(0.662)
Log of Per household income (calendar year=1999, current $)	0.176	0.175	0.275	0.370
	(0.358)	(0.276)	(0.168)	(0.318)
Share of population aged 25 or over with bachelor's degree or higher	1.462	-0.169	1.050	1.417
	(0.763)	(0.977)	(0.860)	(0.839)
Share of population living in same house as 1995	2.416	0.179	0.346	-1.734
	(0.397)	(0.962)	(0.940)	(0.676)
Male share of populations aged 18 or over	0.0833	-1.111	1.266	-1.836
	(0.982)	(0.776)	(0.821)	(0.797)
Owner-occupied share of housing	3.182	7.453*	10.93**	11.61**
	(0.139)	(0.077)	(0.042)	(0.027)
Share of population under poverty line	0.285	5.934	8.505	10.15
	(0.939)	(0.356)	(0.248)	(0.169)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	158	95	89	86

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Our analysis provides some evidence on the effects of economics and socioeconomics characteristics of local community. However, our analysis mostly offers evidence of counter-productive local community pressure. And some of the results are skeptical and need future investigations. Regardless, we contribute to both the scholarly literature and policy debate. Similiter to chapter one, this analysis examines only one sector's environmental management efforts to control pollution disposed into one medium (water) over a three-year period (1999-

2001). We encourage future research to broaden the scope of this empirical analysis by exploring additional sectors, additional media (e.g., air), and additional external actors (e.g., stockholders).

3 Effects of Terrorism on Labor Market: A Case Study of Iraq

3.1. Introduction

Since the terrorist attacks of 9/11 in the United States, there has been considerable speculation and research about the effect of terrorism. Much of this research has focused on psychological costs rather than direct economic impacts. For instance, it may be the case that terrorist attacks increase the cost of supplying labor. If this is true, one way to measure such a cost is to determine how the suppliers of labor react to endangerment. When economic costs are considered, the analysis is generally limited to the economic consequences of one or non-sequential terrorist attacks. This study addresses each of these limitations in the literature by looking at sequential attacks (monthly) for the year 2007 in Iraq and by providing several estimations of the labor supply's reaction to endangerment costs.

Iraq's economy has experienced a number of economic, psychological, sociological, and political shocks resulting from civil conflict and terrorism. Indeed, in recent years, Iraq has experienced an increasingly complex problem with terrorism as the Islamic State of Iraq and Syria (ISIS) has grown in influence. With this context, then, it is particularly interesting to understand a picture of terrorism in Iraq post-2003 invasion and pre-2011 rise of ISIS. As such, we have taken a 2007 survey dataset to explore the impact of terrorism in Iraq between the two above-mentioned time periods. The importance of this kind of research cannot be understated as the mechanisms through which terrorism impacts a society are still not clearly understood. In fact, from an economic perspective, many studies of terrorism focus on more advanced countries (Eckstein and Tsiddon 2004). Further, these studies often focus on macroeconomic questions, as we will discuss later. However, in Iraq, one of the major economic consequences of the conflict and subsequent terrorist activity has been the shocks to the labor supply. As such, this project can offer a unique contribution to the literature using microeconomic data to understand terrorism's distortionary impact on the labor market. Additionally, understanding the impact of terrorist attacks on labor supply of countries under severe pressure from terrorism may provide future motivation for research into refugee crises and labor policies of destination countries. This would have policy implications for countries such as the United States that must make decisions about national security and immigration.

This study provides empirical evidence on the economic consequences of terrorism on the labor market and labor force by examining the effect of terrorism in Iraq on the labor supply measured by, employment status, hours worked, wages and job permenance. These contributions complement the work of Khan and Estrada (2016) who look at the macroeconomic performance in Iraq as a result of terrorism and the rise of ISIS. Indeed, most of the influential studies, like the Khan and Estrada (2016) paper cited above, tend to focus on the macroeconomic impacts or study the labor market using country-level data. There are relatively few empirical studies that analyze the effect of terrorism on the labor market using household-level data. This paper fills that gap in the literature by taking a newly available dataset that surveys at the household level. Work in this area will complement work done at the macroeconomic level and will demonstrate at a granular level the way in which terrorism acts as a shock to the labor supply. The conceptual framework draws on work done with data from Palestine and, as such, could provide important policy implications for a country facing a multifaceted economic crisis and severe political instability.

3.2. Literature Review

While there is a growing interest in understanding the impact of violent conflict on various economic indicators, particularly using a micro-level approach (Prakarsh Singh 2012), much of the research focuses on the effects of terrorism on macroeconomic variables. Within the macroeconomic literature, there has been important work on topics that range from savings to the stock market (For instance, see Venieris and Gupta, 1986; Mauro, 1995; Alesina and Perotti, 1996; Abadie and Gardeazabal, 2003; Echstein and Tsiddon, 2004; Miquel et al., 2004). When using data at a broader level, it can be difficult to find conclusive and consistent results across studies. With this in mind, previous work that includes time-series and cross-country studies has been inconclusive about the impact of terrorism on economic outcomes (For instance, see Blomberg et al., 2004; Crain and Crain, 2006; Gaibulloev and Sandler, 2008; Gries et al., 2011; and Meierrieks and Gries, 2013). Depending on the time span of the study, the impact of terrorism may vary. Particularly when looking at long-run implications of terrorism, some authors have found that the impact on economic outcomes may be negligible (Becker and Murphy 2001). This may be due to variation in specifications, and the broad level of data may obscure important relationships between terrorism and the economy.

When looking at specific parts of the economy, for instance, there are well-established links between terrorism, acting as a negative shock, and a decrease in economic activity in a particular sector. One sector that has been thoroughly studied has been tourism. Empirical work has shown that terrorist attacks can have a significant negative effect on tourism (Drakos and Kutan, 2003; Enders and Sandler, 1991; Enders et al., 1992; Greenbaum and Hultquist, 2006). Drakos and Kutan (2003) show that terrorism even has spillover effects on surrounding countries' level of tourism, which raises an important question to examine the labor market of governorates in Iraq with own terrorist activity and spillover terrorist activity.

To think about the theoretical approach of this paper, there are two significant publications that provide a foundation for this work (Miaari and Sauer, 2011 and Benmelech et al., 2010). Miaari and Sauer (2011) analyze the Israeli-Palestinian conflict to estimate a lower bound of the labor market costs of political instability. Their conflict measures are the number of overseas foreign workers in the Israeli labor market and the frequency of closures of the West Bank of the Gaza strip. The primary focus of their analysis is the effect of conflict on two economic outcomes in the Palestinian labor force in Israel: The employment rates of the population and the monthly earnings. Using an instrumental variable (IV) approach, they found significant negative effects of the conflict on Palestinian employment. This paper looks at the same economic outcomes, in the Iraqi context, and adds a gendered component that examines specific ideas about how conflict is both a gendered experience and produces gendered outcomes.

Another publication that looks at the case of Palestine is Benmelech et al., (2010). They use the Palestinian Labor Force Survey to analyze the economic cost of terrorism on the perpetrators by estimating the effects of suicide terrorist attacks that are completed and the number of casualties from suicide attacks on unemployment and wages in the harboring district.

Their results provide empirical evidence of the high economic consequences in the harboring district as it increases the local unemployment rate and lowers the average wage in addition to lowering the percentage of the district's population working in Israel. This paper expands to include not only a measure of the impact of own district terrorism, but also builds a geospatial variable to incorporate potential spillover effects of terrorism in neighboring governorates of Iraq.

Our contribution to this ongoing literature studies the effect of terrorism in Iraq on the labor force using several measures of the labor force: employment status, wages, hours worked per week and job performance. To do this, we use a nationwide household socio-economic survey conducted in 2007 by the Iraqi Organization for Statistics and Information Technology (COSIT), Kurdistan Regional Statistics Office (KRSO) and the World Bank. This data was only recently released and thus is largely unexplored. Indeed, this paper is the first economic analysis that tries to study the effect of insurgent and sectarian violence on the Iraqi labor supply with micro-level data.

3.3. Iraq Labor Market Characteristics

Iraq is a country in the Middle East bordering the Persian Gulf. Neighboring countries include Iran, Jordan, Kuwait, Saudi Arabia, Syria, and Turkey. Iran has a strategic location on the Shatt al Arab waterway and at the head of the Persian Gulf. Two major rivers, the Tigris and Euphrates, run through the center of Iraq, flowing from northwest to southeast. The government system is a parliamentary democracy; the chief of state is the president, and the head of government is the prime minister. Iraq has a mixed economic system which includes some private freedom, combined with weak centralized economic planning and government regulation. Iraq is a member of the League of Arab States.

Figure 3.1: Political Map of Iraq

Iraq, once a relatively skilled and economically prosperous society, has seen its development thwarted by decades of conflict and economic decline. Today it is an upper middle income, resource-rich, yet fragile and conflict-riven country. With years of government instability and a decade of war, Iraqi's have had to suffer through harsh economic woes. With the lack of infrastructure and only the very beginnings of a stable government, the average Iraqi has been affected by the economy the most. In this section we highlight some facts about Iraq's labor market.[14]

Iraq's economy is well known to be heavily dependent on the oil sector. Oil exports traditionally generated about 95% of foreign revenues. Despite this domination, petroleum industries do not create many job opportunities. Job-seeking Iraqis are dependent on public sector employment, or smaller private industries for work. Given this labor market structure, Iraq has seen a high level of unemployment. For the last decade, Iraq's unemployment has stayed alarmingly high. The year that saw the lowest year of unemployment occurred in 2014 when unemployment hit 15 percent. As of 2016, the unemployment in Iraq reached 16 percent.

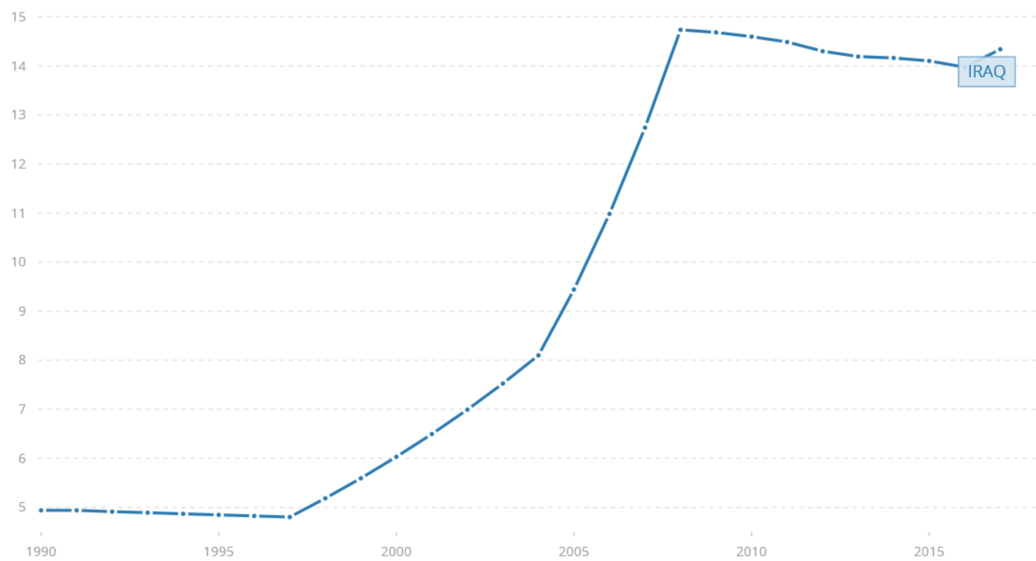
In tandem with the unemployment rate, Iraq has seen a relatively low level of participation in its labor force. Indeed, the participation rate has been dropping since 2003. In 2016, the labor force participation rate was around 46%. This does vary somewhat across the country, with data from 2011 showing Anbar, Najaf, and Wassit governorates as having the highest labor force participation (between 47 to 48 percent), and Dahuk, Thi-Qar, and Muthanna the lowest rates (between 37 to 40 percent).

Noticeably, though, the participation rate for men and women has been moving in opposite directions. While men make up the majority of the workforce, the growth of women working has

[14] It is should be noted that since 2003 Iraq economic statistic has been scarce to non-existent and there is some uncertainty regarding the labor market data. For this section we mainly depend on World Bank, International Labor Organization, the Iraq Statistical Agency, and the Iraqi Central Organization of Statistics and Information Technology data.

been significant. This can be seen in Figure 3.2 , where the labor force participation rate for women in 1990 was around 5 percent, while it reached just over 14 percent in 2016.

Figure 3.2
Iraqi Female Labor Force Participation Rate

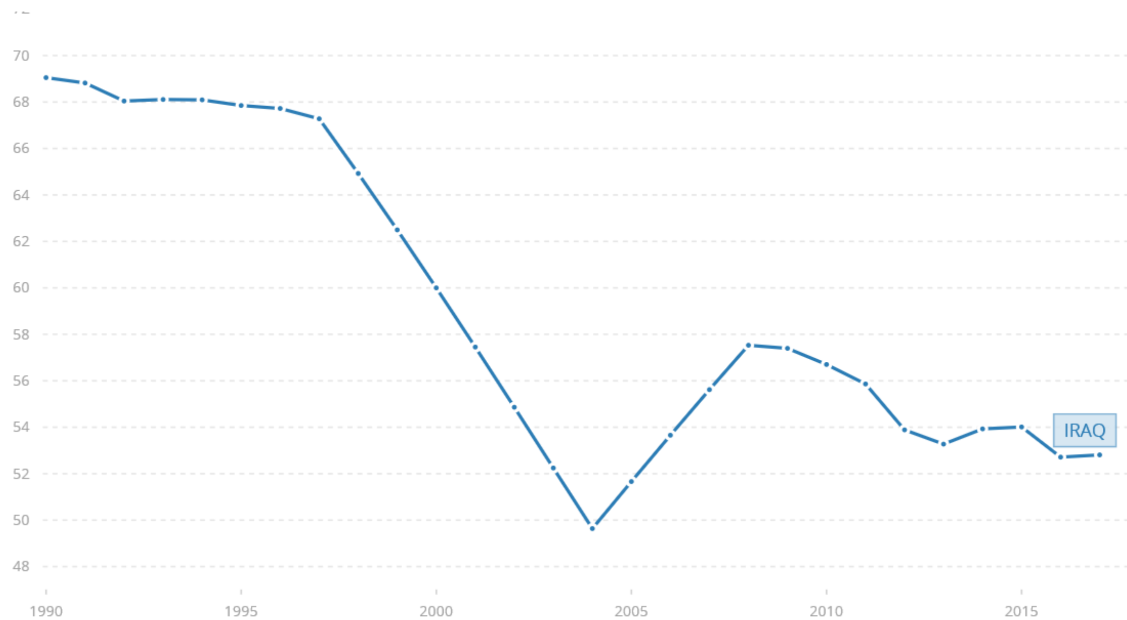


Source: World Bank Database

Much of the cause for the particularly low numbers in the 1990s can be attributed to strict restrictions placed on women in the workforce. Women were pushed out of the workforce in order to make more room for men, particularly in government positions. Some of those more significant restrictions were relaxed with the fall of the Ba'ath party in 2003, and we have seen the growth in women's workforce participation. Data show that women in Iraq tend to find work in the agriculture and services sectors. This is in contrast to men who tend to find opportunities in construction and security.

While women's participation is grown significantly in Iraq's workforce, men's participation has fallen slightly. Between 2002 and 2016, the male labor force participation rate dropped from 51% to 48%. This can be seen in Figure 3.3.

Figure 3.3
Iraqi Male Labor Force Participation Rate



Source: World Bank Database

Employment in the public sector represents approximately 42 percent of all jobs. Adding state-owned enterprise (SOE) employees would bring total employment in the public sector to 3.5 million, close to one-half of all jobs in the country. Relatively high public-sector wages and job security make other alternatives appear undesirable, leading to subdued private sector job growth. In the public sector, the job distribution is highly affected by the conflict and security-related employment is large as a share of the total, out of 2.9 million public employees, 46 percent are employed in civilian ministries, 30 percent work for the defense and interior ministries (in both civilian and armed positions), and the remaining 24 percent were unclassified.

Like many of its Middle Eastern peers, Iraq has a demographic that skews young. According to the world bank, 56% of the Iraqi population is under 24 years of age, and the median age is a mere 21 years. While a large proportion of Iraq's population today is children, in a few years, the country will be well-equipped with a sizable labor force that will face a dark future considering the economic struggle of the country. 78.5 percent of the population is literate, and the majority of Iraqis go through at least 10 years of schooling. However, only one out of every ten Iraqis has at least a diploma, and the likelihood of being unemployed or underemployed in the country increases substantially without a degree.

Because the level of unemployment is high in the formal employment sector, many Iraqis are looking to develop skills that can help make them more competitive in the labor market. Often, Iraqis will look to the informal sector to try to develop skills that may help them find a job in the public or private sector. Indeed, it appears that informal employment will often fill the gaps where formal public and private employment cannot. Thus, the underground sector is a large employer of Iraqis and absorbs a good amount of the labor force.

Labor laws in Iraq are in place to protect a worker's rights to associate and bargain collectively, and prevent forced or compulsory labor, but these laws are seldom enforced. With the lack of formal employment opportunities and the prominence of unregulated and informal labor, many work conditions go unsupervised and fall below satisfactory standards. Half of employed Iraqis are unprotected, which means that they work without a contract, pension, and annual leave. In a survey conducted by the National Democratic Institute in 2012, jobs were rated as the Iraqi people's biggest priority, ahead of even basic services or security.

3.4. Conceptual Framework

This section provides a conceptual framework which we use to derive several testable hypotheses. First, it is important to define the terrorism as it adopt in this analysis. We adopted the US State Department definition of terrorism, contained in Title 22 of the United States Code, Section 2656f(d). Accordingly, "The term 'terrorism' means premeditated, politically motivated violence perpetrated against noncombatant targets by sub-national groups or clandestine agents, usually intended to influence an audience."

Second, we explain the economic conceptual framework. Each individual in each Iraqi governorate faces some level of terrorism. In each period, the individual chooses whether to supply labor or not, as measured either by the working variable we construct or by and allocation of productive capital. The individual gains wages and faces costs, in particular the endangerment costs imposed by terrorist activity. Based on the above, we assume the labor supply under terrorist attacks follows a constrained maximization problem:

$$\text{Max } U(X) \text{ s.t.}$$

$$F = N + wT = pX + wL + wIc$$

$$c < \lambda$$

Here, U(X) is the individual's utility function for consumption X. Let c denote the cost of endangerment from terrorism whenever hours of work are positive. N is non-labor income, p is the price of the consumption good X, w, the wage, is the implicit of leisure or commuting, I is an indicator function equal to 1 when $c < \lambda$ and equal to 0 when $c \geq \lambda$ and F is full income.

If an agent from the individual chooses to work, they would undertake the cost of leisure and incur the endangerment cost from terrorism. If they choose not to work, or work less, they would gain more leisure time, but consumption would be lost. Thus, when maximizing utility, we can think about the intersection of two indirect utility curves, one from each of the above scenarios. If the endangerment cost increases, the indirect utility curve for choosing to work would shift down. Thus, an increase in endangerment cost could induce agents to choose not to work. Additionally, by using comparative statics, we would expect that an increase in endangerment costs would decrease the number of hours spent working. This would have an impact on wages, and we would expect wages to fall in areas where endangerment costs are higher. As such, we develop the four following hypotheses:

H_{1a}: *As endangerment costs increase, the marginal benefit of working decreases, so individuals choose to supply less labor*.

H_{1b}: *The number of hours worked is inversely correlated with endangerment costs.*

H_{1c}: *Individual wages will decrease as endangerment costs increase.*

H_{1d}: *Job permanence will decline as endangerment costs increase.*

3.5. Data and Statistical Summary

The data on the labor force, demographic, economic, political and socioeconomic measures are constructed using the Iraq Household Socioeconomic survey. This survey, which is the first nationwide recently released household socio-economic survey, was conducted in 2007 by the Iraqi Organization for Statistics and Information Technology (COSIT), the Kurdistan Regional Statistics Office (KRSO) and the World Bank between Nov 2006 and Nov 2007. It contains data at the household and individual level in 2007 and has a total effective sample size of 17,822 households. The data is divided into 56 strata where each governorate in Iraq comprises three sections: rural, urban and metropolitan. Only Baghdad is divided into three metropolitan strata. The response rate of the survey is 98 percent.

3.5.1. Dependent Variables

Using the survey data, we constructed several measures of labor supply to look at mechanisms by which terrorist activity can distort labor market outcomes. First, we construct a binary measure captures the employment status of the survey respondent to reflect whether the respondent worked during any month of 2007. Then, conditioning on the employment status we measure the labor supply using the number of hours worked by the respondent in the past seven days, the amount of the last paycheck, which is a combined measure using the amount last paid in cash and the amount last paid in-kind and the job permanence the summary statistics for these variables are included below in Table (1.1).

Table (3.1.1)
Descriptive Statistics for Iraq Labor Supply measures

Variables	observation	Mean	Std. Dev.
Worked during any month of 2007 vs. not	1,526,412	0.227	0.416
Hours worked in past 7 days	127,307	13.2	30.63
Job permanence: Work permanent job with 30 hours a week vs. not	19,564	0.832	0.373
Log of the amount of last paycheck: cash +in-kind (1000 ID)	127,307	-5.30	0.680

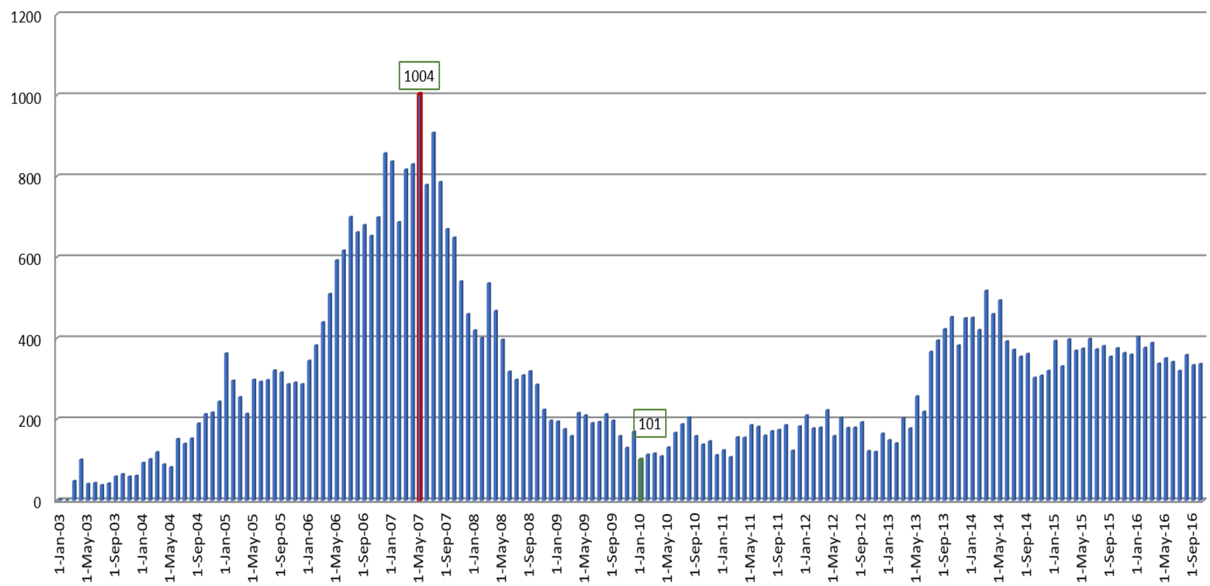
According to table (3.1.1), 22% of the survey respondent were employed at any month of 2007. On average worked 13.2 hours a week and 83.2% of them working permanent job

3.5.2. Main Regressors

To measure the level of terrorism in a particular governorate, we use data from the Iraqi Body Count project (IBC). This data provides the number of terrorism incidents, which we use as a proxy for the terrorist attacks following the previous literature. IBC compiles these statistics using press reports to identify the incidents that kill non-combatants. They then document the number of deaths and this has become a widely-used measure which has been included in several papers that study conflict in Iraq (e.g. Berman et al. (2011)). Additionally, from the IBC, we use a variable for the number of non-combatant fatalities in a single incident within each governorate. This allows for some proxy of severity of terrorism in particular regions that may have an impact on agent decision-making processes. We believe that 2007 is a significant year to study because it was a peak year for the level of terrorism. This can be seen in Figure 3.4 below.

Figure 3.4

Number of Terrorist Attacks by Month in Iraq



Source: Iraqi Body Count Database

The descriptive statistics for the main regressors are listed in Table (3.1.2). These show, for instance, that the number of terrorist incidents increased year-on-year from 2004 to 2007. The average is calculated across eighteen governorates and there is significant variation between governorates that experience more violence and governorates that experience less violent governorates. The number of non-combatant Iraqi fatalities from terrorism attacks killed variable is also an average across the eighteen governorates. This variable takes the incident with the most casualties from each governorate to construct the data.

Table (3.1.2)
Descriptive Statistics for Main Regressors (Cross- Sectional Only)

Dependent Variables	Observation	Mean	Std. Dev.
Log of number of Terrorist Incidents in 2007	127,297	-4.81	2.10
Log of number of Terrorist Incidents in 2006	127,297	-4.72	2.04
Log of number of Terrorist Incidents in 2005	127,297	-3.99	1.81
Log of number of Terrorist Incidents in 2004	127,297	-3.50	1.81
Log of number of civilian fatalities in 2007	127,297	-4.97	2.24
Log of number of civilian fatalities in 2006	127,297	-5.03	2.17
Log of number of civilian fatalities in in 2005	127,297	-5.60	2.38
Log of number of civilian fatalities in 2004	127,297	-5.86	2.13

3.5.3. Control Factors

The control variables are taken from the Iraq Household Socioeconomic Survey, they are split into basic, socioeconomic, and political controls. The basic controls include: governorate, household size, age, sex, size of the governorate (taken from the Iraqi Census data of 2007) and marital status. The socioeconomic controls include: education which we proxy by the highest diploma attained, total household expenditure as proxy for poverty. In addition, we control for the migration effects using a variable that reflects whether the survey respondent born in governate x or not. Finally, we control for political affiliation using overall voter turnout for the Iraqi 2005 parliament elections (taken from the ESOC – Iraq Civil War Dataset) These variables are summarized in Table (3.1.3).

3.6. Econometric Framework

In this section, we provide a justification for the use of the variables listed above. First, the variables are described below, with justifications for each, and then each dataset is considered, cross-sectional and panel data, along with the models employed for each.

Table (3.1.3)
Descriptive Statistics for Control Factors

Variable	N	Mean	Std. Dev.
Household size	127,307	9.00	4.49
Sex	127,307	0.498	0.499
Age	127,292	22.81	18.39
Born in this governorate	127,291	1.06	0.245
Marital status	84,908	1.63	0.908
Economic sector	19,569	2.05	1.371
Highest diploma attained	52,494	4.54	2.067
Total expenditure (1,000 ID/ person/month) (defl. Paasche)	125,748	126.9	77.8
Percentage of voter turnout	127,307	76.7	9.84

3.6.1. Dependent Variables (Labor Supply Measures)

3.6.1.1.Cross-Sectional Survey Based

The dependent variables include whether the individual responding to the survey was employed during 2007, the number of hours worked in the previous week, the job permanence of the respondent, and the amount of the last payment.

We look at the labor market in a slightly different way than the previous literature onthat explore the conflict effects, using variables to examine the stability of the labor market, specifically hours worked per week, compensation, and job permanence. Here, our first variable is the hours worked during the past seven days. Because terrorism can cause disruptions in daily work patterns, this is an important measure of productivity shocks given that employees may not be able to get to work when terrorism is a more regular occurrence. To complement this measure, we also look at the amount of the last paycheck. In the survey data, in kind payments are a significant portion of the amount that is last paid to respondents, so we combine cash payments and in-kind payments to create a more complete measure of compensation.

Because individual decisions are budget-constrained, the consumer problem is significantly impacted by the amount of last compensation. Thus, we feel, from a theoretical perspective, that this particular measure of the labor market is an important indicator for disruptions caused by elevated levels of terrorism, and this is a particularly unique contribution to the literature. Conditioning on the employment status, the measure of job permanence allows this idea to be extended beyond the most recent employment level to look at decisions under a longer time horizon. This question asks respondents "How do you describe your work's continuity (how long it will last)?" Given that the household likely plans over longer periods of time, the impact of terrorism on individual employment stability can be a significant indicator to understand the kinds of problems faced by the survey respondents.

3.6.1.2.Panel-Survey Based

Using the panel dataset, we constructed a binary variable to capture the employment status of the survey respondent where if the respondent indicated they worked in any month of 2007, the variable under consideration would receive a 1 and if they did not work in any month, the variable received a 0. For the panel dataset, we construct a time series for the 12 months of 2007. The variable used is the binary from the respondents whether they worked in January or not, whether they worked in February or not, and so forth. This is possible because each respondent is asked "During which months did you do this work during the last 12 months" and the respondent puts an "x" in each month in which they worked. Using the panel dataset, this allows us to examine how employment changes over time with a sequential measure of terrorist activity (i.e. number of terrorist attacks in each of those months).

3.6.2. Explanatory Variables

The main regressors we use proxy for the impact of terrorism on decisions made by the survey respondents. First, we look at the number of terrorist attacks, and we take both a contemporaneous and a lagged approach, using the number of incidents from 2007 (the same year as the survey), as well as the number of terrorist incidents from 2004, 2005, and 2006. These variables are well established measures of terrorism in the literature and we believe that the number of terrorist attacks play a significant factor in the lives of individuals, given the increased coverage in the press, potential for greater financial damage, and disruption to daily life in areas where terrorism takes place. For both datasets, cross-sectional and panel, we extend the idea of the number of terrorist attacks to give a geographical weighting to each individual for the impact of terrorism on their governorate. This uses the governorate centroids to calculate the distance of each governorate to the terrorism of other governorates as a way to proxy potential spill-over effects that terrorism in one governorate may have on neighboring governorates.

One of the more granular regressors looks at the event with the number of casualties across all events from the governorate, which mainly used for the robustness check of our finding under consideration. Thus, in this measure, for the cross-sectional dataset, one terrorist attack from each governorate provides the number of civilian fatalities in 2007. For the panel dataset, we take the event with the number of civilian fatalities for each month of 2007 by governorate. This complements the previous measure, the number of terrorist incidents, by creating a different approach to measuring impact of terrorism. Rather than frequency of terrorism we are able to look at the largest terrorist event, from a casualty perspective, and determine whether there is a distortion to labor market behavior. This variable also uses a contemporaneous and a lagged approach, with numbers taken from 2004, 2005, 2006, and 2007.

3.6.3. Controls Factors

Our control variables are split into categories that are added to each model for the sake of robustness. We use individual and governorate characteristics, socioeconomic, and political indictors.

The individual and governorate characteristics basically added to capture certain characteristics of the decision maker such as age, gender, marital status. Those characteristics have great influence on the individual decision of labor supply. Additionally, we control for governorate, household size, and whether the individual is a native citizen of the governorate she lives at during 2007. This captures the internal migration effects. Socioeconomic controls include education attainment and poverty level. We proxy the education attainment of the decision maker by the highest diploma attended, this not only reflects the education level but also the year of schooling which both make a great effect on labor market. We also control for the economic sector. We to control for the poverty level using the total household expenditure. Finally, the political control includes the percentage of voter turnout to the Iraqi 2005 parliament election reflect the political engagement of the survey respondent.

3.7. Econometric Analysis

To estimate the effect of the terrorism on the Iraqi labor market we estimate a cross-sectional governorate level OLS estimator with the following:

B. $$Y_{iG} = \alpha_0 + \beta' X_{iG} + \gamma' Z_{iG} + \varepsilon_i G \qquad (1.1)$$

Where

Y_{iG}: Labor market outcome of interest for individual i in governorate G

X_{iG} : The set of explanatory variables represent different terrorism measures

Z_{iG}: The set of control factors

ε_{iG} : The error terms

3.7.1. Estimation Techniques

3.7.1.1. Cross-Sectional Survey

The cross-sectional survey produces more dependent variables than the panel survey, and some of these must be treated differently. Here the outcome of interests includes: hours worked per week, last payment amounts, and job performance. As both the hours worked per week and the last payment amount (combination of cash and in-kind) are continuous variables, we use a standard OLS estimation which provide a sufficient estimator for this kind of variables. While the Job permanence is a binary variable and so we are using a Probit model, as well as a linear probability model. In addition, we conduct marginal analysis to determine the magnitude of the effect.

3.7.1.2. Panel Survey

To examine the impact of terrorist activity on whether survey respondents were working over the 12 months of 2007, we employ several models. The first estimation we do is with a Pooled OLS (Linear Probability Model). Here, we use both fixed effects and random effects. Next, we use Given the binary nature of this dependent variable, we estimate a Probit model as we are interested in estimating the change of the binary variable from a 1 to a 0. For both the linear probability and Probit model we use fixed and random effects in addition to evaluate the economics importance of the coefficients using marginal analysis.

3.7.1.3 Robustness Check

To assess the robustness of our results, the empirical analysis uses four different regressor sets (i.e., models), which vary based on the inclusion of control factors. The first regressor set is the parsimonious model (Model 1), which excludes all control factors. The second set adds gender, governorate, age and Marital status (Model 2). The third set adds socioeconomic variables (Model 3). The full set includes all the control factors (Model 4).

3.8. Econometrics Results

3.8.1. Cross-sectional results

3.8.1.1. Hours Per Week

Table 3.2.1 present the results of OLS estimations of the terrorist attacks effects on hours worked per week. Across all the different specifications (model (1) the parsimonious model to model (4) the full model) the results show significant effects that support the hypothesis that terrorism reduces labor supply. It worth mentioning that we log the dependent variable, hours worked per week, because the distribution is heavily skewed. All significant results indicate a negative relationship between terrorist activity and the logged number of hours worked per week, supporting our hypothesis that endangerment costs would cause households to work fewer hours. In order to check the results, we devise a robustness test to verify the impact of terrorism on the dependent variables. In addition to the number of terrorist incidents, we also look at the max number of civilian fatalities. The same results as shown in table 3.2.2 hold across the different specifications.

In a measure related to the number of hours worked each week, we are able to look at the level of compensation respondents of the survey received on their last paycheck. Here, we have evidence that terrorism, measured by the log of terrorist incidents 2007, negatively impacts the level of wages. This is shown in Table 3.3.1.

Table (3.2.1)
OLS Estimation, Logged Number of Terrorist Incidents 2007 and Hours Worked per Week 2007

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Log Terrorist Incidents, 2007	-0.947***	-0.0428	-0.325***	-0.437***
	(0.000)	(0.160)	(0.000)	(0.000)
Governorate		0.0247***	0.104***	0.0774***
		(0.005)	(0.000)	(0.002)
Household Size		-0.0854***	0.115***	0.188***
		(0.000)	(0.003)	(0.000)
Gender		21.29***	17.30***	15.94***
		(0.000)	(0.000)	(0.000)
Age		0.107***	-0.119***	-0.133***
		(0.000)	(0.000)	(0.000)
Born here (governorate i)		0.0912	0.953*	1.033*
		(0.689)	(0.078)	(0.065)
Marital status		-3.065***	-1.045***	-1.124***
		(0.000)	(0.000)	(0.000)
Economic Sector			-0.480***	-0.828***
			(0.000)	(0.000)
Highest diploma attained				-1.222***
				(0.000)
Total expenditure				0.0151***
				(0.000)
Voter turnout				-0.0739***
				(0.000)
Observations	127,307	84,906	19,538	17,474
R-squared	0.004	0.275	0.090	0.115

Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table (3.2.2)
OLS Estimation, Civilian Fatalities and Hours Worked per Week 2007

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Log Civilian Fatalities, 2007	-0.867***	0.00189	0.00158	-0.142*
	(0.000)	(0.951)	(0.982)	(0.069)
Governorate		0.0264***	0.123***	0.0762***
		(0.003)	(0.000)	(0.003)
		-		
Household Size		0.0866***	0.106***	0.169***
		(0.000)	(0.006)	(0.000)
Gender		21.29***	17.26***	15.96***
		(0.000)	(0.000)	(0.000)
Age		0.108***	-0.116***	-0.130***
		(0.000)	(0.000)	(0.000)
Born here (governorate i)		0.0802	0.820	0.880
		(0.725)	(0.129)	(0.116)
Marital status		-3.066***	-1.022***	-1.067***
		(0.000)	(0.000)	(0.000)
Economic Sector			-0.458***	-0.793***
			(0.000)	(0.000)
Highest diploma attained				-1.163***
				(0.000)
Total expenditure				0.0135***
				(0.000)
				-
Voter turnout				0.0915***
Log Civilian Fatalities, 2007				(0.000)
Observations	127,307	84,906	19,538	17,474
R-squared	0.004	0.275	0.089	0.113

Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

a. Compensation

In a measure related to the number of hours worked each week, we are able to look at the level of compensation respondents of the survey received on their last paycheck. Here, we have evidence that terrorism, measured by the log of terrorist incidents 2007, negatively impacts the level of wages. This is shown in Table 2.3.1.

Table (3.3.1)
OLS Estimation of the Effects of Terrorist Attacks 2007 on the Amount of Last Paycheck

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Log Terrorist Incidents in 2007	-0.0206***	-0.0180***	-0.0225***	-0.0150***
	(0.000)	(0.000)	(0.000)	(0.001)
Governorate		0.00768***	0.0244***	0.0113***
		(0.000)	(0.000)	(0.000)
Household Size		0.000682	0.00608***	-0.0203***
		(0.264)	(0.010)	(0.000)
Gender		0.360***	0.226***	-0.101***
		(0.000)	(0.000)	(0.000)
Age		-0.00344***	-0.0255***	-0.0234***
		(0.000)	(0.000)	(0.000)
Born here (governorate i)		0.0202**	0.0144	0.0555*
		(0.037)	(0.641)	(0.068)
Marital status		0.00405*	0.117***	0.0794***
		(0.051)	(0.000)	(0.000)
Economic Sector			0.556***	0.500***
			(0.000)	(0.000)
Highest diploma attained				-0.113***
				(0.000)
Total expenditure				-0.00229***
				(0.000)
Voter turnout				-0.0145***
				(0.002)
Observations	127,307	84,906	19,538	17,474
R-squared	0.004	0.275	0.089	0.113

Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Again, using the robustness check to verify that terrorism does indeed negatively impact the amount of the last paycheck, we estimate the impact of civilian fatalities. This does show that the log of the civilian fatalities in terrorist incidents is negatively correlated with compensation

Table (3.3.2)

OLS Estimation, Number of Civilian Fatalities 2007 and Last Paycheck 2007

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Log Civilian Fatalities, 2007	-0.0206***	-0.0180***	-0.0225***	-0.0150***
	(0.000)	(0.000)	(0.000)	(0.001)
Governorate		0.00768***	0.0244***	0.0113***
		(0.000)	(0.000)	(0.000)
Household Size		0.000682	0.00608***	-0.0203***
		(0.264)	(0.010)	(0.000)
Gender		0.360***	0.226***	-0.101***
		(0.000)	(0.000)	(0.000)
Age		-0.00344***	-0.0255***	-0.0234***
		(0.000)	(0.000)	(0.000)
Born here (governorate i)		0.0202**	0.0144	0.0555*
		(0.037)	(0.641)	(0.068)
Marital status		0.00405*	0.117***	0.0794***
		(0.051)	(0.000)	(0.000)
Economic Sector			0.556***	0.500***
			(0.000)	(0.000)
Highest diploma attained				-0.113***
				(0.000)
Total expenditure				-0.00229***
				(0.000)
Voter turnout				-0.0145***
				(0.000)
Observations	127,307	84,906	19,538	17,474
R-squared	0.004	0.275	0.089	0.113

Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

3.8.1.3. Job Permanence

For the measure of job permanence, as discussed above, we construct an indicator that determines whether a survey respondent has a more stable employment position or a more transient one. In these results, correlation between the permanence of a job and terrorist activity is statistically zero.

Table (3.4.1)
Linear Probability Estimation, Number of Terrorist Incidents 2007, Job Permanence 2007

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Log, Terrorist Incidents, 2007	-0.00486	-0.00423	-0.00587	-0.00363
	(0.414)	(0.495)	(0.350)	(0.512)
Governorate		-0.000271	-0.000726	0.000352
		(0.855)	(0.629)	(0.841)
Household Size		-0.00217	-0.00201	0.00103
		(0.279)	(0.309)	(0.683)
Gender		-0.109***	-0.0465***	-0.00848
		(0.000)	(0.003)	(0.508)
Age		0.00343***	0.00201***	0.00156***
		(0.000)	(0.000)	(0.000)
Born here (governorate i)		0.0177	0.0213*	0.0112
		(0.169)	(0.079)	(0.428)
Marital status		-0.0217***	-0.0120**	-0.00548
		(0.000)	(0.017)	(0.308)
Economic Sector			-0.0668***	-0.0545***
			(0.000)	(0.000)
Highest diploma attained				0.0155***
				(0.000)
Total expenditure				0.000310***
				(0.009)
Voter turnout				0.000565
				(0.530)
Observations	127,307	84,906	19,538	17,474
R-squared	0.004	0.275	0.089	0.113

Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table (3.4.2)

Linear Probability Estimation, Number of Civilian Fatalities 2007, Job Permanence 2007.

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Log number civilian fatalities, 2007	-0.00318	-0.00221	-0.00435	-0.00142
	(0.623)	(0.728)	(0.509)	(0.809)
Governorate		-0.000112	-0.000553	0.000347
		(0.940)	(0.714)	(0.844)
Household Size		-0.00221	-0.00203	0.000897
		(0.261)	(0.295)	(0.718)
Gender		-0.109***	-0.0466***	-0.00832
		(0.000)	(0.003)	(0.513)
Age		0.00345***	0.00202***	0.00158***
		(0.000)	(0.000)	(0.000)
Born here (governorate i)		0.0165	0.0199	0.0100
		(0.201)	(0.101)	(0.478)
Marital status		-0.0215***	-0.0119**	-0.00504
		(0.000)	(0.018)	(0.350)
Economic Sector			-0.0668***	-0.0542***
			(0.000)	(0.000)
Highest diploma attained				0.0160***
				(0.000)
Total expenditure				0.000298**
				(0.011)
Voter turnout				0.000430
				(0.657)
Observations	127,307	84,906	19,538	17,474
R-squared	0.004	0.275	0.089	0.113

Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Our results remain insignificant for this measure during the robustness check as well. One of the reasons for the lack of significant results may be in the construction of the dependent variable. Even when we run a Probit estimation the result hold the same.

3.8.2. Panel Survey Results

In our panel dataset, we only have one dependent variable: whether a survey respondent was working in each month of 2007. The result of table (5.1) show a strong support hypothesis H1 , as the results show a negative significance correlation between the employment status of the survey respondent and the terrorist incidents across all different specifications.

3.9. Discussion

The results presented above all use robust standard errors. We tried clustering on the governorate level, but this caused a loss of significance across all dependent variables and most levels of specification. In the Econometrics literature there is a discussion about the use of clustering when the number of clustered variables is small. We cluster on 18 governorates, so this approach may not be appropriate for our paper. Additionally, clustering is meant to be used when there is heteroskedasticity in the error terms. Yet, when we conduct a White test, it does not appear that we have such heteroskedasticity. With this in mind, it may be the case that reporting robust standard errors suffices.

Our results, using robust standard errors, show significant and negative results. This is true across the dependent variables that we use in the cross-sectional and panel data, with the exception of Job Permanence in the cross-sectional data. Thus, if we reconsider our four hypotheses, we believe we find evidence in favor of three of them.

Table (3.5.1)

Linear Probability Estimation, Number of Terrorist Incidents 2007, Working 2007

Variables	Model (1)	Model (2)	Model (3)	Model (4)
Log Terrorist Incidents, 2007	-0.00427***	-0.00184***	-0.00685***	-0.00518***
	(0.000)	(0.003)	(0.000)	(0.000)
Governorate		0.000457***	0.000894***	0.000503**
		(0.009)	(0.000)	(0.015)
Household Size		-0.00452***	0.000483	0.000607
		(0.000)	(0.175)	(0.127)
Gender		-0.450***	-0.0201***	-0.0234***
		(0.000)	(0.000)	(0.000)
Age		0.00347***	0.00175***	0.00148***
		(0.000)	(0.000)	(0.000)
Born here (governorate i)		-0.0121**	-0.00770	-0.00961*
		(0.011)	(0.146)	(0.073)
Marital status		-0.0751***	-0.00820***	-0.00444*
		(0.000)	(0.000)	(0.063)
Economic Sector			-0.0136***	-0.0112***
			(0.000)	(0.000)
Highest diploma attained				0.00101
				(0.159)
Total expenditure				2.01e-05
				(0.305)
Voter turnout				-0.000799***
				(0.000)
Observations	127,307	84,906	19,538	17,474
R-squared	0.004	0.275	0.089	0.113

Robust P-value in parentheses: *** p<0.01, ** p<0.05, * p<0.1

H1: As endangerment costs increase, the marginal benefit of working decreases, so households choose to supply less labor.

H2: The number of hours worked is inversely correlated with endangerment costs.

H3: Household wages will decrease as endangerment costs increase.

H4: Job permanence will decline as endangerment costs increase.

The first three hypotheses are consistent with the results that we have presented here in this paper. However, the fourth hypothesis was not supported by the results that we have, both presented in this paper, and in other constructions of the job permanence variable.

3.10. Conclusion

Given the results discussed above, it is clear that terrorism increases endangerment costs for those participating in the labor force, and these elevated endangerment costs impact individual decision-making. As endangerment costs rise, proxied by the number of terrorist incidents and the maximum number of civilian fatalities, labor supply distortions result. There is evidence that individuals choose to not work when the endangerment costs reach a certain threshold. We also see that the number of hours worked per week decreases as endangerment costs increase, and that the amount of the household's last paycheck declines.

We believe that the approach presented here has significant implications for policymakers in two contexts. First, for policymakers in Iraq, these results should lead to specific types of interventions in areas particularly impacted by terrorism. We see that as endangerment costs rise, households choose not to work. However, the willingness to work increases, so there is a productivity gap. Technology could help bridge this gap by allowing people to work remotely or increasing security for transportation routes to business sectors in city neighborhoods.

The second set of policymakers that should find these results interesting are countries like the United States who face an influx of refugees from countries with high levels of conflict and violence. As endangerment costs in countries rise, an inevitable result is an influx of outward migration, often refugees seeking asylum in destination countries. Building on the results here, it would be interesting to understand both mitigation policies on endangerment costs, and the role of destination countries in establishing national security policies to deal with the economic and political upheaval of these costs.

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Appendix A

Table A.1

Pooled OLS Estimation of Local Community Characteristics within 5- Mile Radius on the Ratio of Facility Environmental Employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00475***	-0.00281*	-0.00294	-0.00326*
	(0.000)	(0.097)	(0.102)	(0.081)
Black share of population	-0.0103	0.0282	0.0316	0.0502**
	(0.641)	(0.223)	(0.171)	(0.034)
Log of per household income (calendar year=1999, current $)	0.193**	0.183***	0.153***	0.199***
	(0.020)	(0.002)	(0.007)	(0.001)
Share of population aged 25 or over with bachelor's degree or higher	0.704***	0.629***	0.646***	0.739***
	(0.003)	(0.000)	(0.000)	(0.000)
Share of population living in same house as 1995	0.0474	0.0930	0.150	0.172
	(0.614)	(0.359)	(0.195)	(0.155)
Male share of populations aged 18 or over	0.325**	0.238*	0.135	0.213*
	(0.024)	(0.051)	(0.229)	(0.081)
Owner-occupied share of housing	-0.0213	-0.0202	-0.0813	-0.0687
	(0.673)	(0.781)	(0.356)	(0.467)
Share of population under poverty line	-0.374**	-0.363**	-0.368**	-0.464***
	(0.012)	(0.021)	(0.034)	(0.010)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	724	724	709	709
R-squared	0.071	0.169	0.203	0.233

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.2
Random Effects Estimation of Local Community Characteristics within 5- Mile Radius on the Ratio of Facility Environmental Employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00470	-0.00276	-0.00277	-0.00259
	(0.187)	(0.457)	(0.458)	(0.487)
Black share of population	-0.0223	0.0145	0.0189	0.0177
	(0.729)	(0.828)	(0.777)	(0.791)
Per household income (calendar year=1999, current $)	0.175*	0.152	0.120	0.133
	(0.068)	(0.147)	(0.257)	(0.209)
Share of population aged 25 or over with bachelor's degree or higher	0.649***	0.557**	0.567**	0.610***
	(0.002)	(0.012)	(0.012)	(0.007)
Share of population living in same house as 1995	0.0395	0.0598	0.106	0.105
	(0.801)	(0.745)	(0.569)	(0.573)
Male share of populations aged 18 or over	0.285	0.193	0.0937	0.119
	(0.508)	(0.649)	(0.825)	(0.779)
Owner-occupied share of housing	-0.0223	0.00481	-0.0437	-0.0243
	(0.851)	(0.973)	(0.772)	(0.872)
Share of population under poverty line	-0.339	-0.257	-0.252	-0.244
	(0.282)	(0.453)	(0.474)	(0.487)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	724	724	709	709

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.

Table A.3
Pooled OLS Estimation of Local Community Characteristics within 10- Mile Radius on the Ratio of Facility Environmental Employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00596***	-0.00196	-0.000873	-0.000976
	(0.000)	(0.440)	(0.741)	(0.715)
Black share of population	-0.0912***	-0.0147	-0.0200	0.0104
	(0.002)	(0.561)	(0.456)	(0.723)
Per household income (calendar year=1999, current $)	0.205**	0.193***	0.122**	0.169***
	(0.028)	(0.001)	(0.030)	(0.005)
Share of population aged 25 or over with bachelor's degree or higher	0.777***	0.634***	0.594***	0.675***
	(0.008)	(0.001)	(0.001)	(0.000)
Share of population living in same house as 1995	0.118	0.132	0.162	0.171
	(0.308)	(0.344)	(0.270)	(0.260)
Male share of populations aged 18 or over	0.283	0.167	0.0866	0.202
	(0.429)	(0.580)	(0.784)	(0.530)
Owner-occupied share of housing	0.00825	-0.0502	-0.0953	-0.0491
	(0.895)	(0.629)	(0.416)	(0.701)
Share of population under poverty line	-0.290*	-0.389*	-0.260	-0.370*
	(0.072)	(0.075)	(0.253)	(0.096)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	724	724	709	709
R-squared	0.078	0.168	0.196	0.224

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.4
Random Effects Estimation of Local Community Characteristics within 10- Mile Radius on the Ratio of facility environmental employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00645	-0.00241	-0.00138	-0.00113
	(0.129)	(0.598)	(0.765)	(0.807)
Black share of population	-0.106	-0.0333	-0.0365	-0.0378
	(0.179)	(0.691)	(0.664)	(0.652)
Log Per household income (calendar year=1999, current $)	0.195**	0.173	0.104	0.117
	(0.046)	(0.123)	(0.366)	(0.308)
Share of population aged 25 or over with bachelor's degree or higher	0.733***	0.592**	0.549**	0.595**
	(0.001)	(0.013)	(0.023)	(0.014)
Share of population living in same house as 1995	0.112	0.0960	0.121	0.118
	(0.538)	(0.675)	(0.600)	(0.609)
Male share of populations aged 18 or over	0.142	0.0625	-0.0173	0.00626
	(0.852)	(0.935)	(0.982)	(0.993)
Owner-occupied share of housing	0.00116	-0.0282	-0.0635	-0.0416
	(0.993)	(0.862)	(0.707)	(0.806)
Share of population under poverty line	-0.289	-0.298	-0.179	-0.168
	(0.442)	(0.500)	(0.689)	(0.706)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	724	724	709	709

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.5
Pooled OLS Estimation of Local Community Characteristics within 15- Mile Radius on the Ratio of Facility environmental employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00383	0.00201	0.00276	0.00158
	(0.105)	(0.602)	(0.495)	(0.690)
Black share of population	-0.125***	-0.0205	-0.0265	0.00648
	(0.002)	(0.597)	(0.494)	(0.877)
Per household income (calendar year=1999, current $)	0.202**	0.145**	0.0735	0.134**
	(0.042)	(0.014)	(0.270)	(0.040)
Share of population aged 25 or over with bachelor's degree or higher	0.945***	0.743***	0.659***	0.750***
	(0.002)	(0.000)	(0.000)	(0.000)
Share of population living in same house as 1995	0.129	0.126	0.164	0.191
	(0.301)	(0.242)	(0.183)	(0.146)
Male share of populations aged 18 or over	1.178***	1.048***	0.960***	1.054***
	(0.003)	(0.005)	(0.008)	(0.005)
Owner-occupied share of housing	0.0487	-0.000281	-0.0515	-0.00548
	(0.510)	(0.998)	(0.683)	(0.969)
Share of population under poverty line	0.0547	0.0625	0.142	-0.0167
	(0.740)	(0.788)	(0.591)	(0.947)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	724	724	709	709
R-squared	0.094	0.177	0.201	0.226

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.6
Random Effects Estimation of Local Community Characteristics within 15- Mile Radius on the Ratio of facility environmental employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00505	0.000998	0.00168	0.00155
	(0.338)	(0.866)	(0.781)	(0.797)
Black share of population	-0.143	-0.0375	-0.0423	-0.0444
	(0.101)	(0.694)	(0.660)	(0.645)
Log Per household income (calendar year=1999, current $)	0.201*	0.138	0.0678	0.0774
	(0.057)	(0.268)	(0.598)	(0.548)
Share of population aged 25 or over with bachelor's degree or higher	0.891***	0.693***	0.609**	0.628**
	(0.000)	(0.006)	(0.019)	(0.016)
Share of population living in same house as 1995	0.127	0.0880	0.120	0.113
	(0.520)	(0.728)	(0.644)	(0.663)
Male share of populations aged 18 or over	0.947	0.869	0.794	0.761
	(0.241)	(0.282)	(0.329)	(0.351)
Owner-occupied share of housing	0.0270	0.00328	-0.0378	-0.0158
	(0.855)	(0.985)	(0.836)	(0.932)
Share of population under poverty line	0.0135	0.102	0.179	0.177
	(0.975)	(0.841)	(0.726)	(0.729)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	724	724	709	709

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.7
Pooled OLS estimation of Local Community Characteristics within the distance between 5-Mile radius and 10- Mile Radius on the Ratio of facility environmental employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00151	-0.00339***	-0.00337***	-0.00347***
	(0.211)	(0.001)	(0.001)	(0.001)
Black share of population	-0.0553*	-0.0599**	-0.0565**	-0.0431
	(0.059)	(0.032)	(0.049)	(0.152)
Per household income (calendar year=1999, current $)	-0.000207	-0.00172	-0.00284	-0.00297
	(0.957)	(0.672)	(0.508)	(0.529)
Share of population aged 25 or over with bachelor's degree or higher	-0.0177	-0.200	-0.180	-0.169
	(0.827)	(0.164)	(0.169)	(0.216)
Share of population living in same house as 1995	0.145**	0.0271	0.0273	0.0325
	(0.014)	(0.575)	(0.594)	(0.556)
Male share of populations aged 18 or over	-0.276**	-0.303**	-0.419**	-0.421**
	(0.023)	(0.023)	(0.013)	(0.015)
Owner-occupied share of housing	-0.0201	-0.106	-0.100	-0.104
	(0.724)	(0.190)	(0.177)	(0.166)
Share of population under poverty line	0.163*	0.0431	0.0568	0.0193
	(0.061)	(0.530)	(0.412)	(0.791)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	448	448	439	439
R-squared	0.042	0.083	0.121	0.176

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.8
Random Effects Estimation of Local Community Characteristics within the distance between 5-Mile radius and 10- Mile Radius on the Ratio of Facility Environmental Employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.000726	-0.000189	0.000737	0.00117
	(0.872)	(0.969)	(0.882)	(0.815)
Black share of population	-0.0658	-0.0709	-0.0839	-0.0901
	(0.433)	(0.424)	(0.345)	(0.311)
Log Per household income (calendar year=1999, current $)	-0.00977	-0.00888	-0.0101	-0.0120
	(0.164)	(0.231)	(0.181)	(0.113)
Share of population aged 25 or over with bachelor's degree or higher	0.0142	0.0456	-0.00910	-0.0264
	(0.941)	(0.823)	(0.965)	(0.899)
Share of population living in same house as 1995	0.0893	0.0863	0.0509	0.00475
	(0.725)	(0.744)	(0.848)	(0.986)
Male share of populations aged 18 or over	-0.539	-0.471	-0.494	-0.594
	(0.189)	(0.288)	(0.271)	(0.189)
Owner-occupied share of housing	0.136	0.0862	0.0833	0.121
	(0.457)	(0.682)	(0.692)	(0.566)
Share of population under poverty line	0.563*	0.498	0.542	0.567
	(0.076)	(0.173)	(0.143)	(0.126)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	448	448	439	439

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.9
Pooled OLS estimation of Local Community Characteristics within the distance between 10-Mile radius and 15- Mile Radius on the Ratio of Facility Environmental Employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00151	-0.00339***	-0.00337***	-0.00347***
	(0.211)	(0.001)	(0.001)	(0.001)
Black share of population	-0.0553*	-0.0599**	-0.0565**	-0.0431
	(0.059)	(0.032)	(0.049)	(0.152)
Per household income (calendar year=1999, current $)	-0.000207	-0.00172	-0.00284	-0.00297
	(0.957)	(0.672)	(0.508)	(0.529)
Share of population aged 25 or over with bachelor's degree or higher	-0.0177	-0.200	-0.180	-0.169
	(0.827)	(0.164)	(0.169)	(0.216)
Share of population living in same house as 1995	0.145**	0.0271	0.0273	0.0325
	(0.014)	(0.575)	(0.594)	(0.556)
Male share of populations aged 18 or over	-0.276**	-0.303**	-0.419**	-0.421**
	(0.023)	(0.023)	(0.013)	(0.015)
Owner-occupied share of housing	-0.0201	-0.106	-0.100	-0.104
	(0.724)	(0.190)	(0.177)	(0.166)
Share of population under poverty line	0.163*	0.0431	0.0568	0.0193
	(0.061)	(0.530)	(0.412)	(0.791)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	458	458	449	449
R-squared	0.032	0.265	0.281	0.315

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.10
Random Effects Estimation of Local Community Characteristics within the Distance Between 10-Mile radius and 15- Mile Radius on the Ratio of Facility Environmental Employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0114	0.0121	0.0103	0.00753
	(0.479)	(0.427)	(0.507)	(0.630)
Black share of population	0.178	0.198	0.113	0.124
	(0.583)	(0.505)	(0.712)	(0.686)
Log Per household income (calendar year=1999, current $)	-0.0214	-0.0158	-0.0166	-0.0156
	(0.160)	(0.281)	(0.268)	(0.299)
Share of population aged 25 or over with bachelor's degree or higher	-0.798	-0.560	-0.603	-0.623
	(0.166)	(0.322)	(0.299)	(0.285)
Share of population living in same house as 1995	0.293	0.256	0.426	0.453
	(0.782)	(0.796)	(0.675)	(0.656)
Male share of populations aged 18 or over	-1.024	-0.497	-0.662	-0.910
	(0.609)	(0.791)	(0.730)	(0.637)
Owner-occupied share of housing	-0.367	-0.450	-0.575	-0.565
	(0.586)	(0.478)	(0.373)	(0.383)
Share of population under poverty line	0.180	-0.580	-0.530	-0.772
	(0.901)	(0.666)	(0.697)	(0.575)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	448	448	439	439

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.11
Pooled OLS Estimation of Spatial Local Community Characteristics on Ratio of Environmental Employees

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Within 1-5-mile radius				
Median age	-0.00109	-0.00207	0.00165	-0.000382
	(0.398)	(0.146)	(0.376)	(0.838)
Black share of population	0.000329	-0.0584	0.0103	-0.00908
	(0.991)	(0.157)	(0.794)	(0.860)
Log of Per household income	0.0110***	0.00957	0.00582	0.00176
	(0.007)	(0.241)	(0.484)	(0.839)
Share of population aged 25 or over with bachelor’s degree or higher	0.0426	-0.0267	-0.0674	-0.162
	(0.712)	(0.910)	(0.771)	(0.538)
Share of population living in same house as 1995	0.0958	0.0175	0.192**	0.202**
	(0.201)	(0.820)	(0.040)	(0.049)
Male share of populations aged 18 or over	-0.206**	-0.302***	-0.634***	-0.473*
	(0.034)	(0.006)	(0.001)	(0.053)
Owner-occupied share of housing	0.00427	0.0270	-0.144	-0.143
	(0.948)	(0.725)	(0.163)	(0.169)
Share of population under poverty line	-0.0185	0.101	0.0481	-0.0732
	(0.810)	(0.166)	(0.476)	(0.442)
Within 5-10 miles radius				
Median age	-0.0117***	-0.0193***	-0.0404***	-0.0338***
	(0.008)	(0.000)	(0.000)	(0.000)
Black share of population	-0.296***	-0.204**	-0.393***	-0.316***
	(0.002)	(0.018)	(0.000)	(0.004)
Log of Per household income	-0.0309***	-0.0259***	-0.0513***	-0.0473***
	(0.000)	(0.005)	(0.000)	(0.000)
Share of population aged 25 or over with bachelor’s degree or higher	-0.252*	0.00330	-0.412*	0.0110
	(0.087)	(0.988)	(0.054)	(0.962)
Share of population living in same house as 1995	0.316	1.152***	1.839***	1.508**
	(0.229)	(0.009)	(0.001)	(0.029)
Male share of populations aged 18 or over	-2.282***	-1.057	-1.542*	-1.682
	(0.000)	(0.174)	(0.055)	(0.121)
Owner-occupied share of housing	-0.0919	-0.542**	-0.764***	-0.349
	(0.655)	(0.018)	(0.002)	(0.329)
Share of population under poverty line	0.746	-0.0238	0.434	0.758
	(0.105)	(0.960)	(0.299)	(0.131)

Within 10-15-mile radius				
Median age	0.0312***	0.0384***	0.0568***	0.0385***
	(0.000)	(0.000)	(0.000)	(0.000)
Black share of population	0.937***	1.034***	1.351***	1.317***
	(0.000)	(0.000)	(0.000)	(0.000)
Log of Per household income	0.0145*	0.0293***	0.0305***	0.0263***
	(0.057)	(0.000)	(0.000)	(0.003)
Share of population aged 25 or over with bachelor's degree or higher	-0.0170	0.0217	0.230	-0.362
	(0.957)	(0.946)	(0.429)	(0.226)
Share of population living in same house as 1995	0.131	-0.507	-1.336***	-1.572***
	(0.749)	(0.139)	(0.004)	(0.005)
Male share of populations aged 18 or over	0.109	-1.403	-0.184	-1.524
	(0.903)	(0.344)	(0.905)	(0.423)
Owner-occupied share of housing	-0.0103	-0.0152	0.580*	0.0675
	(0.969)	(0.946)	(0.071)	(0.874)
Share of population under poverty line	-2.520***	-3.074***	-2.817***	-4.107***
	(0.009)	(0.009)	(0.009)	(0.001)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	72	72	70	70
R-squared	0.408	0.551	0.676	0.789

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Appendix B

Table B.1
Linear Probability Estimation of Local Community Characteristics within 5- Mile Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0126	0.0102	0.0110	0.00929
	(0.351)	(0.484)	(0.456)	(0.528)
Black share of population	0.240	0.189	0.205	0.115
	(0.290)	(0.448)	(0.427)	(0.663)
Log of Per household income (calendar year=1999, current $)	-0.381	-0.393	-0.277	-0.478
	(0.316)	(0.363)	(0.532)	(0.304)
Share of population aged 25 or over with bachelor's degree or higher	-1.185	-1.485	-1.479	-1.940**
	(0.145)	(0.101)	(0.117)	(0.046)
Share of population living in same house as 1995	-0.553	-0.637	-0.511	-0.645
	(0.337)	(0.351)	(0.466)	(0.367)
Male share of populations aged 18 or over	-0.532	-0.392	-0.296	-0.818
	(0.726)	(0.802)	(0.851)	(0.608)
Owner-occupied share of housing	0.266	0.289	0.212	0.131
	(0.535)	(0.587)	(0.711)	(0.827)
Share of population under poverty line	0.923	0.748	0.358	0.526
	(0.425)	(0.561)	(0.790)	(0.705)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	253	253	244	244
R-squared	0.027	0.055	0.068	0.123

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.2
Linear Probability Estimation of Local Community Characteristics within 10- Mile Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0128	0.00548	0.00141	-0.00493
	(0.447)	(0.756)	(0.936)	(0.782)
Black share of population	0.316	0.237	0.182	0.0524
	(0.299)	(0.486)	(0.601)	(0.882)
Log of Per household income (calendar year=1999, current $)	-0.581	-0.650	-0.542	-0.702
	(0.135)	(0.131)	(0.227)	(0.130)
Share of population aged 25 or over with bachelor's degree or higher	-1.884**	-2.324**	-2.293**	-2.692***
	(0.036)	(0.011)	(0.018)	(0.006)
Share of population living in same house as 1995	-0.615	-0.425	-0.364	-0.431
	(0.369)	(0.620)	(0.674)	(0.621)
Male share of populations aged 18 or over	-0.764	-1.792	-2.391	-3.342
	(0.805)	(0.593)	(0.478)	(0.319)
Owner-occupied share of housing	0.0294	-0.0617	-0.0641	-0.0853
	(0.954)	(0.921)	(0.924)	(0.905)
Share of population under poverty line	0.628	-0.0274	-0.272	-0.335
	(0.658)	(0.987)	(0.871)	(0.845)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	253	253	244	244
R-squared	0.030	0.065	0.077	0.137

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.4
Linear Probability Estimation of Local Community Characteristics within 15- Mile Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0241	0.0123	0.00616	0.00158
	(0.279)	(0.614)	(0.802)	(0.950)
Black share of population	0.395	0.225	0.148	0.0120
	(0.249)	(0.571)	(0.714)	(0.977)
Log of Per household income (calendar year=1999, current $)	-0.581	-0.565	-0.385	-0.546
	(0.166)	(0.240)	(0.441)	(0.313)
Share of population aged 25 or over with bachelor's degree or higher	-2.017**	-2.116**	-1.869*	-2.200*
	(0.033)	(0.033)	(0.077)	(0.052)
Share of population living in same house as 1995	-1.076	-0.843	-0.707	-0.885
	(0.146)	(0.381)	(0.479)	(0.384)
Male share of populations aged 18 or over	-0.897	-1.032	-1.845	-2.321
	(0.793)	(0.782)	(0.620)	(0.548)
Owner-occupied share of housing	-0.266	-0.301	-0.355	-0.358
	(0.646)	(0.662)	(0.630)	(0.659)
Share of population under poverty line	0.548	0.0814	-0.356	-0.139
	(0.737)	(0.967)	(0.856)	(0.945)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	253	253	244	244
R-squared	0.030	0.057	0.064	0.120

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.4
Probit Estimation of Local Community Characteristics within 5- Mile Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0335	0.0289	0.0313	0.0315
	(0.355)	(0.459)	(0.431)	(0.436)
Black share of population	0.662	0.539	0.551	0.373
	(0.300)	(0.431)	(0.431)	(0.612)
Log of Per household income (calendar year=1999, current $)	-0.984	-1.065	-0.783	-1.224
	(0.308)	(0.335)	(0.488)	(0.300)
Share of population aged 25 or over with bachelor's degree or higher	-3.054	-4.039*	-4.086*	-5.282**
	(0.145)	(0.086)	(0.092)	(0.038)
Share of population living in same house as 1995	-1.461	-1.777	-1.403	-1.778
	(0.343)	(0.337)	(0.456)	(0.360)
Male share of populations aged 18 or over	-1.310	-0.891	-0.655	-1.869
	(0.758)	(0.836)	(0.879)	(0.673)
Owner-occupied share of housing	0.714	0.787	0.532	0.257
	(0.530)	(0.581)	(0.725)	(0.873)
Share of population under poverty line	2.418	2.040	1.040	1.250
	(0.432)	(0.553)	(0.772)	(0.734)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	253	253	244	244

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.5
Probit Estimation of Local Community Characteristics within 10- Mile Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0336	0.0152	0.00451	-0.0131
	(0.454)	(0.751)	(0.925)	(0.790)
Black share of population	0.835	0.642	0.457	0.112
	(0.313)	(0.476)	(0.614)	(0.906)
Log of Per household income (calendar year=1999, current $)	-1.496	-1.767	-1.504	-1.801
	(0.133)	(0.116)	(0.194)	(0.141)
Share of population aged 25 or over with bachelor's degree or higher	-4.851**	-6.357***	-6.341**	-7.407***
	(0.038)	(0.010)	(0.013)	(0.006)
Share of population living in same house as 1995	-1.606	-1.138	-0.959	-1.161
	(0.381)	(0.624)	(0.682)	(0.625)
Male share of populations aged 18 or over	-1.991	-5.082	-6.705	-9.856
	(0.804)	(0.558)	(0.439)	(0.266)
Owner-occupied share of housing	0.0950	-0.190	-0.232	-0.348
	(0.943)	(0.908)	(0.894)	(0.850)
Share of population under poverty line	1.633	-0.200	-0.811	-1.457
	(0.667)	(0.964)	(0.855)	(0.749)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	253	253	244	244

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.6
Probit Estimation of Local Community Characteristics within 15- Mile Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0646	0.0338	0.0188	0.00282
	(0.271)	(0.596)	(0.768)	(0.966)
Black share of population	1.056	0.603	0.366	-0.0152
	(0.255)	(0.563)	(0.728)	(0.989)
Log of Per household income (calendar year=1999, current $)	-1.511	-1.528	-1.073	-1.269
	(0.163)	(0.222)	(0.405)	(0.361)
Share of population aged 25 or over with bachelor's degree or higher	-5.276**	-5.810**	-5.226*	-6.058**
	(0.032)	(0.026)	(0.057)	(0.044)
Share of population living in same house as 1995	-2.912	-2.371	-2.046	-2.863
	(0.147)	(0.356)	(0.439)	(0.293)
Male share of populations aged 18 or over	-2.399	-3.094	-5.324	-7.944
	(0.785)	(0.744)	(0.569)	(0.419)
Owner-occupied share of housing	-0.697	-0.882	-1.047	-0.938
	(0.646)	(0.626)	(0.581)	(0.647)
Share of population under poverty line	1.428	0.0174	-1.085	-1.079
	(0.744)	(0.997)	(0.833)	(0.840)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	253	253	244	244

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.7
Linear Probability Estimation of Local Community Characteristics within the Distance Between 5- Mile Radius and 10 Miles Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0196	0.0174	0.00563	-0.00292
	(0.550)	(0.616)	(0.877)	(0.939)
Black share of population	-0.163	0.239	0.274	0.301
	(0.791)	(0.715)	(0.681)	(0.673)
Log of Per household income (calendar year=1999, current $)	0.0705*	0.0442	0.0381	0.0659
	(0.075)	(0.248)	(0.357)	(0.145)
Share of population aged 25 or over with bachelor’s degree or higher	0.111	0.0576	-0.0654	0.985
	(0.932)	(0.966)	(0.963)	(0.557)
Share of population living in same house as 1995	-0.0970	1.007	0.854	1.425
	(0.958)	(0.587)	(0.655)	(0.472)
Male share of populations aged 18 or over	1.031	0.433	0.655	2.186
	(0.732)	(0.889)	(0.838)	(0.530)
Owner-occupied share of housing	-0.589	-0.275	-0.275	0.0276
	(0.659)	(0.853)	(0.855)	(0.986)
Share of population under poverty line	-2.546	-2.257	-2.660	-2.686
	(0.274)	(0.385)	(0.313)	(0.337)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	159	159	153	153
R-squared	0.025	0.128	0.130	0.212

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.8
Linear Probability Estimation of Local Community Characteristics within the Distance Between 10- Mile Radius and 15 Miles Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0285	0.0243	0.0381	0.0497
	(0.596)	(0.645)	(0.470)	(0.325)
Black share of population	0.814	0.812	1.075	1.658
	(0.469)	(0.485)	(0.377)	(0.170)
Log of Per household income (calendar year=1999, current $)	0.0412	0.0485	0.0579	0.0545
	(0.469)	(0.460)	(0.391)	(0.446)
Share of population aged 25 or over with bachelor's degree or higher	1.661	2.879	3.523	4.336*
	(0.390)	(0.180)	(0.111)	(0.062)
Share of population living in same house as 1995	-5.576	-4.205	-4.936	-5.437
	(0.132)	(0.288)	(0.219)	(0.212)
Male share of populations aged 18 or over	10.53*	9.886	11.55*	11.90*
	(0.089)	(0.130)	(0.086)	(0.079)
Owner-occupied share of housing	1.313	2.070	2.848	3.486
	(0.587)	(0.424)	(0.273)	(0.195)
Share of population under poverty line	0.697	2.247	2.487	4.068
	(0.900)	(0.691)	(0.668)	(0.486)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	162	162	157	157
R-squared	0.043	0.098	0.144	0.242

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.9
Linear Probability Estimation of spatial constructed Local Community Characteristics effects on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Within 1-5-mile radius				
Median age	0.00907	0.0110	-0.0184	-0.0267
	(0.706)	(0.686)	(0.590)	(0.516)
Black share of population	-0.272	-0.606	-0.861	-0.900
	(0.658)	(0.384)	(0.286)	(0.340)
Log of Per household income	0.00494	-0.144	-0.113	-0.180
	(0.929)	(0.196)	(0.286)	(0.150)
Share of population aged 25 or over with bachelor's degree or higher	-0.886	-4.200*	-3.424	-4.333
	(0.530)	(0.061)	(0.129)	(0.126)
Share of population living in same house as 1995	-0.955	-1.311	-1.776	-2.308
	(0.677)	(0.545)	(0.403)	(0.306)
Male share of populations aged 18 or over	0.186	-1.193	-0.0133	0.192
	(0.932)	(0.657)	(0.996)	(0.954)
Owner-occupied share of housing	-1.940	-2.383	-1.110	0.910
	(0.210)	(0.127)	(0.510)	(0.649)
Share of population under poverty line	-1.581	-0.606	-0.596	0.714
	(0.175)	(0.655)	(0.662)	(0.704)
Within 5-10 miles radius				
Median age	0.0697	0.0263	0.0754	0.138
	(0.347)	(0.757)	(0.479)	(0.334)
Black share of population	2.143	4.595**	5.005***	2.431
	(0.167)	(0.011)	(0.005)	(0.268)
Log of Per household income	0.0264	0.0721	0.119	0.257
	(0.869)	(0.681)	(0.548)	(0.196)
Share of population aged 25 or over with bachelor's degree or higher	-2.094	2.717	4.590	8.486
	(0.457)	(0.440)	(0.224)	(0.136)
Share of population living in same house as 1995	0.355	9.750*	3.818	-0.0137
	(0.930)	(0.051)	(0.493)	(0.999)
Male share of populations aged 18 or over	14.01	30.90**	28.47**	11.04
	(0.207)	(0.016)	(0.012)	(0.444)
Owner-occupied share of housing	0.809	0.284	1.242	6.554
	(0.738)	(0.923)	(0.666)	(0.143)
Share of population under poverty line	-5.130	-5.569	-5.672	-1.569
	(0.423)	(0.464)	(0.417)	(0.852)

Within 10-15-mile radius				
Median age	-0.0273	-0.128	-0.187	-0.410*
	(0.839)	(0.402)	(0.282)	(0.088)
Black share of population	-1.972	-4.814	-6.774*	-1.774
	(0.490)	(0.250)	(0.084)	(0.718)
Log of Per household income	-0.0689	0.0801	0.0459	-0.144
	(0.545)	(0.562)	(0.744)	(0.365)
Share of population aged 25 or over with bachelor's degree or higher	0.274	0.0380	0.179	-10.16*
	(0.940)	(0.993)	(0.970)	(0.094)
Share of population living in same house as 1995	-17.14***	-24.51***	-19.12**	-18.29*
	(0.005)	(0.001)	(0.023)	(0.094)
Male share of populations aged 18 or over	10.60	-1.290	12.36	4.273
	(0.413)	(0.949)	(0.479)	(0.834)
Owner-occupied share of housing	4.654	9.845**	5.823	-0.897
	(0.249)	(0.026)	(0.204)	(0.885)
Share of population under poverty line	16.33	19.80	23.16	8.358
	(0.176)	(0.240)	(0.112)	(0.672)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	72	72	70	70
R-squared	0.408	0.551	0.676	0.789

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.10
Probit Estimation of Local Community Characteristics within the distance between 5- Mile Radius and 10 Miles Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0576	0.0522	0.0164	0.00760
	(0.510)	(0.585)	(0.870)	(0.941)
Black share of population	-0.426	0.577	0.657	0.153
	(0.794)	(0.742)	(0.709)	(0.939)
Log of Per household income (calendar year=1999, current $)	0.215*	0.161	0.134	0.269*
	(0.100)	(0.253)	(0.346)	(0.096)
Share of population aged 25 or over with bachelor's degree or higher	0.517	0.315	-0.292	2.240
	(0.887)	(0.936)	(0.942)	(0.635)
Share of population living in same house as 1995	-0.482	2.930	2.475	4.343
	(0.922)	(0.563)	(0.628)	(0.425)
Male share of populations aged 18 or over	2.936	1.269	1.972	7.178
	(0.716)	(0.881)	(0.819)	(0.492)
Owner-occupied share of housing	-1.594	-0.765	-0.773	0.167
	(0.652)	(0.855)	(0.853)	(0.971)
Share of population under poverty line	-7.280	-6.916	-8.509	-10.30
	(0.255)	(0.358)	(0.276)	(0.226)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	159	157	151	151

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B.11
Probit Estimation of Local Community Characteristics within the distance between 10-Mile Radius and 15 Miles Radius on the Treatment Upgrade

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
	0.0676	0.0496	0.0973	0.155
Median age	(0.646)	(0.745)	(0.530)	(0.386)
	2.195	2.323	3.247	8.861**
Black share of population	(0.472)	(0.450)	(0.317)	(0.014)
	0.105	0.121	0.145	0.0635
Log of Per household income (calendar year=1999, current $)	(0.484)	(0.480)	(0.421)	(0.751)
	4.762	7.869	9.911	12.84*
Share of population aged 25 or over with bachelor's degree or higher	(0.386)	(0.188)	(0.116)	(0.064)
	-14.32	-11.16	-13.72	-29.26**
Share of population living in same house as 1995	(0.151)	(0.282)	(0.194)	(0.021)
	29.65*	27.95	33.96*	43.48**
Male share of populations aged 18 or over	(0.098)	(0.136)	(0.082)	(0.043)
	3.190	5.187	7.379	15.07**
Owner-occupied share of housing	(0.621)	(0.446)	(0.279)	(0.049)
	2.057	5.855	6.323	13.37
Share of population under poverty line	(0.885)	(0.686)	(0.671)	(0.420)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	162	162	157	155

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Appendix C

Table C.1

Linear Probability Estimation of Local Community Characteristics within 5- Mile Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00973*	-0.00903	-0.0119**	-0.0115*
	(0.052)	(0.112)	(0.044)	(0.059)
Black share of population	0.0580	0.0341	0.0439	0.0528
	(0.638)	(0.793)	(0.738)	(0.700)
Log of Per household income (calendar year=1999, current $)	0.388**	0.501**	0.615**	0.577**
	(0.039)	(0.030)	(0.015)	(0.022)
Share of population aged 25 or over with bachelor's degree or higher	-0.0108	0.244	0.374	0.353
	(0.977)	(0.574)	(0.421)	(0.463)
Share of population living in same house as 1995	-0.0610	0.244	0.402	0.423
	(0.850)	(0.555)	(0.338)	(0.327)
Male share of populations aged 18 or over	-0.567	-0.666	-0.703	-0.735
	(0.620)	(0.591)	(0.566)	(0.557)
Owner-occupied share of housing	-0.101	-0.348	-0.534	-0.551
	(0.732)	(0.345)	(0.164)	(0.152)
Share of population under poverty line	-1.270*	-1.902**	-2.452***	-2.432***
	(0.056)	(0.018)	(0.004)	(0.006)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	72	72	70	70
R-squared	0.408	0.551	0.676	0.789

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table C.2
Linear Probability Estimation of Local Community Characteristics within 10- Mile Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00719	-0.00697	-0.0103	-0.00915
	(0.189)	(0.281)	(0.152)	(0.220)
Black share of population	0.0441	0.0544	0.0236	0.0365
	(0.801)	(0.771)	(0.898)	(0.851)
Log of Per household income (calendar year=1999, current $)	0.423**	0.616***	0.726***	0.683***
	(0.031)	(0.009)	(0.006)	(0.008)
Share of population aged 25 or over with bachelor's degree or higher	0.516	0.745*	0.924**	0.908*
	(0.199)	(0.081)	(0.048)	(0.056)
Share of population living in same house as 1995	-0.133	0.259	0.351	0.412
	(0.745)	(0.627)	(0.524)	(0.458)
Male share of populations aged 18 or over	1.134	0.842	0.807	0.745
	(0.402)	(0.592)	(0.613)	(0.656)
Owner-occupied share of housing	0.0826	-0.212	-0.298	-0.370
	(0.814)	(0.611)	(0.501)	(0.407)
Share of population under poverty line	-0.759	-1.857*	-2.144**	-2.144**
	(0.371)	(0.063)	(0.038)	(0.039)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	72	72	70	70
R-squared	0.408	0.551	0.676	0.789

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table C.3
Linear Probability Estimation of Local Community Characteristics within 15- Mile Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00556	-0.00759	-0.0128	-0.0110
	(0.436)	(0.392)	(0.224)	(0.317)
Black share of population	-0.0358	-0.0667	-0.109	-0.104
	(0.860)	(0.776)	(0.650)	(0.682)
Log of Per household income (calendar year=1999, current $)	0.402*	0.594**	0.741**	0.684**
	(0.060)	(0.026)	(0.017)	(0.029)
Share of population aged 25 or over with bachelor's degree or higher	0.554	0.782*	1.067**	1.081*
	(0.209)	(0.085)	(0.049)	(0.056)
Share of population living in same house as 1995	-0.0823	0.207	0.362	0.481
	(0.850)	(0.722)	(0.560)	(0.461)
Male share of populations aged 18 or over	2.153*	1.933	1.863	2.196
	(0.085)	(0.159)	(0.182)	(0.150)
Owner-occupied share of housing	0.0310	-0.189	-0.265	-0.389
	(0.941)	(0.678)	(0.581)	(0.429)
Share of population under poverty line	-0.205	-1.093	-1.460	-1.330
	(0.830)	(0.332)	(0.217)	(0.270)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	72	72	70	70
R-squared	0.408	0.551	0.676	0.789

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table C.4
Linear Probability Estimation of Local Community Characteristics within the distance between 5-Mile radius and 10- Mile Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.00551	-0.0130	-0.0145	-0.0144
	(0.621)	(0.310)	(0.286)	(0.278)
Black share of population	-0.321	-0.259	-0.303	-0.267
	(0.297)	(0.420)	(0.354)	(0.459)
Log of Per household income (calendar year=1999, current $)	0.00320	-0.00193	-0.00701	-0.00489
	(0.709)	(0.867)	(0.590)	(0.742)
Share of population aged 25 or over with bachelor’s degree or higher	0.347	0.148	0.125	0.220
	(0.397)	(0.768)	(0.817)	(0.737)
Share of population living in same house as 1995	-0.528	-0.114	-0.235	-0.266
	(0.458)	(0.860)	(0.730)	(0.737)
Male share of populations aged 18 or over	-0.396	-0.372	-0.331	-0.345
	(0.685)	(0.659)	(0.708)	(0.760)
Owner-occupied share of housing	0.501	0.514	0.579	0.655
	(0.190)	(0.248)	(0.217)	(0.190)
Share of population under poverty line	2.222**	2.343**	2.825**	2.897**
	(0.024)	(0.035)	(0.022)	(0.034)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	72	72	70	70
R-squared	0.408	0.551	0.676	0.789

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table C.5

Linear Probability Estimation of Local Community Characteristics within the distance between 10-Mile radius and 15- Mile Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.0192	0.0192	0.0260	0.0294
	(0.167)	(0.289)	(0.180)	(0.158)
Black share of population	-0.597	-0.589	-0.465	-0.582
	(0.203)	(0.264)	(0.399)	(0.342)
Log of Per household income (calendar year=1999, current $)	-0.00134	0.00348	-0.000419	-0.00266
	(0.955)	(0.893)	(0.988)	(0.935)
Share of population aged 25 or over with bachelor’s degree or higher	-0.542	-0.0616	-0.209	-0.159
	(0.557)	(0.957)	(0.856)	(0.909)
Share of population living in same house as 1995	0.160	0.531	0.330	0.585
	(0.901)	(0.714)	(0.823)	(0.718)
Male share of populations aged 18 or over	4.831	4.848	5.267	5.830
	(0.150)	(0.205)	(0.177)	(0.197)
Owner-occupied share of housing	-0.606	-0.0569	-0.0441	-0.115
	(0.506)	(0.955)	(0.966)	(0.921)
Share of population under poverty line	3.567	4.662	4.202	4.782
	(0.201)	(0.127)	(0.162)	(0.170)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	72	72	70	70
R-squared	0.408	0.551	0.676	0.789

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table C.6
Linear Probability Estimation of Spatial Local Community Characteristics on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Within 1-5-mile radius				
Median age	0.00580	0.00857	0.00734	-0.0116
	(0.630)	(0.530)	(0.653)	(0.698)
Black share of population	0.176	0.250	0.283	0.0870
	(0.368)	(0.432)	(0.436)	(0.891)
Log of Per household income	0.0181	-0.0205	-0.0227	-0.00927
	(0.623)	(0.662)	(0.703)	(0.912)
Share of population aged 25 or over with bachelor’s degree or higher	0.811	-0.374	-0.415	-0.959
	(0.256)	(0.766)	(0.767)	(0.611)
Share of population living in same house as 1995	-0.503	-0.577	-0.605	-1.310
	(0.455)	(0.586)	(0.590)	(0.361)
Male share of populations aged 18 or over	0.160	-0.0187	-0.0287	0.945
	(0.665)	(0.982)	(0.981)	(0.691)
Owner-occupied share of housing	0.457	0.437	0.518	1.161
	(0.490)	(0.470)	(0.470)	(0.388)
Share of population under poverty line	0.0202	0.209	0.208	0.324
	(0.969)	(0.726)	(0.764)	(0.847)
Within 5-10 miles radius				
Median age	-0.0304	-0.0475	-0.0533	0.00586
	(0.192)	(0.225)	(0.363)	(0.952)
Black share of population	-0.976	-0.635	-0.732	-0.156
	(0.177)	(0.494)	(0.551)	(0.929)
Log of Per household income	0.00308	-0.0356	-0.0392	-0.0776
	(0.938)	(0.664)	(0.675)	(0.573)
Share of population aged 25 or over with bachelor’s degree or higher	1.247	0.821	1.054	-1.636
	(0.264)	(0.553)	(0.536)	(0.521)
Share of population living in same house as 1995	1.104	2.919	2.677	0.288
	(0.467)	(0.264)	(0.303)	(0.960)
Male share of populations aged 18 or over	2.245	3.571	2.558	3.277
	(0.600)	(0.456)	(0.655)	(0.776)
Owner-occupied share of housing	1.736	2.176	2.450	2.236
	(0.322)	(0.280)	(0.282)	(0.413)
Share of population under poverty line	0.746	-0.0238	0.434	0.758
	(0.105)	(0.960)	(0.299)	(0.131)
Within 10-15-mile radius				
Median age	0.0684	0.0527	0.0483	0.00833

	(0.178)	(0.494)	(0.630)	(0.956)
Black share of population	0.629	0.556	0.581	0.935
	(0.506)	(0.745)	(0.774)	(0.764)
Log of Per household income	0.00485	0.0345	0.0298	0.0216
	(0.901)	(0.492)	(0.597)	(0.811)
Share of population aged 25 or over with bachelor's degree or higher	-1.076	-0.459	-0.662	-1.832
	(0.534)	(0.828)	(0.767)	(0.566)
Share of population living in same house as 1995	-0.144	-2.008	-1.729	3.600
	(0.931)	(0.391)	(0.546)	(0.514)
Male share of populations aged 18 or over	-0.514	-4.451	-2.845	-0.917
	(0.895)	(0.450)	(0.694)	(0.937)
Owner-occupied share of housing	-1.803	1.621	1.331	-1.046
	(0.227)	(0.438)	(0.574)	(0.808)
Share of population under poverty line	-4.788	-4.173	-4.293	-11.94
	(0.270)	(0.413)	(0.462)	(0.280)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	72	72	70	70
R-squared	0.408	0.551	0.676	0.789

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table C.7
Probit Estimation of Local Community Characteristics within the distance between 5- Mile Radius and 10 Miles Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	-0.0532	-0.134	-0.171	-0.151
	(0.678)	(0.422)	(0.351)	(0.449)
Black share of population	-4.454	-1.560	-0.509	2.001
	(0.151)	(0.613)	(0.852)	(0.580)
Log of Per household income (calendar year=1999, current $)	0.104	0.0882	0.0341	0.199
	(0.488)	(0.682)	(0.879)	(0.494)
Share of population aged 25 or over with bachelor's degree or higher	7.484	6.565	9.015	14.81*
	(0.163)	(0.267)	(0.245)	(0.099)
Share of population living in same house as 1995	-7.756	-3.667	-5.177	-9.629
	(0.264)	(0.598)	(0.434)	(0.216)
Male share of populations aged 18 or over	-2.810	-5.799	-1.580	8.101
	(0.788)	(0.604)	(0.867)	(0.574)
Owner-occupied share of housing	8.079**	9.683*	10.95*	14.20**
	(0.011)	(0.078)	(0.067)	(0.050)
Share of population under poverty line	27.95***	29.40**	33.55***	39.52***
	(0.000)	(0.017)	(0.005)	(0.006)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions(*)	No	No	No	Yes
Observations	159	157	151	151

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table C.8
Probit Estimation of Local Community Characteristics within the distance between 10-Mile Radius and 15 Miles Radius on the Extent of Environmental Training

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)
Median age	0.168	0.234	0.525	0.927*
	(0.168)	(0.199)	(0.125)	(0.092)
Black share of population	-7.205	-8.307	-8.347	-22.13*
	(0.167)	(0.163)	(0.353)	(0.089)
Log of Per household income (calendar year=1999, current $)	0.0997	0.0927	0.101	0.550
	(0.716)	(0.757)	(0.777)	(0.300)
Share of population aged 25 or over with bachelor's degree or higher	1.231	6.012	14.08	37.35*
	(0.850)	(0.491)	(0.211)	(0.071)
Share of population living in same house as 1995	4.731	3.994	10.34	30.52
	(0.729)	(0.801)	(0.610)	(0.295)
Male share of populations aged 18 or over	44.84	54.31*	77.84**	124.9*
	(0.157)	(0.077)	(0.025)	(0.054)
Owner-occupied share of housing	-3.663	7.133	6.077	6.346
	(0.662)	(0.472)	(0.611)	(0.718)
Share of population under poverty line	35.16	63.91**	80.36*	142.9**
	(0.160)	(0.026)	(0.056)	(0.030)
Contral factors Included				
Region and Year indictors	No	Yes	Yes	Yes
Facility Charactristics	No	No	Yes	Yes
Regulation and Inspestions	No	No	No	Yes
Observations	162	162	157	155

Robust P-value in parentheses *** p<0.01, ** p<0.05, * p<0.1